DRAFT (6/23/94)

AGRICULTURAL TECHNOLOGY DEVELOPMENT AND POLICY CHANGE IN ZIMBABWE: A PROPOSAL FOR EX-ANTE IMPACT ASSESSMENT

by

Bernard Kupfuma, Duncan Boughton, Thom Jayne and Jim Shaffer[1]

1. INTRODUCTION

Zimbabwe's National Agricultural Research System (NARS) represents an important investment of public funds intended to generate an attractive return. The rate of adoption of improved technology at the farm level is a key factor affecting the level of economic returns to agricultural research. Farm-level technology adoption rates are determined in part by constraints and opportunities in the off-farm economy, communicated through agricultural input and output markets. The introduction of market liberalization can change these opportunity sets, sometimes radically, for example by the withdrawal of guaranteed producer prices and subsidized marketing services. It is therefore necessary that publicly-funded agricultural research anticipate the possible effects of policy change on market opportunities and constraints in the design of research. To accomplish this task, a conceptual framework and analytical methods are required that integrate policy and market considerations with (more familiar) farm-level production concerns. This proposal is intended as a first step in accomplishing this task in complementarity with the agricultural sector policy framework review.

---

[1] Agricultural Economist, DR&SS, and Visiting Specialist, Visiting Assistant Professor and Professor respectively, Department of Agricultural Economics, Michigan State University.

2. POLICY ENVIRONMENT

The Zimbabwe government has committed itself to transforming the economy from a centrally-controlled state to an increasingly market-based one. This reform initiative is the cornerstone of the Economic Structural Adjustment Program (ESAP) which was adopted in 1991. The organs of central state control have to be restructured and their roles reassessed. The most visible organs here include the state marketing boards and public service institutions. Not only is the question of restructuring these institutions important but so is the issue of coordinating their activities .

When restructuring public institutions and marketing boards the nature of products they deal with is important. This is particularly true in the case of public service institutions that are responsible for the provision of public goods. While economic theory justifies the provision of such goods by public enterprises, the changing policy environment requires them to be responsive to markets so that they cater for the needs of their clientele. The provision of agricultural technology is a typical case of public good provision.

The government recognises the role of technology generation and transfer in improving agricultural production. The history of agricultural research and extension in Zimbabwe is impressive. Yet prior to independence, the main beneficiaries of agricultural research were large-scale commercial farmers and communal farmers located in high potential areas. Thus at independence, in 1980, the government directed the Department of Research and Specialist Services (DR&SS) to put more emphasis on the agricultural production problems of the previously neglected smallholder farming sector. The task of designing effective mechanisms to refocus agricultural research activities towards smallholders and coordinate research and the activities of other institutions working on smallholder agriculture problems has not been an easy one for policy makers and planners.

3. ZIMBABWE'S NATIONAL AGRICULTURAL RESEARCH SYSTEM

DR&SS is the primary public agricultural research organization in Zimbabwe entrusted with the welfare and technical progress of agriculture (Avila, et al., 1989). It was spun off from the Department of Agriculture in 1948 and organized along disciplinary and commodity lines. The Agricultural Research Council (ARC) was established in 1961 and reformed in 1970 to give farmers and other interested parties a greater role in the planning and setting of research priorities. The mandate of the ARC included as objectives: to strengthen the national agricultural research system for commercial farmers; improve the nutritional quality and yield of the basic food crops through breeding and plant protection; and improve animal health and production primarily for the commercial farmers. The ARC freed DR&SS from the bureaucracy of the civil service by placing the management of research expenditures in the hands of commodity sub-committees in which commercial farmers played an active role.

Independence in 1980 saw a sudden departure of experienced staff at a time when there was a shift in government policy to place more emphasis on the research needs of communal farmers. But communal farmers face production and institutional constraints that are more technically challenging to researchers than those faced by commercial farmers. To address the special problems of communal farmers DR&SS institutes and stations initiated on-farm research programs. These on-farm programs have successfully brought researchers to the farmers' fields, improved research-extension-farmer linkages and channeled problems of communal farmers to on-station researchers (Avila, et al., 1989).

In 1981, an Act of Parliament stripped the ARC of its statutory powers to allocate research funds and created an Agricultural Research Fund (Tawonezvi, 1994). The Fund came under the control of the Director of DR&SS on behalf of the Secretary of Agriculture. The role of farmers, who can only express their views through the ARC, is now purely an advisory one.

The research budget fell in real (inflation-adjusted) terms by 25 percent from 1980 to 1990, forcing DR&SS administrators to scale back on-farm research activities (Shumba, 1990).

4. IMPLICATIONS OF POLICY CHANGE FOR DEMAND OF AGRICULTURAL TECHNOLOGY

DR&SS lacks a constituency capable of generating adequate financial support because its products are not only uncertain but have a long gestation period. Thus agricultural technology generation has been seen as exogenous to the resolution of the agricultural problems in the country. But technology adoption is influenced by changes in market opportunities, consumer tastes and preferences, farmer characteristics and the preferences of market intermediaries. Any market-driven technology generation and diffusion program should be aware of the nature and extent of its clients' demand for technology. Only then can public research institutions adequately respond to the needs of its clients and hence be truly market-driven.

The government recognises that market forces should guide the activities of its various institutions. If DR&SS wants to be seen as an important player in resolving Zimbabwe's agricultural problems then it has to pay close attention to the markets. It is particularly important that DR&SS develop some capacity to anticipate the impact of past and current policy changes on the structure of agriculture and thus determine the future demand for agricultural technology. This is important given that technology generation has a long gestation period. This will also help avoid producing redundant technologies which will not be adopted by farmers.

The most important policy changes today are those that are part of the ESAP program. The decontrol of many of the commodities and the privatisation of former statutory bodies that used to handle the marketing of these commodities will result in a radical change in

Zimbabwean agriculture. Some commodities will disappear from the markets whilst new ones will be introduced. Agricultural research can play an important part in identifying some of these new commodities. The research institutions can save its human and financial resources by scaling down research activities for those commodities that farmers abandon after market liberalisation. The research planning and priority-setting efforts have to be redoubled if this is to be achieved.

5. STUDY CONCEPTUAL FRAMEWORK AND METHODS

This section is divided into two parts. The first provides a simple conceptual framework for integrating policy change, market opportunities and farm-level technology adoption incentives. The second presents preliminary analytical methods and approach to implementation.

5.1 Conceptual framework

The relationships between farming and marketing systems can best be understood in relation to the food system as a whole. The food system has been defined as "the entire set of actors and institutions involved in input supply, farming, and the processing and distribution of agricultural products (including their links with international trade)" (Staatz and Bernsten, 1992). Both farming and marketing systems are components (or sub-systems) of the food system.

A simple but effective tool for organizing analysis of a food system is a matrix of agricultural products and functions (Figure 1). Originally conceptualized by Shaffer (1973), and further developed by Holtzman (1986), each column of the matrix represents a commodity subsector (i.e., the entire range of productive processes and services associated with a specific

commodity or group of closely related commodities). The rows of the matrix represent individual stages or functions in the production and transformation of commodities.

Figure 1. FOOD SYSTEMS MATRIX

PRODUCTION/DISTRIBUTION FUNCTIONS	COMMODITY SUBSECTORS						
	Millet	Sorghum	Maize	Rice	Cotton	Livestock...	Off-farm
	^						
Input Distribution	| S	Farming Systems Approach					
Extension	| u	<---------->					
Farm-level production	| b						
Processing	| s						
Storage	| e						
Transport	| c						
Exchange, transactions	| t						
Finance	| o						
	| r						
	|						
Coordination functions	| A						
	| p						
- Prices	| p						
- Quality control	| r						
- Regulations	| o						
- Property rights	| a						
- Contracts	| c						
- Risk management	| h						
	|						
Consumption	v						

Source: Adapted from Ndoye and Newman (1984).

Interdependencies, or system interactions, are common to both vertical and horizontal dimensions. At the farm-level production stage (horizontal dimension) different crop enterprises compete for limited household resources of land, labor and capital, while livestock enterprises enhance crop productivity through increased soil fertility. Similarly, in the vertical dimension, transport costs to urban centers play a key role in determining which products can be cultivated profitably, while investment in cooperative processing facilities may provide a means to overcome high transport and storage costs associated with bulky and/or perishable

commodities. Interdependencies between stages in a subsector can thus either help or hinder technical innovation and hence should be taken into account from the outset.

Historically, agricultural research has tended to focus on a single stage (often production) for a single commodity (Staatz and Bernsten, 1992). Interactions with other stages in the commodity subsector, or other commodities at the same stage, were frequently overlooked. Farming systems researchers have consistently stressed the need for a holistic approach to the design of farm-level technology in order to take account of the range of constraints and interactions confronting the farmer (Collinson 1982). This concern has not been limited solely to the farm-level production stage. Other stages with which the farmer as client is concerned (e.g., own consumption taste preferences, on-farm processing technology) have also been taken into account. But agricultural development beyond semi-subsistence requires specialization, and this inevitably draws the farmer into a greater degree of exchange with other stages in the food system. An increasing proportion of inputs are obtained off-farm, and an increasing proportion of farm-level products and services are sold or exchanged.

Zimbabwe's new agricultural policy framework is intended to channel the process of specialization and exchange in ways that respond to consumer demands on the one hand, and producer's comparative advantage on the other, thereby increasing productivity and reducing costly public sector subsidies. The adoption of technology at farm-level will increasingly depend on the extent to which it enables farmers to respond to evolving off-farm client preferences for different product characteristics (e.g., quality, seasonal availability, lot size) as expressed by market prices. In this new policy context, a commodity subsector perspective will broaden the scope for productivity gains. Instead of limiting the search for possibilities to drive down unit costs of production only to the farm level, researchers can examine possibilities at several or all stages in the commodity subsector. As Staatz and Bernsten (1992) observe, if marketing costs

represent 50% of the final product value (as is commonly the case in developing countries) then a 10% reduction in marketing costs has the same effect on the overall productivity of the subsector as a costless 10% increase in crop yield. For farmers, a reduction in marketing costs would be preferable to a yield increase since it requires no additional inputs or risk and would have an upward rather than a downward effect on farm gate prices if any. In the case of export crops such as cotton and coffee, driving down unit costs at multiple stages may be the only way to maintain real incomes in the face of declining real world market prices.

A commodity subsector perspective provides researchers with additional options in the search for innovations. Increasing specialization and exchange in the food system requires coordination between economic agents at different stages in the subsector. Technological innovation by itself may fail to achieve all potential productivity gains within a given commodity subsector because of inadequate coordination. Institutional and policy innovations can complement technological innovation by reducing barriers to the effective communication of consumer preferences and market opportunities to farmers, and by increasing the ability of private-sector participants at all stages of a commodity subsector to respond to those opportunities.

5.2 Method and implementation

In order for publicly funded research to play an effective role in demand-driven technology development it must anticipate the impact of policy change on its clients' technology needs. This understanding involves three stages:

- to predict the impact of specific policy changes on farm-level incentives for adoption of improved technology;

- to identify alternative technology development paths, or compensating institutional or policy innovations, for farmers that are negatively affected;
- to engage farmer groups and key private sector participants (e.g., seed and input suppliers, processors) in a discussion of potential effects of policy change and appropriate technology development paths.

The impact of policy changes on farm-level incentives will be commodity and farming system specific. For example, ending pan-territorial and pan-seasonal pricing for maize would shift price risk from the state to consumers and farmers, reducing the latter's willingness to use cash inputs such as fertilizer. Farmers located further away from main consumer markets would face lower average prices because of higher transport costs. For some farmer groups, a simple readjustment of recommended fertilizer doses may be adequate to safeguard returns. For others, a change in variety and production practices may be needed, or even diversification into alternative crops and cropping patterns. For diversification to be an acceptable strategy, complementary market outlets and/or innovation in processing strategy may be necessary.

DR&SS agricultural economists propose an initial focus on evaluation of the sensitivity of the profitability of farm-level technology in natural regions IV and V for between one and three commodities likely to be significantly affected by policy change. Policy changes of interest would be identified in collaboration with the MLAWD agricultural sector policy framework team, together with the likely range in the impact of these changes on product and/or input prices. DR&SS economists would initially undertake marginal and risk analysis of the profitability of existing technologies over the range of estimated policy impacts within a partial budget framework. For each commodity of interest, farmers would be grouped according to whether the policy changes are likely to have favorable, neutral or negative effects.

For farmers for whom negative effects on technology adoption are expected, DR&SS economists would seek to identify alternative options in collaboration with technical scientists. These options could include reformulating technical packages to make them more financially robust, or developing alternative cropping patterns better suited to the policy and market environment, taking account of the need to avoid further land degradation. Where non-traditional crops are recommended in response to policy change, needed market development studies would be identified. After review of a preliminary report by the agricultural sector policy framework team, DR&SS economists and technical scientists will seek feedback from farmers and other relevant private sector participants.

6. Summary

The new agricultural sector policy framework will have an important impact of incentives for farm-level technology adoption in natural regions IV and V. The research system needs to anticipate these impacts, and analyze appropriate technology development paths, particularly for farmer groups that may be negatively affected. These technology development paths will need complimentary research in the area of market development and institutional innovation. This proposal represents a preliminary attempt to anticipate the implications of policy change for appropriate agricultural technology development strategies in the semi-arid areas. Specific outputs from this assessment will include a report identifying farmer groups for whom existing technology may no longer be attractive, alternative technology development options, needed marketing studies, and/or studies of complementary institutional or policy innovations.

REFERENCES

Avila, M; Whingwiri, E.E. and B.G. Mombeshora. 1989. "Organization and Management of On-Farm Research in the Department of Research and Specialist Services, Ministry of Lands, Agriculture and Rural Resettlement." *OFCOR-Case Study,* Number 5, ISNAR, The Hague.

Collinson, Michael P. 1982. "Farming Systems Research in Eastern Africa: The Experience of CIMMYT and Some National Agricultural Research Services, 1976-81." East Lansing, Michigan State University: International Development Paper No.3.

Holtzman, John S. 1986. "Rapid Reconnaissance Guidelines for Agricultural Marketing and Food System Research in Developing Countries." East Lansing, Michigan State University: International Development Working Paper No.30.

Ndoye, Ousseynou and Newman. 1984. "Approche Méthodologique pour l'Etude de la Commercialisation des Produits Agricoles et Alimentaires au Sénégal". Dakar: Institut Sénégalais de Recherches Agricoles, Bureau d'Analyses Macro-économique, Document de Travail 84-2.

Shumba, E.M. 1990. "Zimbabwe's Experience in Agricultural Research Priority Setting for Communal Area Households." (In "Food Security in Southern Africa" Eds. Rukuni, M. and J.B. Wyckoff), UZ/MSU Food Security project, Harare.

Shaffer, James D. 1973. "On the Concept of Subsector Studies." American Journal of Agricultural Economics. Vol. 55, pp. 333-335, 1973.

Staatz, John M., and Richard H. Bernsten. 1992. Technology Development and Household Food Security. East Lansing, Michigan State University: Agricultural Economics Staff Paper 92-39.

Tawonezvi, H.R.P. (1994) "Evolution of Agricultural Research." (In "Beneath the surface of Zimbabwe's agricultural revolution: Implications for Southern Africa" Eds Eicher, C.K. and M. Rukuni), University of Zimbabwe Press, Harare.