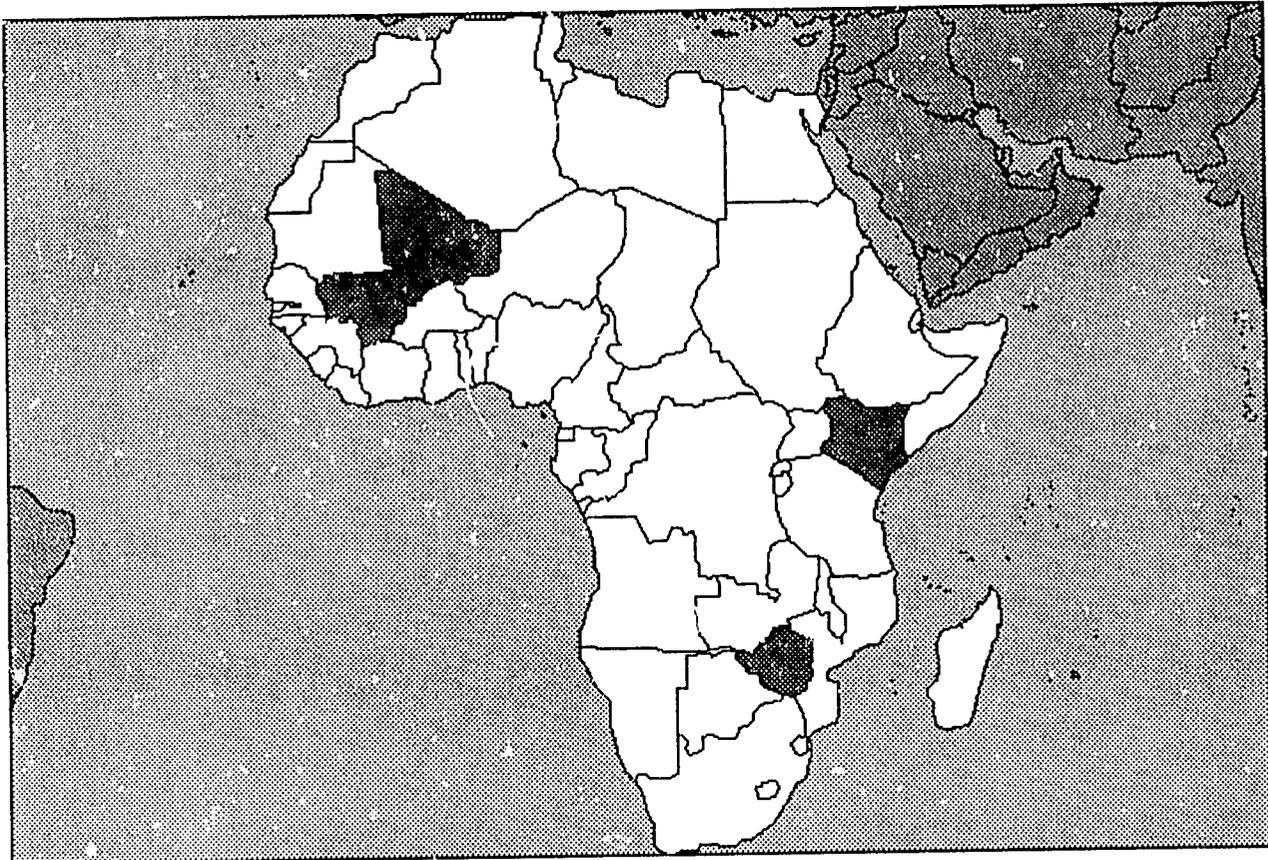


PN-ABL-252
77181

United States Agency for International Development
PDC - 1406-I-00-0073-00
Delivery Order No. 8

Analysis of Private-Sector Technology Transfer Methods



Submitted by:

**Tropical Research & Development, Inc.
June 1992**

Acknowledgements

I would firstly like to thank all the people interviewed in Mali, Kenya and Zimbabwe. They were tremendously helpful and, above all, welcoming. The TR&D staff, especially Paul Wild, were very supportive and efficient. And the report includes contributions from two individuals who deserve special thanks: Michael Colegrove, for the first draft of the section on "Private-sector outlook," and Willem Cornelissen, who was on mission in Zimbabwe for the World Bank. He and I collaborated on some of the Zimbabwe field work.

Thanks also go to the USAID mission staff at headquarters and in the three countries, as well as Jeff Hill and Allen Schroeder in Washington D.C., Bob Armstrong in Zimbabwe, Jim Gingerich and David Soroko in Kenya and especially David Atwood, Dennis Biladeau, Doral Watts and all the very helpful staff from the Mali mission.

My colleagues from both MSU and the World Bank were an immense help in suggesting possible valuable contacts in the field. In particular, I would like to thank Josue Dione, Carl K. Eicher, Lydia Kimenye, David Makanda, Shem Migot-Adolla, Chris Mock, Steven Jaffee, Joseph Rusike and Augustine Zinavashe.

Lisa Schwartz

Table of contents

Acknowledgements	i
List of acronyms	v
Executive summary	vii
1. Background	1
1.1 Introduction	1
1.2 Purpose	1
1.3 Method and organization of the report	1
1.4 Definition of technology transfer	2
2. Literature review	3
2.1 Private technology transfer by organizational types	3
2.1.1 Private agribusiness firms	3
2.1.2 Parastatals	4
2.1.3 Private consulting firms	5
2.1.4 Farmers' associations	5
2.1.5 Not-for-profit, non-governmental organizations	5
2.1.6 Formal educational institutions	5
2.1.7 A mix of organizations is required	6
2.2 Summary of points from the literature	7
3. Private-sector outlook	9
3.1 Market potential for the product or service	9
3.2 Political and business environment	9
3.3 Capital-expenditure requirements	10
3.4 Proprietary information protection	10
3.5 Establishing local representation	10
3.6 Customer orientation of services	11
3.7 Constraint resolution	11
3.8 The agriculture-related private sector in Africa	11
4. Overview of the three countries	13
4.1 Zimbabwe	14
4.1.1 Technology transfer related to input supply	15
4.1.1.1 Chemicals and fertilizers	15
4.1.2 Groups engaged in technology transfer	18
4.1.2.1 Farmers' associations	18
4.1.2.2 Marketing/processing sector	19
4.1.2.3 Other private organizations	21
4.2 Kenya	22
4.2.1 Technology transfer related to input supply	22
4.2.1.1 Chemicals and fertilizers	22
4.2.1.2 Seeds	24
4.2.2 Groups conducting technology transfer	25
4.2.2.1 Commodity-focused organizations and farmers' associations	25
4.2.2.2 Marketers/exporters and processors	26

List of acronyms

Africa Project Development Facility (APDF)
Agricultural Finance Corporation (AFC)
Agricultural Research Trust (ART)
Agricultural Rural Development Authority (ARDA)
Agro Chemical Industry Association (ACIA)
Associations villageois (AVs)
British American Tobacco (BAT)
Canadian Association for the Private Sector in Southern Africa (CAPSSA)
Ciba-Giegy (C-G)
Commercial Cotton Growers Association (CCGA)
Commercial Farmers Union (CFU)
Commercial Grain Producers Association (CGPA)
Commercial Oilseed Producers' Association (COPA)
Compagnie Malian pour le Développement des Textiles (CMDT)
Compagnie Malian pour le Développement des Textiles (CMDT)
Cooperative League of the United States of America (CLUSA)
Cotton Training and Extension Center (COTTEC)
Direction Nationale de Élevage (DNE)
European Economic Community (EEC)
Etablissement Publique a Caractère Industrielle et Commercial (EPIC)
European Economic Community (EEC)
Farmers associations (FA)
Food & Agricultural Organization of the United Nations Development Programme (FAO/UNDP)
Formal educational institutions (FEI)
French quasi-private firm (CFDT)
German Society of Technical Cooperation (German acronym, GTZ)
Government ministries or departments (G)
Government of Zimbabwe (GOZ)
Grain Marketing Board (GMB)
Horticultural Crop Development Authority (HCDA)
Horticultural Producers' Council (HPC)
Integrated pest management (IPM)
International Organization of Agro-chemical Product Manufacturers (French: GIFAP)
Joint European Development Fund (FED)
Kenya Breweries Limited (KBL)
Kenya Farmers' Association (KFA)
Kenya Grain Growers Cooperative Union (KGGCU)
Kenya Horticultural Exports (KHE)
Kenya National Farmers Union (KNFU)
Kenya Planters' Cooperative Union (KPCU)
Kenya Tea Development Authority (KTDA)
La Compagnie Française pour le Développement des Fibres Textiles (CFDT)
Maximum support/minimum staff (MAX/MIN)
Ministry of Agriculture (MOA)
Ministry of Land and Resettlement (MLARR)
National Tested Seeds (NTS)
Non-governmental organizations (NGO)
Not-for-profit non-governmental organizations (NGO/NFP)

Office Du Niger (ODN)
Oil-crop-development scheme (OCS)
Opération Production Semences Sélectionne (OPSS)
Organisation Development Rurale (ODR)
Organisation Haute Vallee (OHV)
Overseas Private Investment Corporation (OPIC)
Petite Moyenne Entreprises/Petite Moyenne Industries (PME/PMI)
Pre-independence extension service (CONEX)
Private agribusiness firms (PAF)
Private consulting firms (PCF)
Project National de la Vulgarization Agricole (PNVA)
Société Maliana Produit Chimique (SMPC)
Tobacco Research Board (TRB)
Tobacco Training Center (TTC)
Tobacco Training Institute (TTI)
United Nations Development Programme (UNDP)
Universities (U)
Zimbabwe Farmers Union (ZFU)
Zimbabwe Fertilizer Corporation (ZFC)
Zimbabwe Institute for Permaculture Training and Extension (ZIPTEx)
Zimbabwe National Farmers Union (ZNFU)
Zimbabwe Tobacco Association (ZTA)

Executive summary

The primary objective of agricultural extension in Sub-Saharan Africa is to increase demand for and utilization of agricultural technology in order to increase agricultural productivity. Agricultural extension services have typically been conducted by the public sector. However, the high, recurrent costs of extension and growing concern for sustainability in development overall has led to a new focus on how to both streamline public-sector extension and supplement it with activities undertaken by the private sector. In most Sub-Saharan Africa cases, private technology transfer -- the supply of information on agricultural technology by organizations in the private sector -- can serve only as a complement to public-sector services. Public-sector extension will continue to be important in Africa in the medium term. Perhaps most importantly, coordinating technology transfer with the private sector could allow public-sector resources to be focused on resource-poor areas, where there is little or no incentive for private-sector involvement. To encourage the private side, the macroeconomic environment must provide incentives for investment. To this end, barriers should be removed which discourage private-sector entry -- of input suppliers, agro-processors and/or exporters -- into either technology markets or commodity markets. Where government control of commercial activities in agriculture is dominant, private-sector technology transfer is unlikely.

The purpose of this study was to gather information on private-sector technology transfer needed by the technology-development and transfer unit of the Africa Bureau to support the field missions. The study is part of a larger effort to study agricultural technology and the private sector -- the Technology Development and Transfer Initiative. The hypothesis of the study is that the private sector can complement public-sector services in the transfer of agricultural technology to increase agricultural productivity in SSA. In addition, the study sought to identify specific ways to encourage public/private sector coordination. The method of the study includes both a literature review and field work in three SSA countries -- Zimbabwe, Kenya and Mali.

For each country, the study provides an inventory of private-sector technology transfer and a discussion of activities that the private sector might undertake in other countries. Possible areas for increased complementarity between private and public-sector technology transfer are identified. The report includes the following sections: a summary of the literature on private technology transfer; a discussion of the private-sector outlook toward business in Africa; country studies; conclusions and policy recommendations; and an annex of detailed case studies.

In all countries examined, a mix of organizational types were involved in the overall extension system. The mix included some or all of the following: government ministries or departments; private agribusiness firms, including both input suppliers and processor/marketers; *parastatals*; private consulting firms; farmers' associations; non-governmental organizations (NGOs); and educational institutions. No single organization provides producers with unbiased, complete information. As each type of technology transfer has limitations, attaining the best mixture of public, private and non-profit NGO services should be the objective.

The primary avenues of private technology transfer in the countries studied included the following: input supply; farmers' associations; and marketing and/or processing firms or *parastatals*. Input supply is an important avenue for private technology transfer. The incentive behind this type of activity is to sell more of the product. Compared to the chemical and fertilizer sector, the seed sector in all three countries is characterized by relatively few firms and, thus, a lack of competition and less involvement in technology transfer. Farmers' associations in all three countries conduct extension activities within their organization. These activities benefit the associations' members and/or industry. Marketing and processing organizations, especially for horticultural products, are active in technology transfer, primarily in Kenya. These actions ensure that strict requirements for quality, quantity and timeliness are met.

Major conclusions of the study are as follows: (1) Processors and exporters of a commodity with a strong, commercial market demand have an incentive to provide extension services to growers of that commodity. Additionally, strong market demand for a commodity provides a good indication that private sources of technology and information -- such as consulting firms and private extension advisors attached to farmers' associations -- will develop. (2) Input suppliers have an incentive to conduct extension activities under the following three conditions: (a) purchased inputs are required to achieve desired quantity and quality benefits from production; (b) relative prices of inputs and output allow profits to be earned under a farming system using purchased inputs; and (c) a fairly high degree of competition exists between input suppliers for the same market share. (3) Access to resources affects the range of activities farmers can undertake profitably and thus their likelihood of being served by private technology transfer. (4) Difficulties in appropriating the benefits of technology-transfer activities discourage private investment in these activities. The ability to appropriate benefits tends to change over time. However, companies often choose to invest in technology transfer even while aware that their ability to appropriate the benefits will erode over time. When market demand is strong, companies may bear this risk to ensure their share of profits in the short to medium term. (5) Bearing heavily on whether a commercial firm or farmers' association will provide technology-transfer services is the amount of risk perceived to be associated with an activity which includes technology transfer or the general business environment. This risk is determined by both the policy and market environment. (6) For technologies applied to high-demand commodities, considerable potential exists for spill-over onto commodities in less demand. This potential, however, may not be fully realized through private-sector technology transfer alone. (7) Public-sector staff often feel inadequate next to better-supported, private-sector staff and thus avoid contact with them. Such avoidance can prevent cooperation in technology-transfer activities between private and public-sector organizations.

Recommendations of the study include both policy and project-level suggestions to promote increased private involvement in the extension system. **At the policy level:** (1) Liberalize input-supply markets to increase technology transfer through private channels. As long as excessive barriers do not prevent entry, input suppliers will respond to demand for their technology. (2) Encourage export of high-value products and create a positive policy environment for investment. The high-value export business -- flowers or fresh fruits and vegetables -- is best run by entrepreneurs with technical know-how, market connections, sufficient investment capital and a certain source of financing, especially during periods of economic down-turn. (3) Develop agro-processing industries to encourage private technology transfer through out-grower schemes. (4) Strengthen farmers' associations. As they develop, these associations may well hire their own extension staff to service members. This function is only one among many that strong farmers' associations typically undertake.

At the project level: (1) In areas where the private sector is involved, promote a maximum support/minimum staff (MAX/MIN) strategy. Where private technology transfer is related to a specific, strong, commercial niche, reduce public-sector technology transfer staff to a minimum, but provide the remaining staff with adequate training and support to allow them to play a coordinating role. In addition, examine possibilities for subcontracting the private firm to use their own staff to disseminate information about other crops. (2) Where appropriate, encourage commodity-focused farmers' associations to assume more responsibility for extension and research. This option is long-term for Africa, but can be encouraged immediately by providing training and an appropriate policy environment, such as leaving farmers' associations free of government intervention. (3) Improve the quality of public-extension staff in order to use them more efficiently in the following ways: increase their capacity to adapt and test new technologies in the field; strengthen their ability to diagnose specific problems of farmers in their area and to teach farm management; and improve skills in the use of different media, as well as staff ability to work with groups. (4) Organize private sponsorship for farmer-service centers and agricultural shows. Such activities will assist in bringing together private-sector resources for input distribution and technology transfer. Private farmer-service centers -- perhaps managed by a farmers' association -- would be useful in areas where access to needed inputs is limited. (5) Join in the efforts of International Organization of Agro-chemical-Product Manufacturers (GIFAP) to promote safe use of agro-chemical products through training

of both private and public-sector staff. The private sector in African countries should be lobbied to contribute funding to educate the public about the dangers of agro-chemicals and household chemicals.

To maximize the benefits of private technology-transfer activities, an ongoing need exists for coordination between public-sector and private-sector technology transfer. To address the primary constraints to technology transfer in SSA, inefficient public-sector extension services must be successfully addressed. Public-sector extension services remain the sole source of essential technical messages to smallholder farmers. The past 10 years or more of reorganization of the structure of extension systems, as well as large amounts of funding for vehicles, training and technical assistance have not substantially improved the effectiveness of public extension service in most SSA countries. Based on the evidence gathered in this study, private-sector technology transfer is not -- in and of itself -- a solution to the problems associated with private-sector technology transfer and improving smallholder productivity in Sub-Saharan Africa. There is a lack of motivation in most public-sector extension institutions because these institutions generally do not have reward systems based on field performance. Thus, in addition to an expanded role for the private sector, efforts are needed to improve incentives to public-sector field staff and especially to their immediate supervisors. Introducing more competition into the provision of public extension services, such as contracting out activities to firms or NGOs, may also provide incentives to improve public-sector technology transfer.

1. Background

1.1 Introduction

The primary objective of agricultural extension in Sub-Saharan Africa is to increase demand for and utilization of agricultural technology as a necessary condition for increasing agricultural productivity. Agricultural extension services have typically been conducted by the public sector. However, the high, recurrent costs of extension and the growing concern for sustainability in development overall has led to a new focus on how to both streamline public-sector extension and supplement it with activities undertaken by the private sector. In most of Sub-Saharan Africa, private technology transfer -- the supply of information on agricultural technology by organizations in the private sector -- can serve only as a complement to public-sector services, which will continue to be very important in Africa in the medium term. Perhaps most importantly, coordinating technology transfer with the private sector could allow public-sector resources to be focused on resource-poor areas, where there is little incentive for private involvement.

To encourage the private side, the macroeconomic environment must provide incentives for investment. To this end, barriers should be removed which discourage private-sector entry -- as input suppliers, agro-processors and/or exporters -- into either technology markets or commodity markets. Where government control of commercial activities in agriculture is dominant, private-sector technology transfer is unlikely.

1.2 Purpose

In order for USAID and other donors to support the private sector's role in supplying information to farmers, detailed information is required on commercial technology-transfer activities. Specifically, the Africa Bureau requires information to provide support to USAID field missions for use in their agricultural-technology development and transfer projects. The purpose of this study was to gather information on private-sector technology transfer needed by the technology-development and transfer unit of the Africa Bureau to support the field missions. The study is part of a larger effort to study agricultural technology and the private sector -- the Technology Development and Transfer Initiative. This initiative addresses a range of factors related to agricultural technology, including the following: research, technology transfer and utilization of innovations, production, processing, agribusiness, marketing and impact on end users.

1.3 Method and organization of the report

The hypotheses of the study is that the private sector can complement public-sector services in the transfer of agricultural technology to increase agricultural productivity in SSA. In addition, the study sought to identify specific ways to encourage public/private sector coordination. The method of the study includes both a literature review and field work in three SSA countries -- Zimbabwe, Kenya and Mali. (The question guideline used in the field is in Annex IV.) Kenya and Zimbabwe are clearly two of the most important countries in terms of commercial agribusiness. Mali had a wide variety of contract-farming schemes in the mid 1980's and a growing number of autonomous farmers' associations or cooperatives.¹ These countries provide the opportunity to study a range of different types of private organizations which supply technology-transfer services and allow for coverage of the continent from West to East to South. For each country, an inventory of private-sector technology transfer is provided, along with a discussion of the kinds of activities the private sector might undertake in other countries. Possible areas for increased complementarity between private and public-sector technology transfer are also identified.

¹ As documented by C. Mock and J. Martin

The report includes the following: a summary of the literature on private technology transfer; a discussion of the private-sector outlook toward business in Africa; country studies; and conclusions and policy recommendations.

1.4 Definition of technology transfer

In the study, private technology transfer is defined as **the supply of information on agricultural technology to a range of clientele by organizations in the private sector.** The study will also consider related goods and services necessary for adoption of technology. Technology transfer involves both extension types of activities and the process of moving technology between countries and institutions. This study focuses on extension activities. The private sector consists of both commercial and non-commercial entities which are not controlled by national governments. However, this report focuses on commercial organizations. On the commercial, or profit-driven, side of the private sector are input-supply firms, individual producers and associations, agricultural processors, technical-assistance consulting firms and private banks. On the non-commercial side of the private sector are NGOs, PVOs, and private-sector targeted aid programs. In addition, some entities cross over the public/ private line, such as universities and *parastatals*. Such organizations are addressed in this report, even though an in-depth discussion of public-sector technology-transfer activities is outside the scope of this paper. Finally, the project also examines the relationship between the private and public sector in regard to technology transfer.

2. Literature review

Detailed information on how private-sector technology-transfer activities are conducted and managed in Africa is scarce. Private agribusiness activities in Africa are somewhat documented, especially in the area of contract farming. Private technology transfer has been discussed in a number of studies supported by USAID. However, these studies have tended to address the topic in general terms, without much field-level information.

The discussion of private technology-transfer activities is usually associated with a specific type of organization. Few documents focus on private-sector technology transfer. This literature review is broken into the following sections: (1) a discussion on the literature of how different types of private organizations are involved in technology transfer; (2) a summary of key, relevant points from the literature review; and (3) a discussion of the private-sector outlook toward business in Africa, with a special focus on agriculture.

2.1 Private technology transfer by organizational types

Most private organizations conduct extension as a part of their overall activities, not as their primary objective. Most countries include a mix of organizational types.² Organizations typically involved in the extension system include the following: government ministries or departments; private agribusiness firms, such as input suppliers, agro-processors and/or exporters; *parastatals*; consulting firms; farmers' associations; non-governmental organizations (NGOs); and educational institutions.

2.1.1 Private agribusiness firms (PAF)

Private agribusiness firms are international or domestic private companies which sell agricultural inputs and purchase and/or process output. Such firms usually provide information, not as their primary activity, but as a necessary part of their overall business. For a processing firm, the key elements are ensuring that certain quality and quantity levels are maintained. For an input supplier, the primary extension task is to build and maintain demand for the firms' products.

"Private-sector firms become involved in extension because they believe this involvement will increase their profits or enhance their ability to survive. Private sector firms can play a predominant extension role for *particular inputs, particular outputs (i.e. commercial crops and commodities) and for particular farmers and in particular geographic areas. Private firms cannot substitute completely for public agencies.*" Agricultural processing firms, for example, may enter into contractual agreements with groups of small and medium-size farmers and/or with producer cooperatives, providing extension services and inputs as a means of assuring the supply and quality of the particular raw material or commodity for their factory. Firms that supply agricultural inputs, such as seeds, chemical fertilizers and pesticides, may use various outreach mechanisms to provide farmers with a range of technical and managerial information to both assure that their products are used correctly and increase agricultural production and income to the farmers. This provision of information by private, agricultural suppliers also assures more consumers will buy more products in the future (Rodgers, 1987, p.14).

² "While the extremes correspond to the distinction between 'public' and 'private' services, much extension occurs within intermediary, mixed institutional types..." (Moris, 1991, p.60).

Processing firms may operate outgrowers' schemes for a particular commodity. The production-management contract is a mechanism which processing firms use to assure that the firm appropriates the benefits of their extension activities. On the farmers' side, the contract reduces the risk associated with trying new methods. In the case of input suppliers, extension is an important part of creating demand. It is often worthwhile for private firms to supply extension without being able to see any isolated benefits attributable to just extension. As farmers adapt to the new methods, they need less intensive extension services. In the case of contract farming, once new methods have been introduced, the intensity of the contact between the firm and farmers can be reduced. This has been observed in many contract-farmer schemes (Watts et al. 1988).

Input suppliers typically provide information that is part promotional and part educational. The information may be a part of a whole package of inputs and other services. While this information is a public good, the suppliers can charge for it by tying it to a certain product. Thus, the information provided by input suppliers will not provide the same utility to all farmers. Information is also provided by processing firms. While this information is a public good, farmers may not be able to benefit from such processor-disseminated information unless they are working as outgrowers. Farmers' work as outgrowers, however, gives them access to inputs, markets, and transport which are complements to agricultural processing and the information provided by processors.

Private-sector processing/marketing firms or input suppliers are trying to maximize profits and, thus, have no incentive to supply information from which they cannot appropriate benefits. These firms may, however, supply information to promote sales, to instruct customers in the use of a product or to "ensure continuous supply or quality of agricultural products for marketing and/or processing (USAID, 1985)". Private consulting services want to sell information. But they will only provide information to farmers that are willing to pay for their services. As a result, these consulting firms primarily serve large, commercial farmers. Non-commercial farmers value information, but the benefits are not great enough to justify allocating monetary resources to acquire it. Producers' associations want to maximize benefits to their members and thus will only provide extension to a select portion of the population.

2.1.2 Parastatals

Parastatals, such as commodity-marketing boards, are quasi-public organizations which function as autonomous companies although they are owned by a government. In the agricultural sector, they generally have primary responsibility for certain commodities or other activities such as production and/or distribution of agricultural inputs or equipment. *Parastatals* share many of the same characteristics of PAFs. *Parastatals* have the same, basic incentives to provide extension services as private firms. This incentive is primarily to guarantee control over the crop. As with a PAF, extension provided by a *parastatal* is only a part of the overall activities of the firm. A common characteristic of *parastatals* is the "vertical linkage of all services concerned with a particular export crop, including adaptive technical research, credit, supply of planting materials and inputs, and single-channel marketing" (Moris, 1991, p.64). Extension is thus provided as a part of a package of goods and services directly related to the primary objective of the *parastatal*. However, due to the *parastatals'* government-owned status, incentives for effective management, including management of extension activities, is relatively weak in *parastatals*. Problems that often cause *parastatals'* extension programs to go awry include the following: political pressure to add excessive numbers of low-level staff, a condition which leads to high overhead costs and other inefficient personnel policies which characterize the public sector.³

³ Additional problems not directly related to, but nonetheless affecting, public sector extension services are breakdown in the timely supply of inputs and services, long delays in payments to growers for crops received due to low levels of liquidity (Moris, 1991, p.66).

2.1.3 Private consulting firms (PCF)

Private consulting firms that provide extension services for a fee consist of consultants with expertise in such areas as agronomy, and livestock health, among others. These firms may also be estate-management firms. Consulting firms may sell their information services directly to farmers or may work on contract for government or private agribusiness firms or *parastatals*. In the case of most other organizational types, the information services provided are a means to an end: selling a product, getting raw materials for processing, rural development and so on. In the case of PCFs, the supply of information and related services is an end in itself. These companies either work for independent clients or as contractors for government. The media is also an example of dissemination of information as an end in itself, as is the case of private agriculture magazines and radio programs. The goal in both cases is to make money by selling valuable information in a timely and useable way. For this reason, direct sellers of information have a vested interest in maintaining the quality of their product in order to maintain their market share.

2.1.4 Farmers' associations (FA)

Farmers associations are organizations made up of agriculture or livestock producers for the purpose of providing services to its members. Autonomous farmers' associations are part of the private sector. Services provided by FAs might include input supply, marketing, information, credit, a political voice and decreased exposure to risk. The incentive for FAs to provide extension to their members is part of the overall goal to improve the welfare of the group in terms of productivity, commercial competitiveness and so on. Through membership fees or other charges, FAs recoup the cost of extension and other services and thereby avoid the "free ride:" problem which characterizes public goods. Thus, FAs are an organizational solution to market failure.

It is often the case that farmers' associations are involved in both the supply and demand sides of the extension market. Farmers' associations focused on important cash crops such as coffee, sugar and cocoa can be very powerful and share many of the characteristics of private processing/marketing firms or *parastatals*. Additionally, FAs provide an opportunity for cost-sharing with the public sector for provision of extension services for food crops. FAs may hire their own extension staff, or borrow them from the public sector for an additional fee (in money or in-kind). Finally, they may send their own members for training and have them return to disseminate information to their members.

2.1.5 Not-for-profit, non-governmental organizations (NGO/NFP)

Not-for-profit NGOs are domestic or international organizations, such as church organizations, private foundations and private-development organizations. Almost all NGO projects related to agriculture have an extension component. Some NGOs establish for-profit companies, which operate similarly to PAFs. Typically, however, if business is poor, they have back-up funding available from private donors. Most NGOs have close and continuous contact with project participants and are often better at providing extension to resource-poor farmers in a project format than government organizations, but on a location-specific basis. NGOs tend to operate on a small-scale in specific, regional areas. In some cases, they work together with private processors or marketers to incorporate a development focus into the business activities of the firm.

2.1.6 Formal educational institutions (FEI)

Universities, colleges, and technical institutes play a number of roles related to extension. These roles are important to both the public and private sectors. These institutions are usually in the public sector, but may be funded in part or totally by NGO/NFPs or international-donor organizations. Educational

institutions may have extension programs of their own for the surrounding community, or they may be primarily involved in training young people to work in public extension organizations or in the private sector. Additional contributions of such institutions to the extension system are basic and applied research, whose results are disseminated by both public and private extension -- including consultants -- and farmers' associations through on-farm trials and other mechanisms.

A key role for educational institutions in regard to energizing the private sector, especially in developing countries, is re-orienting curricula from its focus on preparing students for work as civil servants to educating them for work in the private sector. Formal education also enhances possibilities for using written materials, such as posters and pamphlets, for extension purposes. As noted by Byerlee (1987) "the cost of extension should be significantly reduced by competencies in literacy, numeracy, and cognitive skills imparted through schooling. Better-educated farmers can exploit a wider range of information sources" (pp. 38 - 39). Investments in formal education, especially with special focus on developing diagnostic and decision-making skills, may be a better use of public-sector investments than widespread, public-sector, field-extension staff. However, in areas where education levels are a binding constraint on increased agricultural productivity, investments in education will only yield results in the next generation of farmers. Thus, extension efforts to bring the current generation "up to speed" on managerial skills associated with new technologies are often necessary. The key is to plan the public-sector-investment institution building for the next generation and not build up large bureaucracies on intermediary measures.

2.1.7 A mix of organizations is required

Many different types of organizations are involved in information supply as integral parts of the agricultural technology and information system. The above list is not meant to be exhaustive, but to give a basic indication of major types of organizations involved. For example, organizations such as financial institutions, agricultural banks or savings groups may provide advisory services. For each type of organization, many sub-categories exist for commercial, private-sector organizations. No single type of organization provides producers with all the information they need nor with unbiased information. The public sector is influenced by political and bureaucratic agendas. Private information is either tied to the sale of a product (technology markets) or the maintenance of specific quality and quantity standards in production (commodity markets). For example, information may be provided to outgrowers on how to maximize production of a certain commodity at a given quality level, thus enhancing the profit potential for private agribusiness firms. The same firm, if it is focusing on short-term to medium-term profits, may not have an incentive to inform the farmers or their neighbors of the dangers of soil erosion and water contamination associated with long-term implementation of the production process. In the case of farmers' associations, information may be technically unbiased, but focused on a specific commodity. Other commodities may, however, be covered by other associations. In the case of not-for-profit NGOs, the main objectives tend to be altruistic, political or religious. These organizations provide extension as a part of project implementation, which aims to serve a specific group or area. The information the NGO/NFPs provide is biased by that agenda.

As each type of extension supplier has limitations, the objective becomes attaining the best mixture of public, private commercial and not-for-profit NGO services. As Roth (1987) asserts, the public sector in general is overly burdened with numerous activities, and moving some of them to the private sector might allow more effective implementation of essential services. While extension services cannot be totally privatized, the public sector can more actively seek to collaborate with the private commercial firms and not-for-profit NGOs to improve the overall availability and quality of extension services. In terms of the public sector, government needs a well-defined role in the agricultural technology and information system, a role that primarily involves responsibility for conducting technology-transfer activities that can be characterized as essential public goods and services. The government's role in

technology transfer would also allow for close coordination and sharing of responsibilities with the private sector.

2.2 Summary of points from the literature

As noted above, little literature -- journal articles, books or working papers -- focused specifically on private technology transfer. The topic tends to be addressed in the context of a broader subject, such as articles on different industries in agribusiness agro-processing. The following main points were distilled from the literature review on private technology-transfer activities:⁴

- As the agriculture of a country develops, private and not-for-profit extension tend to take over some of the responsibilities of public-sector extension services, as well as providing additional information services.
- In the early stages of agricultural development, contract-farming schemes and farmers' associations are perhaps the two most prevalent forms of private extension operations. In many developing countries, such organizations may have a mixed public/private structure.
- Different private organizations have varying levels of expenditures on extension services, depending on the potential benefits balanced against costs. Farmers will only pay for information if it is unobtainable for free and the marginal benefit is greater than the marginal cost of acquiring it.
- In developed countries, as agriculture has become more commercialized -- as use of purchased inputs rises, farmers increase their emphasis on marketing and agro-processing activities expand -- the role of public extension services changes. Public extension tends to become more specialized, focuses on regulation, maintenance of natural resources, organization of events together with the private sector and special programs for the resource-poor.
- Public investment in the development of a part of the agriculture sector which successfully makes it more attractive to both domestic and foreign investors will lead to private technology-transfer activities.
- In circumstances where appropriable benefits are few or non-existent, no incentives encourage private investment in technology transfer by either farmers or commercial firms. When no technological package is available, public extension and non-profit NGOs are the most appropriate organizations to identify and implement options for resource-poor farmers.

⁴ The information summarized in this section is distilled from a wide range of sources. (See the bibliography.) Most pertinent of the AID sponsored studies which in some way discuss private sector technology transfer are: Goldsmith 1985 (on private agribusiness and the small farmer), Mock 1986 (trip report on contract farming in Mali), Mooney 1985, USAID 1989 (general paper on USAID and agricultural extension), USAID 1985 (theoretical overview on private extension), Watts, Little, Mock, Billings, and Jaffee 1988 (on contract farming).

3. Private-sector outlook

The private sector, whether "for-profit" or "not-for-profit", has a different outlook than the public sector. The public sector is primarily public-service oriented. Its accountability is to a public audience and its measure of success is in how much service, or how many programs are put in place. There is little financial accountability, only a budgetary responsibility and/or constraint. The public sector is often characterized as being more humanitarian and, because its operations are not dictated by monetary profit, somehow more ethical.

The private sector regards each opportunity from an investment point of view. The investment is directly measurable in terms of the "cost" of time, materials, money and people. Accountability is measured by the rate of monetary return on these investments. Successful private sector endeavors, particularly for-profit companies, do not undertake investments without a thorough investigation of all the factors which will influence success. The key factors that a private firm would likely consider before making an investment in Africa are the following:

- market potential for their product or service;
- political and business environment;
- capital-expenditure requirements;
- proprietary-information protection;
- establishing local representation;
- customer orientation of services; and
- constraint resolution.

3.1 Market potential for the product or service

Demand for new products and services in Africa is long in developing. The decision to try to sell into a new market has to carry with it an internal calculation of how long will it take to "pay its own way". The larger or more creative the firm, the more likely it will be able to wait for a developing market. Invariably, some firms will make a single sale and depart. However most reputable firms would prefer long-term, sustained and predictable sales. Identifying a market for a particular product in the largely amorphous "African market" is not an easy task. Just finding a present or potential sales environment requires careful study of what is already available and what unique role new goods and/or services will play. Quite often similar products or identical products are already represented in the market. Foreign firms may have a competitive edge because of traditional relationships.

Firms generally prefer entering a market with a new product "off the shelf." However, local testing or adaptive research is usually necessary to fine-tune the product. Multinational firms have an advantage in that they are able to draw upon experiences in other countries and can find similar markets there for their products.

Larger firms also play a game of "me too". By watching the competition open a new market, they will follow close behind with competitive or complimentary products or services. Some industries are "leaders," upon which a whole continuum of goods and services are needed for success. Good examples are crop commodities which require seed, fertilizers, agro-chemicals, processing equipment and sales organizations.

3.2 Political and business environment

Once a potential market has been identified, an assessment of risk in terms of the political, legal and financial environment is critical for a private firm. No private-sector company will invest time and resources to develop an on-site operation in a hostile environment. While the political shifts in many African countries have been unpredictable, it is possible to evaluate the business environment. By studying the history of the private sector and comparing it to the political environment, a firm can develop a sense of what the future will hold for their investments. The firm's success hinges on its ability

to more often than not gauge their investment outcome correctly, thus limiting exposure of the company's resources.

Often rhetoric and reality are very different. One case in point is Zimbabwe, where the President espouses socialism, but capitalism, in fact, keeps the ship of state afloat. The contrary would be true of Cote d'Ivoire, where the law openly supports the private sector, but political accommodations are necessary to do business. Expropriation of private assets is far less common in Africa than is commonly believed. Many governments, upon independence, did expropriate property or paid minimal compensation. Since private firms naturally resist exposing their resources to this kind of risk, African governments will usually guarantee the company compensation and/or legal recourse.

An additional factor to be assessed is repatriation of profits. A private firm can be compensated in any number of ways. Each firm will balance the method of payment against the timing of payment and the level of investment. Most reputable firms will accept payment over time, as well as splits between local and hard currencies. However, firms will not enter into financial arrangements that are not profitable or those under which they will not receive an equitable return on investment.

3.3 Capital-expenditure requirements

After a private firm has found a market and assessed the risk involved in entering it, the firm must program the rate and timing of expenditures. To do this, a firm will prepare multi-year budgets and make all possible, predictive assumptions to reflect a series of scenarios. The budgets then become management plans, to be used as indicators of success or failure. Some firms are either willing or compelled by the nature of their business to make large, up-front commitments. This is particularly true in the manufacturing or processing industries, such as chemical formulation, milling, or seed conditioning. In these cases, firms will require greater assurances from the host government, Overseas Private Investment Corporation (OPIC) insurance or higher rates of repatriation of profits.

In cases where products and services can be directly imported, payment is usually through letters-of-credit or against direct-sales receipts. Some firms, especially large multi-national corporations, are willing to undertake barter agreements. Regardless, however, of the form of payment, a private-sector entity attempts to assess all possible options. The chance of success is given the same assessment as the chance of failure. It is never assumed that spending money to promote a service or line of goods will result in success. Again, accountability and profitability is what drives the private sector and creates its success.

3.4 Proprietary information protection

If a firm cannot protect its information, processes or product, it loses its uniqueness and will soon be out of business. The nature of the product or service will determine the degree of proprietary protection required to preserve profitability. Means of achieving such protection are taken into account in the firm's risk assessment. While several countries in Africa have laws that protect patent and copyrights, most do not. With the exception of Kenya and RSA, no country has legislation protecting plant-breeders' rights. Protection of proprietary information shapes the firm's business plan, staffing pattern and import procedures.

3.5 Establishing local representation

One of the most difficult, but most necessary activities a company marketing goods or services in Africa must endure is finding the proper method of representation. Options open to the private sector are usually predicated by investment laws and regulations. Often, certain industries are not open to domestic or foreign private firms. *Parastatals* are still fairly common in the agricultural sector in Africa.

When a foreign business searches for a local representative in Africa, it will find that matching areas of expertise with a local firm and staff is usually a serendipitous occurrence. Few experts in agricultural businesses can be found outside of Kenya, Zimbabwe and RSA. At best, individuals or local firms that have coincidental interests will be found. It is then up to the investing firm to develop through in-house training the needed expertise.

For the most part, foreign companies can not have wholly-owned operations in the private sector. Cote d'Ivoire, Zimbabwe and RSA are exceptions. But the usual rule is for joint ventures with local companies or with government institutions. Some countries will allow for wholly-owned subsidiaries as long as the company is not involved in commercial activities. This allowance provides a window of opportunity for companies that wish to establish regional or representational offices in a country. The arrangement is common in Cote d'Ivoire, Kenya, and Zimbabwe.

3.6 Customer orientation of services

Once a private firm is established in the country, it must develop a program to test and demonstrate the efficacy and usefulness of its service and/or products. It is necessary to make sure the product meets indigenous cultural approval. Activities to determine these qualities are not usually much different than those practiced by the firm in its own country. However, translation of promotional material, demonstration techniques, identification of the target audience must be sensitive to each country's unique culture. Cultural factors are particularly important when dealing with products whose use entails changes in traditional farming practices, crops, food preparation and dietary changes.

3.7 Constraint resolution

Flexibility is probably the single most important factor in making the private sector successful in delivering goods and services. As part of the planning process, private-sector firms factor-in those things that can go wrong. By anticipating problems, some can be resolved before they constrain the company's activities. In addition, the private firm is constantly monitoring itself internally. Almost daily, expenditures of time, money and other resources are accounted for, as well as return on those investments. As soon as problems are identified they are addressed and solved. Plans are checked to see if the assumptions were (or are) correct. If the marketing environment has changed, then the firm will make adjustments mid-stream.

3.8 The agriculture-related private sector in Africa

All the above factors affecting the private sector influence the amount of technology transfer ongoing in Africa. The general nature of the private sector has a direct effect on how much private information supply is on-going in the country. If a country's economic and political atmosphere is conducive to entrepreneurship and investment, agribusiness opportunities will grow, foreign and domestic companies will set up business and in this course undertake technology-transfer activities. The question for the public sector is how to best manage the privatization process to be sure that essential public goods are provided.

Africa's private sector is heterogeneous. Well-established, multinational firms are at the top; a few wealthy traders are in the middle, such as numerous small contractors and input supply firms, small-scale, family- trading businesses dealing in livestock, exports and retail goods. A few successful, commercial agricultural services developed under colonial rule for relatively large scale farms and then extended to small land holders. The crops involved were "either estate crops, such as tea, coffee or sugar, or else mixed grain and livestock produced on favored, highland soils. The initial commercial growth took place before currency and import controls were instituted, and after independence, the companies involved were viewed as protecting a valuable national asset." (Moris, 1991, p.67)

Many obstacles prevent growth of private sector firms that would potentially become suppliers of private extension services in Africa: rigid import controls, high transport costs, high storage losses, unpredictable

swings in volume of produce traded, excessive bureaucratic regulations and corruption, unstable political structures and violence due to war or armed banditry (Moris, 1991, p.66-67). However, as more advanced farmers progress, demand increases for specialist advice from subject-matter specialists, universities and the private sector. Portions of the farming communities in Kenya, Botswana, Zambia, Côte d'Ivoire and Zimbabwe already rely on such sources and to a lesser extent Nigeria, Mali, Ethiopia, Malawi and Uganda. As farmers' associations gain strength in many countries in Africa, they are taking on more responsibility for marketing, input distribution, extension and even research. Often, the incentive behind their new activities is increasing commercial success. This success leads farmers to place a higher value on services accountable to them and which can generate revenue.

In Africa, smaller firms may have a difficult time providing their own extension services due to the expense of training agents and/or supporting farmer training and supervision. However, talented public-sector staff regularly move into the private sector. Africa has fewer trained agronomist/extensionists available than Asia and Latin America. Some larger, commercial schemes have formal training programs. Smaller companies are more likely to work with farmers that already know the crop. Some small firms may establish their own extension service and rely on government extension to supplement their efforts. "For example, the Sidiki Sow company in Mali provides, in their own words, 'some advice' to their 682 contracted farmers beyond the contract specifications of planting and harvesting dates, and encourages the farmers to seek the assistance of government extension agents as well." (Watts, et al., 1988, p.176 -177) In Madagascar, local entrepreneurs, often in association with foreign partners, start up well-organized agricultural operations, including extension, in specialized products, such as wheat for the local flour mills, barley for the breweries that make good beer, gherkin pickles for export purposes, tea, cacao, dairy farming, dry beans for export, temperate fruits, export of luxury products such as long-grained rice. (Bredero, personal communication).

In the case of traditional cash crops -- tea, coffee and cash palms -- technology transfer is part of a vertically integrated operation with production and processing combined in the same operation. The basic functions typically conducted by such organizations are production, processing, transport, delivery, extension and financing (Blume, 1971, p. 24). Two of the most well-known, export-commodity *parastatals* in Africa are the Kenya Tea Development Authority (KTDA) and La Compagnie Française pour le Développement des Fibres Textiles (CFDT) in Francophone West Africa. The extension services of both were characterized by strict discipline. "The schemes that are considered to be more successful show extension ratios for inexperienced farmers of 1:150 or less." In their early years, the British American Tobacco company (BAT) in Kenya had a ratio of 1:50 and KTDA 1:120, BAT/Tanzania at Tumbi 1:116. A nearby, but much less successful Tanzanian-government tobacco scheme at Urambo has a 1:323 ratio. Evaluations of these schemes have concluded that intensive low ratios -- or lack thereof -- are an essential factor behind the success -- or failure. (Watts et al., 1988, p.177) However, over time the ratio can be increased. For example at Tumbi, the ratio was increased from 1:116 to 1:575 between 1965 and 1970. However, fairly intensive ratios are considered desirable even after farmers adopt new skills to ensure that they "adhere to desired crop practices and to control possible crop leakage." (Watts et al., 1988, p.177)

The study examines a range of private-sector technology-transfer activities in three Sub-Saharan African countries. Most of these activities fit under on the following three, major organizational types: input suppliers; marketers or processors; and farmers' associations.

4. Overview of the three countries

The countries included in this study -- Zimbabwe, Kenya, and Mali -- were chosen to reflect a range of different levels of private-sector involvement in technology transfer. In Zimbabwe, a large number of private firms serve the commercial, agriculture sector, which remains dominated by white Zimbabweans, but also includes many of the African "nouveau riche" as well as an integrated network of commodity-focused, commercial farmers' associations. Private involvement in agriculture in Kenya has been mixed with government control through both the role of *parastatals* and the influence of a select, few political and military figures with large commercial farms. However, the private sector is very involved in input importation and distribution, production and export of horticultural crops and major, traditional cash crops, such as coffee and tobacco. In Mali, where a pro-liberalization government took power in March 1992, the private sector is in the early stages of involvement in input supply and marketing. The large-scale, commodity-focused *parastatals* have a long track record of experience, both with their own extension systems and in helping to organize and work with farmers' associations -- or associations villageois (Avs). The once-vibrant Malian horticultural-export sector, which included technology-transfer activities, has, however, severely deteriorated since the mid-1980's.

Although the agricultural sectors of these three countries differ in fundamental ways, they also include the following six, noteworthy similarities. Each country is producing a relatively diverse range of commodities. They have or, in the case of Mali, in the recent past had dynamic horticultural-export markets. They all produce cotton, or, in the case of Kenya, have in the past produced cotton as a major cash crop. Tobacco is an important cash crop in each of the three countries.⁵ All grow a mixture of cereals for domestic consumption, including rice, maize, sorghum, and millet, as major commodities. And each country has large areas of arid and semi-arid lands, where the primary agricultural activity is pastoral or agro-pastoral and infrastructure and services are less developed than in relatively high-potential cropping areas.

The agricultural sector in these nations also include some other similarities. In terms of extension, Kenya and Zimbabwe both have national extension systems based on the model of British colonial agricultural extension. Mali's extension system evolved out of the classic French colonial, commodity-focused model. And each of the three nations have had, and/or are receiving considerable international-donor support for public-sector extension, including World Bank- funded, national extension projects in each of the three nations.⁶

A fair amount of commercial, private-sector activity, in terms of technology transfer, has also emerged in these countries. In Zimbabwe, for example, the input-supply sector and the farmers' associations are involved in technology development and transfer. In Kenya, both private and *parastatal* marketers and processors of specific commodities are highly involved in technology transfer. In Mali, private involvement in technology transfer is already taking place and, in the immediate future, is likely to expand in three areas -- private veterinary pharmacies; input suppliers and farmers' associations.

In each country, the study examined technology-transfer activities that the private sector is undertaking. The results of this examination were the following: an inventory of private-sector technology transfer in these three countries; new understanding of the kinds of technology-transfer activities in which the private sector is most

⁵ Mali produces burley and the other two produce both flue-cured, burley and some minor amounts of oriental tobacco.

⁶ Phase two of the National Agricultural Research, Extension and Education Project is in the planning stages for Zimbabwe, Phase two of the National Extension Project in Kenya has been approved, as has the first phase of the Project National Vulgarization Agricole (National Agricultural Extension Project) in Mali.

likely to become active; a better awareness of conditions which best assure private-sector participation in technology transfer; and a collection of ideas that might be adapted in other countries. In addition, the study emphasizes identification of possible areas for increased complementarity between private and public sector technology transfer activities. In some cases private sector technology transfer activities may be able to reduce the current financial burden on public extension organizations and/or increase available extension services (in some areas) without increasing the public sector burden.

The organization of the following country studies is as follows. Discussed first are technology-transfer activities associated with the input-supply sector, including (1) the structure of the input-supply markets for agro-chemicals, seeds, fertilizers, equipment and credit and (2) related technology-transfer activities. Usually, input suppliers undertake technology-transfer activities in order to increase sales of their products.

Discussed second are technology-transfer activities associated with farmers' associations. Farmers' associations which are fairly prosperous often undertake their own specialized research and extension services to meet the needs of their members.

Discussed third is technology-transfer associated with marketing and processing of agricultural commodities. Processors and exporters of agricultural products have a stake in both the quantity and quality of their supplies and for this reason are often involved in a continuum of activities to encourage technology development, technology transfer and technology utilization. Extension activities undertaken by such processor or exporter firms tend to include management of their own field staff.

Discussed fourth are other private organizations directly or indirectly involved in technology transfer. The fifth section includes selected and detailed cases from each country.

4.1 Zimbabwe

Of the three countries included in the study, Zimbabwe has the most dynamic private-sector involvement in agricultural technology transfer. Several input-supply companies with a strong profit base in the commercial sector⁷ maintain a sales force in the small-scale farm sector. Farmers in the communal and small-scale commercial agricultural sector number about 800,000 -1,000,000 farm families, with about 4,500 in the commercial sector. The well-developed system of commodity-focused farmers' associations, controlled by commercial farmers, provides many opportunities for spill-over of benefits -- especially in terms of research, training and extension -- into the communal sector. Additionally, a number of former employees of both the pre-independence extension service (CONEX) and Agritex work in the private sector. These people have a strong interest in and knowledge of extension, and many are dedicated to finding ways to use the resources of the commercial agriculture sector to promote development in communal areas.

The public-sector service for agricultural extension in Zimbabwe -- Agritex -- is considered one of the best in Sub-Saharan Africa, particularly because of its accomplishment in disseminating hybrid maize varieties throughout the country. However, numerous opportunities exist for increased coordination with the private sector. Some of these opportunities could result in decreasing the financial public-sector burden of extension services. Approximately 2,500 technical staff are maintained under the Agritex budget. (This number is well over 3,000 if support staff are added). The organization's goal is to increase staff numbers to reach of ratio of 1:500 farmers versus the current ration of 1:800-1000. Field staff often suffer from lack of transport, difficulty keeping up with technological change in specialized

⁷ In Zimbabwe small-scale is broken into small-scale commercial and communal (meaning traditional semi-subsistence).

areas and poor middle-level management. Improved collaboration with the private sector could allow for improved extension services without increases in budget or staff size. In addition, introduction of fees for certain public services offered by Agritex, such as soil testing, might help generate revenues for the now tight budget.

4.1.1 Technology transfer related to input supply

4.1.1.1 Chemicals and fertilizers The chemical and fertilizer-supply industry in Zimbabwe is competitive in the commercial-farming sector. Numerous multinationals have a major presence in the country. Some import and have no distribution network of their own. Others import and maintain sales staff only in the commercial areas. Numerous sales representatives compete for the business of the commercial farmer, and these sales representatives are an important source of information on new technologies. Additionally, local firms import and distribute for multinationals, maintaining sales staff in both the commercial and communal areas. Fifty percent to sixty percent of all fertilizer is sold through farmers' cooperatives. In addition, 35 percent is sold through Farmers' Co-op, a local commercial firm which distributes agricultural inputs and equipment. Communal-area farmers represent only 20 percent of their total sales. Most of the small-scale spraying equipment, backpack sprayers, are manufactured and distributed by Taurus Sprayers. Because importation of other sprayers is restricted, including importation of the United Kingdom's CP sprayer, Taurus Sprayers has an effective monopoly. In terms of technology transfer, they have four sales staff well-trained in use of their product, but only one of these staff works in the field.

The agro-chemical industry in Zimbabwe is well organized under the autonomous Agro-Chemical Industry Association (ACIA), with 14 member firms. ACIA has its own technology-transfer activities, especially in the area of safety or product stewardship, which combines efforts of different member firms and outside resources. Mr. Bradshaw of Taurus sprayers, for example, participates although Taurus is not a member. The organization has a safety committee and is involved in developing a cheaper protective clothing kit. Because the traditionally-used gum boots, overalls and gloves may not be affordable or practical for most communal farmers, Dr. Peter Wells of Shell has headed up an effort to develop a cheaper safety kit. The goal is to develop a kit for between 15Z\$ - 20Z\$, down from 150Z\$ -170Z\$. ACIA also produces a newsletter and has recently published a pesticide-registration book with collaboration of staff from Shell, Agricura and a government pesticide-registration officer, who now works for Shell. So that ACIA could present a safe-use demonstration at the Harare Agricultural Show, Windmill, a local fertilizer and chemical distributor, shared its space with ACIA. Spraying demonstrations were conducted on miniature vegetable gardens planted for the show. The demonstrations were jointly conducted by ACIA-member firms and Mr. Elvis Tembo of the public-sector Agritex.

In Zimbabwe's communal areas, three agro-chemical or fertilizer companies are involved in extension activities -- Windmill, Agricura (no fertilizer), and Zimbabwe Fertilizer Corporation (ZFC). Ciba-Giegy did have a presence in the communal area with its Kohwa Pakuru program. For five years, from 1981 - 1986, CG conducted this program in cooperation with Agritex, other government bodies and other private firms. The program helped establish a precedent for private firms training field-level extension staff -- both public and private -- and conducting extension activities, such as holding meetings and publishing pamphlets and posters. Although the program was sponsored by C-G, all interested firms were invited to participate. When Ciba-Giegy tried to turn the program over to the government, the program ended. The firm is still planning continuation of the program as proprietary information. Shell has one sales representative for the small-scale, commercial farming sector and no network of sales representatives in the communal areas. In the commercial sector, Shell has five representatives. These reps do not need to have any specific level of education, but must be able to discuss products confidently and competently. In addition, two development officers who are trained agronomists are under the Shell agro-chemical manager. These reps provide backup to the field and also participate in product development.

Shell used to have agents in the communal areas, but their presence there was determined not to be cost effective. Instead, Shell reached out to the communal market through the network of local distribution firms. For example, Shell benefits from Agricura developing a distribution network in the communal areas, as Agricura Shell products.

The three active firms with a strong profit base in the commercial sector were initially able to invest in communal-area sales staff. And over time, their efforts have paid off. Agricura indicates that supporting field representatives in the communal area costs 6 percent of their overall budget and generates 12 percent of total sales revenue.⁸ Windmill has a total of 17 sales staff working in the communal areas, including 15 field representatives and two sales managers. The staff cover both fertilizer and pesticides. They work closely with the Agritex staff in the field. On an *ad hoc* basis, they sponsor field days and local agricultural shows.

ZFC also has field sales staff, including two regional managers and 13 representatives covering the country. The ZFC staff also have a technical-services group with five crop specialists to provide technical backup. ZFC works with groups of farmers - savings or ZFU groups. They focus their demonstration activities on agro-chemicals and work closely with Agritex field staff. Because of limited growth in demand for fertilizer and chemicals, ZFC had no plans to expand extension activities. If more seasonal credit were available, they would be more interested in expanding their field demonstration activities. The technical team sometimes provides training to Agritex staff at little or no cost. And the company is willing to expand this training role if Agritex indicates interest.

All three firms use variations on the same, basic extension procedures: field visits by sales representatives to address farm meetings organized by their own reps or by Agritex staff. Agricura is perhaps the most innovative, as they are using the tactic of recruiting local coordinators to extend their field sales staff. In addition Agricura organizes their own farm meetings through groups they have established or developed a relationship with. Most of the other private firms doing extension attend meetings organized by Agritex. The sales coordinators are paid commission and have the incentive of a bonus if they sell over a certain amount (30,000Z\$). They are also provided with bicycles which they can buy on an installment plan. Most of the activities of the three firms with representatives in the communal areas are focused on cotton and tobacco growing areas, and livestock producers. In regions 3, 4, and 5, markets are basically limited to animal health products and the cost of covering these areas with sales representatives is not justifiable. In the areas covered, there is some spillover between techniques learned and new technologies applied to cash onto food crops, especially in terms of fertilizer use. However, the use of agro-chemicals is not economic for most food crops in the communal sector.

It is important to recognize that this type of private extension is limited to areas where there is a strong market for a firms' products and one where the firm is pushed by competition to fight for market share. However, the activities of these firms do provide opportunities for collaboration with the public sector in training, sponsoring of field days, shows and other events, and also perhaps opportunities for the public sector to sub-contract some extension work directly to these firms. This final option could be combined with a max/min strategy for the public-sector extension staff in the area: maximum support would be provided to a minimum number of public-sector staff to conduct monitoring and coordination activities in the area.

The Agricura system is an effective way to increase the sale of the firms' products in increasingly remote parts of the communal areas. However, the public sector has an important role to play. It should be

⁸ The numbers on sales revenue were not available. The costs are 1.5 Zim dollars annually.

recognized that while sales coordinators have a strong incentive to sell chemicals, they do not have extensive training on safe use of dangerous chemicals, nor how to communicate the safe-use message to farmers. This discrepancy can lead to problems if no other information on safe use is disseminated. One possibility for addressing this problem is to encourage cooperative efforts between four existing bodies: the safety committee of the Agricultural Chemical Industry Association (ACIA), the Zimbabwe Institute for Permaculture Training and Extension (ZIPTEx), Agritex -- especially the training division -- and the Zimbabwe Department of Research and Special Services -- especially the product-certification division. These organizations are all in varying stages of dealing with safe-use issues and could very profitably work together. ZIPTEx, which is working with six different NGOs in Zimbabwe, is just getting underway. But due to their NGO membership, ZIPTEx has a comparative advantage in grass-roots, community-education work.

As noted above, another firm involved in technology transfer is Taurus Sprayers. Of their four sales staff, however, only one, Walter Ndebele, travels in the field. The Taurus Sprayers staff are adding another field person with whom Mr. Ndebele will divide responsibilities for Zimbabwe. Mr. Ndebele attends meetings arranged by Agritex agents and also occasionally works with sales staff from other companies to do joint field work. They would do more if they had more resources available and if more competition forced them to fight harder to sell their products. Taurus has also been involved in regional technology transfer with funding from the United Nations Development Programme (UNDP). The Taurus Sprayer staff were part of a project to promote Zimbabwean exports. Company representatives attended trade fairs in Lusaka, Dar es Salaam, Maputo, Gaborone and Blantyre and exhibited their products under the auspices of the GOZ. Locally, the promotion thrust of the company has been aimed at country shows, farmer meetings and discussion groups in both the commercial and communal sector. The company is investigating the possibility of sponsoring peak-time, farmer-discussion radio programs in Shona. The results of promotional efforts have encouraged the company to expand radio shows to a regional basis, but costs and logistical obstacles will take time to overcome.

4.1.1.2 Seeds The seed sector, compared to the chemical and fertilizer sector, is dominated by relatively few firms. The main supplier of hybrid seeds is the Zimbabwe Seed Co-op, which has had a virtual monopoly up to the past one or two years. Lately, however, some new entrants, such as Pioneer Hybrid International, are creating competition. Zimbabwe Seed Co-op conducts some extension activities associated with their marketing program. They have six extension workers who conduct about 20 adaptive trials in the communal areas each year, participate in field days and agricultural shows and, in coordination with Agritex, provide direct technical assistance to some farmers.

Other seed producers and/or suppliers are: Panaar Seed (Savanna), National Tested Seed, Farmers Co-op, Cotton Marketing Board and the Zimbabwe Tobacco Seed Association. The latter three, however, do not have specific field extension activities. Panaar Seeds, specializing in drought-resistant varieties from South Africa, is not in direct competition with Zimbabwe Seed Co-op. Panaar sells 94 percent of their seeds to the communal sector. Their products are more expensive than Zimbabwe Seed Co-op. The drought-resistant, heat-tolerant white maize seed Panaar sells is, for example, five times as expensive as Zimbabwe Seed Co-op maize seed. Panaar has five sales representatives and a field supervisor at the provincial level. They organize field days in coordination with Agritex staff and work on about 40 - 50 field trials annually. Panaar provides seed and fertilizer to some of Agritex's field days and demonstration plots.

National Tested Seeds specializes in horticultural seeds. They also wanted to steer clear of direct competition with Zimbabwe Seed Coop. National Tested Seeds does not conduct technology-transfer field activities with small farmers. However, on their own agricultural and livestock operations, National Tested Seeds is conducting some on-the-job training of agricultural extensionists from Mozambique. In addition, the company's general manager, Mr. Ranby, has proposed to the Grain Marketing Board that

many of the input-supply companies could get together and set up farmer-service centers at or near the Grain Marketing Board (GMB) depots. This idea has been accepted and is being implemented in selected sites. Drawbacks to the plan are the location of most of the depots in Northern Zimbabwe and that some of the depots may soon be closed.

4.1.2 Groups engaged in technology transfer

4.1.2.1 Farmers' associations. Farmers' associations in Zimbabwe are split along large-scale commercial and small-scale commercial and communal lines. Small-scale commercial and communal farmers are represented by one organization, the Zimbabwe Farmers Union (ZFU). The ZFU has recently emerged from the marriage of the old National Farmers' Union of Zimbabwe -- representing some 65,000 farmers in the communal areas or about 10 percent -- and the Zimbabwe National Farmers Union (ZNFU), which was representing roughly 9,000 small-scale, commercial farmers or about 90 percent.⁹ Of the total, 4,660 large-scale commercial farmers, about 4,450 are paying members of the Commercial Farmers Union (CFU). What is now CFU began as general agricultural associations of commercial farmers' grass-roots organizations started by farm families to focus on the areas where they lived and their specific problems. CFU has evolved into an umbrella organization for a number of commodity-specific autonomous associations.¹⁰ CFU continues to be the driving force behind several technology-development and transfer activities for its members. Three key elements of its success are: the Agricultural Research Trust; the weekly magazine, *The Farmer*; and bi-monthly CFU reports. In addition, CFU provides or has provided leadership for some of commodity-specific undertakings, such as the Cotton Training Center at Kadoma.

Commodity-specific associations provide a range of services to their members, including research and extension. The funding of commodity-specific, association services is provided through several means, including the following: membership fees; levies on the commodities when marketed, usually amounting to 0.5 percent to 1.5 percent of gross value of production; contributions; and sponsorship from the private sector. CFU and the commodity-specific associations began conducting research and extension activities after independence. These developments were in reaction to the departure of a number of European Agritex extension staff who moved to the private sector for primarily political reasons¹¹ and the shift of a public-extension mandate to the communal sector. In addition, the development of research and extension activities within these organizations ensured their members that vital, good-quality services would be available for commercial farmers, no matter what path the public services followed. The associations employ extension specialists, referred to as district counselors, who work directly with the farmers in an area, usually on specific commodities. Most farmers are members of many associations and rely upon a variety of information sources, including private consultants. The CFU and the

⁹ NFAZ claimed to have a wider organization covering 500,000 farmers in 5,000 clubs, in all 55 districts as of August 1991. (*Farming World*, September 1991, p.5) However, there are actually only 65,000 paying members.

¹⁰ The associations are the Commercial Cotton Growers Association, the Zimbabwe Tobacco Association, the Commercial Grain Producers' Association, the Commercial Oilseed Producers' Association, the Coffee Growers' Association, the Horticultural Producers Council (there are a number of horticultural groups: most importantly the Flower Exporters Association -just formed in October 1991, and the Fruit and Vegetable Producers Association), the Cattle Producers Association, the Sheep Producers Association, and some new groups: the Ostrich Producers Association and the Crocodile Producers Association.

¹¹ Some were pushed out and some left on their own.

commodity-specific organizations maintain linkages with public-sector research and extension. On the one hand, they receive a range of services from the public sector.¹² On the other hand, CFU provides some services to the public sector, such as training at the Cotton Training Center and collaborative efforts in the field, such as the communal-area farm trials of the Agricultural Research Trust (ART) and pesticide demonstrations at farm shows. Farmers' associations most active in technology development and transfer are the Cotton Training Institute and the Zimbabwe Tobacco Association.

Many of the other associations have similar activities for their members, but do not have as much involvement in the communal sector. Two associations whose representatives mentioned potential for working with small-scale, commercial farmers are the Commercial Grain Producers Association (CGPA) and the Horticultural Producers' Council (HPC). The Commercial Grain Producers' Association (CGPA) has its own agronomist and extensionist, but is encouraging developing a special CFU extension unit aimed at small-scale, commercial grain farmers. Their main obstacle to expanding technology-development or transfer activities within the CGPA itself is a low maize price. The low price limits the funding which the organizations receive through a levy. The Horticultural Producers Council is a lean organization, including only three full-time employees and functioning as an umbrella organization for a number of young associations, such as the Fruit and Vegetable Producers' Association and the Flower Exporters' Association. The HPC also provides market information to farmers on prices and helps arrange air freight. If funds were available, the HPC would help encourage and train small-scale, commercial farmers and communal farmers to grow fruits and vegetables. The HPC has prepared a publication titled, *Tropical and Sub-Tropical Fruit Production In Zimbabwe*, which they are distributing. Some materials on vegetable production are also available through Agritex, and some which are specifically aimed at smaller farmers are prepared under the old Agricultural Rural Development Authority program and the Non-agricultural-Development Authority.

4.1.2.2 Marketing/processing sector. Horticulture is an important marketing area for Zimbabwe in terms of both the domestic and export markets. As the Zimbabwean dollar has weakened and prices for Zimbabwe's traditional cash crops, including maize, have fallen, Zimbabwean farmers have turned to horticulture exports to earn foreign exchange. Commercial farmers, who get extension services through either their commodity-specific associations or through consultants, undertake all Zimbabwean horticultural production for export.¹³ The domestic horticultural market, totally separate from Zimbabwe's export markets, is worth approximately Z\$120 million per year.¹⁴ Produce for the local market is of indifferent quality due to post-harvest handling problems and inconsistent packaging. Almost all technical advice to farmers growing for the local market is coming from Agritex or from donor/government-supported development projects, such as the vegetable project in Mashonaland East under Agricultural

¹² Determine regulations based on international requirements (e.g. chemical residue allowances), and national issues (e.g. pest control, soil and water conservation). Enforcing of regulations such as meat quality control, export regulations, pesticide registration etc. Provision of laboratory services to carry out control measures (such as chemical residual analysis), control of contagious pests and diseases (hoof and mouth, tse fly, etc.) and coordination with international organizations on issues such as trade and research.

¹³ Research on horticulture is taking place at the Horticultural Research Centre at Marondera and Nyanga Experiment Station on deciduous fruit, Chiredzi Research Station, Coffee Research Station - Chipinge, and Marondera on tropical and sub-tropical fruit.

¹⁴ The Farmer, October 31, 1991, p.15.

Rural Development Authority (ARDA).¹⁵ Small-scale producers under such projects, in, for example, Mutoko, receive horticultural advice and written technical information through the project.¹⁶ Some good materials have been developed, but are still used by only a small number of producers. These materials could be used more widely through a cooperative effort of ADA, Agritex and private firms interested in contracting small-scale producers to grow horticultural products for growing domestic demand and perhaps also for export. Extension services for small-scale, horticultural producers remain inadequate beyond specific projects.

The food-processing sector in Zimbabwe relies upon contract farming with large-scale commercial farmers. For example, Cairns, a major food processor, buys a large amount of potatoes, all from commercial farmers, who get technical assistance through the Potato Growers' Association and from consultants. The only small-scale production of raw materials for processing are the following: sorghum for Chibuku breweries, guar bean for Goemat, processed into a thickening, binding or stabilizing agent; and some horticultural production on both small-scale and large-scale contract for Lemco, a subsidiary of Lever Bros.¹⁷ Some processors have been involved in introducing new technologies. An example is Delta Co., which introduced hops production for Zimbabwe's breweries. They now have seven contract farmers growing hops, using sophisticated technology, such as night lighting.¹⁸ Heinz Co. has introduced the Michigan pea bean for use in production of their canned beans. A Dutch flower importer started a horticulture project near Harare with expatriate technical consultants to work with commercial farmers.¹⁹ As Zimbabwean businesses increasingly invest in processing opportunities, such as the large freezing project brought underway by Africa Produce Marketers, more incentives will encourage contracting with small-scale producers and conducting technology transfer in order to get the quantity, quality and timeliness required.

¹⁵ ARDA is now ADA the Agricultural Development Authority.

¹⁶ Project staff and farmers feel the major benefit of the project is the provision of trucks, and the innovation of joint marketing of produce due to the severe transport problems in Zimbabwe. This has been more important than any agronomic innovation but is still technology transfer in the sense that they have adopted a new system of marketing management. In the original project plan it was assumed that technology transfer would be done by AGRITEX, however, extra technology transfer workers and housing would be financed to fill in the gaps. Agritex workers were to devote 20% of their time to horticulture. As an insurance mechanism, the project set up its own small staff of extension workers. For further information on this project see, "Mashonaland East Fruit and Vegetable Project Evaluation." Draft final report. September 1991. Hunting Technical Services Limited.

¹⁷ Lemco has four irrigated farms of approximately 100 hectares each which are being cultivated by farmers who have small areas (approximately 1 -1.5 Ha. each) on the schemes. Contact should be made with this company as a part of future research.

¹⁸ Dr. Woodend is the technical man in the field for Delta. He has researched and developed hops production technology for Zimbabwean conditions.

¹⁹ The expansion of floriculture has led to a new local industry in the construction of greenhouses and plastic tunnels used in flower production.

The Kenyan export industry, to be described in section 4.2, provides a good example of technology-transfer activities that occur when incentives encourage small-scale production.

4.1.2.3 Other private organizations The Africa Project Development Facility (APDF) in Zimbabwe was at the time of this study not engaged in any agricultural activities. However, APDF had plans to soon begin one or two horticultural projects. The APDF focuses on individual projects and does not get involved in sector-level activities. They assess the feasibility of a particular project and then organize the necessary resources to implement it. In terms of technology transfer, they do not generally rely upon the public-sector, technology-transfer service. Rather, they bring in technical assistance as needed. In the case of the upcoming horticultural activities, they are likely to find the needed expertise in the country, as numerous local and international consultants are available in Zimbabwe.

Many large consulting firms and individual consultants provide technical advice to large-scale commercial farmers, primarily tobacco and horticultural producers.²⁰ The consulting firms also assume some internationally funded projects. However, they have little or no interaction with the communal sector. A few small-scale horticultural producers take advantage of these services. Because most production-related issues are covered by associations and input suppliers, consulting firms specialize in specific fields of information. The areas of information typically addressed by consulting firms are the following: analysis of farm accounts; budget and cost control; risk management through crop diversification, e.g. into horticulture; advice on acquisition of farm equipment; financial planning; and specialized, technical questions, including questions on irrigation design or greenhouse-climate control. In the field of general and financial farm management, six companies operate in Zimbabwe, four of which are associated with banks.²¹ Two companies not associated with banks are Peter Thomas and Associates, connected to Price Waterhouse, and Agriconsult. Many companies provide irrigation advice.

The main source of farmer credit in Zimbabwe, the Agricultural Finance Corporation (AFC), is not involved in technology transfer directly to farmers' groups. The AFC has staff agronomists and agricultural economists to conduct feasibility studies. But after the loan is made, they work through Agritex to see to the technology-transfer side of implementation. AFC has training activities for dealing with financial and farm-management issues, and these are sometimes attended by Agritex staff. Credit under non-for-profit NGO programs is often combined with agricultural extension, such as those managed by the Zimbabwe Women's Bureau, Africare and others.

The regional Southern Africa Center for Wheat and Sorghum Research is soon to be established and headed by the current head of Cimmyt in Southern Africa, Dr. Bantayehu Gelaw. The headquarters for the new center will be in Zimbabwe. The center will conduct technology transfer at the level of the NARS.

The Canadian Association for the Private Sector in Southern Africa (CAPSSA) is not engaged in technology transfer with small farmers. But the CAPSSA is importing new technologies into the country and conducting training in connection with CAPSSA joint ventures with Zimbabwean business people. The

²⁰ The three largest consulting firms estimated that the total number of large scale farmers using consulting firms in Zimbabwe is 400.

²¹ Zimbank's Agribusiness Division, Standard Chartered's Agricultural Management Division, Barclay's, and Agriservi.

CAPS^{SA} office in Zimbabwe provides the Canadian private sector an opportunity to get involved in the country with a good support base.²²

4.2 Kenya

Private-sector involvement in technology transfer in Kenya takes place mainly in the marketing, processing and export sector. In the horticulture sector, numerous private firms are involved in technology transfer. Small-scale horticultural production through contract growers for export is widespread in Kenya. In the flower sector, three tiers of production each rely upon different information sources. In the traditional plantation crops -- coffee, tea, pyrethrum, and tobacco -- technology transfer is provided to small and large-scale growers through either vertically integrated *parastatals*, such as the Pyrethrum Board, or private firms, such as the British American Tobacco company. Input-supply activities involve a larger government presence in Kenya than in Zimbabwe. The largest government bodies involved are two *parastatals*: the Kenya Seed Company and its SimLaw subsidiary, which is the primary producer and supplier of hybrid and non-hybrid seeds for all crops, and the Kenya Grain Growers Cooperative Union (KGGCU), the largest distributor of agro-chemicals and fertilizers. Little technology-transfer work, however, is being done in the field by private sales representatives. This situation may change in the next few years. No major research and technology-transfer programs are conducted by farmers' associations at this time. The Kenya National Farmers Union (KNFU) is primarily a lobbying body and does not provide technical services to its members. In some cases, private advisors work for a group of farmers, such as those hired by coffee societies.

Plans are underway to dissolve many of the *parastatals* in Kenya. As they are dissolved, competition between supply firms will likely increase, and these firms will probably take a more active role in technology transfer as a part of the process of product stewardship. In addition, as democracy is revived in the country, relatively powerful farmers' associations may assume some of the research and technical-assistance activities now conducted by the *parastatals*.

4.2.1 Technology transfer related to input supply

4.2.1.1 Chemicals and fertilizers A key technology-transfer issue related to chemicals and fertilizers in Kenya is that purchased inputs are not often economic for many farmers to use except on cash crops. When farmers do choose to use chemicals, the local stockist may not be able to provide them with adequate information on chemical use. Appropriate instructions may or may not be included on the package. Safety equipment is difficult to acquire and expensive - as in Zimbabwe. The most successful cases of Kenyan technology transfer in chemicals and fertilizers are in the commodity specific cases -- coffee, barley, pyrethrum and horticultural crops -- green beans. However, very little of this technology transfer may spillover to other crops.

The largest distributor of agricultural chemicals and fertilizers is KGGCU. Their extension activities involve some field days as well as a radio program, written material and posters, all of which the KGGCU coordinates with Ministry of Agriculture (MOA) extension activities. KGGCU expenditures on extension activities are, however, less than one percent of the overall KGGCU budget. KGGCU has a very large network of distributors, but is suffering typical *parastatal*-management problems. They are having trouble remaining competitive in a newly liberalized market with increasing numbers of suppliers moving in where they the KGGCU previously held a monopoly. The deregulation of agro-chemical and fertilizer markets, including the removal of subsidies, combined with the weak Kenyan shilling has led

²² It might be a good prototype for a possible U.S. private sector promotion office outside of government.

to prices for agro-chemicals and fertilizers beyond the reach of most farmers. These conditions have resulted in lower yields and quality, which is especially noticeable in horticultural crops for export.

Numerous private commercial firms are involved in distribution of agro-chemicals and fertilizers in Kenya. Most of them have headquarters in Nairobi or Nakuru. These firms include the following: Twiga, whose company director Jackson Mbatha is head of the Agro Chemical Industry Association; Chemagro, whose company director Henry Ogala is also head of the Fertilizer Distributors' Association; Mea Ltd, headquartered in Nakuru, the second-largest fertilizer dealer and the only firm that does its own blends; Agrico; Farmers Partner; F.A.G.S. stores, with stores around the country and headquarters in Nakuru; Alka and Safina, both in Kisumu; Vershi Devshi in Thika; and others.²³

These firms distribute their products through a network of small stockists, who sell a wide range of consumer goods in rural areas. The multi-national agro-chemical imports, such as Hoechst, Shell and Ciba-Giegy, work through local distributors, who are the link with the stockists. Very little on-the-ground, commercial-firm technology-transfer activity is going on in Zimbabwe. This lack is likely because of change as the input-supply sector becomes more competitive with a reduced role for KGGCU. As competition between supply firms increases, prices may fall, leading firms to be willing to take a more active role in technology transfer as a part of the process of product stewardship. At the time of this study, most of the major commercial distributors only used sales representatives to conduct demonstrations or other technology-transfer activities in the field when a new product needed introduction. In this case, the demonstration is usually a collaborative effort with MOA extension staff who help to organize meetings.

Some of the small companies, such as Farmers Partner, are interested in conducting field activities, but lack the resources to expand their network of sales representatives. They are generally working through stockists, but do participate in local fairs. Mr. Isaac Njogu, director of Farmers Partner Ltd., is an example of a business person with government experience. He worked in extension and at KGGCU and decided to move to the private sector. At the time of this study, he was pursuing public-service activities through business. He organizes local fairs and would like to see more cooperation between the private and public sector in technology transfer by, for example, sponsoring field days or producing radio programs.

Agricultural shows are very important in Kenya. They are held at several levels with the involvement of government, the private sector and the local community. Regularly scheduled, provincial-level farm shows are organized by the Agricultural Society of Kenya. District-level shows are organized by the District Development Officer and the District Livestock and Agricultural Officers, as well as the District Commissioner. Companies are invited to come and show their products, and they bring with them materials promoting their products and describing their use. In general, orders are not taken at shows, but a strong incentive exists for distributors to participate in order to get exposure to potential customers.

Kenyan agro-chemical companies are involved in the Africa Working Group of a project to improve safe use of chemicals. The project was organized by International Group of National Association of Manufacturers of Agro-chemical Products (GIFAP). The project involves establishment of uniform guidelines on safety and also includes a training program for the technical personnel of Kenyan agricultural-chemical companies. The technical personnel in turn will transfer the information to farmers through the network of stockists and through other means, such as field days and radio. The specific details of implementation

²³ Mea also offers a fairly inexpensive service for soil testing service (less than a hundred shillings per test) and matches fertilizers blends to the problems of a specific farmers soil.

of the program were at the time of this study being worked out through initial meetings of the companies and distributors involved.²⁴

4.2.1.2 Seeds. The Kenya Seed Company, started by a group of farmers in 1955, dominates the seed market along with its horticultural-seed-marketing subsidiary, Simlaw. They have some sales representatives who deal mainly with KGGCU and other farm stores, as well as with smaller stockists.²⁵ The director of Simlaw noted that some innovative farmers test new varieties by running their own trials, especially in horticulture. They prepare educational materials indicating the production practices for all the varieties they sell. Similar to chemical and fertilizer distributors, Kenya Seed Co. and Simlaw distribute through a large network of stockists.

There are also some private producers of horticultural seed. Most notable is Mr. Schubach of Hortitech near Naivasha. Hortitech produces a number of different horticultural seeds under different arrangements. And Mr. Schubach has several fairly large-scale growers producing bobby-bean seed for him on contract.²⁶ He has developed a reputation with the horticultural exporters as to the quality of his bean seeds.²⁷ Schubach also has an operation for producing certain types of horticultural seeds on contract for export to Europe. This operation consists primarily of marigold seed and old varieties of sweet peppers, watermelon, okra and other fruits and vegetables that are cheaper to replicate in Kenya than in Europe. Starting in the early 1980's, Schubach introduced the techniques of seed production to a few farmers and worked with the best ones to make them his contract farmers and to also conduct extension with other farmers growing seed for him. He does his own cleaning, germination testing and packaging.

Several of the exporting firms complain of the difficulty of getting good-quality seed grown in the country. Schubach gets fairly positive reviews, but overall, good-quality horticultural seed is lacking. Many farmers use fourth-generation or fifth-generation seed. Exporters who are capable of importing seeds often do not, due to the risk of not recovering the cost.²⁸ This situation has led to quality and yield problems which affect Kenya's overseas reputation for horticultural products.

²⁴ The key contact for these activities in Kenya is Mr. Rob Coombes the GIFAP the Safe Use Project leader for Kenya and an additional person who is very helpful and knowledgeable is Mr. Philip Ofafa at Hoechst.

²⁵ A good contact for Kenya Seed Company in Nairobi is Mr. Charles Njuguna - long term a long-time employee of Kenya Seed Co. and now director of Simlaw.

²⁶ These producers, growing on 10 - 15 hectare plots on the Kenyan slopes of Mt. Kilimajro near Tanzania get all of their technical assistance from Mr. Schubach himself and as they are all experienced, don't require intensive extension.

²⁷ Most of the medium and large scale exporters import some of their seed. ²⁷ According to Mr. Njuguna of Simlaw, some horticultural seeds are not cost effective to grow in the country such as tomato seed.

²⁸ Imported seed is very expensive compared to local. For example, a kilo of seed for French beans locally grown is about 50 shillings whereas the current price on imported seed is 300 shillings per kilo.

4.2.2 Groups conducting technology transfer

4.2.2.1 Commodity-focused organizations and farmers' associations In Kenya, many organizations are largely controlled by government even though they are structured as autonomous companies -- *parastatals* -- which are involved in technology-transfer activities. The most well-known among these is the Kenya Tea Development Authority, which for more than 20 years has been providing extension on tea. Very little, however, is being done in the way of technology transfer conducted by autonomous farmers' organizations, such as the activities discussed above in regard to Zimbabwe.

The Kenya National Farmers Union (KNFU) is primarily a lobbying organization and provides little in the way of technology-transfer services. KGGCU was originally the Kenya Farmers' Association (KFA) until it was taken over by the government and made into KGGCU. Democracy has just been reintroduced into the KGGCU, which may return to being more representative of farmers and increase the services it provides, including technology transfer.

Among the partially government-controlled organizations which provide extension are the Horticultural Crop Development Authority (HCDA), Kenya Breweries Limited (KBL), the Pyrethrum Board, KTDA, the Kenya Planters' Cooperative Union (KPCU). Large-scale sugar plantations at Mumias and Nzoia have some technology-transfer activities under a plantation-style system. East African Industries has struggled to get an oilseed project underway which would include private extension services. Finally, there is the private, commodity-focused company, BAT, which provides intensive extension services to tobacco growers. The unifying factor between all of these operations is the importance of their ability to control the end product.

Kenya Breweries Limited and the Pyrethrum Board are two examples of efficient, *parastatal*, commodity-focused technology transfer. KBL has done such a good job in technology development and transfer for malting barley that this year, they produced almost twice as much barley as required for the breweries.²⁹ KBL intends to restrict participation in barley growing to those with at least 30 hectares planted to barley. The minimum number of hectares now required is ten. KBL have an intensive technology-transfer system, with the extension staff covering only barley. The staff are out in the field four days and three nights each week and spend only one day in the office. The field staff are well trained and well paid. Field staff are often recruited from the best of the regular MOA extension service. The activities of both organizations are paid for through the revenues generated by the companies.

Both KBL and Pyrethrum Board have a specific task and limit their technology-transfer activities to one crop. Their staff are better paid than MOA extension staff, they have better transport, training and a very focused work agenda with consistent management. Both managers interviewed indicated that their staff would be willing to work in closer coordination with government staff. The MOA staff, however, expressed resistance to the plan, perhaps due to a feeling of inadequacy in terms of their relative ability to move around the country, the extent of their technical knowledge in certain areas and their lower salary status.

²⁹ KBL's research has led to the development of high yielding varieties and achieved resistance to disease. Yields have increased from 14.25 bags per Ha in 1977 to 38 bags per hectare in 1988. Over the same period the area under barley has been reduced from 30,000 hectares to 17,500 hectares. There is continued pressure to reduce the number of hectares under barley as production increases with technological improvement.

Kenya Planters' Cooperative Union is an essentially autonomous organization with little government intervention. It has a system for technology transfer for both estates and small-scale growers. Overall, some 650,000 coffee growers are in Kenya and 1,000 estates range from five hectares up. KPCU has a team of seven coffee experts that advise the estate farmers. The small-scale coffee growers are organized into primary societies under the umbrella of the KPCU. The societies are then organized around the factories, each of which serves about 30 grower families. In general, the societies rely on the MOA coffee officers for technological advice. However, stronger societies have been hiring private technical advisers to work specifically for them. Estate farmers and coffee societies also seek assistance from the Coffee Research Board, or the KPCU team. KPCU also cooperates with MOA in the training of coffee officers. The cost of the technology-transfer service is paid out of the coffee levy.³⁰

British American Tobacco operates an extension system to advise farmers on tobacco production and the initial stages of curing.³¹ They also support the establishment of fuel-wood lots, provide seedlings from their own nurseries and have also undertaken substantial research in barn design to decrease the amount of fuel wood required in curing operations. BAT has 215 people on their extension staff, and they maintain an agent-to-farmers ratio of 1:50. The BAT model is well known and clearly effective in terms of technology transfer. It is also effective because of its narrow focus, the limited number of growers and the high quality requirements for tobacco in the export markets. The interesting story concerning BAT is that a new tobacco company (Mastermind) is "poaching" tobacco from the BAT growers. The company was established by an old BAT employee and is now trying to take advantage of BAT's long-term investment in technology development and transfer. The response of BAT has been to try to get legal zones established which would make it illegal for anyone else to buy tobacco in that area. This conflict provides an illustration of the company risk involved in trying to capture the benefits of investments in technology transfer.

Another example of a commodity-focused extension service is the East Africa Industries' oil-crop-development scheme (OCS).³² The project was co-financed by East Africa Industries, which provided 45 percent; Commonwealth Development Corporation, which provided 35 percent; and International Finance Corporation, which provided 20 percent. The project, which began in 1982, includes contract farming with small land holders for the production of sunflower. Following the typical commodity-specific model, the scheme involves provision of extension services to contract growers focused on oilseeds.

The key problem of the scheme has not been technology transfer, but an inability to appropriate the resulting benefits. Poachers have with relative ease been able to buy the sunflower seed produced under the scheme. This scenario illustrates the importance of the characteristics of the commodity in terms of the riskiness of providing technology-transfer services through a contract-farming arrangement. In this case, the commodity, sunflower seeds, is easy to collect, transport and store. As a result, East Africa Industries has had difficulty recovering its large investments in input-distribution and technology transfer made under the OCS. This difficulty has limited the viability of the scheme.

4.2.2.2 Marketers/exporters and processors

³⁰ Mr. Kingangi did not have estimates on hand as to the cost of the technology transfer component, but could provide this information.

³¹ A visit to Malikisi or Embu to see the BAT extension operations would be worthwhile.

³² Mr. Carr is the contact on this at EAI.

4.2.2.2.1 Flowers Thirty five Kenyan private firms licensed to export cut flowers for 1991. Three levels distinguish the flower-production sector and each has a different means of acquiring new technology and information.

The first level includes the highly capitalized, large-scale producers -- Sulmac, Oserian, Shalimar Farms, Yoder, and Orchid Ltd., which get information from their own, in-house technical staff and/or expatriate consultants. An example is, Orchid Ltd., owned and operated by Mr. and Mrs. Kenneth Matiba. Orchid Ltd. has 65,000 plants, including 20 different varieties of orchids. During the peak season, the company daily exports about 200 boxes containing about 20 flowers each or individual blooms.³³ Orchid Ltd.'s main market is Japan, but they also have some European buyers. They started growing orchids in the early 1980's after developing horticultural experience with green beans and other flowers. They developed the farm with technical assistance from an initial, two-year consultancy of a British horticulturalist who continued to monitor the project from the U.K. for an additional year. The farm is managed by Mrs. Matiba and her farm manager, Mr. Ndungu. Both Mrs. Matiba and Mr. Ndungu are involved in the Kenyan Orchid Society, an informal source of new ideas and technical innovation.³⁴

Another highly capitalized operation is Yoder Brothers near Embu, which is involved in high-tech production of chrysanthemum cuttings for export. Yoder Brothers is the world leader in this area. They take care of all their own technology needs and guard their information very carefully. And very large farms like Sulmac, the world's largest carnation exporter, operates no differently than, for example, a farm in the Netherlands.

The second level of horticultural production in Kenya is the medium-scale commercial growers who export and sell locally. Approximately six firms comprise this category, and all are located in the Limuru area. Firms in this level get information mainly from each other and their buyers, but also from the Horticultural Crop Development Authority (HCDA), MOA extension staff and perhaps an occasional consultant.

The third level includes approximately 100 small-scale growers of flowers in the Naivasha area. These farmers are selling to the local market, and those that produce high quality blooms can sell to middle men for export. They get their information from HCDA, MOA extension staff, and, as in the middle case, from each other.³⁵

4.2.2.2.2 Fruits and vegetables One hundred and ninety nine private firms were licensed to export fruits and vegetables from Kenya in 1991. Many of the fruit and vegetable processors and marketers/exporters are involved in technology transfer because of the strict quality, quantity and time re-

³³ The plants are all grown under special mesh shading (not in greenhouses) and they are all in large pots, plastic bags, or narrow beds. They are not grown in soil but in a mixture of horse manure, ash, bark, minerals and a few other items. It is a very expensive operation to get started and not likely to interest small investors.

³⁴ When asked how he handles a technical problem with flowers, Mr. Ndungu said, "I look it up in my orchid books."

³⁵ The upcoming study by Lydia Kimenye, PhD dissertation for MSU, will attempt to better understand how the very small flower growers get technology and information. She will also look into the relationship between the very large flower estates and nearby small growers. Is there technological spillover etc.

quirements of their business. Not all firms are, however, equally involved in technology-transfer activities.

Kenya has two major vegetable canneries. Kabazi, located in Subukia in the Highlands near Nakuru, has almost no extension program. But Njoro Cannery's sister supplier company -- Hortequip -- has perhaps the most intensive private extension program in Kenya. Kabazi cannery has one extensionist working with more than 3,000 farmers. By contrast, Hortequip's large field force works closely with approximately 30,000 farmers in Vihiga. Hortequip's ratio of extensionist to farmer is 1:150.

The important lesson of the Vihiga case is that their extension system has undergone some of the same motivation and control problems over time as have public-sector extension systems. Hortequip had initial success in organizing field activities. The firm expanded beyond a reasonable size at the same time as management-quality slipped, and corruption grew in the ranks. Hortequip got the system back under control with a strong infusion of new and intensive management, improved training and supervision of field staff and increased interaction with farmers. An important ingredient in Hortequip's success in getting the firm back on track was the appointment of two French, long-term consultants to work in Vihiga. The consultants are employees of Bonduelle, the company which distributes the final product in France. Their role with Hortequip illustrates the importance of the product's overseas marketers having some degree of involvement. In the Vihiga case, an intensive relationship existed between the production, processing and marketing firms involved with the product.

Among fresh-produce exporters, some variation is due in part to methods of collecting the produce they sell. Some of these exporters have their own farms and also buy through contract farmers, others only buy on contract, and some buy with cash and do not use contracts. All of the top companies -- Indufarm, Sunripe, KHE, and Homegrown -- have their own farms and buy from farmers or through middlemen, on contract. These companies provide some extension services and inputs to contract farmers. Most technology-transfer activities are closely related to appropriate types of inputs required, how to use them, preventing disease and pest damage, harvesting and post-harvest handling. Only about 20 of the 199 firms licensed to export in 1991 were actively seeking, developing, adapting and/or providing technology transfer related to any of these issues. The key technological issues are quality of seed, pest and disease control, harvest and post-harvest handling. In the case of vegetables that discolor or bruise easily, the limitation of physical damage is key and includes a range of protection from picking in the field to transport, storage and shipping.

Three key problems for exporters related to contract farmers are the following: recovering the value of inputs provided on credit; ensuring the quality of the product delivered (e.g. poor quality hidden at the bottom of the box); devising an efficient and safe method of frequently paying for small amounts of product. The first problem is sometimes overcome by providing farmers with inputs for cash at no mark up or through relatively intensive monitoring at the field level near harvest time. The second problem, ensuring quality, is very expensive for crops like green beans and okra, which are continuously harvested, especially since experienced farmers require little technical assistance. A method used for overcoming all three problems is to work through middlemen. A firm can establish relationships with middlemen who act as collecting centers, purchase the produce from the farmers and then sell it to the exporter. The middleman takes responsibility for distributing inputs, ensuring quality and paying the farmers. In terms of technology transfer, such reliance upon a middleman limits the firms' direct involvement -- except in the case of introducing new inputs or providing a technical man to work with farmers contracted to the middleman. This last method is essentially what the French buyer Bonduelle has done on a large scale in its relationship with Njoro Cannery and Hortequip.

4.2.2.3 Other private organizations The Africa Project Development Facility (APDF) has its regional office in Kenya and has supported a number of programs in the horticultural sector. APDF financed feasibility studies, project design, technical assistance and follow-up for the fledgling firm, Karen Roses, Inc., which exports roses to Europe. APDF has also in-part financed a green-bean-processing activity with Sunripe-Lacour to work with 500 local women growers in Gatundu. Unfortunately, although the company continues to operate at design capacity, the women have failed to raise their matching equity share. The project may or may not proceed. One APDF project in Uganda is a joint venture between a Ugandan businessman and McCormick, a major international producer, processor, packer and distributor of spices. The joint venture involves vanilla production and processing. All extension staff working with outgrowers on the vanilla project are hired by the company. In regard to financial institutions, consulting services in Kenya are similar to those in Zimbabwe although Kenya has fewer.

4.3 Mali

At the time of this study, Mali remained in the process of adjusting to a new government, which came to power in March of 1991. Although liberalization and privatization in the agricultural sector were important parts of the new political agenda, private commercial activity was still fairly sluggish. This is in part a response to long years of dictatorship, as well as a response to the shock of a war which destroyed approximately 51 percent of industrial capacity. Nevertheless, in several areas, private involvement in technology transfer was taking place and seemed likely to expand in the immediate future. These areas were private veterinary pharmacies, input suppliers and farmers' associations. In the Compagnie Malian pour le Développement des Textiles (CMDT) zone a significant amount of private technology transfer was underway in the more powerful association villageois (AVs). The AVs in the other zones have also taken on responsibility for input supply and marketing functions previously undertaken by *parastatal* agents. However, public services were and for some time will be required for less-advanced groups and for monitoring and regulatory activities for more advanced groups.

In Mali, the main players in agricultural technology transfer are the Organisation Développement Rurale (ODR), the Etablissement Publique a Caractère Industrielle et Commercial (EPICs) and not-for-profit NGOs.³⁶ About 14 original ODRs had dwindled to 10 or less. Of these, the following three principle organizations were active in technology transfer³⁷: CMDT, whose principle crop is cotton; Office du Niger, whose principle crop is rice; and Organisation Haute Vallée (OHV). All three are *parastatal* organizations which have evolved from a focus on the production and marketing of particular cash crops to a more integrated, rural-development approach. In addition, CMDT and Office du Niger are both EPICs. All the Mali EPICs and ODRs are listed below with a brief description of their activities related to technology transfer. A lack of appropriate technology to transfer and/or an insufficient long-term-development strategy and inconsistent donor support severely limited the success of seven of the ODRs.

³⁶ The EPICs are basically ODRs with new responsibility for a wider range of activities and a focus on pursuing privatization where possible. The EPICs will be referred to throughout as ODRs.

³⁷ The other ODRs are: ODIPAC which deals with groundnuts; ODIK in the Northwest focusing on cereals, and grains; ORS the rice office in Segou (yields in the area about 170 kilos per hectare) and ORM the rice office in Mopti (yields about 1.5 - 2.0 tons per hectare) both of which deal with extensive swamp rice cultivation versus the intensive paddy rice cultivation within the office du Niger.

CMDT has had long-term support from a French quasi-private firm (CFDT). OHV has had long-term support from USAID, and Office du Niger has been supported by European Economic Community (EEC) and other donors. In Mali, extension services included National Crops and Livestock and Forestry, but these services had little financial support. A World Bank-approved project will apply the training-and-visit approach to bolster existing structures and try to bring the technology-transfer system to the point of being a national service.

Under the Petite Moyenne Entreprises/Petite Moyenne Industries (PME/PMI) project funded by the EEC, the private sector was at the time of this study conducting technology transfer for livestock production.³⁸ About 32 private veterinary pharmacies begun under the project were selling drugs and equipment and providing advisory services. It was envisioned that this activity would, to some degree, assume the role fulfilled by public-sector animal-health agents under CMDT. (For animal traction details, see section 4.3.1.2 below).

The public livestock-extension service, Direction Nationale de Élevage (DNE), mainly staffed by veterinarians, had its peak activity time during the months of December, January, and February, a time when they provide vaccinations. Efforts to improve the overall services and effectiveness of DNE were made for years with little success. Recent legalization of private veterinary pharmacies/clinics was expected to improve livestock-producers' access to animal-health services.

4.3.1 Technology transfer related to input supply

4.3.1.1 Chemicals and fertilizers Agro-chemical use is fairly limited in Mali. In terms of crops, chemicals are used mainly on cotton and to some extent on rice in intensive growing areas, but minimally for vegetable production for domestic markets. Often the use of additional purchased inputs is not economic even though it may increase yields. Pharmaceuticals for livestock are in strong demand because a small investment may save the life of an expensive animal. But commercial input-supply companies in Mali conduct little or no technology transfer. No major multinational chemical firms have commercial licenses to import their products. Rather, their presence in the country is strictly to provide the large EPICs and especially CMDT with technical assistance in the ordering process and to some extent in training field staff. Through regional offices, located mainly in Adbijon, these multinational chemical firms distribute to Malian private, commercial distributors. The market is fairly small and does not justify a major investment in the firm's developing an in-country presence. Many importers maintain small technical-assistance offices in the country. These importers include Ciba-Giegy, Shell, Calliop and others. However, a Ciba-Giegy representative did note that some large commercial importers would be establishing their own distribution networks in the country as the atmosphere becomes more competitive.³⁹ Their long-term objective is to establish a local-distribution company that would engage in both training and sales. According to the CG representative, the benefits to farmers of dealing with a private company include timely delivery and lower prices. Ciba-Giegy was already conducting direct consultations with the more advanced AVs on procurement and use of their products.

³⁸ The project is funded jointly by the through the Joint European Development Fund (FED) and the Ordre National Veterinaire.

³⁹ There has been a slow evolution so far. The Ciba-Giegy office was opened in 1970 and they established an office in Koutchala (in the heart of the CMDT zone) with one agent who only works on training but does no sales. In the rainy season they sometimes hire an additional person to work with him. They are also working with AVs in the OHV zone near Oulessebouyou and have sold them herbicides and sprayers.

And some local distributors of chemicals were already in operation. In areas not covered by the ODRs, Ciba-Giegy was working with private, Malian companies that can directly import and distribute. Also in some parts of the CMDT zone, cotton farmers require inputs for sorghum, millet or other crops. The cotton farmers get these through private companies. The largest is COMADIS which distributes for SENCHIM, which is based in Senegal. These companies did not have sales representatives in the rural areas.⁴⁰ In terms of purchasing and distribution, some major distortions in the market affected private firms' interest and willingness to actively market their products. Firstly, ODRs do not pay customs duties. Second, ODRs are able to cut costs by ordering in very large volumes. Despite these advantages for *parastatals*, commercial input distributors are finding a market for their products, and their market is growing.

Some farmers associations' in each of the three major ODR zones had established their own arrangements for input supply. They prefer commercial firms for a number of reasons, including the following: (a) various AVs have recognized the revenue generating potential for them as input distributors for their area; (b) farmers have been frustrated with the lack of timely delivery by the ODRs and have assumed their own arrangements; and (c) private commercial prices tend to be competitive due to much lower operations costs and a streamlined organizational structure. However, it should be noted that CMDT's costs are, because of the large volume they handle, relatively lower than the other ODRs.⁴¹ If CMDT relinquished its responsibility for input supply, the most powerful AVs might compete with private, Malian distributors to assume this function in the CMDT zone. Eventually, the strongest AVs may draw in some of the smaller groups until regional farmers' associations are formed which could conduct input supply, extension and marketing activities for their members.⁴²

The chemical companies work closely with government agronomic researchers to test chemicals. All the products used by the ODRs are tested before they go into the field. Research suggests certain products to the ODRs, and then ODR requests these from the relevant company. In terms of fabrication, a Malian *parastatal*, mixed Malian business people and government -- the Société Malian Produit Chimique (SMPC), manufactured chemical products using imported raw materials. SMPC distributed to the ODRs and other private distributors.

⁴⁰ It was not possible to speak with their marketing staff during the Mali field work, but it is likely that they would start to establish a field presence as the input supply sector becomes liberalized. Further research should include a Senchim case study of technology development and transfer across several countries in West Africa.

⁴¹ In the OHV zone farmers are being trained under the CLUSA project to use input distribution as a source of revenue for the AV. The problem with timeliness was mentioned primarily in regard to Office du Niger.

⁴² These associations would most likely be organized around the region, with strong focus on the primary cash crop, but also dealing with a range of agricultural needs. Such a system would be more similar to the Argentine model than the very commodity-focused Zimbabwean or Colombian farmers association models.

Mali has serious problems with poor packaging and unsafe use of chemicals.⁴³ Clear labelling is badly needed for Bambara. One option for better labelling is for the government to sub-contract the design and manufacture of Bambara labels to a private firm, such as Comadis. Or AVs who are very active in marketing might assume the labeling project to earn revenue. Mali should consider becoming involved with safe-use technical training and with the local-awareness-raising activity conducted by GIFAP.

4.3.1.2 Veterinary supplies and services Livestock health services and pharmaceuticals are very important in a country where serious diseases, such as rinderpest, bovine pneumonia, parasites and hoof-and-mouth disease proliferate. Private veterinary pharmacies were begun in August 1991, sponsored by the EEC and the Malian Veterinarians Association.⁴⁴ The small private pharmacies buy about 80 percent of their supplies from Dr. Musa Coulibaly's distribution company, located in Bamako. Other local distributors are Dr. Ba, for Saprova company, and Hama Daou, for Sodrivet, as well as the government pharmacie veterinaire. The main suppliers of Coulibaly and other private importers of veterinary supplies in Mali are French -- Rhone-Milieu, MSD, La Provet and Sanofi, as well as other large, multi-national corporations, such as Pfizer. Russel-UCLAF had distributed for Hoechst, but was no longer operating in the country at the time of this study. No local companies were formulating veterinary drugs in Mali.

The project is part of a general government effort to provide opportunities for young graduates to establish private businesses. Thirty two pharmacies have been established with loans of approximately US\$7,000 each.⁴⁵ The pharmacies are run by fully-licensed veterinarians with one or two assistants trained at the certificate or diploma level. The assistants undertake both sales and advisory activities and are actively involved in outreach activities. Most focus on regular attendance at local, weekly or bi-monthly markets, where they sell products and arrange for visits to farms to see sick animals.⁴⁶ They deal with a range of clientele, from villagers to civil servants in town who own a herd for extra income. Staff at all the pharmacies visited expressed interest in expanding their activities to a full range of clinical services, including surgery. A need to develop dipping facilities also exists. Many people are applying acaricides by hand with cloth or by mixing with manure and spreading on the animals.

In addition to selling drugs directly through the staff of the shop, some were sold to CMDT agents, who occasionally cannot get adequate supplies through their own offices. CMDT animal-health staff typically have access to drugs only for treating animal-traction animals. But these staff are often asked for assistance on other animals for which they lack medicines. The pharmacies provide a fairly accessible

⁴³ The Peace Corps volunteer interviewed in Mali (Oulessebouyou) mentioned that she sees a lot of chemical products (both liquid and powders) being sold in unmarked bottles and plastic bags. The author also saw this in the market in Bamako, chemicals being sold in unmarked bags, or bags with only French or other foreign languages on them.

⁴⁴ The association has 600-700 dues paying members and also collects 1% of veterinarians salaries for its financing. They also have separate technology transfer activities such as production of posters and so on.

⁴⁵ There are also private activities related to livestock in the other countries but these have not been covered due to time constraint. This is an important area for additional study under the AMIS project and could constitute an important case study covering more than just technology transfer - following the example of the Genesis sub-sector study in Mali.

⁴⁶ Each pharmacy owner has one or two assistants who share the work of running the shop and doing outreach work.

source for these other drugs. Farmers not engaged in animal traction may, however, be receiving little or no help with animal health from CMDT. These farmers are also served by the private pharmacy/clinic's outreach staff. Over time, the outreach staff of the pharmacy/clinic may be able to assume the duties of the CMDT animal-health staff, thus removing the burden of this cost from CMDT.

The lack of business training for graduates of technical programs is one constraint to expanding private pharmaceutical and clinical services in Mali. An example of a veterinarian who was successful in business is Dr. Musa Coulibaly. Dr. Coulibaly worked in the public sector for 17 years and has experience in animal health, production and other aspects of livestock production. In his private business, he was actively working on development by helping to support and promote small, private pharmacies.

Dr. Coulibaly argues that markets for livestock products are closely related to technology transfer. Limited market opportunities provide few incentives to improve animal production. No private processing or packaging component existed in Mali at the time of this study.⁴⁷ Additionally, their transport of products from the farm to consumers was problematic. Dairy and meat producers often were left with surplus products. And investment was lacking in the types of processing and distribution businesses needed to prepare products for market and transport them to consumers. In Segou, for example, a lot of agricultural by-products are available for use as feed, but producers are reluctant to invest in such intensive production without an assured market. The demand for technology in this case is directly connected to the market for the output of intensive production. The flat market offers little incentive for private technology transfer.

4.3.1.3 Seeds Some seed is imported through the ODRs or EPICs. The Opération Production Semences Sélectionne (OPSS) - a government *parastatal* - is producing seeds, including cereal grains, millet, rice, sorghum and maize. To estimate the annual needs -- in terms of both variety and volume -- of the farmers in different zones, OPSS meets with these agencies every year. To replicate seed and provide farmers with necessary inputs and technical assistance, OPSS works with farmers who are producing seeds for them under contract. Another organization involved in seed production is the Seed Production Project of the Food and Agricultural Organization of the United Nations Development Programme FAO/UNDP. The Seed Production Project works with AVs to train some member farmers to replicate seed for the association and for sale. Finally, the United Nations is supporting a *Projet de Recherche Semenciere*.

4.3.2 Groups conducting technology transfer

4.3.2.1 Farmers' associations A number of farmers' associations within the three major ODRs had at the time of this study already assumed a fair amount of responsibility for marketing their products and distributing inputs to their members. Some had also developed their own technical-assistance staff. The few associations villageois who had their own technical-assistance person were well-established and relatively wealthy. Over time, more and smaller AVs may be able to finance extension for their members. The farmers' groups interviewed -- CMDT and OHV -- indicated that they would be willing to pay for their own extension person if they were doing well financially as a group. The addition of an

⁴⁷ There is a small amount of tanning. This operation may be revitalized with American management consulting soon by an American company interested in buying the output of the factory.

extensionist to such groups should be coordinated with efforts to make public-sector extension services more effective.⁴⁸

The Cooperative League of the United States of America (CLUSA) had implemented an impressive program to strengthen farmers' associations' abilities to manage their cooperative activities. The project, begun in 1989 with 13 associations, used USAID funding in the OHV zone. At the time of this study, 110 associations were involved in the project. The project's primary objective was to help form the associations and build their capacity to manage a range of farm and non-farm activities to generate income. Each of the 26 CLUSA agents worked with about seven villages of 300 - 500 people each. Technical agricultural issues were covered by OHV extension staff in coordination with village-level animateurs. CLUSA and OHV staff did not have formal joint-training sessions, but they did informally attend some of each others' sessions. They were training field staff in how to encourage the formation of associations and in cooperative management, including planning, accounting and staff management.

4.3.2.2 Marketers and processors⁴⁹ Technology transfer conducted under contract-farming arrangements through the mid-1980's ended in the late 1980s with the slowdown of the horticultural-export business in Mali. At that time, Malian marketing of horticultural crops to Europe was drastically reduced.⁵⁰ From approximately 40 commercial exporters in the early 1980's, only two commercial exporters remained in 1991 -- Abu Traore, or Continental Transit, and Fruitema. Fruitema, which had been owned by the previous Malian president and operated by his wife, ceased to function after the March change in government. But horticultural exports had slowed down considerably prior to March as a result of two conditions. First, major marketing problems through the mid-to-late 1980s included planes not able to land, planes arriving and to find an unsatisfactory shipment and farmers not being paid. Second, competition increased from neighboring countries -- Burkina Faso, Guinea and Côte d'Ivoire -- and from well-established fruit and vegetable exporters, such as Kenya.

Business people are not willing to bear much risk to develop new markets for Malian horticultural products. Mr. Traore indicated that he would not look favorably on expanding his activities without some external partner bearing a substantial portion of the risk.⁵¹ He lists two major benefits of an outside partner as: (1) assistance developing outside markets; and (2) air freight is paid for on the European side. Farmers are also wary of contract farming arrangements where they are not paid up front due to past problems collecting.

Technology transfer related to horticultural production for export will only be revived in Mali when the key problem of maintaining market connections is solved. Currently, there is air freight space and room for cold storage at the airport, the export tax has been eliminated (although this may not have been a

⁴⁸ This can best be done by working in coordination with Mr. Q. Duon, the World Bank agricultural extension expert in the Mali resident mission.

⁴⁹ There are also reports on this by Ernest Bergman of Voca 1987, and Martin 1990.

⁵⁰ There is currently very little commercial processing going on, except for some drying of mangoes. There is an operation which started out canning of juices and evolved into packaging juice in tinfoil sachets, very minimal volume currently.

⁵¹ He has pursued options, although none have materialized up to this point. In 1987 he went to Holland to talk with someone about beans at the Champifri - Holland B.V.

constraint to begin with), the license required is not difficult to get, and the crops can be grown and the quality provided. Marketing is the issue to focus on in this part of the agriculture sector.

4.3.2.3 Other organizations. Malian financial institutions have played an important role in providing credit to the associations villageois. This credit allows the AVs to take on additional responsibilities, especially input supply. This support may eventually help some AVs to establish their own research and technology-transfer activities. Banks are not, however, directly involved in technology transfer at the local level.

5. Conclusions and recommendations

Agricultural technology transfer in Africa can be improved through enlarging the role of the private sector and increasing public/private sector cooperation. However, private-sector participation in technology transfer should be viewed as only one part of an overall strategy to provide African farmers, especially those who are relatively resource-poor, with better access to appropriate technologies – both information and physical technologies -- in order to increase agricultural productivity and incomes. Private technology transfer is a complement, not a replacement for public-sector services, which will continue to be very important in Africa in the medium term, the next 10 - 15 years). Much can be done to improve the effectiveness of public-sector extension organizations.⁵² Additionally, opportunities exist for reducing the public-sector burden of extension by coordinating the use of resources with the public sector when appropriate.

In large areas of Africa, the private sector is not involved in extension and few resources are available for public extension services either. Due to the need to focus public-sector attention on resource-poor areas, opportunities should be exploited to coordinate technology transfer with the private sector. In Zimbabwe and Kenya, many small farmers are already interacting in some way with private extension field staff. To take advantage of private involvement, changes can be made in the public-sector extension approach used with these farmers. Specific suggestions will be discussed below.

The private sector will only get involved in technology transfer if the incentives are right for them to profitably engage in business. For this reason, it is important to work on improvements at the policy level to remove artificial barriers to private-sector entry into either technology markets or commodity markets as input suppliers, agro-processors and/or exporters. In a situation where government controls commercial activities in agriculture, private-sector participation in technology transfer is likely to be minimal.

The information presented in the country studies is distilled in this section to extract key lessons concerning the nature of and potential for private extension in Africa and to make recommendations for increased support for private extension on its own and in collaboration with government. The recommendations are presented in general terms with applications to the specific countries studied. Resident technology-transfer experts who understand other countries' potential and constraints can best adapt these recommendations for those countries.

5.1 Conclusions

5.1.1 Commodity markets

Lesson 1: Processors and exporters of a commodity with a strong, commercial market demand have an incentive to provide extension services to growers of that commodity. Additionally, when market demand for a commodity is strong, private sources of technology and information, such as consulting firms and private extension advisors attached to farmers associations will develop.

Strong market demand for horticultural products has led fruit and vegetable exporters in Kenya to develop technology and utilize new technologies, as well as to transfer them to contract growers. Market demand has led flower growers in Kenya and Zimbabwe to seek advice on new varieties and methods of production from commercial seed suppliers, from commercial buyers and from horticultural consultants. Market demand has also led Kenya's flower growers to undertake adaptive research. In Zimbabwe, strong market demand led to the Commercial Cotton Growers' Association developing the Cotton Training Center. Strong market demand in Zimbabwe contributed to the Zimbabwe Tobacco Association's research and extension programs. In Mali, strong market demand has allowed strong village associations

⁵² For a more in-depth discussion of public extension in Africa see Schwartz and Kampen, 1992.

(VA) in the CMDT zone to commercialize many former public-sector services, such as purchase and distribution of inputs, marketing of cotton, provision of technical and marketing advice to members and the VA overall.

When market demand for a commodity is weak, incentives for private technology-transfer services are also lacking. Neither does poor market demand contribute to these services developing elsewhere. However, the benefits of private-sector technology-transfer services may spillover from commodities with strong market demand to those without. CMDT groups whose cotton profits allow them to hire their own technical person generally have that person provide technical information on other vegetable, grain, other food crops, as well as marketing activities. In addition, the government may benefit from the expertise and management capacity of the private sector by subcontracting private-sector expertise to undertake some technology-transfer activities for commodities without strong market demand.

5.1.2 Technology markets: Input requirements, producer prices and competition among suppliers

Lesson 2: Input suppliers have an incentive to supply extension services under the following three conditions: (1) purchased inputs are required to achieve desired benefits from production (quantity and quality); (2) the relative prices of inputs and output allows profits to be earned under a farming system using purchased inputs; and (3) competition is fairly high between input suppliers for the same market share.

Cash crops, such as cotton, tobacco, coffee and vegetables for export are crops where there is a lot of potential business for agro-chemical and fertilizer importers, manufacturers and distributors. The technology-transfer and marketing activities of Agricura in Zimbabwe and the Association Villageois in Mali illustrate the incentive for commercial input distribution associated with these high-input-use crops. For most food crops, producer prices are too low to make use of purchased inputs economic. This condition contributes to the lack of commercial-firms promotion of their products for food crops. If, however, an input supplier has field staff in an area, focusing on a commercial niche crop, the input supplier will start promoting other products. For example, Agricura is promoting the use of various products for vegetables in the cotton-growing areas they cover.

5.1.3 Access to resources

Lesson 3: Access to resources affects the range of activities farmers can undertake profitably and thus the likelihood of their being served by private technology transfer. Access to land, water and other essential resources bears on the level of interest farmers will have in investing in developing their farming operations -- including their assumption of responsibility for their own extension, as well as their willingness to adopt new technologies, especially those which are relatively capital intensive. For example, in Zimbabwe, farmers working on ZTA's tobacco scheme do not own land. Although they may be able to get space on resettlement schemes, their willingness to continue to develop tobacco land will be linked to land ownership. In addition, farmers will usually seek a private source of (purchased) information only if they have a very profitable operation, a condition which is unlikely under resource-poor conditions. In areas where lack of access to productive resources makes investment in commercially viable crops uneconomic, commercial private-sector technology transfer is unlikely to exist. Subcontracting to and/or collaboration with not-for-profit NGOs (e.g. World Vision), private research bodies (e.g. ART in Zimbabwe) are options.

5.1.4 Ability of private investors to receive benefits from their technology-transfer activities

Lesson 4: Difficulty appropriating the benefits of technology-transfer activities creates a disincentive to private investment in these activities. The ability to appropriate benefits tends to change over time. Nevertheless, however, when market demand is strong, companies often choose to invest in technology transfer and bear this risk.

Companies are often unable to capture the benefits of their investment in technology transfer. This usually occurs in two different scenarios. The first scenario is when companies are unable to recover their costs of training and/or physical inputs. This situation may occur due to natural disaster or due to farmers selling the output to another buyer. Secondly, technology-transfer activities may have to be provided for free due to pressure from exogenous forces. This arrangement may be the outcome of a firm's adaptation of internal regulatory standards or an international focus on certain issues.

In the first case, the study provides several examples. Njoro Cannery's french-bean operation, Hortequip, lost 40 percent of the inputs they distributed to growers in 1989. After their improvement in management and training in 1990 and 1991, Hortequip reduced their losses to 17 percent. The company's goal is to reduce losses to 10 percent. Sunripe is suffering 20 percent - 25 percent losses on the outlay of inputs to their contract growers. In Kenya, BAT, after many years of monopolizing tobacco markets, has a competitor, Mastermind, which is "stealing" its growers and thus, the benefits of BAT's technology-transfer investment. All the companies producing high-value crops through outgrowers recognize that the expensive investment in developing the crop can be quickly lost to a buyer offering a slightly higher price or offering simply the same price cash in hand. An interesting effort to limit this problem is Hortequip's effort -- in addition to their intensive monitoring system -- to build grower loyalty through the Bean Growers' Club and seasonal competitions. The East African Industry's efforts to develop an ambitious oilseed growing project using outgrowers was seriously hampered by buyers undercutting them. This is especially problematic with a crop which is easily collected and can be stored without losing much value.

In the case of exogenous pressures, an example is strong, international pressure on multi-national, agro-chemical companies to invest in safety-training activities and to research use of their products in order to develop better packaging and safe-use procedures. This pressure has led such organizations as the International Group of National Association of Manufacturers of Agro-chemical Products (GIFAP) and Ciba-Giegy Foundation to start global projects focusing on the problems of safe use and overall product stewardship.⁵³ These projects represent a good opportunity for the public sector to capitalize on the availability of some additional resources to transfer badly needed technology -- in this case information as well as physical technology. Certain activities could be institutionalized, including the following: chemical-company sponsorship of field days in areas where the company's products are being used; in-service training of staff; development of components for use in the pre-service curricula at the agricultural-training institutes; and preparation of educational materials, such as videotapes, magazines, pamphlets and posters.⁵⁴ All agricultural offices in Africa have some shiny, well-done posters advertising inputs of various types. That same advertising expertise could be applied to some product-stewardship issues. These types of activities are planned under GIFAP and Ciba-Giegy Foundation's programs. Opportunities also exist to encourage private companies to sponsor on-farm research into strategies for integrated pest management (IPM).⁵⁵ A key issue for commercial firms is how to cover the cost of complying with external pressures and regulations while continuing to make profits.

⁵³ French name of the organization: Groupement International des Associations Nationales de Fabricants de Produits Agrochimiques

⁵⁴ In discussion with Mr. M.B.K. Hakutangwi, the Agritex chief training officer, he made it clear that videos were a very worthwhile tool both for training staff and work with farmers. However, he noted the high cost of making quality videotapes and the difficulty of making them well in-house.

⁵⁵ For example, in Zimbabwe in collaboration with Ziptex.

In general, such pressure can lead to increased overall business costs when individual firms engage in more technology development and technology-transfer activities than the firms might ordinarily. For some firms, these activities could result in decreased profits. Both informal public pressure and/or the formal regulatory environment, whether national or international, have a bearing on the type of technology-development and transfer activities firms undertake.

5.1.5 Relative risk perception of different groups

Lesson 5: The amount of risk that a commercial firm or farmers' association perceives to be associated with an activity (within which is included technology transfer) bears upon whether the group will undertake the activity and thus get involved in technology-transfer services. This risk is determined by the policy and market environments.

The amount of risk involved in a commercial activity, such as, perhaps, exporting fresh fruits, vegetables or flowers, affects the importance of access to information for the enterprise. On the side of the farmers producing for sale to exporters, many pieces of information can help reduce risk, including, for example, the following: how to produce a saleable product at a cost which will also provide for profit; available prices for the commodity; how farmers can judge the grade of their own produce to ensure that they will receive a fair price; how to offset risk in the production of the high-value exports with other on-farm and off-farm income-earning activities; and how to prevent competing marketers from "poaching" output, especially in the case of exporting fresh goods.

In addition, the overall political environment in a country affects the riskiness of various business undertakings and also affects the potential for private-sector technology transfer. An environment of political stability, access to foreign exchange, a fair investment code, a functioning banking sector, and reasonable basic infrastructure would lead to increased commercial activity in agriculture with associated technology-transfer activities.

5.1.6 Potential for spillover of new technologies

Lesson 6: Considerable potential exists for spillover of technologies applied to high-demand commodities onto commodities for which less demand exists. However, this potential may not be fully realized through commercial, private-sector technology transfer activities.

In most cases of dynamic, private-sector technology transfer, relatively few resources were devoted to enhancing spillover effects. For example, in both the cases of ZTA and CCGA activities, some attention was given to the crops in the rotation, but not much. In the case of the input suppliers, some attention was given to inputs to be used on commodities with low market demand, but not as much attention as high-demand commodities received. In the case of contract farming, technology transfer is focused on the specific commodity being marketed. Much opportunity exists for collaboration between the private public sector in terms of exploiting the potential spillover effects of technology transfer conducted on commodities for which strong market demand exists. Although quite complex technology is passed on to growers related to a certain commodity, it does not always spillover onto other crops. First, the technology may not be appropriate for other crops.

Second, farmers may view the technology as specific to a certain commodity and not generally suitable for other crops. This perception was the case with many technologies introduced on french beans in Vihiga. The farmers do not themselves eat the beans, and therefore view this crop as separate from the other crops grown for home consumption or local markets. Thus, they do not automatically associate the complex techniques they learn for use on the "foreign" green beans as something they might apply to their other crops. Spillover is most likely to occur over time, as has occurred in many areas of Latin America, where horticultural crops such as cauliflower and broccoli are grown for export. But this

spillover could be accelerated and improved through collaborative efforts between the public and private sector.

A sub-issue is whether new technologies introduced in association with a processing or exporting activity will be sustainable if markets for that commodity wither. It seems that agronomic practices and inputs applicable to other crops would continue to be used. However, the question of the evolution of technology spillover should be examined in future studies.

One method to encourage the use of new techniques on other crops is to "piggyback" extension messages onto those messages which the private-sector sponsors. A good example, is the introduction of cabbages to Vihiga and the encouragement of use of techniques, especially non-purchased inputs and marketing strategies, to other crops. Note that farmers may well be learning more than they realize. It would be worthwhile to help them see how they can use the information to benefit themselves in other ways.

5.1.7 Public/private-sector collaboration

Lesson 7: Public-sector staff often feel inadequate next to better supported, private-sector staff and thus avoid contact with them. This avoidance can create an obstacle to cooperation between private and public sector organizations in technology-transfer activities.

In all three countries, the private sector "poaches" the best people from the public sector. As commercialization proceeds, this phenomenon becomes more pronounced. Several people in Kenya and Zimbabwe remarked that the public technology-transfer service was practically a training stage for future private-sector personnel. This was also the case in Kenya concerning the *parastatals*. This trend leads to some problems for coordination in the field. Many private-sector organizations, including the well-run Kenyan *parastatals*, KBL and Pyrethrum board, noted that public-sector technology transfer staff shy away from close cooperation with their private field staff. Because the public-sector staff are not as well paid as the private-sector staff, are unsupervised and also lack transport and training, they seem to feel inadequate in comparison to their private-sector counterparts. Quite often, the private sector has stringent requirements for hiring, and private firms are willing to let go of inadequate people. A public-sector system will not be as lean and mean as a private company, but fewer, more well-prepared technology transfer staff might be a better alternative in areas where there is a strong private-sector presence.

5.2 Recommendations

Following are some specific policy and project-level suggestions for promoting private technology transfer. These suggestions are not designed with the aim of promoting private technology transfer for its own sake, but rather to improve farmers access to information. Private technology-transfer activities can provide farmers with access to more specialized types of information, such as horticultural products in Kenya or cotton in Zimbabwe. Or it can increase farmer control of technical assistance, as was the case with strong association villageois in Mali or coffee societies in Kenya. However, private-sector technology-transfer options are limited and are likely to fail if market conditions are not supportive.

5.2.1 Policy-level suggestions

A key element in encouraging private technology transfer is promoting activities that naturally include it. The main avenues to pursue are listed below.

- Liberalize input supply markets to increase private extension by commercial firms. Input suppliers will respond to demand for their technology as long as entry is not excessively barred. Thus, at the policy level, distortions such as licensing procedures, tax and tariff structures, interest rates and availability of investment credit can all affect input-supply willingness to enter technology markets. Liberalized markets tend to entail more competition, and this competition is an incentive for firms to

increase their level of product stewardship. Encouraging farmers' associations to work directly with local input-supply firms can lead to lower input prices for farmers and provide a source of revenue for groups if they act as local distributors.

In Zimbabwe, where government intervention in agribusiness is relatively low, the seed industry is diversifying as the chemical industry has already. Zimbabwe's import restrictions are an issue in terms of encouraging the private sector. For example, Agricura would like to start importing sprayers which would be cheaper than those produced by Taurus, but they are not allowed to do so.

In Kenya, continuation of the directions already begun would best accomplish these goals. Privatize the *parastatals*, especially Kenya Breweries, Pyrethrum Board and KTDA. Allow KGGCU to return to its status as a farmer-run association. Piggy-back on the existing, private technology-transfer staff.

In Mali, if CMDT were removed as the largest input buyer and distributor, private companies similar to Agricura, including Semchim/Comadis, will have an incentive to develop a relationship with groups. This involvement will have to be phased, as some groups are much stronger than others. The risk of such a strategy in Mali -- or in any African country undergoing a transition from *parastatal* to private-sector input supply -- is that initially, farmers may have to pay higher prices for inputs due to smaller volumes purchased by suppliers. Removal of any direct or explicit subsidies is another risk.

In Mali many of the farmers' associations are already arranging for their own input supply. Because increased competition for buyers will lead to companies getting more involved in product stewardship, this development provides a good means for encouraging private technology transfer. As companies become increasingly involved, the role of the government agent can shift to coordination and farm-management information. And the most prosperous AVs can hire their own technical person to cover areas of specialization important to them. This scenario is a long way down the road for most AVs. Public-sector technology transfer is still a fundamental need for these groups. However, the idea of cost-sharing for the agent's salary could be introduced into prosperous AVs. Most of the farmers acknowledged that they have had economic benefits from following the advice of the agent. As farmers' revenues increase with the proceeds of marketing their own produce, they may spend a portion of that amount on technology transfer.

In addition to liberalizing markets for inputs, recommendations require economic analysis. For several countries, it was mentioned that a key problem with increased input use was the high cost of inputs. Dr. Elfring, of the German Society of Technical Cooperation (German acronym, GTZ), and Mr. S. Samnani, fertilizer distributor, both mentioned that the recommendations for use of inputs are often not economic, a concern for both the private and public sector. Perhaps work in this area could be jointly funded.

■ Encourage export of high-value products and create a positive policy environment for investment. The high-value export business -- flowers or fresh fruits and vegetables -- is best run by entrepreneurs with technical know how, market connections, sufficient investment capital and a certain source of financing, even during periods of downturn. These requirements are especially important in the ongoing climate of increasing competition between African countries to secure European markets for their horticultural products. If markets are available for a country's products and barriers restricting entry of potential investors are removed, some private technology transfer may develop through outgrower schemes. However, this scenario is likely to affect only a relatively small number of farmers. Even Hortequip in Kenya, which works with 30,000 farmers, only affects a tiny portion of the country's 2.7 million small land holders. In addition, exporters may choose to grow their produce primarily on their own farms -- especially in the early phases -- which would limit private extension activities. The key regarding export-

related private extension is to try to enhance the spillover effects by coordinating technology-transfer activities of the private firm with government extension staff in the area.

For Mali, export markets of high-value products may need to begin with marketing missions to Europe to identify an interested buyer willing to invest time and resources to build the production and packaging operation in Mali. The alternative would be hiring a European consultant for some period. Also useful would be a study tour of Malian vegetable growers and marketers to Kenya to visit the Horticultural Crop Development Authority, farms and exporters. As the Malians are essentially potential competitors for the Kenyans, such a visit would have to be carefully orchestrated.

- Developing a country's agro-processing industry may also result in some private technology transfer through outgrower schemes. This is mainly the case for the processing of products for export. In terms of technology-transfer activities, the same limitations exist as for fresh export-crops. Smaller-scale, local processing activities, which may involve more important economic-growth effects than niche export products, would not tend to involve outgrowers. However, there is a case of a small-scale processing plant (in Zambia) hiring their own extension agent (stolen from the public service) to work with farmers supplying the plant.

- Strengthen farmers' associations, and as they develop, they may hire their own extension staff to service members. This is only one function among many that strong farmers' associations undertake. They may undertake a research program, group marketing and purchase of inputs, lobbying for better prices and infrastructural development in their area. Strong farmers' associations tend to be viewed as a political threat in many African nations, as is the case with the Kenya Farmers' Association, which was turned into KGGCU. This perceived threat has limited farmer involvement in technology development and transfer activities started by and run by farmers.

Certainly, farmers'-association-conducted technology transfer may be biased toward more commercial crops, as in Zimbabwe, and is not an answer to providing extension services to resource-poor farmers. However, Fas may remove some of the cost burden from the public sector and can provide services to small farmers of the relevant commodity, who are not being adequately served by the public sector. Management training programs, such as the one conducted by CLUSA in Mali, are a good option for strengthening farmers' groups to allow them to move in this direction. In Mali, the increasing amount of farmer control in the association villages should be encouraged. It is probable that as AVs grow stronger, an increasing number of them will have their own technical advisors.

In Zimbabwe, the Cotton Training Institute already has assumed responsibility for training in cotton and has begun some demonstrations with small-scale farmers. The CTI could expand their technology transfer activities and over time assume responsibility for technology transfer for all cotton in the communal sector. Similar to the KTDA model with tea in Kenya, the CTI role in technology transfer could begin slowly, concentrating resources in one area for a period and then moving on to the next. It might be possible to use Agritex people as organizers in these areas using a max/min approach.

CTI should also help incorporate information on other crops into the technology-transfer activities. In Zimbabwe, ZTA's activities could be expanded gradually, over several resettlement schemes, coordinating with government to develop some of these areas together. The Tobacco Training Institute and small-holder promotion scheme in Zimbabwe is another model that can both be expanded in Zimbabwe and combined with a public-sector, max/min approach. It could also be tried in other tobacco-growing countries.

Another example of farmer-association involvement in research and technology transfer is the work of the Agricultural Research Trust run by the CFU in Zimbabwe. In Zimbabwe, work with the ART should be expanded, perhaps a chunk of money could be given to ART for special projects in the communal areas. It is unlikely that something like the ART farm would develop in the other two countries in the near future. But commodity-focused, farmer-run research and/or technology-transfer bodies are certainly possible and in some cases, such as KPCU, already exist.

5.2.2 Project-level suggestions

■ Promote a maximum support/minimum staff numbers (MAX/MIN) strategy in areas where private-sector involvement is intense. In areas where private firms are conducting technology transfer related to a specific strong commercial niche, reduce the public-sector technology-transfer staff to a minimum, but provide those left with training and support to allow them to play a coordinating role. In addition, examine possibilities for sub-contracting the private firm to use their own staff to disseminate information about the other crops. Public-sector staff in these areas should be well-supported with transport and trained to work with groups and through FTCs to focus on farm management and marketing, farmer diagnostic skills and coordination of other technology-transfer activities.

Although ratios are not very useful, in a relatively densely populated area, such as Vihiga, a pilot could be tried with one agent to every 2,000 to 4,000 farm families. This agent could help organize fairs and shows, go on the radio, teach courses at an FTC, and travel with some of the commodity-specific people. It is extremely important to pay this person at least as much as the private-sector staff and to tie his or her pay to performance. Otherwise, the relationship between the private and public sector staff will not flourish.

Such a pilot could be tried in several areas of a country where some private technology-transfer activities are ongoing. For example, in the bean-growing area of Vihiga, a pilot could be tried where the number of MOA staff are reduced, their mobility, salary and supervision are improved and they focus their advising on farm/business management, helping people to use what they are learning under the bean operation that can be beneficial to themselves. This kind of advising could lead to friction with the company if coordination is not done very carefully, building consensus along the way.

The max/min approach can be combined with local volunteers. OHV has set a good example in this regard. They have one agent, with a motorcycle, covering a from five - 10 villages, depending upon the population. This person supports and coordinates with the volunteers and CLUSA staff in the villages. The agents are paid by OHV. A question for privatization in this system is whether the strong AVs would agree to pay for or share with government the cost of their agent. Under this arrangement, they would choose the agent.

■ Where appropriate, encourage commodity-focused farmers' associations to assume more responsibility for extension and research. This long-term option for Africa can be encouraged in the short term by providing training and an appropriate policy environment, including leaving farmers' associations free of government intervention. Sub-contracting arrangements for conducting extension could be established with strong farmers' associations that are already involved in marketing or input distribution. Negotiations could be held between farmers' groups and extension staff to work out hiring arrangements where appropriate.

■ Improve the quality of public-extension staff in the following ways: by increasing their capacity to adapt and test new technologies in the field; by strengthening their ability to diagnose the specific problems of farmers in their area and teach farm management; by improving their skills in the use of different media; and by improving their ability to work with groups. In order to make the max/min

approach work, it is necessary to make the most of what is already available. A streamlined staff, with solid field support, must also be better trained to be effective. If staff are better trained and supported, the rate of public-sector attrition to the private sector may slow. Inevitably, some quality extension staff leave the civil service. However, by supporting them well, more utility can be extracted from the time they do spend in the civil service.

- Privately sponsored Farmer Service Centers and Agricultural Shows are both options for bringing together private-sector resources for both input distribution and technology-transfer. Private farmer-service centers, perhaps managed by a farmers' association, would be useful in areas where access to needed inputs is limited. The centers could include space for representatives of different companies to store, display and sell their products. It could also be a simple building used for input-supplier bazaar days, similar to a farmers' market. This would help companies justify the cost of maintaining sales representatives as they travel to put on bazaars in different locations.

Agricultural shows, as found in Kenya, Zimbabwe and more recently, in Mali, provide an important opportunity to bring together the local community with agribusiness people and public-sector extension staff. In Zimbabwe, increased emphasis should be placed on shows for small land holders and "agro-info days" in the communal areas, similar to those held in the commercial areas. These could be arranged in coordination with Agritex staff and community NGO staff. The Kenyan example of district shows is a good model. Another example is the Malian agricultural fairs in the OHV zones. These fairs were developed by staff sent for training in the United States and inspired by the county fairs.

- Join in the GIFAP effort to promote safe use of agro-chemical products and training of both private-sector and public-sector staff. The private sector in African countries should be lobbied to contribute funding for activities designed to educate the public about the dangers of agro-chemicals and household chemicals. This is a critical job which public-sector extension has failed to do. Social marketing techniques, such as radio and poster campaigns, should be supported in combination with research into affordable safety clothing.

A Ciba-Giegy-funded project is being started in Zimbabwe to look at the safe use question, as well. The safety committee of the Agro Chemical Industry Association (ACIA) is a good model for other countries. It brings together diverse private-sector resources and applies them to issues concerning the whole industry. In Zimbabwe, in particular, the ACIA should be awarded a grant to pursue this work. The funds should be administered by Mr. Peter Wells. The activity should also be coordinated with current NGO efforts to develop the Zimbabwe Institute of Permaculture Training and Extension (ZIPTEx) started by Mrs. Helen Vukasin. In Kenya, GIFAP is already underway. This may provide a model for all of Africa, and the Kenya experience should be watched closely.

5.3 Ongoing need for coordination between public-sector and private-sector technology transfer

This study examines the hypothesis that private-sector, technology-transfer activities can complement public-sector extension services in Sub-Saharan Africa (SSA) and alleviate some of the burden of public expenditures on technology transfer. It is assumed that the transfer of agricultural technology is an important part of improving the productivity of agriculture in Sub-Saharan Africa. The information collected indicates that in the case of profitable commodity markets and competitive input-supply markets, scope exists for expanding private technology-transfer activities as well as for increased coordination between public-sector and private-sector technology-transfer activities. However, private technology transfer by commercial firms cannot replace public-sector extension, especially for the relatively resource-poor smallholder farmers, who make up the bulk of the Sub-Saharan African farming population.

In most countries in SSA, medium-scale to large-scale commercial farm operations do to some extent rely upon private organizations for information on new technologies. However, few smallholders are directly reached by technology-transfer activities which commercial firms conduct. This limitation is due in part to the relatively limited smallholder production of cash crops associated with strong market demand and strict quality requirements. Intensive technology transfer is a necessary input to successful production of cash crops. These crops include primarily the traditional cash crops, such as tea, tobacco and cotton, as well as non-traditional exports, such as high-value exotic fruits, vegetables, herbs, and flowers.

Poor access to essential resources, such as land, water, and credit, limits many smallholders to a narrow crop selection dominated by staple-food grain. Another constraint limiting accessibility of technology transfer to smallholders is that use of purchased inputs, such as fertilizer, seed, chemicals and equipment, is not often economic for smallholders because of their low income levels and poor access to credit, as well as their production of mainly low-cash-value crops. As indicated previously in this report, private input suppliers will only undertake extension activities when necessary to maintain profits or as a result of external pressure, such as with new, safe-use initiatives being undertaken by the international agro-chemical industry.

The importance of commercial firms in agricultural technology transfer in SSA will increase as farmers' access to resources improves and/or the productivity of existing resources is improved through technology development. On the other hand, well-managed private organizations, such as farmers' associations, can help strengthen the commercial viability of farming by helping producers share their resources. Not-for-profit NGOs have an important role in supporting such organizations in their early stages. A good example is the work of CLUSA in Mali.

It is not always possible to expand private-sector technology-transfer activities of commercial firms. These firms will only engage in such activities if they can appropriate the benefits. In addition, private firms are willing to assume additional responsibilities only if the outcome will not have a negative effect upon their main objectives. For example, the Vihiga French-bean project in Kenya would not want to teach farmers to introduce new crops that might take away labor time from bean production or that would introduce new disease threats to the bean crop.

To maximize the benefits of private technology-transfer activities, an ongoing need exists for coordination between public-sector and private-sector technology transfer. To address the primary constraints to technology transfer in SSA, inefficient public-sector extension services must be successfully addressed. Public-sector extension services remain the sole source of essential technical messages to smallholder farmers. The past 10 years or more of reorganization of the structure of extension systems, as well as large amounts of funding for vehicles, training and technical assistance have not substantially improved the effectiveness of public extension service in most SSA countries. Based on the evidence gathered in this study, private-sector technology transfer is not -- in and of itself -- a solution to the problems associated with private-sector technology transfer and improving smallholder productivity in Sub-Saharan Africa. There is a lack of motivation in most public-sector extension institutions because these institutions generally do not have reward systems based on field performance. Thus, in addition to an expanded role for the private sector, efforts are needed to improve incentives to public-sector field staff and especially to their immediate supervisors. Introducing more competition into the provision of public extension services, such as contracting out activities to firms or NGOs, may also provide incentives to improve public-sector technology transfer.

**Annex I:
Detailed cases of private-sector technology transfer in Zimbabwe**

Agricura: Technology transfer conducted by a commercial input-supply firm **Conclusions:** Under certain circumstances, commercial input-supply firms invest in deploying sales representatives in the field. These representatives conduct extension work in addition to selling the product. Firms are most likely to undertake this kind of activity if the market for their products is growing or indicates potential for growth in an area combined with active competition for the same market share.

Agricura was started in 1975. The company employs 10 field sales representatives, down from 12 a few years ago. The company's sales representatives receive a basic salary of 1,500Z\$, and their lowest starting salary is 1,000Z\$. The sales representatives have company cars and some allowance for mileage. Agricura staff have in-service training at their company headquarters. Their source of technology for the firm is through their major, multi-national corporation suppliers, such Shell, Ciba-Giegy and their own lab, in which they test new products. They spend 1.5 million Zimbabwe dollars on the small-scale marketing program, which is managed by Mr. Sairai. This amount is 6 percent of total costs for the company. Small-scale sales generate 12 percent of total firm profits.⁵⁶

Agricura is also trying to develop the market through local sales coordinators, who work in their own, local areas. Agricura recruits and trains these coordinators and lends them bicycles, which they can then buy over time. Their main incentive is bonuses for sales. If, for example, a local sales coordinator makes more than 30,000Z\$ in sales in one season, he receives a bonus. Last season, some representatives received bonuses amounting to as much as 2,000Z\$ - 3,000Z\$.

The author attended an Agricura-organized farmer meeting and demonstration on the proper use of herbicides held at a village in the communal area near Mt. Darwin. Mr. Sairai and the technical man from headquarters met the field sales representative on site. We arranged to meet Walter Ndebele -- the Taurus Sprayers representative on site. The technical man, sales manager and the local representative combine forces to run the activity. The field sales representative had invited the local extension agent, who did not attend. The group was about 25 people, all of whom are in a cash group together. They had already bought herbicide from Agricura and were being taught how to use it in the field.

The demonstration included a talk on the problem of weeds in cotton. Various kinds of weeds were discussed and the technical man passed around examples of the weeds. The possible solutions to the problem of weeds were discussed and herbicides were presented as the best solution. The dangers of herbicide application were discussed, as well as safety precautions necessary. The proper clothing for herbicide application was described and Mr. Sairai put it on and then put on the sprayer to illustrate its use. A practical demonstration followed with the people in attendance, including male and female adults as well as school age children, all practicing putting on the equipment and using it. Finally, as part of the practice, several people treated the field of the host farmer.

Agricura has plans to expand its field-sales activities into different areas. The sales manager sees a lot of potential in the communal areas, and he wants to expand his network of local sales coordinators in order to tap into that potential. Rather than complaining about the expense of maintaining field staff, he is experimenting with ways to develop his sales network at a lower cost. He is a development-minded person, but also a very aggressive salesman. His activities could be very helpful in alleviating some public-sector burden, but absolutely

⁵⁶ They did not have figures available on overall profits but they would probably provide this information if a request was made and sent with a copy of the a draft report.

must be monitored. The incentive driving agro-chemical companies to provide extension is to sell more of their products. While their motivation is justified, the public sector can play a balancing role by monitoring food safety, the environment and safe use of herbicides. In addition, the public sector can help to encourage the agro-chemical industry to get involved in international programs to promote safe use and product stewardship. In Zimbabwe, these kinds of efforts are already underway.

Zimbabwe Tobacco Association (ZTA) Zimbabwe accounts for 10 percent of world tobacco exports. The ZTA is involved in a range of research and extension activities for flue-cured tobacco producers.⁵⁷ ZTA is funded through a 1.6 percent levy on all tobacco marketed in Zimbabwe. With this funding, the ZTA finances its organization, including research and technology-transfer activities. The Zimbabwean Tobacco Research Board (TRB) conducts all Zimbabwean tobacco research. The TRB has bred from original Virginia materials all the high-quality varieties grown in Zimbabwe for commercial sale.⁵⁸ The TRB is currently 30 percent government funded, but ZTA wants to take over that portion and make it wholly private. One reason for privatization is the government-imposed government salary ceiling, that prevents TRB from offering competitive salaries to top researchers.⁵⁹

ZTA conducts technology-transfer activities for both large-scale and small-scale commercial growers. The tobacco circus consists of a series of district-level meetings intended to extend TRB research findings. The meetings are held each year prior to the growing season. Throughout the season, TRB researchers attend growers' discussion groups and the 7-8 field days TRB organizes each year. And researchers will visit individual farms to address special problems.

ZTA has started two separate training bodies. The Tobacco Training Institute (TTI), begun in 1985, is pitched at the commercial-level operation. It is designed for skilled workers on commercial farms and includes diploma course for young, international students and for children of commercial farmers. The cost of the TTI is paid by ZTA, as well as from revenue generated by the TTI farm, grants and fees.⁶⁰ A Tobacco Training Center (TTC) at Trelawney Research Station, begun in 1985, focuses on small-scale production. During its first five years, the TTC trained 55 farmers. Its capacity is being expanded from 20-50 students each year. TTC funding sources are an annual government grant and revenue from the TTCs 30-hectare tobacco farm. The TTC is managed by a committee made up of the Ministry of Land and Resettlement (MLARR), Agritex, Agricultural Finance Corporation (AFC), TTI, Tobacco Research Board (TRB) and ZTA.

Finally, ZTA, in coordination with the MLARR, is managing a program for promotion of small-scale production. The program has grown out of the activities at the TTC.⁶¹ The TTC began training both technology-transfer agents and other government staff, such as resettlement officers, in the same groups with other non-government

⁵⁷ The Tobacco Marketing Board (chaired by the Ministry of Lands, Agriculture and Rural Settlement) organizes exports through auction floors to over 70 countries. Burley tobacco is covered by the Burley Growers Association.

⁵⁸ The Tobacco Trade Association - a group of 40 private companies, buying, processing and packaging tobacco support 18% of the operating costs of the TRB.

⁵⁹ They have already lost one top tobacco specialist to Rothmans due to the salary issue.

⁶⁰ Z\$ 5,000 per student.

⁶¹ The program is held on three farms in resettlement areas: Ashenden Farm, Joberini and Nyamuary Estates.

students with experience and/or education in agriculture. To ensure that the TTC program participants could read and write English, only those who had sat, but not necessarily passed O-levels -- the basic British educational-competency examinations -- were admitted to the TTC program. The mixing of civil servants and other students in these programs did not work well, however, so the program began focusing on non-government employees. Because, however, program graduates were not applying on their own farms the methods they had learned in the program, the TTC program was in 1990 augmented by a small-scale-promotion program.

Participants in this program are carefully chosen: only 20 among 2,000 or so applicants are admitted to the TTC. Of those, the best 12 were chosen for the first season. At the time of this study, these 12 were into their second season with another batch of 13 participants. Each farmer participating in the program has two hectares of tobacco in rotation with field crops.⁶² The technology-transfer methods used are intensive. Firstly, all participants have already been through the TTC course. Secondly, a full-time Zimbabwean commercial tobacco farmer is available on the farm as a consultant. Also available are a full-time scheme manager who used to teach at the TTI and a manager in-training. All the staff are aware of the details of each participant's operation and their progress. A demonstration farm is also on site and operating one week ahead of the participants' farms. Before implementing a new stage, participants work at the demonstration farm, going over with the scheme manager each step in the production process. The goal is to graduate the best farmers to 4 hectares, then to 6, and 8, at which point they are ready for commercial-scale equipment and can leave the scheme and begin their own, 10 ha. tobacco farms. Unfortunately, not enough space is available around the existing plots to spread out each farmer's area without breaking it up into different pieces. This lack of space is a disadvantage because many of the program participants are building houses near their plots. However, one of the farmers mentioned that when he was ready to move up to 10 hectares, he was planning on leaving the scheme and getting his own farm. Land tenure may be a key problem in the success of this endeavor.⁶³

ZTA is in the process of setting up a special foundation to focus on development activities and expand the small-scale production and promotion program and provide extension services to small-scale producers of flue-cured tobacco.⁶⁴ ZTA also has plans to expand their farmer-training activities. Activities of ZTA and its associated bodies, in cooperation with government and the private business community, provide a good example of collaboration when all sides have an incentive to do so. It is important to note that tobacco prices were abnormally high in 1992 due to shortages from other major producers and that flue-cured tobacco in general is a very good money maker. The model of private technology transfer undertaken by ZTA is unlikely to be replicable for commodities for with a much lower market demand.

Cotton Training Center of the Commercial Cotton Growers' Association Zimbabwe includes roughly 300,000 ha. of land appropriate for growing cotton. About 42,000 ha. are under commercial cotton production by 450 growers. Eight thousand ha. are grown by small-scale commercial farmers. Seven thousand ha. are grown by the Agricultural Development Authority. Two hundred and fifteen thousand ha. of cotton are grown in communal areas and resettlement schemes by approximately 250,000 communal cotton growers. The major potential for increasing cotton production is thus not from increasing area, but from improving yields. The potential increase

⁶² Barns Z\$2300 each, 1 barn for 720 kg. of tobacco, 6 barns for 2ha.

⁶³ One incentive behind the scheme is to show government that the resettlement schemes can be more productive with good management and that it is not necessary to continue to buy more land (especially not when its being used for commercial tobacco farming) before the currently unsettled area is well used.

⁶⁴ It is expected that approximately 1,040 farmers will be growing flue-cured tobacco in 1992.

for small-land-holder yields is 150 percent, with the adoption of an improved production package of inputs and practices. The Cotton Training Institute is playing an increasing role in spreading improved cotton-production practices throughout the Zimbabwean cotton belt.

The Commercial Cotton Growers Association (CCGA), begun in 1951, is funded by a levy on cotton. In 1979, the CCGA started the Cotton Training Center at Kadoma and began offering courses there in 1981. At the time of this study, 75 people were employed at the center. The training center evolved out of cotton farmers' recognition that in order to increase yields, they had to invest resources in both research and extension. Original funding for the cotton training center came from the cotton farming community and the agro-chemical industry. The center was completed in 1984 with assistance from USAID and the European Community. The center provides training for both farmers and agricultural extension workers. The courses cover cotton production in detail and, to a lesser extent, crops in rotation with cotton.

The center trains about 2,000 people each year. And a total of about 27,000 people have been trained at the center. In 1990/91, about 40 percent of the communal farmers trained at the center were sponsored by the European Community, USAID, NGOs and Agricura. 1992 is the first year the center has presented a "cotton circus" in the communal areas. This event involved travelling throughout the cotton-producing area of the country and conducting seminars on cotton production. The CCGA does not have its own extension program, but conducts these activities through the center. The CCGA staff work in cooperation with Agritex, which is the major provider of extension on cotton to communal farmers. And the CCGA staff work with commercial firms, such as agro-chemical, equipment and processors (ginneries), who also have some extension activities. The cotton industry is interested in expanding its support to the communal sector. A major vehicle for such expansion would be the training center and its outreach activities.

The cotton industry has proposed two possible bodies to improve the development and transfer of technology in the cotton sector. Firstly, the creation of a new Cotton Research and Training Board, which would be jointly funded by both the private sector and the public sector. Such an organization would draw on the combined resources of both the Cotton Research Institute, the Cotton Training Center and the cotton-processing industry to carry out a range of activities, including the following: agronomic research; market research; product development; financial support for small-scale growers and training and extension services. Secondly, a Cotton Training and Extension Center (COTTEC) would provide specialized training and extension on cotton for Agritex. The proposal details an extension approach which would entail leaders in cotton extension, trained at the Cotton Training Center and identified by Agritex and ZFU. These extensionists would cooperate with the local Agritex agent to provide area farmers with specific assistance on cotton production.

Agricultural Research Trust (ART)

The Agricultural Research Trust began in 1981 as a joint effort of the Commercial Oilseed Producers' Association (COPA) and the Commercial Grain Producers' Association. It was located on land the COPA had initially purchased to start an Oilseeds Trust in 1980.⁶⁵ The Zimbabwe Cereal Producers' Association joined ART in 1983, and more recently, the Cattle Producers' Association has developed livestock activities on the farm. The ART combines its own research program, which amounts to approximately 25 percent of the research conducted on the farm, with research activities conducted by the private sector using ART facilities and staff.⁶⁶ The organization was formed after independence in response to uncertainty concerning the nature of the new leadership and a desire on the part of commercial farmers to maintain their capacity to conduct research and disseminate

⁶⁵ The farm is located North of Harare.

⁶⁶ There are 8 professional and management staff and 56 skilled, semi-skilled and unskilled workers.

the results to farmers. The official mandate of the ART is the following: conduct commercial food-crop and horticultural research and provide facilities for contract research; demonstrate commercial production of maize, soybean, groundnut, sorghum, wheat, barley, coffee and beef cattle and pasture management; research, develop and evaluate farm machinery; conduct farm-management analysis; promote commercial agriculture through written materials, field days, demonstrations and visitor programs; and to provide training (day courses) and "on-call" extension services. The activities of the ART are funded through sales of crops and livestock, interest from investments, contributions from commodity associations and income from contract research.

On-farm test sites are located in various areas, including four sites recently started in the communal areas for adaptive research. These activities combine research and extension, as local farmers are invited to participate at every stage of the trials. And the ART extension staff work with Agritex staff to organize demonstrations using the field test sites. The adaptive research in the communal areas was started by Mr. Richard Winkfield, who conceived the idea for the trials, with a small amount of Canadian-donor funding he raised for the project.⁶⁷

ART uses its own staff, who go out and conduct the demonstrations and invite the farmers. This activity reaches a very small number of people, but ART staff indicated that they could easily reach more farmers if they had the resources to do so. This is an excellent candidate for a pilot activity combining adaptive research and technology transfer.

⁶⁷ The contribution from the Canadians consisted mainly of two vehicles to allow them to move around in the field more easily.

**Annex II:
Detailed cases of technology transfer
conducted by processors/exporters in Kenya**

Conclusions: Processors and marketers dealing with export markets require a very consistent, high-level of quality. This requirement can lead them to implement intensive extension activities on a very specific type of crop or animal production. They are especially likely to undertake extension when the costs of acquiring the crop from sophisticated commercial growers or from a plantation system are relatively high, and small-scale subsistence or semi-subsistence farmers can provide the crop at lower cost.

Many of the vegetable marketers and exporters in Kenya are involved in technology transfer. Their role in providing technology transfer is necessitated by the strict quality and timeliness requirements of their business. However, in some cases where the technology-transfer element of the business has been adequately conducted, it is no longer a priority. A good example of this scenario is the case of Kabazi Cannery. Approximately 3,000 farmers in the Subukia area of Nakuru supply the cannery with a wide variety of vegetables, including French beans. The company employs only one extension agent for the whole area. And this extensionist is quite adequate. The farmers, because of their long experience both growing for the European population before independence and for the cannery since shortly after independence, know how to produce the quality desired. The cannery was previously a milk-condensing plant.

In the opposite extreme is Njoro Cannery, which is supplied by its own company, Hortequip. Both Njoro Cannery and Hortequip are owned by a Kenyan businessman. The businesses supply the French buyer Bonduelle. Hortequip is managing 30,000 growers in the Vihiga area. The average plot size for this bean-production activity is 10-meters x 17-meters. This year, the producer price is six shillings per kilo and rising to seven shillings next year. Ten shillings is the total cost of one kilo of beans, and three shillings go for extension and transport. Hortequip has 250 field staff, including extension agents and area supervisors. The ratio of agents to field staff is approximately 150:1. The field agents have no major educational qualifications, they are local people, often primary or secondary school dropouts, who are trained by the company. Since the new French team from Bonduelle arrived in 1989, they have introduced a number of new training techniques and begun organizing bean-farmers clubs. The training for field staff includes more work on educating field staff as to why they are instructing farmers in a certain way, in terms of agricultural practices, rather than just telling the field staff what to do with no explanation. The management is also much more severe in their policy of firing staff who do not keep up good work.

The farmers interviewed said they were happy with the agents that visited them. These farmers joked about how they never saw the public-sector person and the bean man was there all the time. The company is also running competitions for the best bean farmers, and they offer prizes. Hortequip management is convinced that this approach helps the farmers to be better at growing beans and more dedicated to the company. Farmers receive inputs on credit, and then, over the season, (two plantings per year), they record their production. Farmers receive a voucher for each shipment of beans they bring to the collection center. At the end of the season they are paid and the value of the inputs is subtracted. In terms of technology transfer, the farmers are visited almost every day during the high points of the season. Additional staff are added at these times. And the company has a team of four people whose job is to monitor quality. They are separate from the staff, instructing and monitoring farmers activities.

An important technology-transfer point related to this case is that the new techniques used on beans produce only a limited amount of spillover onto other crops. The farmers said that they have increased their use of fertilizers and planting in rows, but they did not, overall, seem to be applying many techniques to other crops or starting to grow other vegetables. Their hesitance may be because they are not educated in the technology they are using, but rather instructed in terms of how to grow beans. It is reasonable that the private company would provide

extension in this manner, but this lack of spillover may indicate an area for contracting by the government to the firm in order to do more comprehensive training. Another possibility is that after the farmers' clubs get organized, the company may sponsor certain farmers to attend general horticulture courses at the Farmer Training Center. Another option is that MOA extension staff coordinate with the bean-extension people to do general horticultural seminars or field days. Sufficient incentives may not exist to encourage the company to conduct these seminars or field days on their own. A risk in investing more in technology transfer is the possibility of free-riders.

The Sunripe case provides an example of the fresh-vegetable-export market.⁶⁸ Technology transfer and input supply are necessary to a certain extent. But they are too expensive to invest in heavily in areas which are close enough to the airport for competitors to enter and buy the product by offering a slightly higher price. Thus, they have evolved a system of buying from middlemen, who are responsible for providing a certain level of quality. The middlemen then have the incentive to ensure that farmers are producing the required grade. The company conducts adaptive research on its own farm using new varieties, which it then distributes to its more reliable and loyal growers. The company has some technical people on their staff who are based on the farm, but also do some outreach work with growers who regularly supply the firm.

For all companies providing inputs, one of the key problems in the business is the difficulty of capturing returns. Sunripe estimates a loss of 20 percent - 25 percent of the value of inputs distributed due to "briefcase" cash buyers who "poach" vegetables from their growers. In 1989, Hortequip was losing 40 percent of the value of their inputs before Bonduelle sent out three French managers. Mr. Sarazin, the French consultant stationed at Vihiga, has brought the leakage down to 17 percent. Sunripe has a different situation on their farm, where they have two professional farm managers. The farm managers work closely with the employees in the field and the packing house, which includes about 30 women picking and 30 women grading and packing. After the women have learned the picking jobs well enough, they will probably implement a piece-work payment system.⁶⁹

Medium-scale flower exporter: Mrs. Irene Gikang'a and Leitken Flowers

Conclusions: Entrepreneurs have an incentive to actively seek technical information. As they acquire new technologies, they may guard them as proprietary or share them with other producers, depending upon the competitive relationships between specific firms.

Most middle-sized Kenyan flower exporters are skilled at finding technical information. They also receive valuable assistance from HCDA's floriculture staff. One such producer is Mrs. Irene Gikang'a of Liruru, who grows astromeria for export to Europe. She also has a shop in town for selling flowers, and she grows roses and houseplants for local sale. She has seven hectares and about four large greenhouses. She employs 28 people for picking, trimming, packing and other tasks. According to Mrs. Gikang'a, access to capital is the largest problem for flower growers. Several high costs are associated with the business, particularly the payment of royalties for new flower varieties. In terms of technology transfer, Mrs. Gikang'a got started with the help of HCDA floriculture advisor Alice Karanja. Alice is the technical advisor for horticultural crops and was trained at Egerton College. Ms. Karanja notes that although she has helped several entrepreneurs like Mrs. Gikang'a to get started,

⁶⁸ Sunripe is a private firm exporting fruits and vegetables from Kenya. They have their headquarters in Nairobi but have farms in several places in the country and are developing new sites in Tanzania.

⁶⁹ The location of the farm is proprietary information.

entrepreneurs learn quickly and because of their ongoing process of trial and error, soon know more than the extensionist. Mrs. Gikang'a said one of her best sources of information was neighboring flower farmers. She also mentioned that the local MOA extension agent is available to ask questions and helpful in some areas, but is not adequately trained in floriculture. Some farmers are unwilling to share information, but others have decided to get together and make joint investments in such items as large cold-storage units and new plant varieties. No flower growers' association exists as yet in Kenya although Ms. Kariuki and HCDA have encouraged it. Other growers who want to guard their already-established markets resist development of a flower growers' association.⁷⁰ Mrs. Gikang'a reports that approximately 100 small-scale flower growers are not exporting, but are on contract supplying flowers to larger flower grower/exporters. Most of these growers are located in the Naivasha area. They get information from the HCDA technology-transfer staff and from each other. An issue to investigate further is whether small, nearby flower farmers benefit from technological or market spillover from the large flower farms, such as Sulmac, in the Naivasha area.

Kenya Seed Company

Conclusions: A large-scale *parastatal* with very similar origins to Zimbabwe Seed Co-op, but with a very different outlook on technology transfer. The difference may be evolution of the political outlook of commercial farmers in each country.

The main producer and distributor of agricultural seeds in Kenya is the Kenya Seed Co. The company on its own conducts very little technology transfer. But with MOA extension staff, the company works in the field and their staff organize demonstrations with extension to introduce new varieties. The company was formed in 1955 by a group of farmers led by William Heilbuth.⁷¹ The formation of the company was inspired by the production of improved cultivars of sub-tropical grass and legume varieties at the Grassland Research Station at Kitale. Despite demand for the new seeds, no organization was replicating seed in sufficient quantities. Most of the original shareholders became contract seed growers to increase the availability of improved seed. A cleaning plant was established at Kitale, which is now the company headquarters. The company is valued at 92 million Kenya shillings, and the last audited turnover was 216 million Kshs.⁷²

Throughout the 1960s and '70s, the company grew. In 1962, the company began commercially multiplying hybrid maize seed. In the early 1970s, it move into certified wheat seed and barley and in 1979, horticultural seeds. A separate company, Horti Seed Kenya Limited, was formed. During the formation of Horti Seed, Kenya Seed Company acquired Simpson and Whitelaw Limited, an importer and distributor of horticultural seeds.⁷³ The two companies are now managed jointly, and Simpson and Whitelaw Limited (Simlaw) is the marketing and importing branch of the horticultural-seed business.

⁷⁰ However, the flower exporters association in Zimbabwe has reportedly visited HCDA and discussed with Alice various market issues which Kenya has more experience. She notes that because Zimbabwean growers are just starting out, they are more able to combine forces without risking loss of established markets (less of a free rider problem).

⁷¹ Incorporated The company was incorporated in 1956 under the leadership of Heilbuth and N. Bertelson.

⁷² US\$1 = 28 Ksh

⁷³ In 1969 the company leased a 727 Ha. farm (elgon Downs) from the Agricultural Development Corporation for the production of horticultural seeds and has since added a further 530 ha.

Each crop-production department within the company is responsible for growing certified seed. Growers are contracted on an acreage basis. Basic seed is allocated on a cost-plus basis. Each production department has a number of field officers who advice and assist farmers as necessary, from selection of fields and planting through all stages of harvesting. In 1974, the Management Service of Kenya Seed Co. was begun to assist seed growers with machinery, inputs and technical information. All company activities have been financed by retained profits and short-term loans from commercial banks. Research is conducted through the government research stations and some companies' research is conducted on its own farm; results are passed on to farmers through the MOA extension service.⁷⁴

An interesting study would be to compare the evolution of the Kenya Seed Company to that of the Zimbabwe Seed Coop. The two organizations started out relatively similarly, but took very different paths in terms of their emphasis on technology generation and transfer.

⁷⁴ Kitale research station (maize and pasture), Njoro station (wheat and with Kenya Breweries, barley, also oilseeds (sunflower - together with East Africa Industries).

**Annex III:
Detailed cases of private-sector technology transfer in Mali**

Private veterinary clinics ⁷⁵

Conclusion: Some technology-transfer activities provided by the public sector can be privatized by handing them over to individual entrepreneurs in a phased manner. When this is done, a level playing field should allow the new private entrepreneurs to compete with public services.

Thirty-two private veterinary pharmacies have been started under the PME/PMI program as described under section 5.3.1.2. A key issue for the pharmacies as they start up is whether they will be obstructed by the CMDT animal-health services. According to M. Lefevre, an EEC representative, a condition of starting one of these pharmacies has been to close the CMDT animal-health office in the area and remove the agent. This does not appear to be happening in Mali, and when and if it does, it will broaden the scope for opening more private pharmacies.

The following possibilities would encourage private veterinary activity in the short term: (a) private suppliers should be allowed to purchase inputs from the lowest bidder and not to have to go first to government sources, as is currently required; (b) the inclusion of animal-health services in the CMDT credit package should be optional for buying a draught team – allowing farmers to decide, when the time comes, who they would like to have service their animals; (c) provide the pharmacies that are best in terms of business management with financing for development of surgical clinics adjacent to the pharmacies and for additional transport. Such credit should be at realistic interest rates and not overly subsidized to avoid an infant-industry trap.

Over the longer term, an additional measure would be to allow para-professionals to run private, animal-health mini-pharmacies in remote locations. In a limited number of locations, full-blown, private pharmacy/clinics are economically viable. Most of these have been covered already under the project. Para-professional animal-health workers might find it more worthwhile to set up a practice in a remote area. However, they are not yet allowed to do so, a condition which limits how much area can be covered by these private services. The list of requirements to open a private shop would be a barrier to entry for most para-professionals; it includes a degree in veterinary medicine and proof of a certain level of financial strength. The key elements for success for para-professionals are probably mobility and training, rather than a formal veterinary degree. This issue should be pursued, as USAID designs the form of its support for the pharmacies.

One method of preparing people for this responsibility is to introduce something along the lines of the Student Enterprise Project in Lesotho. This project, based on a CalPoli model, entails a three-year program instead of two. The first two years of this program are devoted to technical training, and the third year is a hands-on, practical business experience in a certain field. This kind of experience would give para-professional veterinarians and students in other areas an opportunity to hone their business skills in combination with practical application of their technical knowledge.⁷⁶

⁷⁵ Contacts: Musa Coulibaly (private veterinarian and major pharmacy owner), Doral Watts (USAID Mali, Livestock), Peter Bloch (USAID natural resource economist) and Richard Cook (USAID Mali, Livestock).

⁷⁶ Contact American Agriculture International -- Firouz Rooyani (in Washington D.C.) for further information.

Some important questions to look at as the private pharmacies move along are the following: Who is being served in the rural areas?; Are certain farmers getting more attention than others?; Will there be problems of smaller-scale producers losing services if they are fully privatized?; Or will smaller-scale producers receive better services with added choices and competition.

Horticultural exports

Conclusion: Private technology transfer associated with a business in decline will not be sustained. However, some lasting spillover affects may result from the business' initial technology transfer.

The horticultural-export business in Mali declined sharply during the late 1980s due to political and marketing problems. In 1986, Fruitema, the largest exporter had 2000-3000 producers, but now they have closed their doors; the phone is disconnected, and they fired 70 percent of the staff the week before this report author arrived in Mali. Fruitema had been providing seed, fertilizers and extension services to complement extension services provided by OHV. Fruitema had three types of contracts -- individuals, cooperatives and villages. In the mid-1980s, Mock reports that Fruitema had an impressive, semi-mechanized sorting and packing operation for mangoes for selling to Rungis, a French wholesale market. Fruitema's main exported items were green beans, mangoes, lemons, limes, hot peppers and strawberries.

A second major exporter studied in 1986 was Abou Traore. Traore's operation began in 1983 as a seed-importing business -- tomato, carrot, onion, lettuce and cucumber. He began distributing seeds and fertilizers to Cfs for green-bean production. Farmers received technical assistance and guidance on planting dates and cultivation and also used the government technology-transfer service. Producer-contract prices were fixed before planting. According to Mock, in 1986, Traore was contracting with 682 farmers with an average farm size of 2.3 hectares. When interviewed for this study, Traore stated that in the early 1980s, he had 2,500 farmers growing on contract, with seven zones of green beans, including about 300 farmers each, covered by three extensionists. Some green beans and tomatoes are still being produced for cash, but farmers do not want to produce on contract. Other crops that were being exported but are no longer include hot peppers, mangoes and lemon. Exports were going to France, extra-fine green beans to Royal Net, bobby beans to Belgium and Holland and mangoes and lemons to Scandinavia and France.

Also addressed in the 1986 Mock study was another activity which has since dwindled to almost nothing. Amadou Hacko's SOCAM was exporting puree of mango and guava to Germany and tamarind juice and syrup. The company tried aluminum sacks for packaging as cans were too heavy and expensive. The sacks can still be seen around Bamako, but SOCAM seems to be, at least temporarily, out of the exporting business. The company conducted some research on tomato production and had some success in increasing yields. It would be interesting to know if the areas with these increases have sustained them.

Finally, an existing union of vegetable growers, The Union Nationale des Coopératives des Maraîchers et Planteurs du Mali, is a government *parastatal*. The people working in the union are all paid by government. The union has 13 member cooperatives, with a total of 5,000 members around the country, but they are concentrated in Sikaso in the South. The following provide revenues for the union: members fees; sale of seeds and other inputs; and charges for services, such as technical assistance.⁷⁷ The union provides its members with a range of services, including input supply, marketing of crops and technical assistance, both in terms of production and marketing. The union does not, however, have a field presence in terms of technology-transfer agents. Instead, it coordinates on the ground with the public-sector agents of the national technology-transfer system. At the

⁷⁷ Each member pays an annual fee.

district level, the union works together with DNACoop and through the National Crops Extension Service. According to Mr. Traore and others, farmers don't need much technical assistance; they know how to produce good quality for a wide variety of fruits and vegetables. A market incentive would encourage them to try new techniques to improve both quality and yields. Farmers know, for example, how to produce extra-fine green beans. Mr. Traore said that if the farmers have the seed, they can deliver the required quality. However, because of a catastrophe in 1984, the farmers are unwilling to grow beans. In 1984, a plane carrying 32 tons of beans could not land for four days because military planes had wrecked the runway. All the beans were lost. Many farmers went unpaid and many exporters went bankrupt. However, under current circumstances, not much demand exists for improved technologies.

The major activities of the Union are to support its members in terms of input distribution. The union distributes seed, fertilizers and pesticides necessary for production. The farmers' fruit production includes mangoes, oranges, papaya, mandarin oranges and melons. Their vegetable production includes tomatoes, cucumbers, zucchini, eggplant, cabbage, poureaux, okra and green beans. Only green beans and mangoes are grown for export. And in 1991, the union exported no green beans and only a small amount of mangoes. The union is normally responsible for only about 5 percent - 10 percent of mango exports, with Fruitema exporting the rest. An 8 percent export tax prevailed until 1990, but Fruitema had been exempt from it. In 1991, the mango season -- February, March and April -- conflicted with the change in governments and led to a very low level of exports, especially for Fruitema.

In terms of marketing arrangements, the union sends mangoes for export and then pays the farmers 15 days after delivery. The union covers the cost of transporting the mangoes from the headquarters to the airport. The cooperative must transport the vegetables to Bamako. The plane is arranged by the European buyers who finance the air freight. The buyers changing their orders on short notice creates a marketing problem for the union. Sometimes the middleperson is misinformed, and the sellers end up getting a lower price because the buyer claims that the merchandise is not as requested. Some negotiations are ongoing between the Canadians and the union, but price poses a problem for expanding markets across the Atlantic. Crossing the Atlantic before managing a consistent business with Europe does not seem like a good idea.

In this area, the key issues are not yet technology transfer although that may become an issue later. The problems are market related. It may never be worthwhile for Mali to invest in the green-bean market unless they try to attack the market and steal that market share. With Mali's close proximity and new crops, such as flowers, on the rise in Kenya, Mali might be able to do this. However stiff competition from other West African nations and the technically advanced and well-capitalized Kenyan companies would make it extremely difficult. Key initial steps are the following:

- Strengthen the union, which already has infrastructure and relationships with the growers. The union already has plans that each local union chapter should be able, at some point in the future, to take over financial support of its staff.
- Change the name of Fruitema to counteract reputation problems, and train a group of grower representatives or local business people to assume most of the responsibility for running it.
- Keep government involvement to an advisory level.
- Engage in a fairly intensive training period.
(Start with and focus on commodities for which a definite market exists.)
- Develop a strategy for absorbing shocks, such as planes that don't arrive
- Educate the buyers.

This was an important point brought up by the Sunripe in Kenya. They had to work closely with the buyers to make them understand the constraints on the Kenya side. Sunripe now stays in close communication with Europe by phone and fax. Additionally, they continually upgrade their products. The following several elements of buyer education are crucial: good communications between buyer and seller; timely transport from the farm to the airport; good packaging; and consistent quality.

Associations villageois and technology transfer

Conclusion: Strong farmers' associations have an incentive to provide for their own extension needs in order to get specialized information when and how their members need it.

Within all three zones covered by the large development organizations in the country -- CMDT, OHV and OHV - farmers' associations are assuming greater responsibility for organizing procurement and distribution of inputs and marketing of their products. The most progressive farmers' associations have hired technical-assistance staff. Farmers' associations in each of the three zones are discussed in this section.

CMDT covers 450,000 hectares in central Mali. This system, which is similar to those in other West African countries, evolved from the long-term involvement of the Compagnie Francaise pour le Developpement des Textiles, which has been engaged cotton production in Mali since 1959. The main cash crop in the CMDT zone remains cotton, and the bulk of CMDT services are focused on cotton. About 1,300 CMDT field agents serve 145,000 farmers. Farmers in the CMDT zone have long-term experience and little need of instruction in cotton production. However, CMDT is now promoting an integrated farming system, including cereals, sesame, millet, sorghum, livestock and rice. CMDT work on food crops is subsidized with donor funding. Training of technology-transfer staff is usually conducted in the field. Each region has two trainers, in addition to one at headquarters. CMDT collaborates with IER, the national research body, to conduct regular meetings, and CMDT finances a cotton-research station.

CMDT's key problems with technology-transfer activities and other agricultural services relate once again to markets -- specifically, the price of cotton. When prices fall, CMDT must let staff go. The association villageois, begun in the CMDT zone in 1974, were the first in the country and include some of the most well-organized examples of the AV organization and farmers' associations managed and financed technology transfer. CMDT crop and animal-health agents each cover several villages, and they are backed by village-level volunteers. The AVs earn revenue through marketing of cotton, as well as through other activities. As farmers become better organized, they take on more responsibility.

Some strong AVs in the CMDT zone have started their mini-extension service. The AV forms a *conseil de gestion* (management council). Before starting the council, the AV must demonstrate that it is in control of managing input distribution and marketing, cooperative management, and has attained functional literacy. To staff the council, local people are trained to extend advice on technical packages (crops and livestock), to provide literacy training and to conduct feasibility studies in order to identify the key strategic investments for the AV. Training and technical backstopping is provided by CMDT. The individuals working on the council, paid by the AV, usually have as much or more education than CMDT staff.⁷⁸

Because of their higher level of education and intuitive understanding of conditions in the area, these council members adapt relatively easily. In each council, one person must be capable of farm management, including partial budgeting, as well as capable of financial management of a small business and proposal preparation. To get started on the road to forming a council, the AV contacts the zone manager (*chef de zone*), and together they try to work out the orientation of the council, including areas of specialization, number of members and training

⁷⁸ The minimum is typically 9th-12th grade and there may be some degree pursuers who have dropped out after several years.

needs. The AV picks candidates and arranges finances with CMDT for training. The most prosperous AVs had made their management councils strong, and managers were in some cases involved in commodity price negotiations at a high level.

Organisation Haute Vallee (OHV)⁷⁹ covers an area of 10,000 hectares and 900 villages. The main cash crops are cotton or tobacco. AVs are also earning revenue through marketing of crops and distribution of inputs. The technology-transfer system includes OHV agents in a basic, top-down structure, field staff focused on training in cooperative management (working under a project run by the Cooperative League of the USA) covering several villages each, and village-level volunteers.

CLUSA's method of technology transfer is very practical and applied. All specific lessons passed on in training sessions are applied immediately. For example, after discussing credit, the group immediately applies for credit. After training on how to start the project, they immediately begin to implement it. The groups have regular and fairly intensive training for two years, after which they are on their own. The volunteers trained under the project remain as a support. The CLUSA agents are expanding the area they cover over time, and the goal is for each to cover ten villages. The specific types of projects they are doing include the following: shops; livestock pharmacies; fertilizer distribution, which is one of the most successful activities; distribution of other inputs, including implements such as watering cans.

In February 1993, OHV, together with USAID, is conducting a financial and institutional analysis which will include reassessing the ability of AVs to pay for technology transfer now that farmers are marketing their own output and thus generating greater income through this activity. The OHV currently pays the salaries of all its civil-servant employees. USAID pays only per diem. USAID does, however, pay for the CLUSA technology-transfer staff working with the AVs.⁸⁰ Sixty five villages were managing their own marketing activities, delivering to a central point from which their output is shipped by the OHV to the factory. The total number of AVs expected to by 1993 be conducting their own marketing is 298 out of a total 900 villages.

Office Du Niger (ODN) The main cash crop is rice. Farmers are also earning revenue from marketing crops and distributing inputs. Many farmers in Office du Niger are very competent at growing paddy rice. In new areas, technology transfer is required for the first few years, but progress is rapid because of exposure to established growers. The technology-transfer system in ODN includes ODN agents each covering several villages, backed by local-level volunteers. Technology-transfer staff also cover topics such as cattle and fish cultivation in the rice paddy. The ODN includes four main technology-transfer types: (1) the Office du Niger type, in which agents do a variety of tasks, including input supply and marketing; (2) the Caisse Central type (at Retail under a German project), which is very intensive; (3) the Arpon type (under the Dutch); and (4) T&V, which has run under two pilots and will be expanded under the Project National de la Vulgarization Agricole (PNVA).

Along with liberalization, ODN agent responsibility for marketing has been reduced or eliminated as the AVs have assumed these responsibilities. Under the intensive Retail approach, some agents work with the AVs and advise them on everything, but they are paid by the ODN. And training is held at farmers' training centers in the zone (for example in Niono and Dioro) for farmers, technology-transfer staff and members of the AVs. The centers are also used for literacy training.

⁷⁹ Directorate Haute Vallee - DHV this is the acronym typically used to discuss the first phase of the project which established the work in the area.

⁸⁰ The Cooperative League of the USA (CLUSA) is running a project focusing on trying to promote privatization of input supply and strengthening of cooperative management skills within the AVs in the OHV zone.

Many of the farmers' groups are involved in purchasing and distributing inputs and marketing output.⁸¹ The EEC representative felt that it was possible that over time some of the strong AVs in Office du Niger could assume responsibility for technology-transfer activities.

⁸¹ System involves offer of a tender by the farmers organization, then the bank finances the group to pay the businessman with the best offer. The group is jointly responsible for the loan. They then sell the fertilizer, pay off the loan and keep the profits.

**Annex IV:
Survey Questions**

1. *Evolution of the Organization, Its Objective, and the Role of Technology Transfer*

- 1.1 How was the organization started?
- 1.2 What was the sequencing in terms of public and private involvement (if both are relevant)?
- 1.3 What is the overall objective(s) of the organization?

For example, to sell pesticides and make a profit or to make tomato paste and sell it for a profit as in the case of an input supply firm or a processor/marketer, to alleviate poverty and hunger as in the case of some NGOs, or to provide farmers with a representative body and a range of services as in the case of farmers associations.

- 1.4 How important are technology transfer activities in terms of successfully accomplishing the overall objective(s) of the organization? (Use the following four questions to get a proxy but split them up)

- * What is the budget for staff salaries?
 - * What is the number of field staff?
 - * What is the cost of providing transport? (Number of vehicles and cost per vehicle)
 - * How much is spent on training for staff?
 - * What is the total budget?
 - * How much is spent on research (adaptive or other)?
- 1.5 What has been the implementation experience of the organization?
 - * What have been the most successful technology transfer efforts and why?
 - * How is success measured by the organization? (yield increases, quality improvement or other measures)
 - * What have the major problems been?
 - * What strategies have been used to overcome them?

2. *The Content, Approach and Management of Technology Transfer Activities*

2.1 What is the content of technology transfer activities carried out by the organization?

For example, teaching farmers to use the chemical they sell, teaching farmers how to grow the type of tomato required by the factory, advising farmers on a range of agricultural improvements as a part of a project with other components such as nutrition and health information, or advising farmer association members on a specific commodity(ies).

2.2 What is the approach used?

For example, is there a permanent field staff that makes regular visits, is there a training center with courses, is there a seasonal schedule of events, what input do farmers make to the process, what kind of information is collected in terms of farmer reactions, is it used as feedback to research and so on.

2.3 How are technology transfer activities managed?

* How is training of field staff carried out?

* How are staff recruited? Directly from university, or from ministerial extension staff, or other?

* What level of education is required for which positions?

* How are field staff supervised (if at all) - what form of accountability is used?

* What are the adaptive research activities of the organization?

* What is the allocation of responsibilities between researchers, extensionists, farmers, and others involved?

* How is information collected from the adaptive research and how is it distributed?

* Any kind of quantitative measurement available such as area used for on-farm trials, investment in trials, number of farmers participating, yield increases or other improvements exhibited in the trials.

* Who has control of setting up the budget for field activities?

3. *Financing of Technology Transfer Activities*

3.1 How are technology transfer activities financed?

* Do farmers pay? (e.g. through higher input prices, lower output prices, or on a fee-for-service basis)

* Are costs shared with other organizations such as NGOs, international donors, government or others?

* If so, what is their role: purely provision of financing or some direct management?

* What are the biggest cost constraints?

4. *The Target Group of the Organization*

4.1 What group of producers are being supplied with agricultural information by the organization.

- * What is the average farm size of farm of producer served?
- * What is the average number of animals owned by producers served?
- * What is the level of education?
- * What is the gender breakdown of those served?
- * Where are clients located?
- * How may are reached?

5. *Linkages: Between Organizations and with the Public Sector*

- * What is the relationship between the technology transfer activities of various organizations?
- * What is the relationship between the public and private sector organizations involved in technology transfer in the country?
- * What is the sequence of public and private involvement in this case?

6. *Other possible things to cover (if relevant):*

- * What do managers think of the public sector extension operations?
- * What would happen to their information supply activities if markets for their products collapsed?
- * What is the main source of market information in the country?
- * What is the relationship between the public/private mix and other elements like macro-economic policy, political system, commodity mix in the country?

**Annex V:
Persons contacted during the study⁸²**

ZIMBABWE

- * Richard H. Amyot, Chief Executive, Commercial Grain Growers Association (Harare)
- * Bert Bernland, Director, Zimbabwe Tobacco Association (Harare)
- John H. Cockburn, Director Special Projects, Zimbabwe Tobacco Association (Harare)
- Consultant, ZTA small-scale promotion farm
- * Joseph M. Made, Deputy General Manager, Agricultural Development Authority (Harare)
- * Helen L. Vukasin, Consultant, Zimbabwe Women's Bureau (Harare)
- * Rex Tattersfield, Head of Research, Zimbabwe Seed-Coop (Seed Co-op Research Station, Harare)
- * Willie Ranby, General Manager, National Tested Seeds (Harare)
- * K.J. Wilson, Managing Director, Agricura (Pvt.) Ltd. (Harare)
- * J.N. Sairai, Sales Manager, Agricura (Pvt.) Ltd. (Harare)
- Twenty-five farmers from the Mt. Darwin area
- * Stephen J.L. Moyo, Country Manager, Ciba-Giegy (Harare)
- * Frank W. Dyson, Managing Director, Shell Chemicals Zimbabwe (Pvt.) Ltd. (Harare)
- Peter L. Wells, Agricultural Chemicals Manager, Shell Chemicals Zimbabwe (Pvt.) Ltd. (Harare)
- Sylvester Mavindidze, Consumer Products Manager, Shell (Harare)
- L.S. Dollimore, Agrochemicals Product Stewardship, Shell International Co. Ltd. (London)
- * S.T. Heri, Economist, Horticulture Promotion Council (Harare)
- * J.M. Coyler, Director, Africa Produce Marketing (Pvt.) Ltd. (Harare)
- * A.R. Gibbins, Executive Director, Canadian Association for the Private in Southern Africa (CAPSSA) (Harare)
- * Omari M. Issa, Regional Manager, Africa Project Development Facility
- * C. Machingaifa, Assistant General Manager, Agricultural Finance Corporation (Harare)

⁸² Not including AID mission staff or telephone interviews.

- * M.B.K. Hakutangwi, Chief Training Officer, Agritex (Harare)
- * R.H. Vaughan-Evans, Director - Cotton Training Center, Commercial Cotton Growers' Association of Zimbabwe (Kadoma)
- W.N.P. Adlam, Secretary, Commercial Cotton Growers' Association of Zimbabwe (Harare)
- * Andy McAllister, Marketing Manager, Taurus Spraying Systems (A Division of Mashonaland Holdings) (Harare)
- Geoff Bradshaw, Applications Specialist, Taurus Spraying Systems (Harare)
- * David McConaghy, Technical Services Manager, ZFC Limited (Harare)

KENYA

- * Jagmeet Singh Ghulla, Technical Director, Njoro Canning Factory (K) Ltd. (Nakuru)
- Thierry Lardier, Project Consultant, Njoro Canning Factory (K) Ltd. Nakuru
- Mr. Sarazin, Project Consultant, Hortequip Ltd. (Vihiga)
- Group of approximately 10 Vihiga bean growers
- * Martin A. S. Mulandi, Managing Director, Horticultural Crops Development Authority (Nairobi)
- Peninnah K. Kimweli, Project Manager, Horticultural Crops Development Authority (Nairobi)
- Alice Karanja, Floriculture Expert, HCDA (Nairobi)
- * Mr. Ndungu, Farm Manager, Orchids Ltd. (Limuru)
- * Mrs. Irene Gikang'a, owner, Leitken Flowers (Limuru)
- * Mr. Kusterani, Director, Kabazi Cannery (Subukia)
- * Shanti Shah, Director, Sunripe Ltd. (Nairobi)
- Hasit Shah, General Manager, Sunripe Ltd. (Nairobi)
- * O.P. Bij, Managing Director, Makindu Growers and Packers Ltd. (Nairobi)
- * Shabudin Samnani, Director, Economart International (Nairobi)
- * Badur Samnani, Director, Walji Mulji and Company (Kisumu)
- * Charles Njuguna, General Manager, Simpson and Whitelaw Seeds (Nairobi)
- * Philip J Payne, Manager Leaf Operations Nyanza & Exports, British American Tobacco (Nairobi)

- * Mr. Kingangi, Director, KPCU (Nairobi)
- * Symon K. Chemnjor, Marketing Manager, Kenya Grain Growers Co-op Union Ltd. (Nakuru)
- * Isaac Njogu, Director, Farmers Partner Ltd. (Nakuru)
- * Mr. Nathani, Director, Agrico (Nakuru)
- * Kungu Gatabaki, Director (East African regional office), Commonwealth Development Corporation (Nairobi)
- * Phillip O. Ofafa, Agricultural Manager, Hoechst East Africa Ltd. (Nairobi)
- * Rob Combes, Project Leader, Safe Use Project (GIFAP) (Nairobi)
- * Anonymous sources at Kenya Breweries Ltd. and Pyrethrum Board (Nakuru)
- * Jacob Kampen, Agriculturalist, World Bank (Nairobi Office)
- * Mr. Ndegwa, Extension Specialist (local consultant), World Bank (Nairobi)
- * Dr. Elfring, Agricultural Economist, GTZ (Nairobi)
- * Price Waterhouse consultant working on agribusiness at Egerton Agricultural Resource Center (Njoro)

MALI

- * Yaya Togola, General Director, Operation Haute Vallee (OHV) (Bamako)
- * Adly M. Hassanein, Chef of Party, DHV Project (Experience Inc. consultant) (Bamako)
- Cheickne Sidibe, Chef of Extension Section, OHV (Bamako)
- * Lassana Sanogo, Secretary General, CMDT (Bamako)
- * Abderamane Djire, core technical staff, CLUSA project (Bamako)
- Mohamed Agakuratani, core technical staff, CLUSA project (Bamako)
- Jeff Felton, core technical staff, CLUSA project (Bamako)
- Fatimata Guindo, core technical staff, CLUSA project (Bamako)
- * Jean-Baptiste Diabate, Head of Service Technique, CMDT (Bamako)
- * Mamadou Kale Sanago, Head of Vulgarizaation (at regional office -- Segou --, Office du Niger.
- * Mme. Diarra K. Samoura, Director, Center D'Animacion Cooperative (Segou)
- Seydou Traore, Cooperative Technical Assistant, DNA Co-op (Segou)

- *, assistant, private veterinary pharmacy (Konobougou)
- * Souleymane Guindo, assistant, private veterinary pharmacy (Fana)
- * 32 farmers in Goreli-Were village plus the extension agent and animateurs
- * 50 farmers in Bugula village plus the extension agents, CLUSA agent, Peace Corps volunteer, and the animateurs.
- * Mr. Lefevre, livestock specialist, EEC (Bamako)
- * Dr. Moussa Coulibaly, owner, Officine Veterinaire Kounandji (Bamako)
- * Cheick Tidiani Kone, Chef Division Marketing, Union Nationale des Cooperative des Maraichers et Planteur du Mali
- * Abou Traore, owner, Continental exports (Bamako)
- * Brehina Ouattara, Administrator General, Ciba-Giegy (Technical Assistance Office in Bamako)
- * Robin Poulton, PVO Coordinator, Bureau de Developpment Generale (Bamako)
- Boubacar Kante, Assistant PVO Coordinator (Bamako)

**Annex VI:
Bibliography**

- Abbot, Richard. 1991. "Privatization of fertilizer marketing in Cameroon." AMIS PROJECT report, Bethesda: Abt Associates.
- Abbot, Richard D. and David A. Lloyd. 1991. "Privatization of fertilizer marketing in Cameroon: A third-year assessment of the fertilizer sub-sector reform program." AMIS PROJECT report, Bethesda: Abt Associates.
- Africa Project Development Facility. 1990. Report of Operations Washington D.C.: International Finance Corporation.
- Arnon, I. 1989. Agricultural Research and Technology Transfer. New York: Elsevier Applied Science.
- Baranson, J. 1970. "Technology Transfer through the International Firm." American Economic Review no.60:435-440.
- Barwell, I. 1983. "The Real Test for Technology: Can Local Manufacturers Use It?" Ceres 16(1):35-37.
- Birkhaeuser, Dean, Robert Evenson, and Gershon Feder. 1991. "The Economic Impact of Agricultural Extension: A Review" Economic Development and Cultural Change April:607-650.
- Blume, Hans. 1971. Organizational Aspects of Agro-Industrial Development Agencies: 9 Case Studies in Africa (Tea - Cotton - Oil-Palm). München: Weltforum Verlag.
- Buch-Hansen, M. 1980. "Agro-Industrial Production and Socio-Economic Development: A Case Study of KTDA Small-Holder Tea Production in Buret, Western Kenya." Working Paper no.11. Institute of Geography, Socioeconomic Analysis and Computer Sciences. Roskilde University.
- Business International Corporation. 1990. Privatization in Latin America. New York: BIC.
- Bwambale, H.E. 1978. "Agricultural Research and Technology Diffusion by Foreign Agribusiness Firms in Kenya." Ph.D. Dissertation: Harvard.
- Byerlee, Derek. 1987. "Maintaining the Momentum in Post-Green Revolution Agriculture. A Micro-Level Perspective from Asia." MSU International Development Paper no. 10. East Lansing: Department of Agricultural Economics, Michigan State University.
- Byrnes, Kerry J. 1991. "A Cross-Cutting Analysis of Agricultural Research, Extension and Education (AG REE) in AID-Assisted LAC Countries." Vols. 1 and 2. Washington D.C.: USAID/Chemonics.
- Chipika, Stephen. 1990. "Agricultural Technology in Zimbabwe - the Smallholders Choice." Appropriate Technology. Vol. 17 (1): 22 - 25.
- CGIAR Secretariat. 1988/89 Annual Report. Wash D.C. Sept. 1989
- Claar, John B. 1988. "Private Sector Extension: Constraints, Potential." in Interpaks Exchange 5(2):4-5
- Crowder, Van L. 1991. "Extension for Profit." Human Organization. 50 (1): 39 - 42.

- Dembele, N., John Staatz, and J. Egg. 1990. "The Experience of Mali." Cereal Market Information Systems: National Experiences Series for the CILSS/Club du Sahel seminar on cereal market information systems. Bamako.
- Dembélé, Niama Nango, John M. Staatz, and Johny Egg. 1990. "The Experience of Mali." in Cereal Market Information Systems. Document no. 1. Bamako: Club du Sahel.
- Development Alternatives, Inc. 1988 - 1989. African Development Bank Agricultural Sector Study. [Three volumes: Phase 1 Report; A survey of trends and issues, Sept. 1988. Phase 2 Report; The Bank's experience in lending to agriculture, January 1989. Phase 3 Report; Options and recommendations, April 1989.] Bethesda: DAI.
- de Janvry, Alain, David Rúnsten, and Elisabeth Sadoulet. 1987. "Technological Innovations in Latin American Agriculture." Program Papers Series No. 4. Inter-American Institute for Cooperation on Agriculture.
- Eriksen, John H. "A strategic framework for commodity systems research in agriculture." USDA Purchase Order # 40-319P-1-00227-00 (dated 26 February 1991). Final Report submitted May 1991.
- Evenson, Robert E. 1986. "The Economics of Extension." In Investing in Rural Extension: Strategies and Goals. Jones, Gwyn E. (editor). New York: Elsevier.
- Feder, Gershon and Roger Slade. 1984. "The Acquisition of Information and the Adoption of New Technology." AJAE V.66(3): 312-320.
- Feder, Gershon and Roger Slade. 1985. "The Role of Public Policy in the Diffusion of Improved Agricultural Technology." AJAE V.67(2):...
- FAO. 1989. "FAO's Experiences in Agricultural Extension in Agricultural and Rural Development." paper presented at the Global Consultation on Agricultural Extension, FAO Headquarters, Rome, Italy, December 4 - 8.
- FAO. 1991. International Directory of Agricultural Extension Organizations. Rome: FAO.
- Gilbert, Elon. 1990. "Non-governmental organizations and agricultural research: The experience of the Gambia." Network Paper 12. U.K.: Overseas Development Administration.
- Gill, Dhara S. 1989. "Returns to Expenditure on Agricultural Extension Services: Evidence from the Literature" Staff paper 89-19. Department of Rural Economy, University of Alberta.
- Goldsmith, Arthur. 1985. "The Private Sector and Rural Development: Can Agribusiness Help the Small Farmer." World Development 13(10/11): 1125-1138.
- Hayward, John. 1989. "Agricultural Extension: The World Bank's Experience and Approaches." paper presented at the Global Consultation on Agricultural Extension. FAO: Rome.
- Head, John G. 1974. Public Goods and Public Welfare. North Carolina: Duke University Press.
- Hobbs, S.H. and T.A. Taylor. 1987. "Agricultural Research in the Private Sector In Africa: The Case of Kenya." Working Paper no. 8. Netherlands: ISNAR.

- Holtzman, John S. 1990. "Towards an Africa Bureau agricultural marketing strategy and action plan." AMIS Project paper. Bethesda: Abt.
- Hormann, D.M. "Export Oriented Horticulture in Developing Countries - Kenya." Working paper no. 31. Institute for Horticultural Economics: University of Hanover.
- Huffman, Wallace E. 1978. "Assessing Returns to Agricultural Extension" American Journal of Agricultural Economics 60(5):969-975
- Hunting Technical Services Limited. 1990. "Cotton Sub-Sector Study: Interim Report." England: Hunting Technical Services Limited.
- ISNAR. 1991. "Potential roles of public and private sector agricultural research in Sub-Saharan Africa." Netherlands: ISNAR.
- ISNAR. 1991. "Potential roles of public and private sector agricultural research in sub-saharan Africa." working paper for Africa Bureau, Office of Technical Resources, USAID.
- Jaffee, Steven. 1990. "Alternative Marketing Institutions for Agricultural Exports in Sub-Saharan Africa with Special Reference To Kenyan Horticulture." unpublished D. Phil. Dissertation. Oxford: Department of Agricultural Economics.
- Judd, M. Ann, James K. Boyce, and Robert Evenson. 1986. "Investing in Agricultural Supply: The Determinants of Agricultural Research and Extension Investment." Economic Development and Cultural Change 35(1):77-111.
- Kontos, Stephen. 1990. "Farmers and the Failure of Agribusiness in Sudan." The Middle East Journal. 44(4): 649 - 667.
- Kurien, V. 1978. "Food Aid in the Form of Dairy Products: The Linkage Between Food Aid and the Development of Milk Production and the Dairy Industry in India." speech presented at the XX International Dairy Congress. Paris.
- Kusterer, Kenneth C. 1981. "The Social Impact of Agribusiness: A Case Study of ALCOSA in Guatemala." AID Evaluation Special Study No. 4. Washington D.C.: USAID
- Lafourcade, Olivier. 1988. "Research and Extension: Lending Strategies." In Trade, Aid, and Policy Reform: Proceedings of the Eighth Agriculture Sector Symposium Roberts, Colleen (editor). 65 - 69. Washington D.C.: World Bank.
- Lionberger and Chang. 1970. Farm Information for Modernizing Agriculture: The Taiwan System. New York: Praeger.
- Lowdermilk, Max K. 1981. "Promoting Increased Food Production in the 1980's Approaches to Agricultural Extension in Different Production Systems" in Promoting Increased Food Production in the 1980's, proceedings of the 2nd Annual Agricultural Sector Symposia. 76 - 103. Washington D.C.: World Bank.
- Makau, B.F. 1988. "Agricultural research and technology diffusion by the private sector: A bibliography." NCST, no. 25. Nairobi: National Council for Science and Technology.

- Makau, B.F. 1988. "Survey on private sector research and development (R&D) resources and activities in Kenya." NCST No. 26. Nairobi: National Council for Science and Technology.
- Marsden, Keith. 1990. "African Entrepreneurs: Pioneers of Development." Discussion Paper no.9. Washington D.C.: IFC.
- Martin, Jerry. and Charles J.D. Stathacos. 1990. "A Pre-feasibility Study of Malian Horticultural Export Crops." AMIS Project paper. Bethesda: Abt.
- Mascarenhas, R.C. 1988. A Strategy for Rural Development: Dairy Cooperatives in India. London: Sage.
- Mateen. Rabihah. 1991. "North Cameroon Seed Multiplication Project, Phase II." Final Report. Washington D.C.: Development Assistance Corporation.
- Minot, Nicholas. 1991. "Impact of the fertilizer sub-sector reform program on farmers: The results of three farm-level surveys." AMIS PROJECT paper. Washington D.C.: Abt Associates.
- Minot, Nicholas. 1986. "Contract Farming and Its Effect on Small Farmers in Less Developed Countries." Working Paper no. 31, MSU International Development Paper Series. East Lansing: Department of Agricultural Economics, Michigan State University.
- Mock, Christopher. Trip Report on Mali Contract Farming.
- Mooney, Timothy J. 1985. "AID Agribusiness Activities in Africa." Bureau for Science and Technology, USAID.
- Moris, Jon. 1991. Extension Alternatives in Tropical Africa. U.K.: Overseas Development Institute.
- Nayman, Oguz, B. "Seekers of Light" or "Information-Seeking Habits of Farmers: An Explanatory Survey." Punjab-Pakistan.
- Netherlands Ministry of Agriculture and Fisheries. 1988. "The Agricultural Extension System in the Netherlands." The Hague: MOAF.
- Netherlands Ministry of Agriculture, Nature Management and Fisheries. no date. "Agricultural Structure Memorandum" Abridged version.
- OECD. 1989. "Survey on Effects and Consequences of Different Forms of Funding Agricultural Advisory Services." presented at the Preparatory Meeting for the Tenth Working Conference of Directors of Agricultural Advisory Services. Paris.
- Orivel, F. 1983. "The Impact of Agricultural Extension Services: A Review of the Literature." In Perraton, Hilary, D.T. Jamison, J. Jenkins, F.Orivel and Laurence Wolff. 1983. "Basic Education and Agricultural Extension - Costs, Effects, Alternatives." World Bank staff working paper no.564. Washington D.C.: World Bank.
- Pazvakavambwa, S. 1991. "A Policy Analysis of Agricultural Extension in Zimbabwe." paper presented at a conference on "Zimbabwe's Agricultural Revolution", Victoria Falls, Zimbabwe 7-11 July.
- Pineiro, M. 1985. "Agricultural Research in the Private Sector: Issues on Analytical Perspectives." Proagro Paper No.1. Netherlands: ISNAR

- Posner, Joshua L. and Elton Gilbert. 1990. "Sustainable agriculture and FSR teams in semi-arid West Africa: A fatal attraction?" Journal for Farming Systems Research-Extension. Nov.,
- Pragma. 1986. "Quick Reference Guide to Private Sector Projects in Sub-Saharan Africa." working paper, Africa Bureau, USAID.
- Pray, Carl and Ruben Echeverria. 1989. "Private Sector Agricultural Research and Technology Transfer Links in Developing Countries." Linkages Theme Paper no.3. Netherlands: ISNAR.
- Rama, Ruth. 1985. "Do Transnational Agribusiness Firms Encourage the Agriculture of Developing Countries? The Mexican Experience." Food Systems. 37(3): 331 - 343.
- Repo, Aatto J. 1987. "Economics of Information." In Annual Review of Information Science and Technology Vol 22. pp. 3 - 35. (editor) Martha E. Williams. New York: Elsevier Science Publishers.
- Rice, E.B. 1971. "Extension in the Andes: An Evaluation of the Official U.S. Assistance To Agricultural Extension Services in Central and South America." (Condensed version), AID Evaluation Paper 3.
- Rogers, William L. 1987. "The Private Sector: Its Extension Systems and Public/Private Coordination." In Agricultural Extension Worldwide: Issues, Practices and Emerging Priorities. p.13 - 21. (Editors) William Rivera and Susan Schram. New York: Croom Helm.
- Roling, Niels. 1982. "Alternative Approaches in Extension." In Investing in Rural Extension: Strategies and Goals. Gwyn Jones (Editor), Elsevier Applied Sciences Publishers, pp. 65-91: U.K.
- Roth, Gabriel. 1987. The Private Provision of Public Services. Washington D.C.: Oxford University Press for the World Bank.
- Sankar, T.L. and Y. Venugopal Reddy. 1989. Privatization: Diversification of Ownership of Public Enterprises. Hyderabad: Booklinks Corporation.
- Schwartz, Lisa A. and Jacob Kampen. 1992. "Agricultural Extension in East Africa." World Bank Technical Paper No. 164. Washington, D.C.: World Bank.
- Schwartz, Lisa A. Forthcoming. "Balancing Private and Public Sector Extension: Theory and Case Studies." draft discussion paper. Washington D.C.: World Bank;
- Serafini, Phillip. 1991. "Private Sector Contributions to Agricultural Research and Development in Africa: The Ciba-Geigy and Pioneer Hi-Bred International Examples." draft paper presented at AMIS Project seminar. Bethesda: ABT.
- Stavis, Benedict. 1974. "Rural Local Governance and Agricultural Development in Taiwan." Special Series on Rural Local Government. Ithaca: Cornell University.
- Stiglitz, Joseph E. 1989. "Incentives Information and Organizational Design." National Bureau of Economic Research Working Paper no. 2979. Cambridge: NBER.
- Straub, Gordon A. 1978. "The Use of Radio in Basic Village Education." unpublished report prepared for USAID.

- Tendler, Judith. 1983. "What to Think About Cooperatives: A Guide From Bolivia." Rosslyn: The Inter-American Foundation.
- Toulmin, Camilla. 1985. "The Allocation of Resources to Livestock Research in Africa," African Livestock Policy Analysis Network Paper, no.4, International Livestock Centre for Africa (ILCA), Addis Ababa.
- Umali, D., G. Feder, and C. de Haan. 1991. "The Balances Between the Public and Private Sectors in the Provision of Livestock Services." Working Paper. Agricultural and Rural Development Department, Agricultural Policies Division: Washington D.C.: World Bank.
- USAID. 1991. "A Strategic Framework for Promoting Agricultural Marketing and Agribusiness Development in Sub-Saharan Africa." Africa Bureau, Pub. Series No. 91-1.
- USAID. 1989. "International Assistance in Agricultural Extension: The USAID Experience." USAID working paper, Washington, D.C.
- USAID. 1988. "Dominican Republic: The Superior Institute of Agriculture - Development of a Private Institution of Higher Agricultural Education." AID Project Impact Evaluation Report No. 67. Washington D.C.: USAID.
- USAID. 1985. "Stimulating Private Sector Extension." Draft Working Paper. Washington D.C.
- USAID. 1982. "Private and voluntary organizations." Policy Paper. Washington D.C.: USAID.
- USDA. 1990. Food and Agricultural Export Directory. Misc. Publication No. 1481.
- USDA. "Agxport": Export Services of the U.S.D.A." Washington D.C.: USDA.
- US Wheat Associates. 1991. "Questions & Answers; A 10-year Overview; Success Stories." Washington D.C.: USWA.
- VITA. 1990. Micro Enterprise Project: Central Africa Republic. Fourth Activity Report.
- VITA/Africare. 1986. Central Africa Republic Post-harvest Food Systems Project: Phase I Reports.
- Watts, Michael, Peter D. Little, Christopher Mock, Martin Billings, and Steven Jaffee. 1988. "Contract Farming in Africa." Vol. 1 Comparative Analysis. N.Y.: Institute for Development Anthropology.
- Winrock International Institute for Agricultural Development. 1991. On-Farm seed Project Annual Report.
- World Bank. 1990. "Agricultural Extension: The Next Step." Policy and Research Series no.13. Washington D.C.: World Bank.

World Bank Internal Documents

- Agricultural Sector Review, Argentina, Volume I: Main Report, June 30, 1989, report no. 7733 - AR.
- Operations Evaluation Department, "Pakistan: The Aga Khan Rural Support Program Second Interim Evaluation," March 1, 1990, report no. 8448-PAK.

SAR, Argentina Agricultural Services and Institutional Development Project, January 29, 1991, report no. 9138 - AR.

SAR, Bolivia Agricultural Technology Development Project, February 15, 1991, report no. 8979 - BO.

SAR, Mexico Agricultural Extension Project (PROCATI). 1987. Report No. 6620-ME.

Sub-sector review, Venezuela Agricultural Research, Extension and Education, May 31, 1991, report no. 9631-VE.

Sub-sector report, Mexico Agricultural Extension Services, 1984, report no. 5255 - ME.

Additional Related References

Boyce, James K. and Robert E. Evenson. 1975. National and International Agricultural Research and Extension Programs. New York: Agricultural Development Council. (Good for theory and some application)

Donahue, John D. 1989. The Privatization Decision: Public Ends, Private Means. New York: Basic Books Inc. Publishers.

Thirtle, Colin G. and Vernon W. Ruttan. 1987. The Role of Demand and Supply in the Generation and Diffusion of Technical Change. New York: Harwood Academic Publishers. (Good for theory only)

Widstrand, Carl (editor). 1975. Multi-National Firms in Africa. Uppsala: Scandinavian Institute of African Studies

Van Den Ban, A.W. and H.S. Hawkins. 1988. Agricultural Extension. England: Longman Scientific and Technical. (in the U.S. by John Wiley and Sons).

Voll, Sarah Potts. 1980. A Plough in Field Arable: Western Agribusiness in Third World Agriculture. New Hampshire: University Press of New England.