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Zambia Agriculture Sector Strategy: Issues and Options

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Preface

This report incorporates major substantive comments made at the Agriculture Sector Strategy Workshop held at Siavonga in Zambia during May 23-24, 1991, to review and discuss the draft Green Cover. This workshop, intended to provide a forum for consensus-building on strategic issues and options in agriculture among Zambia officials and donors, was attended by representatives from the Ministry of Agriculture; Ministry of Cooperatives; Ministry of Lands, Water and Natural Resources; National Commission for Development Planning; Bank of Zambia; Lintco; ZAFFICO; Commercial Farmers' Bureau; Zambia Cooperative Federation; Lima Bank; National Savings Bank; University of Zambia; AFDB; EC; Swedish Embassy; GTZ; UNDP; the Royal Netherlands Embassy; Embassy of Finland; FAO; NORAD; UNICEF; USAID; and the World Bank. The author is grateful to all these officials for their insightful and constructive comments. Written comments on the report's Executive Summary were, in addition, received from the Director of Planning in the Ministry of Agriculture. While all endeavor has been made to accommodate most comments, it was not possible to reflect all concerns expressed by individual or group participants in the workshop. Any errors, omissions or interpretations in this report remain the responsibility of the author.

ZAMBIA
AGRICULTURE SECTOR STRATEGY

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ACRONYMS

ADMADE	Administrative Management Design for Game Management
AFC	Agricultural Finance Company
AFP	Agriculture Framework Paper
AFDB	African Development Bank
ARB	Agricultural Research Branch
ARPT	Agricultural Research Planning Team
BCR	Benefit-Cost Ratio
CBPP	Contagious Bovine Pleuropneumonia
CCS	Cooperative Credit Scheme
COZ	Credit Organization of Zambia
CSO	Central Statistics Office
CUSA	Zambia Credit Unions and Savings Association
DFI(s)	Development Financial Institution(s)
DPB	Dairy Products Board
DRC	Domestic Resource Cost
EC	European Community
ECF	East Coast Fever
EPC	Effective Protection Coefficient
FAO	United Nations Food and Agriculture Organization
FDC	Factor Distribution Coefficient
FEMAC	Foreign Exchange Management Committee
FMD	Food and Mouth Disease
GDP	Gross Domestic Product
GMA	Game Management Area
GRZ	Government of the Republic of Zambia
GTZ	German Technical Assistance Agency
IBRD	International Bank for Reconstruction and Development
ILHD	Irrigation and Land Husbandry Division
IMF	International Monetary Fund
LB	Lima Bank
Lintco	Lint Company
MADIA	Managing Agricultural Development in Africa
MAWD	Ministry of Agriculture and Water Development
MOH	Ministry of Health
MSR	Maize Strategic Reserve
MVP	Marginal Value Product
Namboard	National Agricultural Marketing Board
NCSR	National Council for Scientific Research
NGO	Non-Government Organization
NNSP	National Nutrition Studies Program
NORAD	Norwegian Agency for Development
NPC	Nominal Protection Coefficient
NPWS	National Parks and Wildlife Services
NSCB	National Savings and Credit Bank
PCS(s)	Primary Cooperative Societies
PCU(s)	Provincial Cooperatives Union(s)

PFP	Policy Framework Paper
PTA	Preferential Trade Area
SADCC	Southern Africa Development Coordinating Committee
SDR	Special Drawings Right
T&V	Travel and Visit
UNDP	United Nations Development Programme
UNICEF	United Nations Children and Education Fund
UNZA	University of Zambia
USAID	United States Agency for International Development
WMA	Wildlife Management Authority
WMU	Wildlife Management Unit
WPRDP	Women's Participation in Rural Development Program
ZADB	Zambian Agricultural Development Bank
ZAFFICO	Zambia Forestry and Forests Industries Corporation
ZCCM	Zambia Consolidated Copper Mines
ZCF-FS	Zambia Cooperative Federation-Financial Services
ZIMOIL	Zambia Oil

Executive Summary

Macroeconomic Framework for Agricultural Development

1. Zambia's agriculture is predominantly rainfed, with rainfall the major determinant of sector performance in a given year. Overall agricultural production is dominated by smallholders who constitute the majority of the farming population. Agricultural output primarily consists of crops and livestock, although forestry, fisheries, and wildlife play a part.
2. During the past decade, the macroeconomic environment has been characterized by slow overall growth, declining employment, falling real incomes, high inflation rates, heavy dependence on declining copper exports, large current account deficits, sizeable and growing external debts, large fiscal deficits, and a highly overvalued currency. These factors, together with pervasive price controls and trade restrictions, have had a damaging impact on real agricultural growth, which averaged 3.5 percent a year between 1970 and 1988, slightly below the population growth rate of 3.7 percent. The sector's performance has been far below potential, and food imports have been necessary.
3. Government has pursued an interventionist strategy in managing the sector, including nationalization, establishment of parastatals, regulated markets, price controls, and subsidies. This strategy is now collapsing under the heavy weight of increasing subsidies and extensive inefficiency in resource use. The current policy mix of heavy Government interventions, regulation, and concentration of resources on subsidies provides a weak and unsustainable foundation for future growth. The cost of pursuing this strategy, with its resultant distortions, has been substantial; without such distortions it is estimated that average growth in maize production during 1966-84 would have been higher by 28 percent a year. Maize and fertilizer subsidies have placed a heavy and increasing burden on the Government budget. Also, by impeding maize production and reducing smallholder income by 15 percent a year, on average, Government policies have contributed to the worsening relative poverty levels and food insecurity in rural Zambia. The strategy also hindered the development of institutional capacity to manage maize marketing and fertilizer distribution. Only maize consumers, mostly in urban centers, persistently benefitted from the policy, due to an annual average subsidy of 52 percent. Zambia can no longer afford these costs. Government should rethink and revisit these interventions and replace them with strategies with lower social cost and more desirable and effective outcomes.

Agricultural Growth Potential

4. Although Zambia's agroecology and abundance of natural resources (land, water, forestry, fisheries, and wildlife) permit a wide variety of farming systems, little structural change or diversification has taken place in agriculture. Considerable potential for diversification lies in all subsectors, particularly livestock and wildlife. Similarly, Zambia's irrigation potential is considerable; only 6 percent of it is being utilized. Irrigation development represents one of the best options for diversifying large-scale farming and for developing a crop export sector. Although Zambia's land supply is considerable, labor constraints tend to counteract its potential impact on production and productivity. Facing considerable labor constraints, farmers tend to resort to suboptimal crop husbandry practices that depress yields.

Strategic Issues in Agriculture

5. Although not new and years in the making, the agriculture sector's problems have been brought to the fore by the current macroeconomic crisis. Tight fiscal resources, stagnation in growth, and high domestic inflation are forcing the Government to confront many issues. Agricultural subsidies are the largest in the budget. Beyond the urgent need to extricate the sector from the impact of fiscal crisis, is the challenge to address the underlying and fundamental issues affecting the rate and pattern of sectoral growth. Strategic issues in Zambian agricultural development relate to: agricultural growth and diversification, farm production efficiency, producers' incentives, the availability and quality of farm labor, impact of agricultural development on the environment, the role of women in agriculture, and the land tenure system. A better understanding of these issues is a necessary precursor to formulating options for agriculture's future development.

Agricultural Growth and Diversification

6. The rate and pattern of agricultural growth determine the degree of diversification in Zambian agriculture. Despite impressive performance in the last five years, growth remains fragile. In addition to being highly dependent on weather conditions, growth has remained lopsided, with crops overwhelmingly dominating output. The dominance of maize is disturbing.

7. Zambia's agricultural exports are insignificant, despite considerable potential. The majority of smallholders engage in subsistence production and the degree of monetization is lower for food crops than for cash crops. Between 1974 and 1988, growth in food crops, particularly aided by the currency overvaluation, was faster than in tradables. Tradables were constrained by the currency overvaluation and inappropriate pricing policy (including price controls).

8. Expansion in cropped area, rather than change in technology and increase in yields, has been the major determinant of growth. Given environmental and labor supply constraints, however, a strategy that relies entirely on land expansion is unsustainable in the long run. Growth in yields has been generally low, particularly among maize smallholders, largely due to suboptimal practices (e.g., late planting, improper plant population and weeding regimes) which stymy the genetic potential of improved varieties. Substantial yield differentials between large commercial farmers and smallholders are largely due to husbandry practices. There is a declining trend in yield growth in smallholder agriculture, partly due to a policy-induced shortage of farm labor and partly to inadequate investment in human capital. Smallholders have been replacing labor with fertilizer, but appropriate and timely husbandry practices are more critical to yield than fertilizer application per se. The Government fertilizer and seed subsidy policy has partly abetted suboptimal practices and failed to raise productivity. Improving crop yields would require realistic pricing policies for both inputs and produce, complemented by strategies that encourage better use of fertilizer and improved husbandry practices. Although Zambia's research system has been able to release new and improved varieties of planting material for most crops, their applicability under actual conditions has been limited because adaptive research and extension have been inadequate, except for maize.

9. Similarly, in the livestock subsector, increase in numbers rather than productivity gain has been the major source of growth. Much of the average annual growth in beef

production has been due to increases in the national herd and off-take rate. Productivity has remained depressed due to inadequate animal nutrition, husbandry and health conditions at the farm level. Improvements in these areas are critical to future growth and increases in productivity among smallholders. Substantial improvements are possible among native breeds. Unlike the crop subsector, technological change (i.e., improved breeds) is not a prerequisite for significant livestock productivity gains. The relatively large herd of native breeds represents a considerable potential source of growth. Exploitation of this potential would require minimal investment by smallholders in feed production and adequate provision of services to smallholders by Government.

Production Efficiency

10. Farm production efficiency is influenced by two allocative issues: the impact of policy-induced distortions (e.g., taxes, subsidies, and price controls) on the utilization of labor and land and the efficiency of resource use at the farm level. These are critical to policy formulation for increasing sectoral growth, food security and alleviating rural poverty. This report finds that the policy environment is key to production efficiency, diversification, and adoption of technological innovations by farmers.

11. Price-distorting policies have discouraged Zambian farmers from allocating more labor and land to the production of most crops, except maize. High rural-urban migration rates during the 1970s and 1980s and the presence of abandoned or idle farms formerly under crop production are evidence of labor disinvestment in agriculture.

12. Significant variations in marginal productivity among crops imply that there are good prospects for improved efficiency through crop diversification at the farm level, particularly among smallholders. Farmers have considerable opportunities for improving production efficiency by shifting to commodities with relatively high value added in which they have comparative advantage, and thus improving their incomes. Opening up international trade will also encourage efficiency and diversification. Implementation of policy reforms and the investment strategies proposed in this report should help realize these possibilities.

13. At the prevailing exchange rate, Zambian farmers are generally efficient in allocating resources at the margin, and Zambia appears to have a comparative advantage in producing almost all agricultural commodities, except cassava, millet, and sorghum. A shift to the best-available technologies would not significantly improve the production efficiency of the latter commodities. There is no economic justification for investing in extension services for their production until research generates more profitable technological packages. However, public investment in research is justified because these commodities are considered the poor farmers' crops in Zambia and are critical to food security and poverty alleviation in the future. The need is greatest in areas with relatively acid soils and where smallholders have few crop alternatives. Soil acidity affects over 50 percent of cultivable area in the country, yet research and extension have accorded this condition the least attention.

14. Smallholders are generally more efficient users of domestic resources than medium- or large-scale commercial farmers, particularly in the production of maize and other cereals. On the other hand, the latter appear to have comparative advantage in groundnuts, soyabean, sunflower, and wheat. Government's strategy for supporting both smallholder and commercial agriculture is justified, with the former as its cornerstone.

15. Adoption of improved technology would permit better use of domestic resources in the production of most commodities under an appropriate exchange rate policy. This is a strong argument for investment in research and extension to enable the agricultural sector to exploit its potential comparative advantage in the short and medium term. Investment in these services, without corresponding improvements in the exchange rate, would be less productive.

16. Exchange rate policy is particularly critical to agriculture's production efficiency. The aggregate effect of currency overvaluation was substantially to erode farmers' production efficiency. Zambian agriculture's production efficiency is more sensitive to the country's exchange rate policy than it is to change in technology in the medium and long term. Indeed, marginal changes in commodity technology would not improve a commodity's production efficiency under an inappropriate exchange rate regime.

Incentive Structure for Producers

17. Agriculture's supply response is primarily determined by its terms of trade, price incentives and non-price factors facing farmers. All these have been less favorable to increased production in the sector.

18. **Terms of Trade.** Agriculture's terms of trade remained depressed during 1974-89 and have become worse in the past three years. In particular, food producer prices deteriorated significantly, reflecting Government's determination to keep food prices low in the face of higher rates of inflation. Deterioration in the overall terms of trade suggests suboptimal resource allocation between agriculture and other sectors of the economy. Agriculture's contribution to GDP was also suboptimal.

19. **Prices.** The price incentive structure, as measured by an effective protection coefficient, for most farmers and commodities has been generally negative. Price controls and an overvalued currency acted as taxes on farm incomes for all commodities in Zambian agriculture. The most taxed commodities were cotton and tobacco (export crops), as well as import-replacing commodities (maize, wheat and oilseeds).

20. Overvaluation of the kwacha has accounted for much of the bias against agriculture. Under currency overvaluation, improved technologies could not significantly alter the price incentive structure for farmers or individual commodities.

21. The impact of policy distortions on factor incomes has been severe. Zambian smallholders depend almost entirely on income from labor. They earned only one-quarter of the incomes they would have received for each unit of output in the absence of distortions. The policy-induced taxation has therefore aggravated rural poverty and also made rural Zambians relatively susceptible to food insecurity.

22. The relative bias toward urban consumers has also damaged the long-term prospects of the urban sector, because low rural incomes reduced the internal market for manufactures and the source of foreign exchange as farmers disinvested both labor and land from agricultural production.

23. **Non-Price Factors.** The relative importance of subsistence for the majority of smallholders underscores the critical importance of non-price incentives. Non-

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price incentives for agriculture include basic agricultural services (research and extension), rural financial services, marketing, storage, processing, and transportation. These have been inadequately provided, and Government interventions (e.g., price controls and exclusive rights) have virtually stifled private sector initiatives in these areas. Due to inefficient food markets and low incomes in rural areas, attainment of food security by rural households remains difficult.

24. Agricultural research and extension services, monopolized by Government, have been extremely inadequate in terms of quality and coverage. Adaptive research for Zambian smallholders is still in its infancy. Inadequate supply and dissemination of adaptive technologies have critically constrained farmers' ability to improve yields and ensure food security.

25. Deficiencies in the agricultural research program, which is largely supply-driven, affect the extension program in various ways: messages to smallholders are less relevant to farmers' constraints and needs; coverage is limited to a quarter of farming households; and the most disadvantaged farmers (e.g., the resource poor and females) are excluded. These inadequacies undermine the process of technological change among smallholders.

26. The rural financial sector is poorly developed and has not been able to play its critical role adequately in facilitating adoption by smallholders. Weak institutional capacity, inappropriate linkages between credit and crop marketing, input distribution and agroprocessing, inappropriate interest rate policy, and inadequate savings mobilization are major issues.

27. Inadequate rural infrastructure, consisting of roads, transportation, processing, storage and irrigation, has constrained agricultural growth in Zambia. Smallholders generally have poor access to these facilities and services. Due to the poor state of rural roads and transportation services, smallholders do not transport their inputs and outputs on time. Transport costs are extremely high in rural areas. Poor rural storage and lack of rural processing capacity have contributed to underdevelopment of rural trade and food insecurity. Despite its high potential, irrigation is underdeveloped, preventing the development of an export crop sector and increase in crop productivity.

Human Capital Investment

28. Insufficient investment in human capital development has had adverse impact on agricultural productivity. Inadequate provision of primary and agricultural education, health, nutrition, and family planning services in rural areas has resulted in poor quality of farm labor. Widespread diseases and malnutrition, symptoms of inadequate investment in human capital, afflict a large portion of the rural population and result in low availability of farm labor at critical farming operations. This has contributed to the relatively low productivity of labor, the principal asset of Zambian farmers.

Agricultural Sustainability and the Environment

29. Localized deforestation, soil degradation, and loss of wildlife and habitat are some of the most serious environmental problems which are inextricably linked to agricultural development in the country. Clearing for agricultural production is the leading

cause of deforestation in Zambia, since expansion in land cultivation has been the major source of agricultural growth. This cannot be sustained forever.

30. Market failures resulting from inappropriate pricing policies, subsidies, and institutional inadequacies have been at the heart of natural resources degradation in the country. They have encouraged overconsumption and waste of natural resources, especially forestry and wildlife, and the use of chemical fertilizers on unsuitable soils.

Women's Role and Constraints in Agriculture

31. Women constitute almost two thirds of the rural population in Zambia and account for three quarters of the agricultural labor supply, but they face numerous constraints. Changes in technology (e.g., permanent cultivation, introduction of ox or tractor cultivation) have not relieved women of their workload. Women continue to face major constraints in improving their labor productivity. These include limited or lack of access to land, research and extension services, credit, and human capital services (e.g., education and health). Women's access to these services must be increased and traditional tenure systems reformed to make women's critical role in agriculture more productive.

Land Tenure System

32. Traditional land tenure systems, in most parts of the country, are not meeting smallholders' needs for security in land and credit facilitation generated by commercial agriculture. Commercial production in agriculture will be continued by individuals utilizing labor and capital. It is necessary to provide a system of private rights in land which provides incentives for long-term investment in on-farm improvements (e.g., liming and irrigation) in smallholder agriculture.

33. The major policy issues implied in the Land Act (1975) relate to the concept of land being a "free good" and without cost. Consequently, land improvements are not reflected in the value of land and a uniform rental fee is imposed on leaseholdings irrespective of quality and location. These policies have discouraged on-farm improvements and optimal use of land. Establishment of rent differentials that reflect the potential rather than the current use of each piece of leased State Land and legal recognition of the value of developments on leased land would encourage optimal land use in large-scale commercial agriculture.

Strategic Options and Priorities

34. The above issues present daunting challenges that help to define the strategic options and priorities for increasing agricultural growth and transforming it into a major source of economic growth and diversification. The challenge is to develop a competitive agriculture sector capable of increasing employment and income opportunities for the rural poor, sustaining the physical resource base, ensuring internal food security, and generating substantial exports and import substitution.

35. Achieving a pattern of agricultural development that successfully meets these long-term challenges will require the Government to design and implement appropriate policy and institutional reforms and restructure public investments or expenditures to focus on sectoral priorities. In the absence of major technological breakthroughs and in the face of

binding resource constraints, future growth must come primarily from increasing production efficiency, shifting at the margin into commodities with higher value added, and increasing efficiency of public (budgetary) resources.

Policy and Institutional Changes

36. Zambia's policy and institutional framework for agricultural development must be changed in the short run to: (i) improve the incentive structure for all farmers; (ii) enable smallholders to participate in growth by increasing their access to rural infrastructure and human capital facilities and services; (iii) encourage the use of available labor on which most rural Zambians depend for their income; (iv) encourage increasingly efficient use of the abundant land resource; and (v) promote the production and use of adaptive technology to increase farm productivity among smallholders.

37. The policy changes required affect both macroeconomic and sectoral policies. Most of the required changes in macroeconomic policy are being implemented under the Government's structural adjustment program. Of critical importance to agricultural growth are appropriate exchange rate policy, sustained reduction in the rate of inflation, and public expenditure reforms.

38. Sectoral changes should essentially focus on improving the incentive structure in the short and medium term by reducing disincentives in agriculture. Actions include: elimination of price controls; liberalizing product and factor markets; encouraging private sector participation in the liberalized markets; implementing a floor-pricing system that guarantees border price equivalents to producers; and eliminating import/export restrictions on agriculture.

39. Institutional changes are needed to improve the access of all farmers, particularly the disadvantaged, to land, marketing, input distribution, agroprocessing, rural financial services, rural transportation, and extension services. This would require, inter alia, land tenure reform; elimination of cooperative and parastatal monopolies; development of private sector participation in marketing and agroprocessing; improvement of rural infrastructure to attract private sector investment; improved performance of agricultural cooperatives and credit institutions; and specific measures to improve the management and delivery of basic agricultural services. Several of these changes can only be done in the medium and long term, but the promotion of private sector development and improvements in cooperatives and credit institutions are essential for improving competition in the short run.

Investment Priorities

40. Elimination of subsidies, thereby restructuring public investments toward improving farmer incentives and promoting production efficiency, will not only release budgetary resources but also address the underlying issues affecting the pattern and rate of sectoral growth. In implementing its investment program, Government's role should concentrate on areas with clear and unequivocal comparative advantage for the public sector, namely research and extension, infrastructural development, and policy incentives to correct market failures.

41. In addition to improving the policy and institutional environment, specific investment programs are required to increase and diversify agricultural growth in the next two

or three decades. Three priorities should underpin their design: (i) increasing sustainable productivity by smallholders, (ii) developing new sources of growth, and (iii) wider participation of the rural poor. The strategic options for implementing these priorities are as follows:

42. **Increasing Agricultural Productivity.** This is the most daunting challenge. While land expansion will remain critical to future growth, complementary yield increases are vital. Efficiency in resource use and increased production will also reduce the amount of land (and deforestation) required to meet additional demand resulting from rapid population growth.

43. Increasing agricultural productivity, essential for poverty alleviation and food security at the household level, will critically depend on increasing smallholder access to land, improved agricultural research, extension, and credit, as well as to more and better rural infrastructure and human development opportunities. Increased yields for maize and other crops will result from adoption of better husbandry practices and labor-saving technologies (e.g., intercropping and on-farm transportation). In livestock, increased productivity is possible with improved animal husbandry and nutrition practices. Adaptive research and extension would be key to productivity improvements in smallholder agriculture and they should command high priority.

44. **Developing New Sources of Growth.** Diversifying sectoral output is possible, given Zambia's resource base, agroclimatic conditions, and the strong domestic and external demand for most products. Zambia needs to make better use of its considerable soils, water, livestock, fisheries, forestry and wildlife resources -- all of which have high-growth potential. Increased production in non-crop subsectors would result in diversifying sectoral output.

45. Within the crop subsector, it is possible to increase the production of other crops without replacing maize, mainly through lagged intercropping or changes in farming systems that permit saving labor and land at the same time. Elimination of policy distortions (especially maize-related subsidies) is a precondition for diversifying crop production. Diversification options are many and include wheat, cassava, and paddy rice for food crops and cotton, groundnuts, sunflower, tobacco, and soyabean for import substitution and export. Zambia appears to have exceptionally good comparative advantage in producing maize for export within the PTA/SADCC arrangements. Nevertheless, public policies and programs may be justified to steer commercial farmers away from maize into crops in which they have better comparative advantage than smallholders, such as coffee, irrigated wheat, soyabean, tobacco, sunflower, and horticultural crops. Irrigation development among commercial farmers would be a necessary condition for the development of an export subsector based on these products.

46. In livestock, native breeds of beef cattle have the highest potential for growth, with dramatic productivity gains, up to 30 percent, possible in smallholder livestock. Livestock research and extension programs should emphasize the utilization of existing genetic potential over technological (breeding) change in smallholder agriculture.

47. Natural resources are another major source of potential growth. Their management and utilization, though critical to sustainability, have not been accorded proper attention in public policy and program formulation. An effective strategy for increasing their

contribution must begin with improving public policy and program formulation and strengthening institutional capacity to minimize market and policy failures. Equally important will be the involvement of target beneficiaries. Allocation of adequate budgetary resources is necessary to improve implementation capacity in ministries responsible for natural resources development.

48. The removal of fertilizer subsidies and maize price decontrol will help reduce fertilizer use in areas prone to soil acidity and where its application has marginal impact on yields. Policy incentives, in the form of higher interest rates, charcoal prices, tax rebates for conservation tillage and crop rotation, need to be implemented to encourage environmentally sound agricultural practices. Research and extension should be devoted to developing and disseminating technological options to counter soil acidity, including liming.

49. Irrigation will be key to agricultural diversification, export orientation, and intensification. In the medium and long term, Zambia should focus on: private sector irrigation schemes, organizational and staff improvements in the ministry responsible for irrigation development, and adaptive irrigation research and extension.

50. **Participation of Rural Poor in Growth.** The rural poor require access to basic agricultural services, human capital facilities and services, rural infrastructure, and other public programs critical to poverty reduction in the medium and long term. To reduce poverty, Zambia's focus should be on the recovery of economic growth and diversification to provide additional incomes and employment and to generate resources for poverty alleviation programs. Nevertheless, clearly defined poverty alleviation initiatives are necessary, such as broadening the impact of some ongoing programs (e.g., agricultural extension and credit) to reach more smallholders, focusing rural investments on projects or programs (e.g., rural infrastructure and agroprocessing) that stimulate the demand for unskilled labor and raise real wages, and incentives for the rural population to invest in human capital.

51. In pursuing social justice, Zambia should, however, avoid its past mistakes of implementing poverty alleviation programs that cannot be sustained in the long run. Instead, the Government could pursue various options: a gradual devolution of financial and implementation responsibility to the local level; insistence on payment for services provided by public programs; emphasis on maintenance and improvement of existing systems that are also made accessible to the poor; private sector participation in agricultural marketing, rural input distribution, and agroprocessing; and restructuring the cooperative movement to make it more responsive to the needs of its members by minimizing Government interventions. The private sector and cooperatives can play an important role in advancing the processes of economic and political pluralism in the country.

Agricultural Growth Prospects

52. Provided Government implements the proposed policy framework and strategies in a fully coordinated fashion, it is possible to more than triple agricultural real GDP by the turn of the decade. Failure to implement the strategy or delayed and uncoordinated reforms would have substantial costs in the form of foregone opportunities in terms of agricultural growth and structural change in the sector. Government needs to play a coordinating role in shaping the framework for agricultural growth and adjustment. Although several vehicles are available to Government for this purpose (e.g., perspective and annual plans, annual budgets, public investment programs, and Policy Framework Papers), a

proposed Agriculture Framework Paper (AFP) is considered a more efficient mechanism. This annual document, to be prepared jointly by Government and the Bank, will specify the priorities and sequencing of policy actions of a medium-term agricultural adjustment program. Shaping the framework of policies, infrastructure, and agricultural services would in itself enable farmers to respond to market signals and new opportunities. Under the proposed framework, the share of crops in agricultural GDP is expected to decline from 55 percent during 1986-91 to 35 percent in 2000, leaving the livestock and natural resources subsectors to make up the remainder. The extent to which projected growth would affect incomes and employment of the rural poor would depend critically on the policies and strategies pursued to achieve growth. The emphasis placed on the participation and ownership by the rural poor (as beneficiaries) in development programs and program services should ensure reduction in relative rural poverty.

I. MACROECONOMIC FRAMEWORK FOR AGRICULTURAL DEVELOPMENT

1.01 Rainfall is the major determinant of Zambia's agricultural performance in a given year. Overall agricultural production is dominated by smallholders who cultivate under rainfed conditions and constitute the majority of the farming population. Agricultural output primarily consists of crops and livestock, although forestry, fisheries, and wildlife are important features. Agriculture is expected to play a critical role in Zambia's economic growth and restructuring. This report examines the prospects and analyzes the issues and options for achieving agricultural growth and diversification during and beyond the Government's adjustment program (1990-93). Focusing on strategic choices, its coverage of issues and options is highly selective.

1.02 The Bank has extensively examined Zambia's agriculture since its independence in 1964. The 1975 Agricultural and Rural Sector Survey addressed in detail such issues as: (i) the economic trade-offs between equity and growth objectives in sectoral development; (ii) agriculture's role in overall economic development; (iii) appropriate investment and production strategies for efficient agricultural development; and (iv) requisite policy reforms and institutional changes for implementing the recommended strategy. The 1981 Agricultural Recurrent Budgetary Study highlighted the sector's underfunding and public investment problems and recommended improvements in its investment priorities and project portfolio. In 1984, the Bank and Government prepared Zambia - Policy Options and Strategies for Agricultural Growth. Focusing on issues relating to marketing and pricing, parastatal efficiency, public resource allocation, production efficiency, and land tenure, it recommended a sector development strategy of policy and institutional reforms and a smallholder-oriented public investment program. The Government partially implemented the report's recommendations before it decided to abandon the Bank/Fund-supported adjustment program in 1986.

1.03 Considerable knowledge about Zambian agriculture is contained in country economic memoranda and public expenditure reviews. The 1990 Public Investment Program Report, prepared by Government with substantial Bank assistance, contains the latest information and Government thinking on agriculture and other sectors. This report builds on the knowledge contained in earlier reports, as well as recent Bank studies such as the Managing of Agricultural Development in Africa (MADIA) series and Sub-Saharan Africa: From Crisis to Sustainable Growth.

1.04 Unlike previous studies, this report focuses on analysis of the following strategic issues: (i) sources of agricultural growth (diversification); (ii) efficiency of agricultural production; (iii) the role and form of producer incentives (price and non-price factors); (iv) the environmental impact of agricultural development; (v) the influence of human capital (i.e., quality and quantity of farm labor) on farm productivity; (vi) women's role and constraints in agriculture; and (vii) land tenure systems. Finally, on the basis of such analyses, it recommends strategic choices regarding policy changes, institutional reforms, and public investment priorities for optimizing the sector's growth and contribution to GDP. This report neither deals with the description of the structure nor the conduct of the sector, both of which have been adequately treated in previous studies.

Agriculture in the Economy, 1983-88

1.05 Zambia's real GDP grew at an average annual rate of only 2 percent between 1983 and 1988 (Table 1.1). The compression of imports (due to shortages of foreign exchange caused by declining export earnings) and a decline in gross fixed investment (mainly due to insufficient domestic savings) led to slow growth and an overall decline in real GDP per capita. Between 1987 and 1988, however, real GDP increased by 7 percent, mainly as a result of 20 percent growth in real agricultural production and strong expansion in manufacturing. Since population growth has increased faster than GDP, per capita GDP has consistently declined since 1974, falling by almost 90 percent.

Table 1.1 Zambia: Gross Domestic Product by Sector of Origin, 1983-88
(K million)

	1983	1984	1985	1986	1987 ¹	1988 ²	1984	1985	1986	1987	1988	Growth Rate (%)
Agriculture, forestry, and fishing	314.6	332.2	343.8	373.8	365.6	440.6	6	3	9	-2	20	
Mining and quarrying	221.7	200.0	185.8	176.5	184.2	166.9	-10	-7	-5	4	-9	
Manufacturing	382.7	384.3	417.1	425.3	450.0	517.6	0	9	2	6	15	
Electricity, gas, and water	72.2	70.9	72.7	71.1	62.7	66.7	-2	3	-2	-12	6	
Construction	88.6	88.6	77.1	81.1	77.3	73.7	0	-13	5	-5	-6	
Commerce ³	227.6	216.9	226.0	221.4	228.1	233.3	-5	4	-2	3	2	
Transport, communications, and storage	119.4	116.2	109.2	110.1	113.5	111.6	-3	-6	1	3	-2	
Financial services ⁴	234.5	242.0	239.6	235.4	243.6	256.3	3	-1	-2	3	6	
Community, social, and personal services	355.7	354.9	365.6	357.9	371.2	373.4	0	3	-2	4	1	
Import duties	18.5	18.0	19.9	22.5	24.6	24.3	0	11	13	9	0	
Less: imputed bank service charges	18.5	17.0	16.8	15.8	15.2	16.9	0	0	0	0	0	
GDP	2,017.0	2,006.5	2,040.0	2,059.3	2,105.6	2,247.4	-1	2	1	2	7	
GDP per Capita	326	313	304	296	292	301	-4	-3	-3	-1	3	

^{1/} 1987 data are preliminary.

^{2/} 1988 data are provisional.

^{3/} Includes trade, hotels, and restaurants.

^{4/} Insurance, real estate, and business services

Source: CSO Digest of Statistics.

1.06 The major structural shift in the economy (Table 1.2) has been a relative decline in the mining sector's share from 41 percent in 1965 to about 15 percent in 1988, while value added from the services sector has expanded from 32 percent to approximately 43 percent of the total. Manufacturing's share has encouragingly expanded from 7 percent in 1965 to 25 percent in 1988. Agriculture's share has varied little since independence, although its share of GDP (14 percent) masks the extent to which Zambians depend on the sector.

About 60 percent of the population depends directly on agriculture for livelihood. Agriculture employs 67 percent of the labor force and remains by far the major opportunity for employment for rural women. It will remain the major source of new jobs for at least the next decade, even at higher industrial growth rates, due to the relatively small industrial base and declining mineral resources. Similarly, the impact of agriculture on the economy is not insignificant. For example, agricultural prices, especially for food crops, have a major impact on the cost of living and general price trends due to the large numbers of rural and urban poor. Agricultural issues also figure prominently in the country's fiscal problems. Subsidies to the sector averaged almost 3 percent of GDP during 1983-88 and have been growing, while low agricultural exports have exacerbated the trade deficit.

Table 1.2: Percentage of Gross Domestic Product by Sector of Origin, 1965-88
(Current Prices)

	<u>1965</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1988</u>
Agriculture, Forestry & Fishing	14	11	13	16	13	14
Mining & Quarrying	41	36	14	14	16	15
Manufacturing	7	10	16	18	23	25
Construction and Other Industry	6	8	12	5	4	3
Services and Other	<u>32</u>	<u>35</u>	<u>45</u>	<u>47</u>	<u>44</u>	<u>43</u>
GDP	100	100	100	100	100	100

Source: CSO Monthly Digest of Statistics.

1.07 Apart from marginal increases in 1984 and 1987, overall employment declined 1 percent between 1980 and 1988. By sector, the greatest declines were in construction (13,400) and mining and quarrying (5,600). The agriculture sector, however, which accounted for about 10 percent of total employment in 1988, posted a 4 percent increase between 1983 and 1988.

1.08 Average annual earnings (cash only) also fell in real terms between 1983 and 1988. In 1988, overall real cash earnings fell by 30 percent. This decline may reflect a compression of total earnings (data on earnings in kind are not available, so it is difficult to be certain). The most affected sectors appear to be construction, transportation, communication, and finance, reflecting sectoral weaknesses. Cash earnings in the agriculture sector were only 52 percent of average earnings for all sectors in 1988, indicating the relatively low level of incomes in the sector.

1.09 In 1988, the price level continued its rapid upward trend that started in 1986. The composite retail price index (a weighted average of the low- and high-income indexes) increased by 54 percent. Inflation (56 percent) hit the poorer segment of the population hardest. Until June 1989, many prices in the economy were controlled by

Government, mainly as an anti-inflationary measure. The controls were implemented either directly via the administrative mechanism, or indirectly via the pricing policies of Government-controlled firms which competed with the private sector. Few prices accurately reflected either demand or cost of production, and shortages were frequent. For maize and maize products, which prices are still controlled, consumer prices continue to be set too low to permit profitable trading margins for cooperatives and millers. In addition to maize, prices for fertilizers and seeds are still controlled, as well as the transport rates for these commodities. Agricultural terms of trade, which reflect the relationship between price changes in the sector and rest of the economy, have considerably deteriorated in recent years - from 109 percent in 1974 to 66 percent in 1989, largely due to erosion of real farm prices under conditions of generally high inflation. As a result of the introduction of a floor producer pricing system in 1989, most farm prices now reflect market conditions and are usually higher than the floor prices guaranteed by Government. This should help to improve future agricultural terms of trade.

1.10 Critical to Zambia's external sector are copper exports, external debt, and exchange rate policy. Copper still accounts for 85 percent of total foreign exchange earnings. Despite a positive trade balance since 1983, the current account has consistently exhibited large deficits, and the overall balance even larger deficits (Table 1.3). These deficits reflect the large scheduled debt service and low disbursements in recent years. Arrears have become the main source of financing. The positive trade balance reflects the need to finance the deficit on non-factor services. Export revenues have been heavily influenced by the general downward trend in both copper prices and copper volumes. Imports have had to bear the brunt of adjustment and have substantially contracted. Non-traditional export receipts, accounting for about 8 percent of total export revenues, have remained stagnant in nominal dollar terms and have yet to develop into a serious alternative source of export earnings.

Table 1.3: Balance of Payments, 1983-90

(SDR million)

	1983	1984	1985	1986	1987	1988	1989	1990
Trade Balance	143	130	37	17	95	267	388	137
Services (net)	-334	-343	-318	-354	-412	-495	-581	-578
Unrequired Transfers	-17	-35	15	100	75	65	44	100
Current Account	-208	-248	-271	-237	-242	-164	-148	-340
Nonmonetary Capital	-134	-106	-100	-64	-205	-141	-71	-268
Errors & Omissions	85	9	-85	-182	-17	-66	-56	-21
SDR allocation/ Gold revaluation	-8	--	--	--	--	--	--	--
Overall Balance	-265	-345	-456	-473	-464	-371	-276	-629

Source: Bank of Zambia and mission estimates.

1.11 Despite agriculture's potential, the sector's export performance has been dismal. Agricultural exports (mainly sugar, cotton, coffee, beef, tobacco, and maize) accounted for less than 2 percent of total export values between 1983 and 1988. For most commodities, export performance has been erratic. In current terms, the value of agricultural exports has not exceeded SDR 100 million per year. With the recent currency devaluation and removal of excessive export controls or bans, high hopes are now attached to the potential for increased exports of fruits and vegetables, tobacco, cotton, beef, and coffee.

1.12 Zambia's external debt is larger both in absolute terms and relative to GDP than that of most other African countries. Short-term debt is significant, and some of it has partial exchange rate guarantees. Scheduled debt service has exceeded exports of goods and services in a number of recent years. Actual payments, however, have been strictly limited by the unilateral debt service policy.

1.13 Zambia's exchange rate policy has been substantially altered three times since 1985, with varying nominal and real rate stability. An auction system, with market determination of the exchange rate, pertained between October 1985 and April 1987. Characterized by substantial depreciation of the kwacha, it was a major realignment. The auction system was abandoned in May 1987 and the exchange rate fixed at an appreciated level for 18 months. The fixed nominal rate and high inflation (nearly 50 percent) meant a continuous real appreciation of the kwacha (up 70 percent). In November 1988 and July 1989, two exchange rate adjustments were made, which stabilized the real effective exchange rate. Even so, the real effective exchange rate as of July 1, 1989 was more than 50 percent higher than the rate following the abandonment of auction in May 1987.

1.14 Two or three other independently set exchange rates exist: the black market rate, which is not officially recognized; the rate obtained by exporters who use excess retained foreign exchange to import for third parties; and, it could be argued that discounting of external debt gives rise to a third exchange rate, given that claims can be redeemed at face value at the Bank of Zambia.

1.15 Foreign exchange is subject to numerous controls. Foreign exchange receipts must be surrendered at the official exchange rate to the Bank of Zambia. Until recently, most foreign exchange allocations were made by the Foreign Exchange Management Committee (FEMAC). Imports, however, also can be made using retained foreign exchange from exports or using funds obtained elsewhere ("no funds involved").

1.16 Foreign exchange was allocated first to a preferential category, and second, in fortnightly FEMAC allocations. The preferential category included allocations to Zambia Consolidated Copper Mines (ZCCM), Zambia Oil (ZIMOIL), Zambia Airways, National Agricultural Marketing Board (Namboard), Post and Telecommunications, Zambia State Insurance Corporation, medical stores, working balances of commercial banks, and export retention. The fortnightly FEMAC allocations were based on a multiple set of criteria, with results published in the newspapers.

1.17 For all exporters other than ZCCM, up to 50 percent of export proceeds could be retained for up to 60 days to finance import requirements, profit remittances, and reduction of pipeline debt. Furthermore, since December 1987, retained foreign exchange can be used to import essential inputs for third parties. The Bank of Zambia's approval of all transactions is

required. "No funds involved" imports are only restricted by a negative list of mainly agricultural goods, and no questions are asked as to the source of the foreign exchange.

Economic Adjustment Program

1.18 Recognizing the need to improve and sustain the economy's performance, Government has begun to implement a program of policy and institutional reform based on a 1990 Policy Framework Paper (PFP), agreed on with the Bank and the Fund, as the first step in the stabilization and adjustment process. The major components are:

- (i) Price decontrol of all products (except maize) and inputs;
- (ii) Exchange rate adjustment in real terms and elimination of exchange rate restrictions;
- (iii) Liberalization of export and import trade, while providing export incentives;
- (iv) Fiscal austerity measures to reduce budget deficits and control domestic inflation;
- (v) Monetary policy measures to adjust interest rates and tighten monetary supply;
- (vi) Reform of public investment program to focus on resource allocation to priority sectors and programs;
- (vii) Reform of civil service and parastatals to improve efficiency and performance; and
- (viii) Privatization program to encourage private sector participation.

1.19 The specific agricultural policy measures and strategies required to complement these macroeconomic measures in order to create the right incentive structure for sustainable agricultural growth and development are outlined in Appendix 1. Some of these measures are currently being implemented by Government.

II. THE AGRICULTURE SECTOR

Objectives and Strategies

2.01 Government's stated long-term objectives in agriculture include equitable distribution of income and employment, food security, increased production of import-replacing commodities in which Zambia has domestic comparative advantage, and diversification to broaden the export base of the economy. In pursuit, Government's past strategies have emphasized public interventions and controls for marketing and processing of major commodities (e.g., maize, cotton, tobacco, oilseeds, and fertilizer). For this purpose, 20 parastatals have been established to service agriculture. As other Bank studies have revealed, however, budgetary allocations to the sector have been inadequate and inappropriate. A large proportion has been spent on least cost-effective Government production schemes, rather than on programs for providing support services to farmers. The Government intends, under the adjustment program, to improve allocative and institutional efficiency in the sector and to enable more active participation of the private sector.

2.02 Provision of financial incentives for increased agricultural production and exports is the cornerstone of Government's sectoral strategy under the adjustment program. Actual and contemplated reforms in agricultural marketing and input distribution are also aimed at improving producer incentives by putting in place more effective and responsive channels. Finally, fiscal reforms, entailing sustained real increases in budgetary allocations to rural infrastructure, agricultural research, extension, credit, and other services, and gradual removal of public subsidies, will be implemented.

Performance

2.03 Agriculture's outstanding growth rate of 20 percent in 1988 was triggered by a combination of substantial improvements in prices and good weather conditions. On average, the sector's real growth rate was 7.2 percent between 1984 and 1988 (Table 1.1), compared to 2.4 percent over 1965-82. This upward trend is welcome and must be sustained, given the population growth rate. Much of the recent growth is attributable to increased production of maize, sugar, and wheat which together expanded by nearly 29 percent a year during 1983-88, compared to 2 percent a year between 1965 and 1982. The decline in per capita output of food that characterized most of the post-independence era appears to have been arrested, at least temporarily.

2.04 Although individual industrial crops (including exports) experienced better annual growth rates between 1984 and 1988 than during 1965-83, their total production did not sustain an upward trend -- indicating the possibility of crop substitution at the farm level, as well as lack of incentives. Lack of incentives has been due largely to an overvalued exchange rate and other distortions (e.g., price controls). Consequently, little structural change (diversification) has taken place in Zambian agriculture, which remains essentially a maize culture. Meanwhile, food imports (mainly wheat, dairy products, and vegetable oils) account for at least 10 percent of total value of the country's imports, and agricultural exports (mainly tobacco and cotton) account for less than 2 percent of total export earnings. Diversification is key to sustaining a high rate of growth in the sector.

Structure

2.05 Zambian farmers fall into four categories (Table 2.1): smallholders and three graduated sizes of commercial farming. Smallholders (75 percent of the estimated 600,000 farm households) dominate, each cultivating an average of 2 hectares (ha), using family labor and simple hand tools, and producing primarily for subsistence, with occasional marketable surplus. Their lack of regular cash income and appropriate technical packages limits the use of purchased inputs. There are some 120,000 small-scale commercial farmers, popularly known as "emergent farmers," (21 percent of farm households) who each cultivate an average of 10-20 ha and produce a large marketable surplus using oxen plows, improved seeds, and fertilizers. Also, there are some 26,000 medium-scale (20-60 ha) and large-scale (above 60 ha) commercial farmers (4 percent combined of farm households), using hired labor and oxen or tractors and having a broader technological base (including improved varieties or animal breeds, irrigation, fertilizer, and herbicides).

Table 2.1: Estimation of Number of Farm Units per Province

<u>Province</u>	<u>Large-Scale Commercial</u>	<u>Medium-Scale Commercial</u>	<u>Emergent Commercial</u>	<u>Smallholder Households</u>
	<u>(Above 60 Ha)</u>	<u>(20 - 60 Ha)</u>	<u>(10 - 20 Ha)</u>	<u>(1 - 9 Ha)</u>
Southern	330	9,000	51,000	6,000
Central	300	7,500	21,000	18,000
Lusaka	90	2,000	4,500	14,000
Copperbelt	-	500	2,000	18,000
Eastern	20	6,000	23,000	8,000
Western	-	10	5,400	85,000
Northwestern	-	70	2,900	53,000
Luapula	-	60	2,000	73,000
Northern	-	90	7,400	112,000
Zambia	740	25,220	119,200	459,000

Source: Ministry of Agriculture.

2.06 Small-scale commercial farmers have a comparative advantage in the production of all crops, except wheat which is mostly a large-scale crop. They, together with the large number of traditional farmers who occasionally produce for the market, are of strategic importance to agricultural development in the country. Commercial (marketed) agriculture, mainly concentrated along the line-of-rail and in Eastern Province, has been the major source of

agricultural growth. Its contribution to agricultural output increased from 19 to 55 percent between 1965 and 1988, while the real rate of growth in traditional (subsistence) agriculture has been stagnant and its relative share has declined significantly. Commercial farmers (large and small) are most likely to respond quickly to improvements in the incentive structure in the short run. The response of smallholders will lag and also require public investment in essential support services and necessary infrastructure (rural roads and markets).

III. GOVERNMENT INTERVENTION AND GROWTH POTENTIAL IN AGRICULTURE

Interventionist Syndrome

3.01 Since independence, Government's strategy of economic management has been premised on direct interventions. By 1968, Government nationalized or took over a majority interest in many large private enterprises and created parastatals. Although parastatals existed before independence in produce marketing, Government had little direct price control over crops other than maize. Gradually, it intervened directly in producer and consumer prices for crops. The main instruments were price controls and export/import restrictions. Eventually, government intervention and control pervaded the economy and, in particular, agriculture.

3.02 In recent years, policies have been geared to crisis management. The deepening economic and financial crisis of the 1980s forced Government to rethink and reevaluate its economic management. Policy reforms, introduced over 1984-90, included exchange rate adjustment, price decontrol, tax incentives for agricultural producers, increases in producer prices, and marketing liberalization for farm produce. Maize and fertilizer remained exceptions. Domestic trading of maize and fertilizers was liberalized in September 1990, but the producer prices for both commodities, as well as the consumer price for maize meal, are still controlled. Maize producer and consumer prices are important politically because maize is produced and eaten by most Zambians. Maize and fertilizer are politically and technically close cousins. Over 80 percent of fertilizer consumption is maize-related, and maize production accounts for the same share of the fertilizer subsidy.

3.03 The interventionist syndrome is epitomized by the role played by Government in maize and fertilizer marketing (Box 1). Although Government has agreed to decontrol prices for both before the 1992/93 marketing season, the lessons learned from intervention are indicative of the need to rethink and review Government policies and strategies for managing agriculture.

Costs of Intervention

3.04 Jansen (1988) provides a useful analysis of the long-term effects of intervention on maize output, consumer prices for maize meal, income distribution, budgetary resources, and institution building, as summarized below.

3.05 **Effects on Maize Production.** Under the Government's price control and uniform pricing policy, all producers received the same price for maize, regardless of location and timing of supply. Two related effects on maize production were: more expensive maize marketing as production shifted from low-cost areas close to main consumption centers toward more distant and high-cost areas (Box 1), and an estimated 28% lost growth in production due to heavy taxation of maize production in line-of-rail provinces (annual rate only 8.5 percent instead of 10.9 percent). See Table 3.1. This conclusion is consistent with the findings of the effective protection analysis in this report.

Table 3.1: Long-Term Effects of Pricing Policy on Maize Output, 1966-84

<u>Production Year</u>	<u>Production Change (metric tons)</u>		
	<u>Commercial Sector</u>	<u>Smallholder Sector</u>	<u>Total Maize Sector</u>
1966	36	40	76
1967	-176	-286	-462
1968	-90	-75	-165
1969	-702	-1,023	-1,725
1970	-924	-1,180	-2,104
1971	-3,227	-4,059	-7,286
1972	-4,355	-5,075	-9,430
1973	-835	-783	-1,618
1974	-1,452	-2,078	-3,530
1975	-870	-1,797	-2,667
1976	-623	-1,785	-2,408
1977	-393	-1,366	-1,759
1978	-292	-750	-1,042
1979	-484	-779	-1,263
1980	-512	-764	-1,276
1981	-1,283	-2,238	-3,521
1982	-1,071	-1,266	-2,337
1983	-1,300	-364	-1,664
1984	-1,190	-142	-1,332
Average 1966-84	-1,039	-1,341	-2,380

Source: Doris Jansen (1988): Tables 23 and 24.

3.06 Effects on Maize Consumers. The difference between border equivalent and actual retail price of maize meal amounts to a subsidy for consumers, as presented in Table 3.2. During 1975-85, consumers were subsidized at an average rate of 52 percent, increasing to 58 percent during 1986-89. Subsequent to food riots in 1986, maize meal prices were frozen at pre-riots level for three years, only to increase substantially in 1989.

Table 3.2: Maize Consumer Subsidy, 1967-89
(K/90 Kg Bag of Roller Meal)

Year	Import/Export Parity Retail Price	Actual Retail Price	Consumer Subsidy or Tax	
			K/90 Kg B.g	As % of Actual Price
1967	5.84	5.20	0.64	12.3
1971	12.19	5.20	6.99	134.4
1975	12.17	5.58	6.59	118.0
1979	19.81	11.30	8.51	75.3
1980	23.00	14.22	8.78	61.7
1981	29.93	18.81	11.12	59.1
1982	30.44	23.40	7.04	30.1
1983	33.66	30.42	3.7	10.7
1984	41.95	37.15	4.80	12.9
1985	54.55	53.82	0.75	1.4
1986	70.93	53.82	17.11	32.0
1987	90.09	53.82	36.27	67.0
1988	117.11	53.82	63.29	118.0
1989	351.61	298.75	52.86	18.0

Source: Doris Jansen (1986): Table 28 and Mission Estimates for 1986-89.

3.07 Effects on Income Distribution. Table 3.3 shows considerable annual variations in the effect on incomes, primarily because of changes in border-equivalent prices. During 1967-84, maize smallholder incomes were, on average, depressed by almost 15 percent each year. This is consistent with the findings of the domestic resource analysis in this report. Contrary to Government policy objective, the effects of uniform pricing differed by province: maize producers in maize-surplus Eastern Province earned higher incomes (by 12 percent on average); those in non-line-of-rail deficit regions (Luapula, Northwestern and Western) had their incomes reduced by about 40 percent each year; those in the line-of-rail provinces suffered an average 18 percent loss in their incomes each year over 1967-84. By providing strong relative incentives for increased additional production in surplus areas (Eastern Province) and negative incentives to maize producers in deficit areas, the policy has resulted in relatively high transport costs. These have been subsidized through the budget, and taxpayers have borne the brunt.

3.08 It is clear that uniform pricing has been inequitable. Without it, producers in deficit provinces would receive considerably higher incomes for maize than those in surplus provinces. This would lead to higher consumer prices in the short run. In the long run,

however, higher prices would stimulate increased production which, in turn, would depress consumer prices. It is not easy to determine, however, the extent to which the elimination of uniform pricing would affect incomes, because production costs for a given yield differ by province. To the extent that costs are higher in deficit areas, estimates in Table 3.3 overstate the negative impact of uniform pricing.

Table 3.3: Real Income Effects of Pricing Policy, 1967-84
(Percent)

-----Small-Scale Maize Producers (Food Crop)-----

Harvest Year	Eastern	Luapula	Northern	North-Western	Western	Line-of-Rail	Ave. All Smallholders	Comm. Maize Producers Line-of-Rail
1967	-13.0	-46.0	-26.9	-27.2	-24.6	-13.7	-14.3	-14.1
1968	74.3	-32.7	-33.2	-32.4	-30.3	-2.4	2.9	-2.7
1969	-43.7	-48.4	-49.7	-40.1	-39.9	-42.4	-42.9	-44.0
1970	-47.3	-61.0	-61.9	-55.1	-55.4	-52.7	-53.4	-54.8
1971	-35.9	-57.7	-54.9	-51.9	-51.9	-46.7	-46.5	-52.3
1972	-14.8	-60.8	-49.7	-46.0	-48.3	-33.0	-32.0	-40.8
1973	114.1	-31.7	-29.2	-36.5	-40.7	16.62	33.0	33.1
1974	-7.4	-52.0	-51.5	-55.2	-57.3	-32.9	-29.6	-31.6
1975	12.1	-47.6	-46.1	-50.4	-53.0	-22.7	-17.1	21.3
1976	31.1	-42.3	-40.6	-45.7	-48.6	-12.6	-9.1	7.92
1977	36.0	-48.7	-47.0	-52.0	-54.8	-17.6	-8.9	-15.6
1978	50.6	-46.4	-44.6	-50.0	-53.1	-12.1	-2.4	-2.3
1979	1.7	-48.7	-47.4	-51.4	-53.0	-26.6	-22.1	-29.8
1980	15.1	-44.7	-43.1	47.7	-50.4	-19.1	-10.8	-13.1
1981	-11.1	-49.2	-48.0	-51.5	-53.6	-31.2	-27.0	-29.2
1982	12.0	-42.6	-40.9	-45.5	-48.2	-18.1	-12.32	-19.9
1983	20.2	-42.3	48.9	-45.5	-48.4	-15.3	11.4	-21.5
1984	21.9	-38.2	47.4	-41.4	-44.4	-11.3	14.6	-10.5
Avg. 64-84:	12.1	-46.1	-34.5	-45.8	-47.6	-21.9	-14.9	-17.8

Source: Doris Jansen (1988): Table 38.

3.09 Effects on the Budget. Both price controls and uniform pricing for maize and fertilizer have no explicit impact on budget revenue, but they do have substantial impact on expenditure (Table 3.4). Maize and fertilizer subsidies linked to pricing policy comprise subsidies to the major agricultural parastatals and cooperatives for price differentials and handling costs. These subsidies are required to cover the differential between the purchase and the consumer or end-user price. It is evident that the entire maize subsidy was intended for consumers. The maize handling subsidy, intended to cover transport and handling costs of moving maize from surplus provinces to major consumption urban centers and deficit provinces, is substantial and has been increasing.

Table 3.4: Maize and Fertilizer Subsidies, 1970-90
(K Million)

	1970	1975	1980	1982	1983	1984	1985	1986	1987	1988	1989	1990
A. Subsidies for Maize												
Maize Coupon System	-	-	-	-	-	-	-	-	-	-	600.0	1300.0
Price diff. to Namboard	2.5	7.8	66.3	14.5	8.1	-	n.s.	n.s.	n.s.	-	-	-
Handling costs to Namboard	4.7	12.0	30.9	17.8	9.0	7.0	-	-	590.0	n.s.	270.0	267.1
Price diff. & handling to Coop.	5.4	3.2	11.5	57.3	73.5	58.5	31.3	-	-	770.0	700.0	1303.8
Sub-total for Maize	12.6	23.0	108.7	89.6	90.6	65.5	31.3	n.s.	590.0	770.0	1570.0	2871.0
B. Subsidies for Fertilizer												
Price diff. to Namboard	-	28.1	36.2	31.6	11.9	11.8	n.s.	n.s.	-	-	-	-
Handling costs to Namboard/Coops.	1.2	4.8	13.8	18.7	8.0	8.2	n.s.	n.s.	205.9	205.9	367.0	950.0
Sub-total for Fertilizer	1.2	32.9	50.0	50.3	19.9	20.1	n.s.	n.s.	205.9	205.9	367.0	950.0
Total Subsidies	13.8	55.9	168.7	139.9	110.5	85.6	31.3	n.s.	795.0	975.9	1927.0	3821.0

Sources: Doris Jansen (1986) Table 31 and Mission Estimates for 1985-90.

3.10 The fertilizer subsidy, intended for producers, mainly goes to maize producers who account for the bulk of fertilizer consumption in the country. It has accounted for about a quarter of the subsidy amount for maize and fertilizers, confirming the observation that maize consumers have been the central beneficiaries of Government agricultural policy. During 1970-89, maize-related subsidies accounted for about 10 percent of total agriculture expenditures and nearly 60 percent of budget deficits.

3.11 **Institution-Building Effects.** The impact on institution building has been equally negative. The administered price regimes and inflexible margins, implicit in price controls, have dampened initiatives by parastatals and cooperatives to adopt commercial considerations in their marketing operations. They have become dependent on "restitutions" from the government budget, encouraging cost maximization rather than cost minimization. This dependency has led to financial unsustainability among marketing agencies dependent on maize and fertilizer trading, as demise of the Grain Marketing Board, Agricultural Rural Marketing Board, and Namboard attest.

3.12 Insolvency and operational problems among cooperatives in Zambia are largely due to the unprofitability of maize trading. Price controls that require millers and traders to sell maize at prices below cost have adversely affected their financial position. To cover operating losses, while waiting to be restituted by Government, cooperatives resort to large bank overdrafts on which interest has to be paid. Again their operating expenses are increased and financial integrity is undermined.

3.13 Stifling the Private Sector. In addition, continued price control of maize and fertilizer would also paralyze the entire maize and fertilizer marketing system. Parastatals and cooperatives would sooner or later be unable to finance the purchase and distribution of these commodities without the Government providing the funds. The least noticed, but perhaps more important, impact has been long-term adverse effects on private sector involvement in domestic trade of agricultural products. Restricted trading margins have stifled private sector interest in participating in maize and fertilizer trading. For this reason, the recent market liberalization for these commodities will not attract private sector participation until price decontrol is also implemented.

A New Marketing System for Maize

3.14 In practice, Zambia, like most developing countries, has three options for reorganizing its marketing system for maize: a free market; a floor price system; and a single channel system. All three models currently co-exist in Zambian agriculture, but are applicable to different commodities. A free market, characterized by ready access for buyers and sellers, product differentiation and active pricing policy, pertains to agricultural chemicals, farm implements and machinery. This system operates fairly well and efficiently with full private sector participation.

3.15 Floor pricing has recently been introduced for all agricultural commodities, except maize. Cooperatives buy at floor prices fixed by Government for each commodity. Farmers have a choice to sell to whomever they choose at negotiated prices which are usually higher than floor prices. Market forces operate freely if prices exceed the floor, and consumer price variations are reduced by selling stocks when prices rise. The latter is unlikely in Zambia because demand generally exceeds supply for most commodities. Consequently, there has been no need to provide funds to the buyer-of-last-resort (the cooperatives) to finance the purchase and storage of commodity stocks for stabilizing the market.

3.16 A single channel system applies to maize, tobacco and seed cotton. The antithesis of free marketing, its shortcomings are most apparent in maize marketing: the system can be very costly if large quantities are involved and managerial skills are inadequate.

3.17 It is proposed that a floor pricing system be adopted for maize at the same time as the new fertilizer marketing system takes effect, during the 1991/92 season, as follows:

- (i) Free participation in purchasing maize from producers by cooperatives, private traders, millers, and individual or institutional consumers (initiated in September 1990).
- (ii) Cooperatives, private traders and millers be allowed to engage in intra-provincial maize trade (i.e., purchasing and selling maize and maize products).
- (iii) Cooperatives, private traders and millers be permitted to participate in inter-provincial maize trade.

- (iv) Cooperatives and private traders be able to engage in maize export trade under normal export licensing regulations.
- (v) A maize strategic reserve (MSR) be established as a short-term measure to stabilize both maize supplies and prices during the initial years of the adjustment program. The strategic reserve would be operated on a flexible-reserve-stock and break-even basis. Reserve operations would be fully financed by Government.

Effects of the New Pricing Policy

3.18 The new pricing policy and marketing system for maize would have both short- and long-term effects on production and marketing efficiency, consumption and processing of maize. These are examined below with special reference to short-term effects.

3.19 **On Production and Marketing.** In the medium to long term, price decontrol and market liberalization will encourage maize production near the main consumption centers, where ex-farmgate prices would be highest, because the cost of transport to mills would be lowest. Contrary to common belief in the country, maize production will not only be concentrated along the line-of-rail, but also close to provincial and district consumption centers. Production in non-line-of-rail provinces would be mainly intended for intra-provincial trade, which accounts for almost half of domestic maize trade. Inter-provincial trade, accounting for the other half, would cease to be profitable for marketing agencies in non-line-of-rail provinces (e.g., Eastern Province). Instead, the entire consumption in major centers (i.e., Lusaka and the Copperbelt cities) would be met by production from areas along the line-of-rail. In terms of transport costs, they would be the cheapest source of maize, and the likely major sources of surplus maize for export. Current pricing policy and marketing arrangements have contributed to maize exports being uneconomic at existing international prices, but the new policy would make them profitable at existing prices (Table 3.5).

Table 3.5: Economic Viability of Maize Production under Alternative Marketing Pricing Policies and System
(in 1990 Prices)

	Unit Price USD (Metric Ton)	Current	Proposed
		K/ton	
Average f.o.b. price (Jan. - May, 1990)	152.5	8387.5 ^{1/}	8387.5 ^{1/}
Less Cost of Sales:			
Producer Price		5555.56	6111.12 ^{2/}
Transport and Handling Cost		3082.64 ^{3/}	1628.88 ^{4/}
F.o.b. charges ^{5/}		83.88	83.88
Total Cost of Sales		8722.08	7823.88
Gross Margin		-334.58	563.62

1/ Exchange rate is K55 = USD1

2/ The market price assumed to be 10% above floor price in line-of-rail provinces.

3/ K 280.24 (K97.02 for intra-provincial and K183.22 for inter-provincial costs) per bag in high-cost provinces.

4/ K148.8 (K34.14 for intra-provincial and K113.94 for inter-provincial costs) per bag in low-cost provinces.

5/ Documentation expenses estimated at 1% of f.o.b

Source: Mission estimate.

3.20 Lusaka and Copperbelt cities account for over 63 percent of maize consumption. Supplying these centers from low-cost provinces would reduce consumer prices of roller meal by at least 37 percent in 1990 under the new pricing policy (Table 3.6). Since the non-line-of-rail provinces are self sufficient in maize production, the new pricing policy would simply encourage them to sustain their respective self-sufficiency levels, and discourage production beyond self-sufficiency. The losers in this respect would be the Eastern and Northern provinces, which would have to curtail their maize production substantially. Conceivably, Eastern Province could continue producing maize at the existing level, provided it can find markets in Malawi and Mozambique. Luckily enough, farmers in both provinces could expand production in alternative crops, namely tobacco, cotton, sunflower, soyabean and groundnuts in Eastern Province and sunflower, soyabean, wheat and coffee in Northern Province. In general, the new policy would not lead to loss of income among farmers in all non-line-of-rail provinces. If anything, it would result in diversified production in Eastern and Northern provinces.

3.21 Floor producer prices, which reflect full recovery of intra-provincial transport costs in line-of-rail provinces and both intra-provincial and inter-provincial transport costs as well as for the maize strategic reserve (MSR) operating costs, would be highest in line-of-rail provinces and lower in other provinces. These prices would act as a safety net, providing farmers with a reasonable basis for negotiating higher prices with marketing agencies. Surplus production in non-line-of-rail provinces would be significantly reduced as the returns on production above local requirements would be lowered, especially in relation to alternative crops. In the medium term, the new pricing policy would therefore result in a more efficient pattern of production and marketing structure.

Table 3.6: Maize Price Structure under a Liberalized Marketing System in 1991^{1/}
(Kwacha)

	Produced and Consumed in Line-of-Rail Areas	Produced and Consumed in Non-Line-of- Rail Areas	Produced in Non-Line-of- Rail and Consumed in Line-of-Rail Areas (MSR Maize)
Producer Price (1991/92 marketing season)	500.0	420.0	420
Marketing Costs:			
Intra-provincial	100	169.0	169.0
Inter-provincial	132.0	-	232.0
Sub-total	732.0	589.0	821.0
MSR	30.0	30.0	30.0
Mill-gate Price	762.0	619.0	851.0
Raw Material	213.0	173.0	238.0
Milling and Distribution Costs	82.0	82.0	82.0
Consumer Price	295.0	255.0	320.0
Existing Ceiling Consumer Price	198.0	198.0	198.0
Implied Increase	97.0	57.0	122.0
Percentage Increase	49.0	29.0	62.0

1/ Based on following assumptions:

- (i) Regional price differentials at all levels of the marketing system.
- (ii) No intra-provincial trade for non-line-of-rail provinces.
- (iii) Maize supply for line-of-rail areas would be from within except for MSR maize.
- (iv) No f.o.b. pricing policy.

Source: Mission estimates.

3.22 On Consumption and Consumers. The proposed changes in pricing policy and marketing would result in three sets of mill prices. These would be higher in line-of-rail provinces (K762/bag) and for strategic reserve maize (K821/bag) bought from surplus non-line-of-rail areas and lower (K549/bag) in other provinces. The proposed marketing arrangement would eliminate transport costs mainly related to transfer from non-line-of-rail provinces to major consumption centers. MSR maize bought in surplus non-line-of-rail areas and transferred to deficit areas along the line-of-rail would be the exception. Both intra- and inter-provincial costs would be incurred, amounting to K401/bag in 1991/92. During the 1991/92 marketing season, consumer prices for roller meal are estimated at K295, K320 and

K255 per 2^tKg bag for line-of-rail, MSR and non-line of rail, respectively. Compared to consumer prices for 1990/91, these represent a 49 and 62 percent increase for line-of-rail consumers and 29 percent for consumers in other areas. Compared to the existing situation, with all marketing costs passed onto consumers, the proposed policy would result in reducing roller meal prices by 21 percent in line-of-rail provinces and 33 percent in non-line-of-rail provinces, based on savings in transport costs. Consumer savings in line-of-rail areas are relatively small because of the higher producer prices that would be necessary to stimulate higher production in these areas.

3.23 On Milling. Free availability of maize should result in competition among millers in major consumption areas and help minimize the regular short supply of roller meal in retail markets for consumers. During the marketing season, it is likely that large-scale producers would directly supply significant quantities of maize to millers, who would then assume the functions of financing and storing their stocks, thus relieving cooperatives of such burdens. Similarly, large producers would transport maize to mill-gates, also providing relief to overburdened cooperatives. Both producers and millers would benefit from direct trading through better prices and reduced costs. To increase their milling and purchasing flexibility under competitive conditions, large-scale millers are likely to expand their storage capacity, which is currently negligible.

3.24 Fiscal Effects. Subsidies related to maize and fertilizer marketing have increasingly posed a substantial fiscal burden (Table 3.4). Under the new pricing policy it is envisaged to eliminate both subsidies by passing them to consumers or users. Only subsidies related to the coupon system to protect vulnerable groups would be continued. Under the new policy, changes in roller meal prices would raise the face value of a coupon from K21 to an average of K22. The coupon system was estimated to cost K1,300 million in 1990.

Potential and Growth Prospects

3.25 As a result of Government interventions, Zambia's agricultural growth has been generally modest and less than its potential. Other countries in the region (e.g., Malawi) with relatively severe resource constraints have performed better. Zambia's agroecology permits a wide variety of farming systems and crops. Analyses of resource base, market prospects, and comparative advantage suggest that Zambia has good potential for expanding and diversifying its agricultural production. Realization of this potential, especially among smallholders, will require more public policy changes and increased investment in research, extension, and infrastructure. Existing technology in emergent and large-scale commercial agriculture is adequate to generate increased production, provided the adjustment program is implemented on a sustainable basis.

3.26 Zambia's considerable resource of native cattle breeds also represents a substantial potential for growth (Table 4.13). Tapping this genetic potential will require improvements in animal nutrition (feed supply) and husbandry practices. With such improvements, productivity increases of up to 30 percent could be expected. Public investments in extension services for this purpose would thus have a high payoff.

3.27 Of Zambia's estimated 9 million ha of cultivable land, only 12 percent is of good agricultural potential. It is concentrated in the already densely populated and relatively better developed central, south, and eastern plateaux. Some 46 percent of total land is highly leached, relatively infertile, and prone to acidity, and another 28 percent has low rainfall and

acidic sandy soils which are suitable for extensive cattle ranching. Nevertheless, the supply of arable land is abundant, even though investments at farm level (e.g., fertilizer and irrigation) might be required to improve its quality in some parts of the country. Irrigation potential, currently estimated at 423,000 ha, or about one third of total cropped land, is substantial. Zambia's irrigation potential is one of the highest in sub-Saharan Africa. Only 25,000 ha or 6 percent of potential is currently utilized. Much of the irrigation potential is accounted for by surface water.

3.28 As a result of abundant land, the average smallholding in Zambia tends to be larger than in many other sub-Saharan African countries. Its inelastic supply of labor, however, tends to counteract the potential impact of an elastic supply of land on production and productivity. Smallholders face considerable labor constraints at certain points in the farming season and resort to suboptimal crop husbandry practices (e.g., planting behind the plow and high fertilizer applications).

3.29 Zambia also has an enormous wildlife resource which is underdeveloped. Wildlife is a renewable resource which, if protected and well managed, can be a major source of income and foreign exchange. Illegal poaching, however, presents a serious threat, particularly to black rhino, elephant, cheetah, leopard, lechwe, and crocodile. Nevertheless, the potential of Zambia's 19 national parks (covering 6.3 million ha) and 32 game management areas (covering 16.2 million ha) as a source of foreign exchange earnings remains considerable. Controlled wildlife harvesting, regulated hunting, and game ranching and farming also constitute considerable potential for generating state and individual income. The Administrative Management Design for Game Management Areas (ADMADE), conceived by the National Parks and Wildlife Services, is a commendable step toward realizing this potential.

3.30 Future agricultural growth will depend on: (i) an appropriate mix of land expansion and increase in yields; (ii) diversifying into new commodities or subsectors (especially in the relatively undeveloped, but high-potential natural resources); (iii) increasing efficiency in existing commodities by ensuring optimal use of land and labor resources leading to more output per unit of land and labor; and (iv) achieving yield increases and sustaining the resource base of agricultural production through measures that minimize natural resource degradation. The previous strategy based on crops, particularly maize, wheat, and sugar (which have driven overall sector growth) was predicated on import substitution (self-sufficiency) to meet demand created by rapid population growth in the last two decades. Zambia has now achieved self-sufficiency in basic foodgrains under normal weather conditions, and increasing regional trade in maize and wheat is possible, but would not likely be a major source of growth, at least in the long run.

3.31 There are promising opportunities for diversifying agricultural production into commodities with high-growth potential and favorable income-demand elasticities (Table 5.1). Farmers have ample opportunities for improving production efficiency by shifting to commodities with relatively high value added in which they have comparative advantage, and thus improving their incomes. Opening up international trade will also encourage diversification. Increasing agricultural diversification does not mean neglecting foodgrains or the crop sector. Government's high priority for food security is fully justified. Food security will be critical to agricultural diversification. Indeed, it is the attainment of food security that will permit Zambia the flexibility to diversify the agriculture sector. Smallholders can only diversify after pressing food needs are adequately met. During the adjustment program,

however, improvements in yields and labor and land utilization can allow Zambia to meet future foodgrain needs on the same or less land area. With a proper incentive structure, most shifts in production at the margin would be out of commodities (e.g., millet, sorghum and soyabean) in which smallholders and emergent farmers do not have a strong comparative advantage.

3.32 Zambia needs to formulate a strategy that will create an enabling environment for agricultural growth. Such a strategy need not be based on quantitative models with specific targets relating to inputs, output, and investments, but one that is aimed at improving the incentive framework comprising price and non-price factors that allow producers to respond to market signals and new opportunities. It would be futile for Government to determine commodities for farmers or to forecast future market shifts and prices, technical charges and dynamic comparative advantage among commodities. Innovations and growth in the agriculture sector will, and should, not depend on Government decisions, but rather should depend on the daily decisions of the numerous, but individual Zambian farmers. Nevertheless Government can play a vital role in influencing these decisions, through designing appropriate policy incentives, investing in research and extension to generate new technologies, and developing rural infrastructure and human capital. Government should also tackle problems in patterns of public investment in these critical areas which influence farmers' decisions. Zambia can no longer afford the cost of distorting policies. There is need to improve the efficiency of public investment in these areas to allow agriculture to respond to changing needs, while reducing risks that face the farming community. Since improved technology is embodied in inputs and information that are made available to framers, improvements in basic agricultural services and infrastructure are essential for increasing efficiency and promoting technical change. Improvements must therefore be made in the research and extension systems to ensure that these are appropriate and adapted to the needs of the majority of farmers. Public investments must be targeted to these priority areas, and efficiency improved, especially in view of the resource constraint in the economy.

3.33 For the above reasons, in addition to the fact that the reform agenda is extremely complex in terms of the issues to be addressed, the strategy proposed in this report is not prescriptive, but suggestive in the choice of options to be followed in shaping the required incentive structure for agricultural development. The agenda for restructuring is long. It comprises both urgent short-term actions and medium- and long-term changes addressing fundamental issues in agricultural policies, institutions, and programs (i.e. strategies). In the short term, priority options consist of : (i) allowing private sector participation and development in agricultural marketing, input distribution, and agroprocessing through removal of maize and fertilizer subsidies, price controls on maize meal, and import and export restrictions, and liberalization of maize, seed and fertilizer marketing; (ii) improving agriculture's incentive structure by reducing the level of taxation in agriculture through the elimination of price controls and the introduction of market-determined producer prices for products and inputs; (iii) formulating a floor pricing system, as a transitional instrument, in which producer prices would be guaranteed at border price equivalents by a strategic maize reserve, a buyer of last resort; and (iv) restructuring public expenditures for agriculture by eliminating maize and fertilizer subsidies and concentrating limited budgetary resources on priority programs intended to improve farmers' incentives and production efficiency, especially research and extension, farm credit, and infrastructural development. Implementation of these changes is essential for laying the foundation for future growth.

3.34 In the medium and long term, Zambian agriculture faces daunting challenges. Several options are available, involving difficult changes in policies, institutions, and programs that will require sustained political support. In the long term, priority options are: (i) sustaining improvements in the incentive structure through appropriate exchange rate and monetary policies; (ii) stimulating private sector development and participation in the provision of rural financial services, marketing, storage, processing, and transportation; (iii) implementing changes in the management and delivery of basic agricultural services so that they become more efficient and relevant (demand-driven); (iv) investing more in human capital (education, health, and nutrition) to improve the quality and quantity of agricultural labor; (v) implementing changes in traditional land tenure systems so that these are capable of providing security in land and credit facilitation; (vi) formulating a land use policy capable of encouraging long-term on-farm investments and optimal use of land in commercial, large-scale agriculture; and (vii) increasing women's access to public programs and services.

Adjustment Strategy Impact

3.35 The strategic framework proposed in this report will have considerable impact on the sector's growth and production pattern. In the short run, changes in crop-specific growth rates can be expected, while changes in production pattern can only take place over the medium and long term. In the short run, growth will depend on producers' responses to market liberalization and price decontrol measures for maize and fertilizers. Lack of suitable data and severe market distortions in the past do not permit quantitative specification of supply response in Zambia. Nevertheless, there is overwhelming evidence in other countries with similar conditions that farmers are generally responsive to price changes that accompany market liberalization and elimination of price controls. Moreover, analysis of production efficiency in this report indicates that possibilities exist for shifting production into commodities with relatively high value added, while, at the same time, improving production efficiency. This underlies the short-term strategy proposed in this report. In the medium and long term, farmers' responses would primarily be determined by improvements in non-price incentives, comprising improvements in basic agricultural services, rural finance, storage, and transportation as well as improvements in human capital, environmental conservation, and farm-level management. The expected impact of the proposed strategic framework on agriculture is specified in Appendix 1 and quantified in Tables 5.1 and 5.2.

3.36 Although market liberalization and price decontrol would result in relatively higher prices for inputs and products currently subject to controls, it is not possible to gauge the extent of such a rise. Relatively higher input prices would reduce demand for inputs and products, with the likely results being both production and consumption substitution. Maize production in particular, being relatively fertilizer-intensive (especially in commercial agriculture), may experience a slight decline as it is substituted for less fertilizer-intensive crops (e.g., oilseeds). In smallholder agriculture not much production substitution is likely in the initial stages. Smallholders would tend to reduce the area planted to maize and, to the extent possible, intensify crop husbandry practices within the fixed amount of labor. Since improved crop husbandry practices are critical complements to fertilizer in achieving optimal maize yields, overall maize production among smallholders may actually increase as maize area is reduced at the margin.

3.37 In general, crops that are less fertilizer-intensive (e.g., cotton, sorghum, millet, and sunflower) or do not require fertilizer (e.g., groundnuts and soyabean) are likely to substitute for fertilizer-intensive crops (e.g., maize and tobacco) at the margin. As a result

of this substitution effect, there may be no significant increase in aggregate product supply in the short run. Production of crops that have exhibited relatively high growth rates in recent years (e.g., oilseeds) may continue to expand rapidly during the adjustment period. Their impact on overall supply and production structure is, however, likely to remain low by virtue of their initial small base. Given the availability of relatively appropriate technologies in commercial agriculture, relatively more significant commodity-specific supply response by commercial farmers can be expected than in smallholder agriculture. Wheat, soyabean, and beef are the principal commodities in commercial agriculture that are likely to increase significantly in the short run. In the long run, aggregate supply of agricultural commodities may increase significantly as a result of sustained interactions of several adjustment measures.

3.38 In the medium and long run, sustained adjustment in the exchange rate in real terms, coupled with removal of export restrictions, may promote expansion in the production of export commodities in which Zambia has comparative advantage. It is therefore possible that improved relative comparative advantage of export commodities may lead to increased farm incomes and employment in these subsectors, while they may decline at the margin in the non-export subsectors, especially oilseeds and foodgrains. Nevertheless, improved efficiency in domestic trade and marketing is likely to stimulate demand for import-substituting commodities, especially oilseeds whose demand is currently supply-constrained.

IV. ANALYSIS OF STRATEGIC ISSUES AND OPTIONS

Background

4.01 Zambian agriculture, defined broadly, consists of five subsectors: crops, livestock, fisheries, forestry, and wildlife. Based on official production data, crops and livestock dominate. Data on forestry and wildlife are limited and unreliable and, in some cases, non-existent. Similarly, data on non-marketed crops, livestock, and fisheries are unreliable. The following analysis of the sector's characteristics and performance is based on official data.

4.02 Zambia's national accounts contain little information on fisheries, forestry, and wildlife, the most important natural resources. These are hardly valued as productive assets and their depreciation or appreciation is not reflected in the value of national production. Consequently, natural resource depletion (e.g., forest clearing or killing of wildlife) is usually not charged against gross domestic product. For this reason, it is not possible to analyze quantitatively the performance of these three subsectors. Nevertheless, a qualitative analysis is necessary to highlight the importance of and issues or options pertinent to their development.

4.03 Agriculture in Zambia is faced with numerous issues, not all of which can be examined adequately in this report. Instead, a set of core issues with strategic importance for the sector's development has been selected: agricultural growth and diversification, production efficiency, producers' incentives, human capital investment, agricultural sustainability and the environment, women role in agriculture, and land tenure.

Agricultural Growth and Diversification

4.04 The rate and pattern of growth critically influence diversification in the sector over time and are examined below.

Growth Rate

4.05 Aggregate real agricultural growth averaged 2.4 percent a year between 1965 and 1982, compared to 7 percent during 1983-88. This recent impressive growth indicates the sector's capacity and potential for higher growth, provided both market and Government failures are minimized. Despite this performance, Zambian agricultural growth remains fragile for a number of reasons.

4.06 First, Zambia's agricultural growth is highly dependent on weather conditions. Despite its enormous irrigation potential, almost all crops except wheat and sugar are rainfed. Drought in 1986/87 resulted in significant contraction of the sector (Table 1.1); indeed, four major contractions between 1974 and 1988 were associated with poor weather, mainly drought. Conversely, the best years for sectoral performance (1985/86 and 1987/88) were marked by adequate and normally distributed rainfall. Irrigation would minimize this dependence.

4.07 Second, crops overwhelmingly dominate growth and output. Production in other subsectors has played a secondary role (Table 4.1). Government policy has promoted

this lopsided development. Its public investment strategy has consistently allocated more budgetary resources to crop development (Table 4.2); for example, forestry, fisheries, and wildlife development combined accounted for 18 percent of sectoral expenditure between 1985 and 1988. Data to examine the economic rationale for this strategy are not available, but it is unlikely that comparative advantage, in economic terms, has been the main reason for this policy bias. Since private investment is also likely to be low in non-crop subsectors, their lack of growth is not surprising. Unless deliberate public policy measures are undertaken to direct more public and private resources into these subsectors, their potential will remain underutilized. Their contribution to sectoral growth will continue to be suboptimal, thus perpetuating the sector's lack of structural change (diversification) and its vulnerability. The potential for more dynamic growth in the neglected subsectors is examined in Chapter V.

4.08 Within the crop subsector, growth has also been unbalanced and vulnerably dependent on a single crop: maize. This dominance of maize is disturbing (Table 4.3). On average, maize accounts for about 70 percent of the land cropped annually, and almost 85 percent of crop production. Maize has clearly been the "engine" of growth in sectoral performance: the sector's record performance of 20 percent growth in 1988 was propelled by a real 90 percent increase in maize production. Government policies that subsidize both maize production and consumption are largely responsible for this dominance. Likewise, growth in fertilizer use is correlated.

Table 4.1: Gross Agricultural Production by Subsector of Origin, 1970-88

Subsector	1970	1975	K Million in constant 1977 prices					Growth Rate (Percent)			
			1980	1985	1986	1987	1988	1970-85	1986	1987	1988
Crops	169.1	195.7	151.5	206.3	227.3	175.5	244.0	1.9	10.0	-23.0	39.0
Livestock	45.0	63.2	75.8	68.8	74.8	114.1	121.0	3.3	9.0	53.0	6.0
Forestry	22.7	25.3	38.0	34.4	37.4	38.0	39.0	3.5	9.0	2.0	3.0
Fisheries	13.7	10.1	22.8	20.6	22.4	22.8	23.0	0.6	9.0	2.0	1.0
Wildlife	9.2	6.8	15.8	13.7	11.9	15.2	13.5	0.7	-13.0	28.0	-11.0
Total Sector	260.2	301.1	303.9	343.8	373.8	365.6	440.5	2.2	9.0	-2.0	20.0

Source: Estimated from CSO Monthly Digest of Statistics and MAWD Agricultural Statistics Bulletins.

Table 4.2: Agricultural Expenditures by Subsector^{1/}, 1985-88
(K Million in constant 1986 prices)

	1985	1986	1988	Average Total	1985-88 %
Crops	73.5	137.9	204.3	118.8	42
Livestock	48.8	136.0	112.0	112.0	40
Forestry	21.8	52.6	31.3	35.2	13
Fisheries	3.9	9.8	12.1	8.6	3
Wildlife	3.5	6.4	5.9	5.3	2
Total Sector	151.5	298.7	389.5	279.9	100.0

1/ Including recurrent and capital expenditures.

Source: Zambia Public Expenditure Review, 1986 (Report No. 6438-ZA).

4.09 Evidence (1974-89) suggests that expansion in maize production, in cropped area and output, has been occurring at a slower rate than that of other crops, except Virginia tobacco (Table 4.4). There is no clear explanation for this phenomenon. Maize's terms of trade vis-a-vis other crops remained virtually stable during 1980s, except during 1988-90 when they deteriorated slightly (Table 4.7). Nevertheless, due to the low initial base of other crops, coupled with the need to feed a growing population, the higher growth rates of other crops have not diminished the dominance of maize. These crops would have to grow much faster if the crop subsector is to be diversified in the medium term.

4.10 Third, in order to understand the fragility of agricultural growth it is important to analyze the degree to which production is monetized. Commercial agriculture, ranging from the small-scale farmers (producing some surplus for the market) to large-scale (producing entirely for the market), constitutes only 25 percent of farming households.

4.11 Growth in the commercial production has been dynamic, particularly during 1983-88 (Table 4.5). Its contribution to total agricultural GDP increased from 19 percent in 1965 to about 41 percent and 49 percent in 1982 and 1988, respectively. This structural change is largely due to an increase in the number of small-scale commercial farmers (also known as emergent farmers), from less than 50,000 in 1965 to approximately 120,000 in 1988.

4.12 Subsistence production consists of retention for consumption or seed. Subsistence agriculture stagnated over 1965-83. Recently, it has shown moderate improvement, with real annual growth of about 1.2 percent during 1983-88 (Table 4.5). This growth, however, was too small and too slow to arrest its declining share in GDP, down from 81 percent in 1965 to 59 percent in 1982, and 51 percent in 1988. Rural population growth of an estimated 3.0 percent a year suggests a decline in per capita production.

Table 4.3: Changes in Production of Selected Crops, 1970-88

Production	Unit	1970	1975	1980	1985	1988
<u>Maize</u>						
Sown Area	(000ha)	266.7	212.2	539.9	581.9	723.1
Yield	(kg/ha)	1005.0	2827.0	2002.0	1093.0	1,854.0
Output	(000tons)	268.3	599.9	1080.7	636.3	1341.0
<u>Wheat</u>						
Sown Area	(000ha)	0.1	1.0	2.4	2.3	6.9
Yield	(kg/ha)	1030.0	1020.0	4430.0	5005.0	4450.0
Output	(000tons)	0.1	11.8	11.8	11.3	30.8
<u>Seed Cotton</u>						
Sown Area	(000ha)	12.9	10.9	30.3	45.8	76.1
Yield	(kg/ha)	630.0	629.0	747.0	660.0	770.0
Output	(000tons)	8.1	6.9	22.6	30.3	58.5
<u>Sunflower</u>						
Sown Area	(000ha)	n.a.	18.5	57.0	62.6	44.6
Yield	(kg/ha)	n.a.	773.0	592.0	399.0	271.0
Output	(000tons)	n.a.	14.3	33.7	25.5	12.1
<u>Soyabbeans</u>						
Sown Area	(000ha)	n.a.	n.a.	n.a.	9.8	20.3
Yield	(kg/ha)	n.a.	n.a.	n.a.	1077.0	1280.0
Output	(000tons)	n.a.	n.a.	n.a.	10.6	26.0
<u>Virginia Tobacco</u>						
Sown Area	(000ha)	5.7	7.2	4.3	1.5	4.0
Yield	(kg/ha)	840.0	900.0	950.0	1459.0	887.0
Output	(000tons)	4.8	6.5	4.1	2.1	3.5
<u>Groundnuts (shelled)</u>						
Sown Area	(000ha)	10.7	11.2	134.0	31.9	75.7
Yield	(kg/ha)	600.0	795.0	869.0	510.0	441.0
Output	(000tons)	6.4	8.9	116.5	16.3	33.4

Table 4.4: Commodity Performance, 1974-89

Commodity	Area Growth Rate	Yield Growth Rate	Production Growth Rate ^{1/}
			Percent
Maize	10.8	-2.1	8.5
Millet	15.1	-2.0	12.9
Sorghum	19.9	4.8	26.0
Paddy Rice	20.4	2.3	22.6
Wheat	80.0	20.0	70.0
Mixed Beans	22.5	0.3	22.5
Groundnuts	20.7	-3.0	17.1
Cotton	39.1	1.1	41.1
Tobacco (Virginia)	1.3	-3.4	-2.3
Tobacco (Burley)	30.6	-4.1	24.5
Soyabbeans	27.8	-3.1	23.4
Sunflower	16.5	2.5	19.4
Beef	-	-	3.4
Poultry	-	-	12.4
Dairy	-	-	19.0

^{1/} Area growth rate and yield growth rate do not add up to production growth rate due to data deficiency

Source: Mission estimates from CSO data.

4.13 The degree of monetization is also critical to the sector's supply response to improvements and types of price incentives. A high degree of subsistence production calls for more improvements in non-price incentives (e.g., agricultural services and rural infrastructure) to stimulate production.

4.14 As indicated in Table 4.6, the degree of monetization as measured by a monetization coefficient - - the ratio of marketed production to total production - - varies among crops and from year to year. The coefficients reveal no consistent trend, largely because crop retention by farmers is dependent on a combination of factors that varies from year to year, household food reserves, marketing infrastructure, market prices, and product consumability. Nevertheless, for most crops, except sorghum and millet, monetization is

relatively high. These findings, similar to micro-level results in earlier Bank studies^{1/}, suggest extensive bartering as a means of exchange among the rural population. Monetization in other subsectors, particularly forestry and wildlife, is extremely low. It appears that adjustment measures that focus on improving rural infrastructure (marketing, processing, and transportation) may be the most effective means to stimulate supply response in the subsistence subsector. Such measures would also accelerate its transformation toward market-oriented production.

Table 4.5: Agricultural Growth Rates and Shares by Sector, 1965-88
(percent per annum)

<u>Period</u>	<u>Commercial Production</u>		<u>Subsistence Production</u>	
	<u>Growth Rate</u>	<u>Sectoral GDP</u>	<u>Growth Rate</u>	<u>Sectoral GDP</u>
1965-82	5.9	19.41	0.3	81.59
1983-88	11.0	41.49	1.2	59.51

Source: World Bank Report No. 4764-ZA and mission estimates.

Table 4.6: Monetization Coefficients in Agriculture, 1970-88

Crop	1970	1975	1980	1987	1988
Maize	.54	.57	.34	.65	.78
Wheat	-	.07	.81	.71	.81
Rice	.10	.08	.58	.21	.63
Soyabeans	.90	.95	.98	.93	.89
Sunflower	.80	.96	.97	.86	.97
Cotton	1.00	1.00	1.00	1.00	1.00
Tobacco	.99	.98	.98	.97	.98
Groundnuts	.31	.50	.50	.62	.63
Sorghum	.24	.11	.04	.02	.05
Millet	.21	.07	.08	.01	.03
Total Crop	.52	.65	.54	.59	.77

Source: Mission estimates from CSO data.

^{1/} World Bank Report No. 841a - ZA, Vol. II, Annex 3.

Table 4.7: Commodity Relative Producer Prices (to Maize), 1980-90

Year	Maize	Tobacco	Cotton	Sunflower	Sorghum	Groundnuts
1980	1.0	11.7	3.0	2.5	2.8	3.4
1981	1.0	10.6	3.1	2.3	2.7	3.5
1982	1.0	12.9	2.6	2.3	2.6	3.3
1983	1.0	14.3	2.9	2.4	2.8	3.8
1984	1.0	10.1	2.1	1.6	2.2	3.3
1985	1.0	10.8	2.2	1.8	2.2	3.7
1986	1.0	8.5	1.6	1.4	2.0	2.7
1987	1.0	7.2	1.8	1.6	1.9	2.3
1988	1.0	15.8	3.4	2.0	2.7	4.0
1989	1.0	12.0	3.0	2.7	2.6	3.5
1990	1.0	12.0	3.0	2.5	2.5	3.1

Source: Mission estimates from CSO data.

4.15 Monetization can be a strategic instrument for promoting poverty-alleviating growth. Many regions that produce cash crops for domestic or export markets (Eastern, Central, and Southern) are better off than regions that are largely under subsistence production (Luapula, Northwestern, and Western). The poor in the former areas are relatively better paid or have higher average incomes from agricultural production. Although this is insufficient to establish a causal link between monetization and poverty, monetization has positive effects on the income and nutrition of smallholders. For example, the opening of marketing channels by Lintco for coffee, soyabean and cotton has increased production of these crops by smallholders in various areas of the country. Casual observations indicate that smallholders who have monetized, have also adopted yield-increasing technology for maize or other food crops. Such complementarities between monetization and technological change are likely to pertain to other sectors and areas of the country. They should be tapped to help alleviate rural poverty, and improvements in rural marketing, processing and infrastructure put in place to support the process.

4.16 Finally, sectoral growth in production between 1974 and 1988 was concentrated in cereals and mixed beans (nontradables) (Table 4.4), with a 16.3 percent annual average growth. Maize, the largest subsector, grew at 8.5 percent. Tradables (i.e., export and import-substituting commodities) registered impressive growth rates, too, except Virginia tobacco and beef. Cotton, burley tobacco, soyabeans, sunflower, and dairy products were particularly impressive. Tradables (especially Virginia tobacco) did not significantly benefit from the 1985-86 currency devaluation, mainly because devaluation was short-lived. Similarly, the pricing policy, which fixes producer prices uniformly over a 12-month period,

did not permit producers to enjoy short-run gains from the devaluation. It is therefore crucial that adjustment measures (including currency devaluation) should be complemented by sector-specific measures which ensure that farmers actually and almost immediately benefit from devaluation. Elimination of price rigidities resulting from uniform pricing and price controls is essential.

4.17 Although agriculture's export potential is considerable, the sector's export base is extremely narrow and almost insignificant. Export production consists of small quantities of tobacco, cotton, coffee, and beef. Except cotton, growth in production, from low levels, has been relatively small and sluggish (Table 4.3). Exports of sugar, maize, fish, and forestry products are equally small and erratic. Zambia is the only country in the region without a fully developed agricultural export sector. Development of an efficient agricultural export sector is a key strategic challenge under the adjustment program, and Government's commitment is vital.

4.18 In the following analysis of factors underlying growth in the crop and livestock subsectors, strategic issues are highlighted. Supply-side factors are centered, because presumably demand is not a serious constraint. Zambia is a net importer of most agricultural commodities, except maize and sugar in some years. For agricultural exports, Zambia is a marginal producer facing given demand and price schedules. Similar analysis of the fisheries, forestry, and wildlife subsectors is not possible due to lack of data. Future sector work should address this need.

Sources of Growth in Crops

4.19 Crop production can be increased by: (i) expansion in cropped area, (ii) change in technology to increase yields and cropping intensity, and (iii) change in cropping patterns.

4.20 **Cropped Area Expansion.** Raising agricultural production by bringing more land under cultivation without reducing the average fallow period is generally possible in most parts of Zambia. Ample evidence suggests that area expansion has been the major source of agricultural growth to date (Table 4.4). If the production growth rate is broadly defined as a function of area growth and yield growth, then data in Table 4.4 suggest that area expansion entirely accounted for production increases of maize, millet, groundnuts, tobacco, and soyabbeans between 1974 and 1989, since their yield growth rates were generally negative.

4.21 Three factors account for the importance of area expansion to growth: abundant land, land tenure systems, and a large smallholder subsector. Land availability is generally not a constraint. Although almost all of Zambia's high-potential cultivable land (estimated at 1.4 million ha) is currently utilized and concentrated in already densely populated areas, 84 percent of the total cultivable land (about 9 million ha) goes uncropped each year. Investments at the farm level (e.g., fertilizer, irrigation, and liming) might be required to improve its quality in some parts of the country. Except in relatively developed and densely populated areas of the central, south, and eastern plateaux, agroecological conditions do not appear to restrict expansion in cropped area. While the elastic supply of land has been vital to increasing agricultural production, it has tended to encourage smallholders, who face a labor constraint, to substitute land for labor by adopting suboptimal crop husbandry practices (e.g., single weeding under high fertilizer application). These practices, though based on rational decisions by farmers, result in marginal value products

that are not equal to the prices of land and labor, respectively. Land supply in most parts of Zambia is likely to remain elastic in the medium to long term and has important strategic implications for the adjustment program.

4.22 Traditional land tenure systems do not appear to have constrained expansion in cropped area by smallholders. Movement of people from one area to cultivate land in another under the jurisdiction of the same ethnic group is generally possible. However, production expansion on state and trust-lands -- by medium- and large-scale farmers -- may be constrained by a limited supply of land or tenure uncertainties. Commercial agriculture is highly sensitive to tenurial arrangements, and traditional tenure systems will continue to limit commercial production.

4.23 The large number of smallholders (Table 2.1) and their ubiquitous distribution in all agroecological zones has facilitated expansion in cropped land. Smallholders account, on average, for 65 percent of total land under cultivation in any given year. The largest numbers of smallholders are in provinces where land supply is still highly elastic (Northern, Northwestern, Western, and Luapula), and expansion of cropped area in these provinces has been generally more rapid than in the relatively agriculturally developed provinces (Southern, Central, and Eastern). Smallholders' share of cultivated land is highest in maize (60%), millet and sorghum (90%), cotton (67%), groundnuts (85%), and paddy rice (95%), which crops experienced some of the highest growth in cropped area. Similarly, medium- and large-scale commercial farmers expanded area to increase production of wheat and oilseeds (Table 4.4).

4.24 For the above reasons, land expansion is likely to remain the cornerstone of Zambia's agricultural growth. The impact of expansion as strategy on overall sectoral performance, however, is limited by the availability of farm labor and technology, particularly in the smallholder subsector.

4.25 Expansion of cropped land is generally possible under conditions of elastic supply of farm labor or availability of labor-replacing technology (e.g., farm equipment and chemicals). Under conditions of constrained labor supply, crop yields may not increase. In Zambia, labor-replacing technologies have been restricted to cultivation, imposing a labor constraint on subsequent farm operations which are critical to increasing yields.

4.26 Smallholders with 5-20 ha holdings who use ox-plows face considerable labor constraints at certain points in the season and generally compensate by resorting to suboptimal husbandry practices (planting behind the plow which leads to irregular crop establishment, minimum weeding, and large amounts of fertilizer to substitute for labor). The result is a high input-low output farming system, as evidenced by the low returns per unit of nutrient which characterize much of smallholder agriculture (Table 4.8).

4.27 Maize production typifies the high input-low output system. During the 1984/85-1988/89 seasons, 7.5-15.8 kg of maize per unit of fertilizer nutrient were produced, on average, compared to a reasonable expectation of 10 kg for local maize and 20 kg for hybrid maize. Hybrid maize gets the bulk of fertilizer. The response ratio for fertilizer was satisfactory only in one year, while in other years labor-induced deficiencies in husbandry practices lowered the response ratio.

4.28 An inelastic supply of farm labor tends to counteract the potential impact of an elastic supply of land on production and productivity in Zambian agriculture. It is important that strategies and investments help farmers overcome labor constraints and enable them to benefit fully from an elastic supply of land. Strategies could involve, for example, the use of weedicides, improved harvesting techniques, and intercropping possibilities which spread labor requirements over longer periods.

Table 4.8: Comparison of Production and Fertilizer Use in Maize, 1984-89

Crop Season	Maize Produced	Maize Produced
	per Ton of Fertilizer	per Kg of Nutrient
	(tons)	(kg)
1984/85	4.6	11.8
1985/86	3.7	9.6
1986/87	2.9	7.5
1987/88	6.1	15.8
1988/89	6.2	13.5

Source: Mission estimates.

4.29 Changes in Technology. Technology has two types of impact on agricultural growth: yield increase and cropping intensity. Yield increase is generally a result of using improved varieties and modern inputs (e.g., fertilizers and agricultural chemicals) in combination with improved farming practices (e.g., early planting, appropriate plant density, and weed control). Cropping intensity results from changes in crop varieties (e.g., short-maturity varieties), introduction of irrigation, or reduction in fallow.

4.30 Growth in yields has been extremely low and slow (Table 4.4). Indeed, most crops except wheat, sunflower, sorghum, and paddy rice have experienced negative growth in yield. Between 1974 and 1989, maize, the centerpiece of agricultural research and extension in Zambia, registered a negative 2 percent in yield growth. This negative in yield was not due to lack of improved maize varieties or their adoption by farmers. Indeed, Zambia greatly improved the range and quality of hybrid maize in recent years. Adoption rates of new varieties by smallholders were also reasonably good. The area planted to hybrid seed doubled from 275,560 ha in 1984/85 to 544,160 ha in 1988/89, and the share of maize area planted to such seed grew from 47 to 60 percent.

4.31 The preponderance of smallholders and their unsatisfactory or suboptimal husbandry practices largely accounted for the decline. In Zambia, maize yields are particularly sensitive to late planting, plant population, and weed competition. Survey data indicate that a substantial proportion of smallholder maize is planted late: Ox owners wait for the rain to soften the soil and fresh grass to strengthen the oxen, and late planting kills off

more weeds and reduces subsequent weeding. Although optimal plant population depends on the variety and soil fertility, most smallholders use a high rate of nitrogen for a suboptimal plant population, leading to a considerable waste of fertilizer. This is particularly true of ox-cultivators who plant straight behind the plow. Generous fertilizer subsidies have fostered this relatively high input (fertilizer) - low output (maize) system in smallholder agriculture. Also, when there is cheap (subsidized) fertilizer use, weed competition becomes even more serious. Adaptive Research Planning Team (ARPT) studies indicate that untimely and minimal weeding reduce yields by almost 50 percent.

4.32 Similar studies also indicate that in an extensive farming system where labor is in short supply during the early part of the season, the use of herbicide or weedicide to compensate for poor weed control would be more profitable to the farmer and the economy than the application of fertilizer. Intercropping, in which maize is planted immediately after the first rain year and cowpeas or beans are interplanted in maize two to four weeks thereafter, can help to spread labor requirements at critical periods. The first weeding could occur at about the same time as cowpea/bean planting. A second weeding would occur approximately one month after the first.

4.33 The critical importance of good husbandry practices to yield improvements has been demonstrated in Zambian and Kenyan research trials. These trials show that good husbandry practices, such as early planting, timely weeding, and appropriate plant populations, are relatively more important to yield increases than fertilizer application -- and less expensive. The trial results are indicative: suboptimal fertilizer and husbandry practices yielded 1.4 tons/ha (approximating the "national average yield" in Zambia), compared to 4.6 tons/ha for an optimal combination of fertilizer and hybrid seed under suboptimal husbandry practices, and 4.9 tons/ha for an optimal combination of husbandry practices and local maize seed without fertilizer use. The combination of fertilizer, hybrid seed, and husbandry practices at optimal levels yielded 8.8 tons/ha..

4.34 These results partially explain the negative rates in maize yield between 1974 and 1989. A policy of subsidized fertilizer and seeds, under conditions of constrained farm labor supply, was the least cost-effective from the economy's point of view. Zambia has paid heavily in terms of foreign expenditures on imported fertilizer and relatively low productivity. It is evident that the Government fertilizer subsidy has not achieved its objective of raising productivity among smallholders. Rather, related farmer practices have kept yields depressed, especially for maize.

4.35 Significant Government subsidies on fertilizer have, however, enabled favorable returns to farmers for fertilizer. In areas of stable rainfall and favorable soil conditions, a benefit-cost ratio (BCR) of 2:1 is considered adequate to induce farmers to use an input (fertilizer). Table 4.9 shows the amount of maize that would have been required to give a 2:1 BCR in recent years. Until the 1989/90 season, smallholders could achieve a 2:1 BCR on fertilizer application, with 30-50 percent of maize yield response. In other words, a normal response to fertilizer has been giving a 1.8:1 BCR. By comparison, in Malawi, farmers had to obtain 15-20 kg of maize per kilogram of nutrient to obtain a 2:1 BCR during 1984-88. This is almost twice as much as that of the Zambian counterparts.

**Table 4.9: Production of Incremental Maize Required for 2:1 BCR
for Fertilizer, 1984-90**

Period	Maize Price (K/Kg)	Nutrit. of rice (°J/Kg)	Maize Required (Kg)
1984/85	0.32	1.25	7.9
1985/86	0.61	1.25	4.1
1986/87	0.87	3.40	7.8
1987/88	0.89	3.40	7.6
1988/89	1.20	4.00	6.9
1989/90	3.20	18.10	11.3

Source: Mission estimates.

4.36 Fertilizer consumption has increased in recent years (Table 4.10), but virtually no yield increases occurred in the crop subsector except in wheat production (Table 4.4). Consequently, Zambia, with a similar population size and cropped area as Malawi, has used almost twice as much fertilizer annually on a smaller total maize production (before the 1988 season). Improvements in crop yields through the use of fertilizer will not be realized as a result of exhortation or injunction, but as a response to realistic pricing policies for both inputs and produce. These policies should be complemented with strategies that encourage farmers to make better use of fertilizer, improve husbandry practices, and overcome farm labor constraints.

**Table 4.10: Fertilizer and Nutrient Consumption in Zambia, 1983-88
(000 tons)**

<u>Year</u>	<u>Fertilizer</u>	<u>Nutrient</u>
1983	165.8	66.0
1984	143.9	56.4
1985	211.1	80.2
1986	190.7	77.1
1987	243.8	95.8
1988	225.0	87.7

Source: USAID/GRZ, A New Fertilizer Marketing System in Zambia, May 1989.

4.37 Increased consumption of fertilizer also poses an environmental problem, especially in areas with soils which tend to be leached and acidic. In recent years, the problem of increasing acidity (declining pH) as a result of continuous cultivation, combined with increasing use of nitrogen fertilizers, has also been detected in many areas. This, perhaps, partly explains the generally low impact of fertilizer use on yield increase in Zambia. There is an urgent need to give serious attention to alternative strategies for dealing with soil acidity in the country. These include: (i) the use of lime which would require investments with a high foreign exchange component for quarrying and transport; (ii) the use of acid-tolerant plants such as millet, sorghum, and cassava; and (iii) periodic resting of the land (fallow) to permit a build-up of organic matter to raise soil pH. To date, the focus of Government policy has been on lime which is probably feasible on farms near good roads and lime quarries. There is urgent need, however, to evaluate the strategies with respect to their scientific rationale, practical application, and costs and benefits. This should constitute a priority for the agricultural research program in the country.

4.38 Adaptive research and extension remain a fundamental problem in Zambian agriculture. Its research system has released new and improved varieties of planting material for most crops, except cassava, but their suitability and adaptability under farm conditions are problematic. All planting materials require comprehensive testing under smallholder constraints. Hence, the ARPT program, a farming system approach to adaptive research, needs to be accorded high priority within the research program. The rationale is evident in the average yield differentials between commercial farmers and smallholders (Table 4.11) which are largely due to husbandry (managerial) practices, although fertilizer use might also play a role.

Table 4.11: Average Yield by Farmer Category, 1989
(Ton/Ha)

Crop	Smallholder Farmer ^{1/}	Commercial Farmer ^{2/}	Yield Differential (%)
Maize	2.3	5.0	54
Sunflower	0.8	1.4	43
Soyabean	0.7	1.8	61
Cotton	0.8	1.2	33
Groundnuts (Makuru Red)	1.2	1.8	33
Wheat	2.7 ^{3/}	5.2 ^{4/}	48
Tobacco (Burley)	1.4	1.8	22
Tobacco (Virginia)	1.8	2.4	25

1/ Farmers using oxen and hoe technologies.

2/ Medium- and large-scale farmers using tractors.

3/ Rainfed wheat by smallholders.

4/ Irrigated wheat by medium- and large-scale farmers.

Source: Mission estimates from MAWD Agricultural Statistics Bulletins.

4.39 Availability and access to new technologies alone have not helped smallholders to improve their yields under prevailing pricing policies for inputs and outputs. For example, mechanization (tractors and oxen-ploughs) among smallholders has induced farmers to plow and plant more land than their labor supply would dictate, only to encounter labor constraints during critical operations. Under these circumstances, mechanical plowing aggravates rather than solves the labor constraint. Extension has not appropriately emphasized the critical importance of husbandry practices to yield increases. Instead, fertilizer alone is perceived by most farmers to be the most important factor. Reinforced by subsidies, this perception has contributed to widespread suboptimal practices by smallholders.

4.40 Change in Cropping Pattern. Decomposition of sources of growth (Table 4.4) shows that for the best- performing crops (wheat, cotton, sunflower, mixed beans, and paddy rice), both yield and area increases contributed to high growth rates. In others with some growth (maize, millet, groundnuts, tobacco, and soyabean), area expansion has been the primary source.

4.41 Cropping intensity does not appear to have been a significant factor in yield increases in Zambian agriculture, which is rainfed except for wheat. Although some varieties (e.g., groundnuts and maize) have short maturity, none can be double cropped in a given season. Limited double cropping for maize is practiced by some peri-urban farmers using irrigation to produce "green" maize in winter. The fact that most commercial farmers with irrigation facilities have not been tempted into double cropping maize is indicative of its unfavorable economics. Nevertheless, Zambia's irrigation potential should eventually permit cropping intensification, particularly for wheat, soyabean, paddy rice, and maize.

Sources of Growth in Livestock

4.42 Increase in numbers has generally been the major source of growth in Zambia's livestock subsector (Table 4.12). For example, much of the average annual growth rate of 3.4 percent in beef production was due to increases in the national herd and offtake rate. This was also the case for the dairy and poultry subsectors. More pure and cross-bred animals in the dairy herd, however, have increased productivity by about 1 percent a year during 1974-89. Due to feed supply problems, the poultry industry's productivity declined at an alarming annual rate of 4.4 percent during the same period. The erosion in financial profitability caused by this decline resulted in a 30 percent reduction in overall poultry meat production by 1987.

Table 4.12: Sources of Growth in the Livestock Subsector, 1974-89
(Annual Percentage)

Subsector/Commodity	Increase in Herd/Number	Off-Take Rate	Productivity Increase	Physical Production Growth Rate
Beef Cattle	2.0	7.1	0.2	3.4
Dairy	5.4	-	1.0	19.0
Poultry	17.0	-	-4.4	12.4

Source: Mission estimates.

4.43 Although data on the genetic performance of various breeds in Zambia are generally unreliable or non-existent, the performance indicators (based on survey data) contained in Table 4.13 confirm the lack of productivity gains in traditional beef production. These data, though inadequate and imprecise, indicate that existing productivity parameters in traditional beef production (e.g., average liveweight per livestock unit, milk yield per lactation, calving rates, and age at first calving) are generally unsatisfactory. Unsatisfactory animal husbandry and health conditions and inadequate animal nutrition at the farm level have depressed both livestock productivity and overall smallholder production. Also lack of progeny testing and selection among native breeds has resulted in widespread inbreeding within the native breeds. These factors are essentially related to managerial (husbandry) practices, which, as in the crop subsector, are critical to future growth.

4.44 Substantial improvements are possible in commercial livestock production based on native breeds (Table 4.13). As in the crop subsector, improved husbandry is a prerequisite for significant productivity gains. For example, improved husbandry practices in meat and milk production from native breeds could result in productivity gains of up to 30 and 50 percent, respectively (Table 4.13). Hence, the existing relatively large herd of native breeds represents a considerable potential resource. This resource could be exploited with minimal investments in feed production (e.g., hay preparation) and purchase of supplementary feeds (e.g., molasses and minerals) and in increased public expenditure on extension services focused on improvements in animal husbandry and nutrition. Government policies and

programs (e.g., livestock extension) have not focused on this potential for shifting farmer production functions to higher levels without changing the genetic base in traditional beef production. In the future, this should constitute the focus of Government policy and strategy for increasing livestock productivity and production in the medium term. In the longer term, additional productivity gains could be achieved through investments in livestock research focused on resolving the problems of progeny selection and inbreeding within native breeds.

Table 4.13 Existing and Potential Genetic Performance Indicators of Native Breeds

<u>Breed</u>	<u>Existing Performance Indicator</u> ^{1/}				<u>Potential Performance Indicator</u> ^{2/}			
	Live Weight (kg)	Milk Yield (Kg)	AFC ^{3/} (Years)	Calving Rate (%)	Live Weight (Kg)	Milk Yield (Kg)	AFC ^{3/} (Years)	Calving Rate (%)
Tonga	275	400	3.5	58	325	600	2.8	70
Barotse	340	600	2.2	60	450	850	2.7	75
Angoni	200	300	3.5	55	250	450	3.0	65
Mixed	200	300	3.5	55	250	450	3.0	65

1/ Average performance per lactation under traditional husbandry and nutrition.

2/ Average performance per lactation under improved husbandry and nutrition conditions.

3/ AFC = Age at first calving.

Source: Mission estimates based on MA survey data and interviews with commercial farmers.

4.45 Cattle production is also constrained by diseases and tsetse infestation, which problems have attracted Government investment. Diseases which cause serious mortality and loss if not contained, include contagious bovine pleuropneumonia (CBPP), East Coast fever (ECF), foot and mouth disease (FMD), and trypanosomiasis, which is transmitted by tsetse fly and poses the most serious constraint to expansion of cattle production.

4.46 Almost one third of the country is tsetse-fly infested. With considerable public expenditure, Government strategy has concentrated on controlling tsetse infestation on state land (i.e., commercial farming areas) and where tsetse encroachment was threatening native cattle stocks. Operations in the latter areas have had only partial and temporary success, as re-infestation occurs.

4.47 Feed has played a critical role in the growth of the commercial poultry industry in Zambia. An adequate supply of quality poultry feed facilitated a 36 percent annual growth rate between 1965 and 1975. Between 1975 and 1989, however, production declined dramatically as a result of problems in the supply and quality. The dependence of stockfeed on imported ingredients (i.e., fishmeal and vitamin concentrates) and the shortage of foreign exchange to finance such imports have been major reasons for deterioration in quality and improper feed preparation, leading to low meat conversion ratios, rising production costs, and poor profitability levels. Provided the problem of feed supply is satisfactorily resolved,

there is considerable potential for rapid expansion in the production of both poultry meat and eggs. Poultry has the potential to replace large quantities of red meat in urban and rural markets and to permit an increase in Zambia's beef exports.

Production Efficiency

4.48 Two allocative efficiency issues are examined: the impact of policy-induced market distortions (e.g., taxes, subsidies, and price controls) on the utilization of labor and land and efficiency of resource use at the farm level. The discussion helps illuminate the effects of agricultural policies on the allocation of labor and land and facilitates analysis of related issues, such as rural poverty alleviation, rural unemployment, underutilization of land, and rural-urban migration. Whereas much of the analysis of agricultural policies in Zambia and elsewhere in Africa has concentrated on output, income, and fiscal effects (e.g., Doris Jansen, 1988), this report explicitly examines input effects of market distortions by estimating factor distortion coefficients derived from a multicrop production function within a static equilibrium framework.

4.49 Farm-level resources consist primarily of labor, land, and purchased inputs (e.g., fertilizers, farm machinery, and equipment). The pertinent issue here is the extent to which Zambian farmers use these resources efficiently across a variety of activities or farm enterprises. The analysis provides a useful basis for understanding two strategic aspects of the agricultural development process in Zambia: the sector's growth (income) capacity and potential and the overall comparative advantage of the sector and subsectors or commodities within the context of domestic and international trade.

Factor Distortion Coefficient (FDC) Analysis

4.50 Using a multicrop production function model at the farm level, the effects of government taxes, subsidies, and price controls on the allocation of labor and land in smallholder agriculture were evaluated. The details and structure of the model are presented in Appendix 2. The salient assumptions of the model can be summarized as follows:

- (i) Labor and land account for the bulk of the value added. Much of the land and most of the labor is not crop-specific, since two or three crops are cultivated each season. Both land and labor are not subsidized.
- (ii) The levies on crops consist of direct taxes, such as export taxes and income (revenue) taxes, which range 10-20 percent, and indirect taxes, such as the differential between domestic and world market prices and excessive operating costs of cooperatives. The latter were converted into a tax rate as a proportion of expected or actual market value.
- (iii) As indicated by domestic resource cost analysis, smallholders generally allocate land and labor (i.e., domestic resources) efficiently -- i.e., so that the resources available are utilized up to the point where their respective off-farm acquisition prices equal their marginal value products (MVPs).

4.51 The effects of distortions on real values of labor and land used for selected crops in smallholder agriculture during 1984-88 are summarized in Table 4.14 and detailed in Appendix 2. A distortion coefficient above unity implies that less labor and land were being used than would have been the case in the absence of distortions. Less use refers to both the reductions in utilization of labor and land that occurred and disinvestments in quantities of labor and land in the farm sector.

4.52 Smallholders pay the real cost of hired labor or bear the real costs of family labor. For all crops except maize, the above-unity distortion coefficients in Table 4.14, particularly for labor (hired and family), indicate that smallholders have been using less than they would have in the absence of market distortions. Underemployment is not implied, because labor disinvestment has been accompanied by substantial rural-urban migration, creating severe labor constraints in agriculture. Given the relatively high growth rates in cultivated area for most crops (Table 4.4), it would appear that the impact of distortions on land use has been relatively less significant than on labor. In other words, the high distortion coefficients are attributable to labor disinvestment at the farm level. This implies that relatively more land than labor was used in the production of most crops, especially maize and groundnuts. This collaborates the earlier observation that smallholders have been generally substituting capital for labor.

Table 4.14: Factor (Land and Labor) Distortion Coefficients, 1966-90

Crop Season	Maize	Virginia Tobacco	Seed Cotton	Sunflower	Soyabean	Shelled Groundnuts
1966/67	0.08	12.50	0.71	0.24	0.20	0.33
1979/80	0.00	1.15	1.96	0.29	0.69	3.33
1984/85	0.22	2.00	3.23	1.41	1.35	4.35
1985/86	0.68	11.11	4.00	8.33	5.56	1.79
1986/87	0.76	14.29	7.69	5.88	5.26	1.69
1987/88	0.45	25.00	14.29	16.67	12.50	4.00
1988/89	0.75	25.00	20.00	12.50	14.29	6.67
1989/90	1.52	33.33	33.33	10.00	11.11	10.00

Source: Mission estimates.

4.53 Table 4.14 also suggests that smallholders' investment in export crops such as tobacco, soyabeans, sunflower, and cotton has been relatively unprofitable, due to price-distorting policies -- tending to reduce investment or possibly lead to disinvestment in them. High rural-urban migration rates during the 1970s and 1980s and the presence of abandoned or idle farms (especially tobacco) are manifestations. Since the distortion coefficients can also be interpreted as marginal value products of individual crops, it is evident that Zambian smallholder agriculture does not exhibit production efficiency in static terms. In other words, intra-sectoral allocative efficiency (i.e., in which the supply of any product would not be varied at the margin without affecting the supply of other products) has not been achieved.

Not only have smallholders been facing different market prices (MVPs), but such prices have not been equal to efficiency prices (scarcity values). There are ample opportunities for improving intra-sectoral efficiency via reallocation of resources and, by implication, good prospects for crop diversification at the farm level. This has important strategic implications for restructuring smallholder agriculture in the country.

4.54 The proposed policy reforms under the economic adjustment program would have important and far-reaching implications on the use of labor and land in Zambian agriculture. The removal of fertilizer subsidies is likely to fix the stocks of labor and land (i.e., their marginal value products would respectively be equal to their rural prices). Under the subsidy policies, these stocks were considered variable by most farmers. The removal of fertilizer subsidies would most likely lead to reallocation of resources in favor of commodities with higher market prices (MVPs). On the other hand, the removal or reduction of taxes (both direct and indirect) would lead to additional employment of labor and land among smallholders, depending on the magnitude of tax reduction in relation to the subsidy removal, the initial quantity of resources deployed, and the differential between acquisition and salvage values of the resources. For lack of reliable data, these cannot be estimated. Nevertheless, the strategic policy options implied by the FDC analysis are clear: minimization or removal of market distortions would be more consistent with optimal resource allocation than existing policies and, hence, with sectoral objectives for rural poverty alleviation, rural employment, and reduction in rural-urban migration.

Domestic Resource Cost (DRC) Analysis

4.55 Allocative efficiency, measured by domestic resource costs (DRCs), was estimated using economic prices in order to remove market distortions. The 1989 border prices for tradable inputs were adjusted by estimated conversion factors to eliminate the market and foreign exchange distortions. All capital expenses were based on a real interest rate of 10 percent. Labor was valued at estimated conversion factors. Farm-level budgets were constructed for each crop and livestock enterprise, based on estimates of production costs and yield levels currently used by the Ministry of Agriculture. Prices used were those prevailing in December 1989. DRCs were estimated for smallholder, emergent, and commercial farms.

4.56 DRCs are a measure of comparative advantage, and hence proxy indicators for production efficiency at the farm level because they indicate the level at which farmers make use of resources. The analysis focuses on the influences of production technique (technology) and exchange rate policy on DRCs and the consequent implications for investments in agricultural research and extension services. DRCs are estimated at both current and best-available level of technology (packages recommended by the Ministry of Agriculture to increase farmers' profitability and efficiency in a commodity). In the case of livestock, improved technology is one that could be applied profitably by smallholders, given existing knowledge from agricultural research and commercial farmers' experience.

4.57 DRCs measure the cost of domestic resources used to produce a unit of output for export or to replace imports of a commodity. Below unity indicates that domestic resources are used relatively efficiently and its production can be expanded for export or import substitution; above unity suggests the contrary. With labor and land constituting the bulk of domestic resources, DRC estimates in Tables 4.15 and 4.16 primarily measure the

efficiency of their use in combination with purchased inputs (e.g., farm implements, fertilizer, and agricultural chemicals).

4.58 Several general conclusions can be drawn from the analysis: Zambian farmers are generally efficient in their allocation of resources. Zambian agriculture appears to have a comparative advantage in producing almost all commodities except millet, cassava, and sorghum at the existing exchange rate (K25 = USD1). While devaluation (K40 = USD1) improves the DRCs of millet, cassava, and sorghum, improved technology does not. Since the best-available technologies do not significantly improve production efficiency for these crops, there is little economic justification for investment in their extension to farmers. However, research investment to generate better and more profitable technological packages for these crops is needed, because they are considered "poor farmers' crops" and will be critical to poverty alleviation in the future. Being relatively acid-tolerant, they are grown in areas with low pH soils and where other cereals (e.g., maize) have no comparative advantage. In the past, Government research has tended to bypass these crops in favor of maize.

4.59 The analysis shows that smallholders are generally more efficient users of domestic resources than either emergent or commercial farmers, confirming the findings of the 1984 World Bank study. This superiority of smallholders is particularly evident in maize production at both existing and improved levels of technology. The subsidies accorded to both maize production and consumption have facilitated the development and adoption of improved maize technology by all farmers, especially smallholders. In the production of other cereals (e.g., sorghum, millet, cassava, and rice), fertilizer has been hardly used among smallholders, due to relatively low response and soil acidity problems. Low fertilizer use and inappropriate husbandry are the most important factors limiting productivity, hence, comparative advantage for these crops.

4.60 In the absence of currency overvaluation, emergent and commercial farmers have more or less the same degree of comparative advantage as smallholders in the production of crops such as groundnuts and rainfed wheat (Table 4.16). Commercial farmers have better comparative advantage than smallholders in the production of groundnuts, soyabeans, and sunflower, and better comparative advantage than emergent farmers in groundnuts, sunflower, and tobacco. Irrigated wheat by commercial farmers has reasonable comparative advantage. This clearly justifies the Government's strategy of promoting expansion in production of smallholder, emergent, and commercial farmers, with smallholders as its cornerstone. This strategy should be continued in the medium and long term.

4.61 Improved technology enables the efficient use of domestic resources in the production of most commodities (i.e., cotton, chalimbana groundnuts, maize, soyabeans, sunflower, tobacco, and wheat), despite currency overvaluation. There is thus a strong argument for investment in research and extension to enable the agriculture sector to exploit these crops' potential comparative advantage in the short and medium term. In the medium term and with an appropriate exchange rate policy, improved technology enhances comparative advantage of all commodities, and investment in research and extension to exploit their respective potential would be fully justified.

4.62 Zambian agriculture has a comparative advantage in producing cassava, millet, sorghum, and soyabeans by smallholders, but an inappropriate exchange rate policy makes it inefficient to do so. Devaluation, effective June 1990, has made the comparative advantage of these crops favorable.

4.63 The difference in DRCs shown in Table 4.15 and 4.16 for each enterprise or commodity is a measure of the effects of exchange rate policy. The aggregate effect of currency overvaluation was to erode farmers' comparative advantage by an average of about 50 percent. The effect on tradables was 54 percent, suggesting the sensitivity of DRC estimates to prices of tradables (inputs and outputs); on non-tradables (especially the food subsector) the effect was to reduce comparative advantage by about 50 percent. The implied elasticity of efficiency (DRCs) to changes in exchange rate is quite high for the entire sector (0.85). Change in technology under the existing exchange rate improves comparative advantage only slightly (4 percent). Such a change, accompanied by currency devaluation, however, results in improving farmers' comparative advantage by 12 percent. Consequently, DRC estimates are not as sensitive to technology levels as they are to the exchange rate. If improved technology for tradables and non-tradables requires the same investment in research and extension services per hectare, then allocation of research and extension resources to tradables would provide slightly higher payoffs to society, provided farmers do not face an inappropriate exchange rate policy. The structural adjustment program's emphasis on tradables is partially justified by this conclusion. The other justification is provided by the analysis of effective protection.

4.64 In summary, the issue of low productivity in Zambian agriculture can be traced to inappropriate Government policies that have discouraged optimal utilization of labor, land, and purchased inputs (fertilizer). The labor constraint facing most farmers is attributable to substantial rural-urban migration caused by policy-induced distortions (e.g., subsidies, taxes, and price controls) that made farming relatively less profitable than urban sectors. Intra-sectoral inefficiency is suggested by the FDC analysis and confirmed by substantial differences in DRCs among crops and farmer groups. Reallocation of labor and land to achieve improved efficiency in resource use is a strategic option that is confirmed by both FDC and DRC analyses. Both the growth and the DRC analyses support increased investment in agricultural research and extension to improve comparative advantage via technological change.

Table 4:15: Comparative DRC Estimates by Technology and Farmer Type at Prevailing Exchange Rate, 1989
 (Exchange Rate: K25 = USD1)^{1/}

Commodity	Smallholder		Emergent Farmer		Commercial Farmer	
	Existing Technology	Improved Technology	Existing Technology	Improved Technology	Existing Technology	Improved Technology
Cassava	0.70	1.06	1.06	1.18	-	-
Cotton	0.12	0.09	0.11	0.09	-	-
Groundnuts (Chalimbana)	0.70	0.67	0.66	0.61	-	-
Groundnuts (Makuru Red)	0.42	0.45	0.45	0.48	0.37	0.39
Maize	0.34	0.27	0.41	0.30	0.45	0.35
Millet	1.32	1.37	1.37	1.39	-	-
Paddy Rice	0.68	0.82	0.78	1.06	-	-
Sorghum	1.15	1.19	1.20	1.26	-	-
Soyabeans	1.43	0.90	-	-	0.76	0.71
Sunflower	0.48	0.44	0.42	0.45	0.23	0.26
Tobacco (Burley)	-	-	0.25	0.20	0.21	0.20
Tobacco (Virginia)	-	-	0.19	0.15	0.17	0.14
Wheat (Rainfed)	0.95	0.69	0.64	0.53	0.79	0.51
Wheat (Irrigated)	-	-	-	-	0.35	0.37
Native Beef Cattle	0.54	0.76	-	-	0.88	-
Purebred Beef Cattle	-	-	-	-	0.83	-
Purebred Dairy Cattle	-	-	-	-	0.70	-
Crossbred Dairy Cattle	-	-	0.90	-	-	-
Broiler Chicken	-	-	1.55	-	1.55	-
Egg Production	-	-	0.58	-	0.58	-

^{1/} Exchange rate during the field mission for this study.

Source: Mission estimates.

Table 4:16: Comparative DRC Estimates by Technology and Farmer Type at Adjusted Exchange Rate, 1989
 (Exchange Rate: K40 = US\$1)

<u>Commodity</u>	<u>Smallholder</u>		<u>Emergent Farmer</u>		<u>Commercial Farmer</u>	
	Existing Technology	Improved Technology	Existing Technology	Improved Technology	Existing Technology	Improved Technology
Cassava	0.44	0.69	0.69	0.77	-	-
Cotton	0.07	0.06	0.07	0.05	-	-
Groundnuts (Chalimbana)	0.44	0.43	0.43	0.39	-	-
Groundnuts (Makuru Red)	0.27	0.29	0.29	0.31	0.24	0.25
Maize	0.21	0.17	0.26	0.19	0.30	0.23
Millet	0.83	0.86	0.86	0.87	-	-
Paddy Rice	0.47	0.57	0.54	0.73	-	-
Sorghum	0.72	0.75	0.75	0.79	-	-
Soyabeans	0.91	0.59	-	-	0.51	0.48
Sunflower	0.31	0.26	0.27	0.25	0.15	0.14
Tobacco (Burley)	-	-	0.16	0.13	0.13	0.13
Tobacco (Virginia)	-	-	0.13	0.10	0.11	0.06
Wheat (Rainfed)	0.57	0.44	0.44	0.38	0.52	0.35
Wheat (Irrigated)	-	-	-	-	0.23	0.24
Native Beef Cattle	0.26	0.36	-	-	0.40	-
Purebred Beef Cattle	-	-	-	-	0.36	-
Purebred Dairy Cattle	-	-	-	-	0.32	-
Crossbred Dairy Cattle	-	-	0.43	-	-	-
Broiler Chicken	-	-	0.71	-	0.71	-
Egg Production	-	-	0.29	-	0.29	-

Source: Mission estimates.

Producers' Incentive Structure

4.65 In this report, incentives are broadly defined as the major determinants of supply response, including terms of trade, producer prices for output and inputs, and non-price factors. Three issues are examined: the overall incentive structure of the agriculture sector vis-a-vis the rest of the economy, using estimated barter terms of trade; the price incentive structure facing farmers, using effective protection coefficient (EPC) analysis, and the influence of non-price factors -- basic agricultural services (research and extension), rural financial services, and rural infrastructure (rural marketing, processing, transportation, and storage) -- on supply response.

Agriculture's Terms of Trade

4.66 Barter and income terms of trade are the two general indicators of overall producer incentives. The barter terms of trade for agriculture are defined here as the quotient of the index of agricultural producer prices and the index of cost of living (excluding food prices). Income terms of trade is barter terms of trade multiplied by an index of monetization. Official producer prices are used in this analysis. Since a considerable amount of food is not marketed through the official marketing channel, estimates in Table 4.17 underestimate the actual barter terms of trade.

Table 4.17: Agriculture's Barter^{1/} and Income Terms of Trade,^{2/} 1974-89

Year	Food Crop Sector	Export Crop Sector	Barter Terms of Trade	Income Terms of Trade
1974	1.09	1.09	1.09	0.87
1975	1.00	1.00	1.00	1.00
1976	0.87	1.08	1.05	1.07
1977	0.86	0.92	0.92	0.96
1978	0.78	0.94	0.88	0.78
1979	0.74	0.95	0.91	0.86
1980	0.76	0.96	0.96	0.80
1981	0.97	0.93	0.95	0.87
1982	1.06	0.97	1.01	0.89
1983	1.09	0.88	0.99	0.86
1984	1.05	0.84	0.94	0.85
1985	0.99	0.75	0.86	0.77
1986	1.03	0.77	0.90	0.78
1987	0.87	0.80	0.81	0.74
1988	0.76	0.81	0.78	0.74
1989	0.35	0.78	0.66	0.78

1/ Barter Terms of Trade = Index of Agricultural Producer Prices
Overall Index of Consumer Prices

2/ Income Terms of Trade = barter terms of trade x index of monetization.

Source: CSO Monthly Digest of Statistics and Ministry of Agriculture.

4.67 As confirmed elsewhere, agricultural prices have not risen as fast as other prices in the economy, with agriculture's terms of trade remaining depressed over 1974-89,

and worsening in the last three years. The terms of trade for food crops have been generally satisfactory, except in the last three years, which implies that real food prices relatively kept pace until then. Since 1989, food producer prices deteriorated significantly, reflecting Government's determination to keep food prices low in the face of higher rates of inflation. The barter terms of trade for export crops have deteriorated consistently since 1982. Falling relative producer prices for export crops underscore the subsector's mediocre performance.

4.68 The income terms of trade captures the effect of increased marketed quantity and is a relatively better indicator of farmers' well being than barter terms of trade. As suggested by the barter terms of trade, falling prices were equally to blame. In fact, the decline in producer incentives was faster than suggested by the barter terms of trade. Farmers who increased their marketed surplus and were using subsidized inputs (fertilizer) might, however, have experienced relatively favorable income terms of trade during the period.

4.69 Deterioration in the overall terms of trade for agriculture suggests that there has been suboptimal resource allocation between agriculture and other sectors and that agriculture's contribution to GDP has been suboptimal as well. It is therefore necessary to improve agriculture's incentive structure. In practical terms, structural changes are needed, including decontrol of producer prices, improvements in commodity markets, and improvements in rural infrastructure. These changes constitute a major component of the proposed agriculture strategy.

Price Incentives: Effective Protection Analysis

4.70 Producer price incentives are distorted when the prices of products, inputs and services do not reflect their scarcity value. For traded goods, the scarcity price is indicated by the border prices at which goods can be exported or imported. For non-traded goods (e.g., organic manure, millet, sorghum, and cassava), the scarcity price can be measured by the opportunity cost of their production when the alternative would be to produce traded goods, or by their scarcity value in displacing traded goods.

4.71 In Zambian agriculture, Government policies have been the main source of price distortions. These policies have included a single-channel marketing system which prevailed for all crops until May 1989; fixed country-wide producer prices for crops and fertilizer that remain for the 12-month marketing season; controlled road haulage rates for fertilizer and maize that have been partially subsidized by Government; marketing and consumer subsidies for maize; export taxes on sugar, tobacco, coffee, and tea; and a 15 percent tax on agricultural incomes.

4.72 The nature of the single-channel marketing system, administered by the cooperatives and commodity-specific parastatals (e.g., Lintco and Tobacco Board of Zambia), was such that prices paid to farmers were not necessarily market-clearing because their levels were in no way related to relative prices in the "free" domestic and world markets. Similarly, the monopoly situation enjoyed by cooperatives and parastatals left the farmer without choice for maximizing earnings from crops. The single-channel marketing system and its antecedent price controls, however, were abolished in May 1989 and replaced by a free marketing and floor (guaranteed) pricing system for all crops, except maize. Prices for maize and fertilizer are still controlled. The maize marketing and pricing policy and its impact on producer and consumer prices is summarized in Box 1.

Box 1: Maize Marketing System and Pricing Policy

Attaining food self-sufficiency through intensified production of maize has long been a primary objective of agricultural policy in Zambia. Increased maize production has been sought through such measures as guaranteed producer prices, subsidized consumer prices, and an expanded network of input supply and crop collection depots. The Provincial Cooperative Unions (PCUs) undertake all inter-district maize trading, while primary cooperative societies (PCS) operate the local markets, acting as Government agents. The PCUs' main responsibility is to ensure marketing outlets for the maize-surplus regions, an adequate and equitable maize supply in the deficit regions, and availability of fertilizer in all parts of the country. The purchase, handling, storage, and transport of maize is primarily the responsibility of the cooperative system.

Until September 1990, the marketing structure was a single-channel system with controlled producer prices set by Government and maintained at the same level throughout the crop season. Since then the system has been liberalized, giving farmers the option to sell directly to consumers, millers, cooperatives, and private traders. The controlled producer price now has become the floor or guaranteed price. The floor price, however, remains the same throughout the country and season. Costs incurred by the cooperatives in connection with transport, handling, storage, and management overheads are compensated for by Government subsidies. Consumer prices are still controlled and the coupon subsidy program for roller meal is being continued for poor urban households. While the heavily subsidized and controlled maize marketing and pricing system was intended to increase production and reduce inequities between the urban and rural sectors, it has resulted in inefficiency and a substantial drain on the Government budget. Controlled producer prices for maize have tended to be below--in most years significantly below--import or export parity. The net effect of the maize pricing policy, therefore, has been to induce a structural regional shift in production away from the low-cost areas close to the main consumption centers into more distant and high-cost areas. For example in 1970 some 87 percent of total maize purchases came from low-cost provinces; by 1989 that figure had fallen to approximately 50 percent (Box 1, Table 1 below). As a consequence, the maize subsidy to cover transport and handling costs has continuously increased. In some areas where maize production has increased, it has been at the expense of traditional food crops--such as sorghum and cassava--for which some areas are more suited.

Box 1, Table 1: Sources of Official Maize Purchases, 1970-89

(In Percent)

Year	Low-Cost Provinces ¹	High-Cost Provinces ²	National Total
1970	87.0	13.0	100.0
1975	85.0	15.0	100.0
1980	82.0	18.0	100.0
1985	63.0	37.0	100.0
1989	51.0	49.0	100.0

1 Southern, Central, and Lusaka.

2 Eastern, Copperbelt, Northern, Northwestern, Western, and Luapula.

Sources: CSO, Namboard, and ZCF Data.

The policy of maintaining a uniform price throughout the year has made it unprofitable to store crops on the farm. Farmers, therefore, have tended to sell their maize immediately following the harvest. This practice has overtaxed the buying, transport, and storage facilities of the cooperatives at all levels, particularly during good harvests. Uniform pricing also has discouraged other market participants (e.g., millers) from assuming part of the financing, transport, or storage functions. The controlled consumer price for maize meal also has contributed to inefficiencies. Farmers needing maize for their own subsistence have been encouraged to sell their maize to the cooperatives and buy maize meal at lower prices than if the milling had been done locally. This practice has increased the cost of the system and has strained national transport services and grain storage facilities. Cheap maize meal in rural areas, to the extent that it has been distributed and available, also has undercut the market for other staples grown locally.

The pricing system also has provided no incentives for marketing agencies to pursue maximum efficiency in performing their job. The extensive network of marketing depots throughout the rural areas, for example, has required that PCUs send trucks long distances, over difficult roads, to pick up maize and pay the same price as is paid to farmers near the main depots. Private traders have been unwilling to enter into maize marketing given the low commission on crop handling, delays in receiving payment, and problems of obtaining Government guarantees for reimbursement of the differential between producer prices and miller sale prices. The cost to Government of maintaining maize subsidies has been substantial. In the early part of the 1980s, maize subsidies--including all marketing and fertilizer subsidies as well as the provision of mealie-meal coupons--constituted 5 to 10 percent of the Government budget. By the latter part of the 1980s, maize subsidies increased to about 16% of the total budget. The maize subsidies have become increasingly burdensome and it is doubtful whether they could be maintained in view of the present economic and financial situation in the country. Reform in the marketing and pricing system should be aimed at improving efficiency, providing adequate incentives to all participants in the sector, and maintaining flexible and responsive marketing and pricing systems which will enable farmers to respond quickly to changes in domestic and external markets. Allowing market forces to determine prices over time and space will encourage production near the main consumption centers, where producer prices will be highest because the cost of transport to mills will be lowest. Demand in Lusaka and Copperbelt cities--which accounts for over 63 percent of national consumption of maize--should be met by production in areas along the line-of-rail which are, in terms of transport costs, the cheapest sources of maize. Production in non-line-of-rail provinces should be mainly intended for intra-provincial trade, which presently accounts for almost 50 percent of the domestic maize trade. Price decontrol and market liberalization should encourage private sector involvement in the provision of services, especially marketing, which is expected to increase efficiency and reduce costs.

4.73 The distorting effects of pricing and marketing policies on the producer incentive structure can best be measured by the use of the effective protection coefficient (EPC). It was necessary first to estimate the "opportunity costs" of primary factors and non-traded goods. The difference between the economic producer price and the actual producer price represents the extent of producer incentives or disincentives for producing a given commodity. Incentives, in this sense, are measured as the outcome of all interactions between the domestic system (marketing, taxes and subsidies, and price controls for products and inputs) and the relatively free play of the world market.

4.74 EPC measures the effects of policy on value added and is expressed as a ratio of the value added in domestic market prices (actual producer prices) to value added in border (economic) price equivalents. EPC estimates are summarized in Tables 4.18 and 4.19. Like DRCs, the EPCs were sensitized to changes in technology and exchange rate policy to examine their respective interactions with producer price incentives. A positive EPC means that, at a specified exchange rate and technology, policy measures provide incentives to a given group of farmers to produce the commodity, while a negative EPC indicates discrimination against the commodity and group of farmers. Official floor prices were used in the calculations, though such prices may exaggerate the rate of protection or lack of it since actual prices were higher, but unknown.

Table 4.18: Comparative EPC Estimates by Technology and Farmer at Prevailing Exchange Rate, 1989
 (Exchange Rate: K25 = USD1)

Commodity	Smallholder		Emergent Farmer		Commercial Farmer	
	Existing Technology	Improved Technology	Existing Technology	Improved Technology	Existing Technology	Improved Technology
Cassava	1.37	-5.75	-5.75	-1.77	-	-
Cotton	-0.91	-0.89	-0.89	-0.91	-	-
Groundnuts (Ch.)	-1.06	-1.11	-1.10	-0.89	-	-
Groundnuts (Makuru Red)	-0.56	-0.67	-0.67	-0.72	-0.55	-0.57
Maize	-0.40	-0.34	-0.67	-0.46	-0.85	-0.59
Millet	-1.08	-0.96	-0.96	-0.94	-	-
Paddy Rice	1.44	2.39	2.04	-6.82	-	-
Sorghum	1.56	1.14	1.12	0.82	-	-
Soyabeans	-0.12	0.99	-	-	0.26	0.26
Sunflower	-0.59	-0.56	-0.50	-0.63	-0.33	-0.38
Tobacco (Burley)	-	-	-0.30	-0.24	-0.24	-0.23
Tobacco (Virginia)	-	-	-0.22	-0.19	-0.20	-0.17
Wheat (Rainfed)	-1.15	-0.89	-1.78	-1.31	-3.82	-1.07
Wheat (Irrigated)	-	-	-	-	-0.81	-0.85
Native Beef Cattle	0.33	0.33	-	-	0.33	-
Purebred Beef Cattle	-	-	-	-	0.33	-
Purebred Dairy Cattle	-	-	-	-	0.33	-
Crossbred Dairy Cattle	-	-	0.33	-	-	-
Broiler Chicken	-	-	1.36	-	1.36	-
Egg Production	-	-	0.25	-	0.25	-

Source: Mission estimates.

Table 4.19: Comparative EPC Estimates by Technology and Farmer at Adjusted Exchange Rate, 1989
 (Exchange Rate: K40 = USD1)

<u>Commodity</u>	<u>Smallholder</u>		<u>Emergent Farmer</u>		<u>Commercial Farmer</u>	
	Existing Technology	Improved Technology	Existing Technology	Improved Technology	Existing Technology	Improved Technology
Cassava	0.74	1.14	1.14	1.50	-	-
Cotton	-0.86	-0.85	-0.85	-0.86	-	-
Groundnuts (Ch.)	-0.52	-0.59	-0.59	-0.53	-	-
Groundnuts (MR)	-0.42	-0.49	-0.49	-0.51	-0.44	-0.44
Maize	-0.34	-0.31	-0.49	-0.38	-0.58	-0.45
Millet	2.14	2.66	2.66	2.99	-	-
Paddy Rice	0.91	1.09	1.04	1.70	-	-
Sorghum	-0.70	-0.75	-0.77	-0.88	-	-
Soyabean	1.53	0.43	-	-	0.32	0.31
Sunflower	-0.40	-0.32	-0.36	-0.32	-0.29	-0.24
Tobacco (Burley)	-	-	-0.20	-0.17	-0.17	-0.17
Tobacco (Virginia)	-	-	-0.16	-0.14	-0.15	-0.08
Wheat (Rainfed)	-0.67	-0.56	-0.88	-0.73	-1.22	-0.63
Wheat (Irrigated)	-	-	-	-	-0.50	-
Native Beef Cattle	0.50	0.50	-	-	0.50	-
Purebred Beef Cattle	-	-	-	-	0.51	-
Purebred Dairy Cattle	-	-	-	-	0.51	-
Crossbred Dairy Cattle	-	-	0.50	-	-	-
Broiler Chicken	-	-	2.09	-	2.09	-
Egg Production	-	-	0.40	-	0.40	-

Source: Mission estimates.

4.75 As evidence from Tables 4.18 and 4.19 indicates, the incentive structure for most farmers and most commodities has been negative. Paddy rice and sorghum were the only exceptions, perhaps because their marketing was normally outside the single-channel marketing system. A change from existing to improved technology, under the existing exchange rate regime, did not significantly improve the incentives, except in a few cases, such as soyabean grown by smallholders and rainfed wheat and maize by commercial farmers.

4.76 The impact of kwacha overvaluation on incentives is clearly depicted. Virtually all disincentives implied in Table 4.18 decrease significantly with the currency devaluation specified in Table 4.19. Two exceptions are cassava and sorghum -- commodities whose comparative advantage is dubious. Overvaluation has been the single major

disincentive to all farmers for all commodities in Zambian agriculture. The most hard hit were export commodities such as cotton and tobacco, as well as import-replacing commodities such as maize, wheat, and oilseeds. With devaluation, the incentive structure for these commodities has tremendously improved.

4.77 Using the average shares of marketed production of each commodity, a weighted average EPC of negative 0.75 was estimated for the crop and livestock subsectors in 1989. Distorting policies have thus led to considerable bias against agriculture. Since value added is a measure of net earnings of untraded domestic primary factors employed in the sector, coefficients of protection also measure the impact of the distortions on factor incomes. Primary factors (labor and land) in Zambian agriculture earned only 25 percent of the income that they would have earned for each unit of output under free trade. This finding has important implications for rural incomes and rural poverty alleviation, as well as for the use of these resources in agriculture.

4.78 Market distortions have aggravated the poverty situation among rural people. Since labor is smallholders' major asset and source of most income, encouraging its use is generally consistent with rapid and efficient growth. Yet Zambia has adopted policies that are implicitly biased against the use of labor in agriculture. There is a need to reverse this bias if agriculture is to contribute more significantly to employment and income generation as envisaged in the National Development Plan.

4.79 In Annex 3, calculations of the ratios of effective protection to nominal protection (EPC/NPC) indicate clearly that for most crops nominal protection was generally greater than effective protection. Since EPC measures the protection accorded producers, while NPC has more relevance to consumers, it can be inferred that distortions have been relatively more biased in favor of consumers, consistent with Government policy to keep food prices relatively low.

4.80 The price incentive structure for all farmers needs to be improved. Price decontrol and market liberalization, as well as continual depreciation of the kwacha, have been recently adopted under the Government's economic program. By depressing producer prices, past policies even damaged long-term prospects of the urban sector, because low rural incomes stalled or reduced the internal market for manufactures and the source of foreign exchange as farmers disinvested both labor and land.

4.81 Discrimination against production of cash crops and food crops has been quite significant (Table 4.18). Prices have been too low to induce smallholders to grow more than subsistence needs or to adopt cash crops such as soyabeans, cotton, groundnuts, and sunflower. This discrimination partly explains the low monetization coefficients in Table 4.6 and low levels of production in Table 4.3.

Non-Price Factors

4.82 The analysis of non-price incentives to farmers raises the issue of the role of Government in agricultural development. Should the Government play the role of competitor, controller, and/or supporter in production, marketing, and processing of agricultural products and inputs? The Government's strategy to date has emphasized its roles as producer and controller rather than supporter.

4.83 Non-price incentives primarily include basic agricultural services (research and extension), rural financial services, and infrastructure (marketing, storage, processing, roads, transportation, and irrigation). Government has played a dominant role in all areas except in irrigation, with minimum participation from the private sector, even when its participation is suitable, as in marketing, storage, processing, and transportation. Government price controls and exclusive right have virtually stifled private initiative.

4.84 Studies in India and Latin America and selected African countries (MADIA), among others, have demonstrated that non-price incentives play a critical role in influencing farmers' supply response. For Zambian agriculture, the dominance of subsistence among smallholders underscores the critical importance of non-price incentives (Table 4.6). In this sense, inadequate sectoral performance since independence can be attributed to inadequate and ineffective Government non-price incentives to the farming community.

4.85 **Agricultural Services.** Agricultural services provide technical incentives for farmers' adoption of innovations. The generation of agricultural technologies by the research system and the transfer or dissemination of relevant technologies to farmers by the extension service are key to increasing productivity. Research and extension services are virtually monopolized by Government, except in the case of extension services to commercial farmers which are shared with the Commercial Farmers' Bureau (a voluntary association of large-scale commercial farmers in the country).

4.86 **Research.** In Zambia the National Council for Scientific Research (NCSR), a parastatal, is responsible for agricultural research. It contracts research programs or projects to the Ministry of Agriculture, its Agricultural Research Branch (ARB), the University of Zambia (UNZA), and other agencies (e.g., the Forestry Research Division and Fisheries Division of the Ministry of Lands and Natural Resources, and the National Parks and Wildlife Services). The Ministry of Agriculture has formulated a detailed Agricultural Research Action Plan, which incorporates some of the strategic elements proposed in this report. Despite various inadequacies in the research program for crops and livestock, numerous technologies suitable for adoption by large- and medium-scale commercial farmers have been generated. These have been forwarded to smallholders without addressing their on-farm constraints and needs. The result has been suboptimal utilization of such technologies by smallholders. Appropriate adaptive technologies for smallholders remains a strategic issue which the agricultural research program must address in the medium and long term. A farming systems approach to adaptive research is in its infancy in Zambia, and should be supported.

4.87 Smallholders are rationally risk-averse and can only be induced to adopt technological innovation if full advantage of its opportunities, including increased incomes, is likely. At the very least, favorable market conditions that permit farmers to internalize the gains of innovative activity or commodity are required. This prerequisite has not been met in Zambia, primarily due to pervasive market distortions such as price controls and currency overvaluation. Under such circumstances, inappropriate technologies may compound the impact of price disincentives, particularly for risk-averse smallholders and apparently for oilseeds and food crops grown in less-favorable areas such as millet, sorghum, and cassava.

4.88 Appropriate technology is crucial. Evidence suggests that Zambia's agricultural research system has been more supply-driven than demand-driven. Basic commodity research has dominated, at the expense of adaptive research geared toward farmer

conditions. While commodity research is a precondition for adaptive research, a disproportionate share of the program's resources (human and financial) and output relates to commodity research. Rather than lagging behind basic commodity research, more emphasis must be given to adaptive research for most commodities including maize in the medium term.

4.89 Also, the research program has neglected the problems of soil acidity, potentially affecting more than 50 percent of cultivable area. Only a few research trials have been conducted on the impact of soil acidity on maize yields, caused by fertilizer use. More extensive research is needed on relatively acid-tolerant crops (e.g., mi!let, sorghum, and cassava) and the impact of soil acidity on other crops. The majority of smallholders cultivate on acid-prone soils, and area expansion to meet future demand of the growing population will take place on these soils.

4.90 The livestock research program has inadequately addressed the potential of native breeds and its determinants. The program has focused its investigations on exotic breeds and cattle diseases. In view of the strategic importance of native cattle breeds in future livestock development, high priority ought to be accorded to research on their potential performance under alternative husbandry and feed supply conditions.

4.91 A better-designed research program that emphasizes adaptive research and is properly managed and adequately funded would be critical to improving smallholder incentives for adopting new technologies to improve productivity in the medium and long term. The high payoffs to farmers and, by inference, to society associated with investments in agricultural research are shown to be considerable by DRC analysis. The burden of managing and financing the country's agricultural research program, an important issue in Zambian agriculture, could be reduced by sharing it with the Commercial Farmers' Bureau. In practice, this arrangement would involve contracting specific adaptive research projects to the Bureau. The Bureau has made such a proposal to the Government and it should be considered.

4.92 **Extension.** The quality of an extension service depends on the quality of the research system. The deficiencies in adaptive research suggest that extension services to smallholders have been equally deficient. Extension messages for maize production, for example, have not addressed the binding labor constraint in smallholder agriculture. Due to the lack of adaptive research in soils and acid-tolerant technologies, there are virtually no extension messages for ameliorating soil acidity, nor for restoring soil fertility (other than the use of commercial fertilizers, even in areas prone to acidity). Similarly, extension messages for livestock, especially beef cattle and dairy, have not adequately addressed the serious problems of husbandry practices and feed supply, but have focused on animal diseases. The significant yield differentials between smallholders and commercial farmers (Table 4.11) partly reflects the deficiencies of extension messages to small farmers.

4.93 Adaptive research, weak in its own right, is ineffectively linked to extension services. In some areas of the country (e.g., Eastern and Southern provinces) teams of research and extension workers provided linkages, but due to inadequate budgetary resources, they have become non-operational.

4.94 Availability of extension services is, strictly speaking, a privilege rather than a right for many smallholders. Coverage is roughly estimated to reach about 25 percent of

smallholder and emergent farming households. Most disadvantaged farmers (e.g., resource poor and female farmers) are not in touch with extension workers. In the past 15 years, budgetary cutbacks have not only hampered expansion of agricultural extension, but have left the service with too many personnel and too few resources. The program has virtually become demobilized or desk-bound.

4.95 Adequate and balanced financing between personnel and operating expenditures is key to the efficiency and effectiveness of the extension program. The program's management, which has exhibited weaknesses in priority-setting and developing suitable extension methodologies, also needs strengthening.

4.96 **Rural Financial Services.** Small and poorly developed, rural financial services have not been able to play a critical role in facilitating technology adoption by farmers. In addition to the Bank of Zambia, nine commercial banks, two parastatal development financial institutions (DFIs), and three savings organizations (the Post Office Savings Bank, Zambia Credit Unions and Savings Association [CUSA], and National Savings and Credit Bank) comprise the subsector. Lima Bank (LB), Zambia Cooperative Federation-Financial Services (ZCF-FS), CUSA, and NSCB are the major players.

4.97 Rural financial services consist of savings or deposit and credit facilities. ZCF-FS caters exclusively to cooperative credit needs, mainly for smallholders. Credit under the cooperative credit scheme (CCS) is channelled from ZCF-FS to individual farmers/members through the cooperative societies and unions. Until 1987, CCS operated under a well-conceived management system comprising credit regulations, joint responsibility and liability for loan repayment at the primary society level, an accounting system linking credit recovery with crop payments, and credit training to staff and farmers. Over 90 percent loan recovery was achieved. Then, ZCF-FS was pressured into administering Government agricultural credit, and recovery declined below 70 percent in 1989.

4.98 The major issues in rural finance are weak institutional capacity, inadequate linkages between credit and crop marketing and input supply functions, inappropriate interest rate policy, and insufficient savings mobilization.

4.99 **Institutional capacity.** The history of Zambia's rural financial sector has been characterized by changes in the names of financial institutions servicing agriculture without fundamental reforms in the institutions' mandates and operating policies. The Land and Agricultural Bank, inherited at independence, was renamed the Credit Organization of Zambia (COZ) but collapsed in 1970 to give birth to the Agricultural Finance Company (AFC). In 1979, this was changed to the Zambian Agricultural Development Bank (ZADB) which, in 1986, gave way to the Lima Bank.

4.100 All Government-owned rural financial institutions have suffered from: (i) skill deficiencies among professional and administrative support staff; (ii) lack of medium- and long-term corporate planning; (iii) lack of autonomy evidenced by frequent Government interventions in management; (iv) inadequate capital structure and financial resources; and (v) inappropriate corporate structure and culture. These problems have prevented rural financial institutions from providing adequate financial services to the rural population for the adoption of new farm technologies. Only about 25 percent of the farming households are estimated to have access to financial services, especially credit.

4.101 Credit linkages. Financial activities of the major institutional lenders are closely linked with the input supply and crop marketing functions of marketing agencies (Lintco) and marketing cooperatives (PCUs). Loan disbursements have been traditionally tied to "local purchase orders" and loan repayments to marketing through a "stop order system." While this system allows lending institutions to operate without requiring tangible securities from borrowers and facilitated loan recovery at minimal costs, it can only function under a single-channel marketing system. Recent and further market liberalization in the sector will lead to the collapse of both the local purchase order and stop order systems. This will require adoption of effective and sustainable loan disbursement and recovery strategies consistent with a free market system. The earlier experience of the CCS may be instructive in this regard.

4.102 Interest rate policy. In Zambia the results of access by farmers to subsidized credit as an incentive for adoption of technologies have been not encouraging. Subsidized credit has resulted in substantial operating losses, thereby eroding the financial integrity of both financial institutions and programs. In addition, it is not clear whether credit has been reaching the target groups (i.e., smallholders) or is being used for intended purposes. Meeting lending targets appears to have been emphasized at the expense of prudent and profitable lending. The worst example of indiscriminate lending occurred during the 1986/87 season when K80 million (mostly from counterpart funds generated through bilateral aid) was given to ZCF-FS and CUSA to provide credit to any farmer (not necessarily to members) who could prove cooperative or political party membership. The lending target was met, but a substantial portion went to farmers who were not creditworthy. Credit recovery has been a problem for ZCF-FS and CUSA ever since. More prudence in extending credit would facilitate loan recovery and improve farmer incomes.

4.103 Savings mobilization. Mobilization of rural savings has not been a major consideration in Government's development strategy. Attention focused instead on designing agricultural credit programs. Lack of rural facilities as well as uncertainties created by high rates of inflation have discouraged the mobilization of rural savings. ZCF-FS and CUSA pilot savings schemes have demonstrated that reasonable amounts of rural savings can be mobilized by providing farmers with access to savings facilities. Negative real deposit or savings rate, due to Government's interest rate policy implemented through the Bank of Zambia, has inadvertently discouraged rural savings. In the long run, real returns inevitably have some impact on savings mobilization. As a result, the entire agricultural credit program is dependent on Government budgetary allocations and donor funds. The size and nature of the informal credit market in Zambia is unknown, but interest rates charged by moneylenders are said to be as high as 100 percent per annum. If market size is considerable, then the interest rate level may not be decisive in determining the borrowers' willingness to borrow -- an argument inherent in Governments' advocacy of subsidized interest rates.

4.104 The constraints posed by rural financial services on farmers' response are not easy to quantify. Nevertheless, it is obvious that access to credit has been critical to the adoption of hybrid maize, soyabean, and cotton, the latter two crops promoted by Lintco in a package of extension service and credit. Area expansion for soyabean and cotton grew at annual rates of 28 and 39 percent, respectively. By inference, inadequacy of financial services, especially credit, has constrained the adoption of technologies for crops not covered by specific credit schemes. The narrow coverage of the credit program has also left many farming households without access to credit and, hence, the means to finance new technology.

4.105 Rural Infrastructure. Rural infrastructure consists of rural roads, processing, storage, transportation, and irrigation. Government programs to provide infrastructure have a great influence on the level and pattern of agricultural growth and on private investment in agriculture. Improving rural infrastructure is an essential condition for agricultural growth in Zambia where smallholders have poor access to public facilities and services. For example, improved market incentives through liberalization and price decontrol can easily be thwarted if the physical barriers and economic costs of transporting goods to and from local markets are too high. Experience in some African countries and other developing countries indicates that the supply response of structural adjustment operations can be effectively stifled by deficiencies in rural infrastructure. On the other hand, empirical studies indicate that an increase in paved roads is associated with a significant rise in agricultural output. Also an analysis of completed Bank-supported projects to create agricultural infrastructure found that economic rates of return averaged 17 percent. In this sense, rural infrastructure is an important element of agriculture's incentive structure.

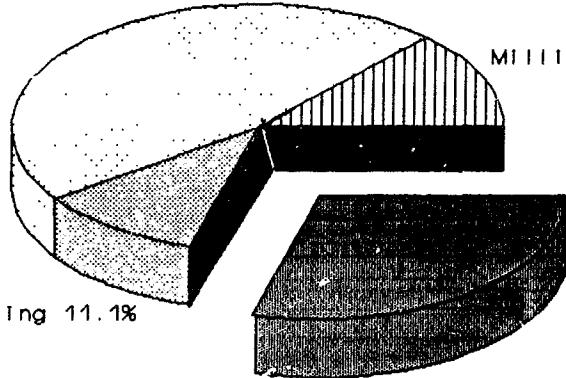
4.106 Rural roads and transportation. Rural transportation in Zambia is made difficult by low population densities, low levels of income, and weak institutional and financial capacity for road planning and maintenance. Generally, the main roads in Zambia are paved and at varying levels of maintenance. From these main roads, smaller unpaved roads lead to rural areas. Feeder roads to areas where the majority of smallholders live are generally in poor condition, many impassable during the rainy season and for a short time thereafter. As a result, smallholders are frequently unable to transport their inputs and outputs on time. Road transporters are generally unwilling to operate on these village roads because of their substandard condition. Repair and maintenance of feeder roads are delegated through the Ministry of Decentralization in the Cabinet Office to the provinces and through them to the district councils.

4.107Rural transport is deficient, primarily due to poor road conditions, acute shortage of vehicles and spare parts, and tariff controls. It is estimated that only 25 percent of Zambia's trucking capacity is suitable for use on rural roads; the bulk is intended for international and highway traffic. These deficiencies seriously impede the timely transportation of farm inputs and products, as well as human movement at both the local and national levels. Poor rural road conditions and shortages of transport services often lead to high transport costs despite government tariff controls. For example, it is estimated that transport costs account for about 45 percent of the consumer price for maize meal (Box 2). Improvement of rural roads alone may not result in increased availability and efficiency of transport services for goods and people. Adequate supply of suitable trucks and buses, through allocation of foreign exchange to private transporters, is a necessary condition. Road rates for maize and fertilizer and bus fares are controlled by Government.

Box 2: Breakdown of Cost of Maize Meal

Maize Meal Cost Structure
for 1990/91 Marketing Season

Producer Price 46.5%



Milling & Retailing 13.1%

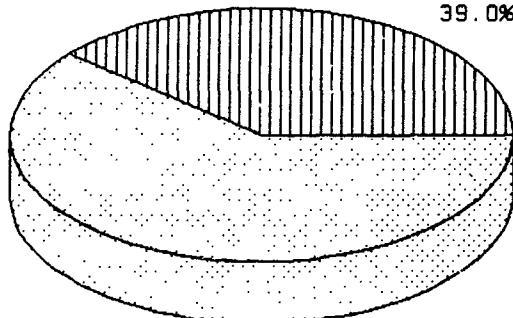
Marketing 11.1%

Subsidy 29.3% (see below)

Composition of Maize Meal Subsidy
for 1990/91 Marketing Season

Marketing & Milling

39.0%



Interprovincial Transport

61.0%

4.108 Donor-supported and Government programs to improve agricultural productivity in Zambia have generally not focused on transport activities. Given the labor-constraints in Zambian agriculture, the introduction of productivity improvements related to on-farm transport and movements would be critical. Changes in on-farm transport technology, especially alternatives to headloading (e.g., wheelbarrow, bicycle, and animal draft) can lead to labor productivity increases, technical changes, and strengthened market linkages, as well as rural employment and rising labor incomes.

4.109 In view of the strategic importance of rural roads and transportation services in stimulating agricultural production and productivity, there is a strong need for formulating a coherent rural roads and transportation strategy in Zambia. While such a strategy is not within the scope of this report, it would be a necessary complement to the agricultural strategy proposed in Chapter V.

4.110 **Rural marketing, processing, and storage.** In most villages in areas outside the line-of-rail and Eastern provinces, unquantified amounts of marketing and bartering of traditional crops and livestock take place. Prices are unregulated in these exchanges. Cooperatives, as Government buying agents, however, buy most crops at floor prices or controlled prices for maize. The existing trade in traditional and other crops remains comparatively small and undeveloped. Poor roads and transportation and lack of local processing capacity and storage facilities have contributed to this phenomenon. In addition, Government policy to date has sought to encourage the marketing of locally grown hybrid maize only to meet local demand by providing for local processing facilities. In recent years, the acute shortage of consumer goods (e.g., radios, bicycles, corrugated iron sheets) in rural areas, coupled with their substantial price increase, has acted as a disincentive on agricultural production. Studies in other African countries (Malawi and Tanzania) suggest that the availability of consumer goods can be critical to both increased crop production and marketed surplus.

4.111 Rural processing or small-scale processing of crops other than maize is virtually non-existent. For example, oilseed processing is concentrated in Lusaka, the Copperbelt cities, or Eastern Province. Oilseeds from other provinces must be transported to them for processing, sometimes involving distances exceeding 1,000 kilometers, then transported back to rural areas as processed vegetable oil. The cost of transportation alone accounts for over 60 percent of the consumer price for domestic vegetable oils (sunflower, cotton, and soya). Decentralized processing for most agricultural products would be justified by the savings in transport costs and the employment and income opportunities that village or district-based processing facilities are likely to generate. The private sector should play a leading role.

4.112 The bulk of urban processing facilities are medium- and large-scale parastatals. Establishment of small- and medium-scale private enterprises in regional or district centers would make agroprocessing more competitive and efficient. Also, agroprocessing in Zambia has ignored natural resources such as wildlife, fisheries, and forests. Much of the processing in these subsectors is inefficient and carried out within the context of the informal sector. For example, charcoal is produced using traditional and inefficient technology which results in considerable waste of wood. Similarly, fish processing, especially fish smoking, uses fuelwood inefficiently. Technologies to enhance productivity in agroprocessing should be an essential element of an agricultural strategy. The

Government needs to provide a more conducive policy environment as well as the physical infrastructure and financial (credit) support to the private sector. Private investment in processing, transportation, and storage facilities is critical to diversified agricultural growth among Zambia's smallholders and should be accorded the highest priority by Government.

4.113 Irrigation. Irrigation is relatively undeveloped in Zambia, despite its considerable potential and agriculture's susceptibility to drought. Only 25,000 ha are under irrigation of which 10,000 ha are mixed smallholder and commercial farms and 15,000 ha are devoted to sugar estates. Zambia's irrigation potential can only be roughly estimated, since a national water master plan, with systematic balancing of water supplies and demands and detailed information on soils and their suitability for irrigated agriculture, does not exist. Nevertheless, using information from various reports, a summary of different river basin characteristics is shown in Table 4.20.

Table 4.20: Summary of Zambia's Irrigation Potential
('000 Hectares)

<u>Catchment/Basin</u>	<u>Existing Scheme</u>	<u>Irrigation Potential</u>		<u>% of Total Potential</u>
		<u>Additional Potential</u>	<u>Total Potential</u>	
Upper Zambezi Basins	2.0	110.0	112.0	26
Kafue Basin	13.0	152.0	165.0	39
Luangwa Basin	0.0	14.0	14.0	3
Luapula/Tanganyika Basins	2.0	62.0	64.0	15
Commercial Farms (in different basins)	8.0	-	8.0	2
Groundwater Irrigation	-	60.0	60.0	14
Total Irrigation Potential	25.0	398.0	423.0	100

Source: Euroconsult Study, 1987.

4.114 These estimates confirm considerable scope for irrigation development and gross underutilization of a strategic resource. Surface water accounts for 83 percent of the potential and the rest relates to groundwater. The Kafue Basin is extremely important for irrigation development, followed by the Upper Zambezi Basins and the Luapula and Tanganyika Basins.

4.115 Data on water availability and soils are scanty, thus an evaluation of potential development based on matching water resource with the quality of soils for irrigated agriculture is not possible. Also, little research has been conducted on the agronomic potential of specific areas with major irrigation potential, although limited research generally confirms the suitability of the country's agroclimate and soil resources for the irrigated production of a wide range of crops. In the absence of more and better information on local

soils, irrigation agronomy, and engineering, much of the potential for irrigation remains tentative. Irrigation research should also be strengthened to provide technical backstopping to the extension service during development of the country's irrigation potential.

4.116 Previous studies (Euroconsult, 1987) have examined some strategic options for irrigation development. Evaluation of project size and project location indicate that: medium- and large-scale irrigation schemes (above 250 ha) would have better payoffs (in terms of income, implementation capacity, and resource use efficiency) than smallholder schemes. While contributing significantly to employment generation, smallholder schemes were found to cost more per ha (50 percent) and demand more capacity for implementation. Contrary to Government's Fourth National Development Plan, which emphasizes the development of smallholder irrigation schemes, the thrust of future irrigation development should be medium- and large-scale projects. Further, a strategy seeking to exploit irrigation potential anywhere in the country would be justified, since location did not appear significantly to affect viability. Such a strategy, however, would have to be implemented under a decentralized system which requires little or no coordination with the center or other projects. This suggests strong support for private rather than public investment and management of irrigation development.

4.117 Euroconsult analyzed 23 irrigation projects covering 21,561 ha and found nearly 80 percent of them economically viable, with internal economic rates of return above 10 percent. Although viability would be influenced by cropping patterns and intensities, as well as the macroeconomic environment (e.g., exchange rate), the results confirm the viability of irrigation development in general. An improved macroeconomic environment, as envisaged under the structural adjustment program, should enhance the profitability of irrigation development. In the past, commercial farmers' initiatives were dampened by the lack of an incentive structure for irrigated agriculture.

4.118 Inadequate institutional capacity has significantly contributed to the lack of irrigation development. The Ministry of Agriculture, responsible for irrigation development, almost completely lacks specialized staff for such development. There are no Zambian irrigation engineers nor irrigation agronomists, and there is an extreme shortage of irrigation professionals. The number of expatriate irrigation engineers is severely limited, almost all of them working at the head office in Lusaka without field representation. In addition, irrigation research, like other research activities of the Ministry of Agriculture, has been constrained by inadequate funding. Both human and financial constraints have essentially prevented a national irrigation program from developing. Since smallholders' participation in irrigation would be dependent on implementation capacity, such capacity first needs to be created in Government.

4.119 The above analysis suggests that smallholder-centered irrigation development is not a viable nor practical proposition in the short and medium term. Rather, a medium- and long-term development strategy aimed at enabling large-scale commercial farmers to utilize the country's irrigation potential would be justified.

Human Capital Investment

4.120 There is overwhelming evidence that investment in human capital and agricultural productivity are correlated. Investment in human capital relevant to agricultural development in Zambia consists of public expenditures for primary education, health facilities

and services, agricultural extension as a form of on-the-job training, adult literacy and numeracy, food security and nutritional programs, and family planning services in rural areas. Smallholders' access to these services is key to alleviating poverty in rural Zambia, yet protracted deterioration in public investment in such programs has deferred human capital development. In turn, this lag has important implications for agricultural productivity in the long term.

Agricultural Education

4.121 The efficacy of agricultural research and extension depends on human capital at both ends. The 40 percent real decline in research and extension services in Zambia between 1980 and 1988, particularly affected training services to farmers. Decline in investment not only stunted the extension program, but also smallholders' investments in new technology, with adverse impact on agricultural productivity. Although Zambia's farm labor has been growing at about 2 percent a year in the past decade, its quality remains relatively poor because of inadequate investment in primary education. Since children below 14 years of age account for 49 percent of the population, expenditures on primary education should be high. Nevertheless, per capita investments in primary education declined, in real terms, by about 50 percent between 1972 and 1988 and are likely to continue to decline in the foreseeable future. This is not to belittle the impressive growth of primary education in Zambia over the past three decades. Primary school enrollments have increased from 53 percent of the school-age population in 1965 to 97 percent in 1987. Literacy rates have more than doubled.

4.122 In Zambia, as in most of sub-Saharan Africa, however, education that is most relevant to increased farm productivity gets less attention than needed. Formal schooling, rather than basic and informal education, has continued to receive the lion's share of primary education expenditures. Informal education increases the productivity of labor, the primary asset of Zambian farmers. Many studies in other countries show that primary education, coupled with appropriate extension service, results in higher income. Educated farmers are more likely to adopt new technologies and virtually all studies on agricultural productivity show that better educated farmers get a higher return on their land. For example, a study in Kenya found that farmers who completed four years of education -- the minimum level for achieving literacy and numeracy -- produced, on average, about 8 percent more than farmers who had not gone to school. Numeracy and literacy were identified as the essential skills for increasing farm productivity. It is roughly estimated that less than half of Zambian farmers are literate and numerate. In the face of acute and chronic budgetary constraints, expenditures on agricultural education and extension services have been cut back, demobilizing the extension service to smallholders who depend on such services for improving their productivity. Increased primary schooling, complemented with adaptive research and extension services, could substantially raise farm productivity.

Rural Health

4.123 Similarly, health is a basic requirement for sustained economic growth in general and increasing agricultural productivity in particular. Zambia's health system is urban-biased; the best facilities and services are concentrated in urban areas, and facilities are better equipped and staffed than rural health centers. Rural areas are relatively neglected and preventive health services are inadequate. Distribution of drugs in rural areas is inefficient and erratic and health clinics go without drugs for weeks, if not months. Even though

average life expectancy is estimated at 53 years, it is shorter in rural areas, perhaps as low as 47 years, in either case, the prime of productive life. Zambia's infant mortality rate is estimated at 78, making it one of the few African countries with a rate significantly below 100. Infant mortality in rural Zambia, however, is probably higher, due to fewer and inadequate facilities (Box 3).

4.124 Although the economic effects of improved health on farm productivity are less documented than those of education, increased life expectancy and reduced infant mortality can raise farm productivity in various ways. Longer life means increased productive use of human resources (i.e., increased labor time). At present, the short life span, compounded by poor health, leaves extremely low productive labor time among smallholders. It is well known in Zambia and elsewhere in Africa that loss of the family breadwinner to death or debilitating disease may force a whole household into poverty or substantially reduce farm productivity and income. Reduction in infant mortality, as a result of improved nutrition and health services, can allow parents (especially mothers) to spend more time on farming to improve productivity. In Zambia, frequent child mortality reduces productive labor time for the household and village, since nobody is supposed to work on farms during the mourning period which may last up to five days. In addition, mothers nursing sick children spend a lot of time away from their farms, even at critical farming periods.

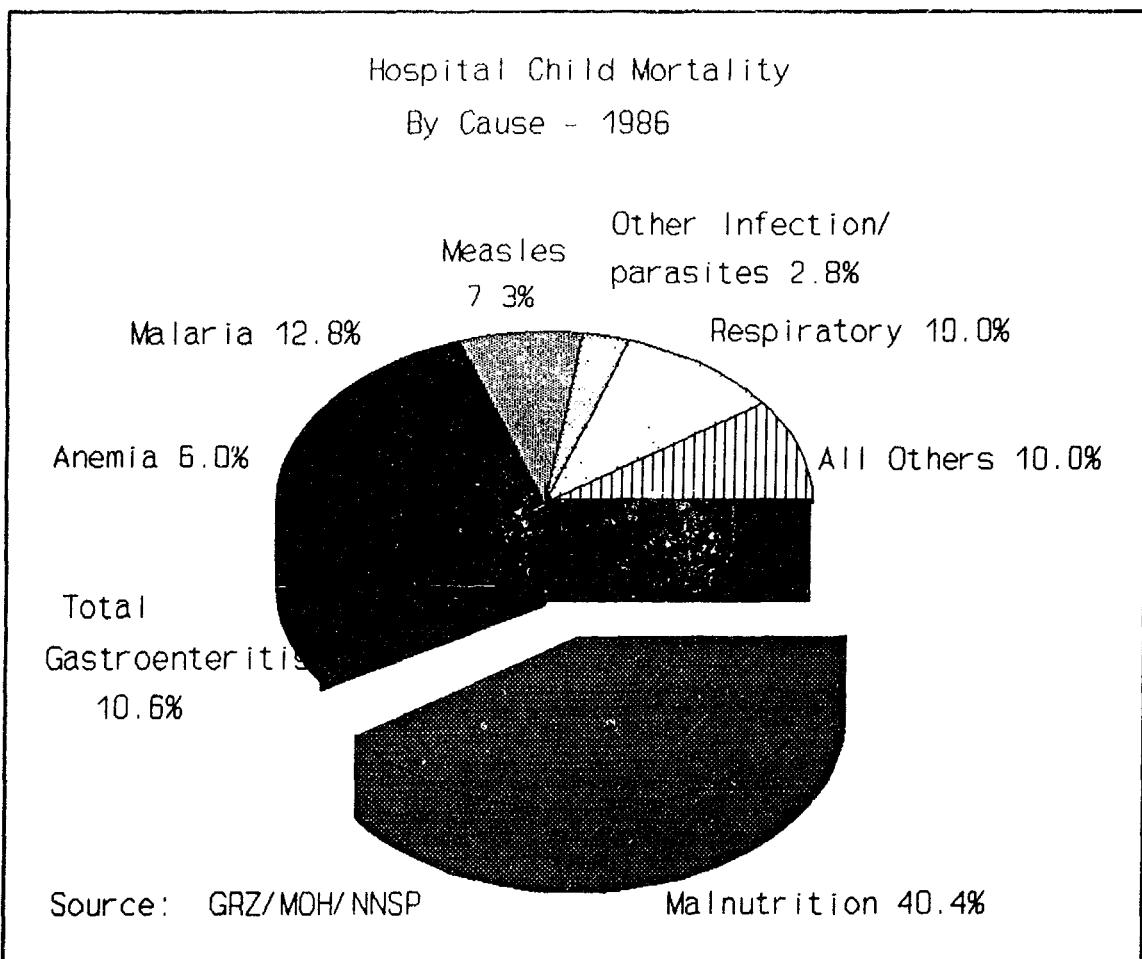
Food Security and Nutrition

4.125 Human physical ability is essentially a function of nutrition and health. In Zambia, as in many African countries, nutrition has worsened in recent years. The causes are many and complex, but an increasing number of Zambians -- rural and urban -- are unable to command adequate food or sufficient nutrition for normal growth and healthy and productive lives. The food security problem in Zambia is not so much a question of inadequate supplies or production of food at the national level as it is the general decline in per capita real income under rapid inflation. In addition, there is considerable evidence that many rural households are experiencing nutritional deficiencies, in part due to insufficient food supplies at the household level, at least seasonally.

Box 3: Causes of Infant Mortality in Zambia

Malnutrition is the leading cause of death among children aged 1-14 years in Zambia. In 1986, it accounted for 40 percent of all hospital deaths among children. More than 25 percent of Zambian children under 5 years suffer from undernourishment. In certain provinces -- Northern, Eastern, North Western, and Luapula -- the figure is about 33 percent. Malnutrition is even more pronounced in infants 6-24 months, especially among those in the 7-8 month group, an indication of serious weaning difficulties. Central, Copperbelt, Southern, and Lusaka provinces have consistently recorded about 20 percent of children being significantly underweight, while relatively better-off provinces are those in the center of the country, clustered around major transport links -- the same area where Government policies have focused agriculture sector investments.

Box, Figure 1:



4.126 Zambia has addressed food security as if it were principally a matter of guaranteeing sufficiency of maize production at the national level rather than of ensuring food sufficiency for all households -- rural and urban. With the urban poor increasingly unable to purchase adequate food, in January 1989, Government initiated an urban food subsidy scheme involving coupons for the poorest households. Traded for rations of maize meal, coupons cover a large part of the monthly caloric requirement for all members of poor families. If Zambia's economic rate of growth remains as low and slow as it has been in the last two decades, the country will not succeed in reducing malnutrition, largely due to budgetary constraints on this and other measures. Moreover, there is need to extend the program to the rural poor, yet fiscal considerations may not permit this in the medium term. Zambia will have to find more effective ways of dealing with the problem of food insecurity if agricultural productivity is to improve significantly in the long run.

Population Growth

4.127 Zambia's population growth rate of 3.7 percent a year has serious implications for agricultural productivity. Poverty and rapid population growth reinforce each other in many ways. Inadequate education (especially for women) and high infant mortality -- both linked to poverty -- contribute to high fertility rates and thus to rapid population growth. In Zambia, women of childbearing age account for 46 percent of the population and the fertility rate is estimated at 6.7 percent.

4.128 Increased education for girls and women is key to a reduction in fertility, because when mothers work and their productivity is high, the opportunity cost of bearing an additional child is relatively high. Similarly, reducing mortality among children is critical to a reduction in fertility. Families with educated mothers tend to have lower child mortality. Rapid population growth not only makes the task of investing in human capital in order to reduce poverty or improve productivity more difficult, but also results in growing poverty. High fertility often impairs the health of both mother and child as a result of closely spaced pregnancies. This reduces the mother's labor time for farming, leading to inadequate production of food, which, in turn, leads to malnutrition of both mother and child. Providing family planning services is the most direct way to invest in human capital in Zambia. At present, these services are virtually non-existent in rural Zambia, compounding the problem of farm productivity.

4.129 Better agricultural education, rural health, food security and family planning are reinforcing prerequisites for improving agricultural productivity in Zambia. Continued low levels of investment in human capital development increase the probability that Zambian farmers and their children will remain poor. Achieving increases in farm productivity will require policies that provide opportunities to the rural population and enable them to participate in overall economic growth. For this purpose, a human capital development strategy is necessary. It should emphasize: (i) human capital investments in the rural sector, especially in agriculture; and (ii) specific sectoral policies which improve the participation of the rural poor and women in growth by increasing their access to education, health, food, and family planning services. Despite the crucial linkages of such a strategy with agricultural development, it is not possible to make it part of an agricultural strategy. Its scope and complexity require that it be separately formulated and implemented by Government.

Agricultural Sustainability and the Environment

4.130 Localized deforestation, soil degradation, and loss of wildlife are some of the most serious environmental problems in Zambia, and they are inextricably linked to agricultural development. Deforestation is most acute near the major towns along the rail line where trees are cut to meet demand for fuelwood and charcoal. In rural areas, deforestation and soil degradation are most intense where population densities are increasing and fallow periods are consequently reduced. Poaching, as well as loss of habitat, has diminished wildlife numbers throughout the country. A high population growth rate and uneven population distribution underlay these problems. Of primary concern in this report are the pricing policies, subsidies, and institutional inadequacies that encourage overconsumption of natural resources, including wildlife, cultivation on unsuitable soils, and fertilizer use that is exacerbating soil acidity.

Environmental Symptoms

4.131 The average rate of overall expansion in land cultivation, the major source of agricultural growth, was 15 percent a year between 1974 and 1988. Clearing for agricultural production is the leading cause of deforestation in Zambia. *Chitemene*, a form of shifting cultivation, is practiced on some 130,000 square kilometers in Luapula, Central, and Northern provinces. As traditionally practiced, plots are cultivated for about six years, during which time the soil is leached of its nutrients. When the chitemene plots reach a critical point of diminished yields, farmers abandon the land and begin to clear the next woodland area for cultivation. It is estimated that about 10,000 square kilometers of natural woodland are cut each year under chitemene.

4.132 Chitemene does not have any adverse environmental impact on the soil or forests where population density is low and land is plentiful enough to allow fallow periods of more than 20 years -- the time required for forests to regenerate sufficiently for further use. It is estimated that the chitemene system can support up to four people per square kilometer on a sustainable basis. Beyond this, land pressure becomes too high for full regeneration, soil fertility falls, erosion sets in, and regeneration is further weakened. Population density in many parts of Zambia is exceeding this sustainable level, leading to progressive deforestation and soil degradation.

4.133 Smallholders and commercial farming are adding further pressure on wood resources. Twenty percent of the land area has already been cleared for agriculture in Eastern, Northern, Southern, and Luapula provinces. Farming is becoming more intensive around the main urban centers of the Copperbelt, Lusaka, and along the line-of-rail, which intensification should help reduce the rate of forest depletion.

4.134 Fuelwood is the principal source of energy supplies for rural households and an important input in flue-cured tobacco processing. More than 90 percent of the urban population depends on charcoal for its energy needs. Zambia's sustainable yield of forests and woodlands is estimated to be 19-24 million cubic meters, and current consumption of fuelwood is about 16-17 million cubic meters annually. While fuelwood demand is not causing deforestation on a national scale, it is locally produced, especially in Lusaka Province where consumption outstrips production by nearly 300 percent, and in Southern Province by 23 percent. Elsewhere there is a general balance. Taking total above-ground biomass into account, Southern Province is consuming most of its aggregate woodfuel supply each year and

Lusaka Province is seriously in deficit. The problems of shrinking local fuelwood supply and resulting environmental degradation are heavily concentrated in the central "spine" of the country. Sources of fuelwood are becoming progressively more distant from these centers of demand.

4.135 Agroecologically, Zambia is divided into four major zones: Region I with low and erratic rainfall; Region IIa with largely high-potential land; Region IIb with severe soil and climatic constraints to annual crop production; and Region III, the largest, with few climatic constraints, good rainfall, and a long growing season, but soils that are leached and tending to be acidic. In general, the soils in Zambia are moderately acidic and not well suited for long-term fertilizer application.

4.136 Loss of wildlife is another major environmental problem. As land is brought under cultivation, wildlife habitat is lost. Moreover, while hunting is not permitted in the national parks, poaching is common -- even in the designated national parks -- and is the primary cause for depletion. Poaching has brought a number of mammals, reptiles, and birds to the point of extinction. The Black Rhino, which was seen in many parts of Zambia a few decades ago, is now an endangered species seen only in Kafue and Luangwa national parks. The threat of illegal hunting to Zambia's wildlife resources is illustrated by the dramatic decline in the elephant population in the Luangwa Valley, the area of highest elephant concentration in Zambia. Between 1973 and 1985 the elephant population dropped from 70,000 to 21,000 -- a 70 percent decrease in 12 years.

Environmental Impact of Pricing Policies and Subsidies

4.137 In Zambia, no incentives are offered to farmers to engage in environmentally sustainable agriculture. No tax rebates are offered, for example, for conservation tillage. In fact, as the following section illustrates, pricing policies and subsidies often have the effect of discouraging environmentally sound cultivation practices.

4.138 Policies with perhaps the most profound influence on soil resources in Zambia are maize and fertilizer pricing. The main objective of Government policy has been increased maize production, with subsidized fertilizer supporting this objective. Nearly all fertilizer used by small-scale farmers -- accounting for 60 percent of the fertilizer market -- and 90 percent used by commercial farmers are applied to maize. Maize thus commands the most-favored position in the agriculture sector, effectively stifling diversification into alternative crops. Most soils in Zambia, however, are more naturally suited to acid-tolerant crops. Continuous cultivation of maize rapidly depletes soils of their nutrient content and restoration of fertility, through fertilizer application, becomes necessary.

4.139 Fertilizer subsidies -- averaging 45 percent -- have encouraged high levels of use. In 1988/89, retail prices were K2,675-3,980 per ton, while subsidized prices were K1,060-2,040 per ton. The total amount used increased from nearly 166,000 tons in 1983 to 225,000 tons in 1988 (Table 4.21). Unfortunately, most fertilizer was not optimally used and in some areas aggravated soil acidity problems.

Table 4.21 Apparent Fertilizer Consumption in Zambia, 1980-88

	N	P2O5	K2O	Total Nutrient	Total Product
-----'000 tons -----					
1980	53.0	19.5	6.1	78.6	196
1981	57.6	20.9	6.7	85.2	219
1982	54.1	23.7	7.0	84.8	218
1983	43.1	17.2	5.4	66.0	166
1984	37.8	14.1	4.5	56.4	143
1985	53.4	18.7	8.1	80.2	211
1986	53.9	16.5	6.7	77.1	191
1987	62.0	23.9	9.9	95.8	244
1988	56.4	22.8	8.5	87.7	225

Source: Ministry of Agriculture and Cooperatives.

4.140 The negative effects of long-term use of nitrogen fertilizers are well documented. Urea and ammonium nitrate -- the most commonly used nitrogen fertilizers for top dressing -- both undergo a nitrification process which increases soil acidity. Local research has confirmed that all forms of nitrogen fertilizer, both organic and inorganic, lead to soil acidity and declining yields with time. One study shows that when calcium ammonium nitrate (26 percent nitrogen and less acidic than urea or ammonium nitrate) was used as fertilizer in the Northern Province, soil pH fell from 5.2 to 4.2 over a six-year period. The decline in maize yields was 300 percent, from 6 tons per hectare to 2 tons.

4.141 In practice, farmers can be found at all levels who do not abandon their land until high levels of fertilizer are required to correct declining yields. It is unlikely that land abandoned because of extreme acidity will recover a productive capacity by regeneration alone. While the acidifying effects of fertilizer can be counteracted through the application of large amounts of lime, smallholders do not generally have access to lime, so liming is not a current viable solution.

4.142 Interest rate subsidies have also encouraged farmers -- at least commercial farmers -- to engage in practices which lead to soil degradation. The Government controls commercial bank interest rates, presently set at 35 percent while inflation is around 100 percent. With interest rates lower than the inflation rate, commercial farmers are encouraged to take out loans and invest in farm machinery, such as tractors. Mechanical ploughing of fields renders soils more vulnerable to wind erosion and leaching, although it reduces labor requirements for land preparation. Moreover, subsidized interest rates, coupled with fuel subsidies, have tended to discourage conservation farming (e.g., minimum tillage practices) among large-scale commercial farmers.

4.143 In some cases, Government pricing policies may be encouraging the overconsumption of natural resources. The market price for charcoal is controlled, but does

not adequately reflect the economic cost of replacing the fuelwood used. The 1986 market price was K6.2/GJ, compared to a market gate price of K11.2/GJ (based on plantation wood -- K3.1/GJ; cost of production -- K3.6/GJ; plus average economic costs of transport to market -- K4.6/GJ). An 81 percent subsidy to consumers is implied.

4.144 The large difference between economic cost and market price is attributable to the fact that most charcoal producers pay nothing for wood. Only about 5 percent of charcoal is produced from wood licensed by the Forest Department. For this wood, a stumpage fee of K8 per cord (USD0.20/cord), based on 1983 prices and costs, is charged. The remaining 95 percent is produced from wood taken from forests under the domain of traditional law or designated forest reserves. Transporters are charged a removal fee of K 0.5/bag if no stumpage fee has been paid, but only a small proportion of the fees is collected. The fact that few or no fees are paid for the use of wood encourages overconsumption and waste.

Institutional Capacity

4.145 Zambia has not produced legislation nor a long-term policy on the environment. The major institution entrusted with the protection of natural resources is the Ministry of Water, Lands, and Natural Resources, covering the Commissioner of Lands, the Forest Department, and the Natural Resources Department. Further, the major institutions responsible for protecting the environment are weak, due to inadequate staffing and limited financial resources.

4.146 In principle, local forests are managed and utilized with the consultation and approval of the Forest Department. In reality, the Forest Department does not have appropriate organizational structure nor adequate staff to monitor local forests or enforce forest laws. For example, despite mandatory licensing requirements, the majority of about 25,000 rural households are engaged, at least part-time, in charcoal production and do so without license, and a still larger number transports and trades charcoal. The Department does not have an adequate record of those who have licenses nor a systematic mechanism to collect fees from charcoal producers. As a result, the revenues generated from charcoal producers and forest resources is insignificant given the country's vast forest resources.

4.147 Issues of property rights also affect the utilization and management of forests and fisheries in Zambia. Everyone has free access to wood on trust lands. As on most grazing areas, fuelwood on trust lands is owned in common and exploited under conditions of unregulated individual competition within tribal communities. With the forest viewed as a public good, the individual household does not perceive its consumption as diminishing the resource available to the community. Forests, however, are not a purely public good. The combined actions of all households have significant effects on the sustainable consumption rate and, hence, on the amount of forest resource. Even when individuals begin to perceive an increasing rate of consumption, and hence a growing scarcity, there is no incentive to conserve the resource by lessening use.

4.148 It is through joint or coordinated actions that the externalities (e.g., environmental deterioration) associated with depletion of a common resource can be internalized. Fuelwood production and control are now undertaken by Government, financed through tax revenues. Instead, it is necessary to implement policies that make individuals bear the costs of resource use and enjoy the benefits of producing or conserving the resource. Appropriate and economic user charges, coupled with effective control of individual access to

the resource, need to be instituted. The situation relating to forest resources also applies to other natural resources such as fisheries, wildlife and grazing land.

Women's Role and Constraints in Agriculture

4.149 Women -- constituting 65 percent of the rural population and 50-75 percent of subsistence labor -- play a critical role in Zambia's agriculture sector. Women have primary responsibility for subsistence or food crops and are involved, in growing numbers, in cash crop production. Traditionally, men were responsible for clearing land and tilling soil and helping women to plant and harvest. Women prepared the soil for planting, planted, weeded, kept animals and birds out of the fields, harvested, and carried the produce back to the village for storage and preservation. Changes in the sector have mainly relieved men of their workload. The time spent felling trees and clearing new land has been declining as permanent cultivation becomes increasingly common, and the introduction of oxen and tractors for plowing and cultivation has made men's tasks easier.

4.150 By contrast, village studies show that women on average spend more time per day working in the fields (53 percent of total hours) during the farming season than do men (47 percent). In a random sample of 112 households in three disparate locations, for example, women spent an average of 6.6 hours per day in agriculture, while men spent 5.7 hours. Women also spent considerably more time on other household activities than men -- 4.1 hours per day compared to 0.4 hours, respectively.

4.151 A large proportion of rural households are headed by women due to male migration to urban areas and the Copperbelt. Female-headed households are generally more heavily dependent on cash income than other households. They also tend to be poorer than households run by men, due to fewer resident workers, more dependents, and smaller landholdings. Also female-headed households are much less likely to have access to productive services such as agricultural extension and credit. Female-headed households tend to have the highest levels of food insecurity and malnutrition in rural Zambia.

4.152 An ARPT survey in Central Province that compared male- and female-headed households in terms of cropping patterns, inputs, constraints, and sources of income found that while female heads of household are interested in producing a surplus for market, it is difficult for them to get beyond subsistence, because of lack of exposure to new ideas, inputs, and technology.

Key Constraints

4.153 Despite women's major role in improving productivity in the agriculture sector, they face several key constraints: insecure land tenure, inadequate agricultural extension, and lack of access to relevant technology and credit.

4.154 **Access to Land.** Traditionally, user-rights to land followed the same system as inheritance, and depending on ethnic group, the right could come through the mother's or father's line -- or both. Formal laws of inheritance, ownership, and control of land, however, tend to discriminate against women.

4.155 Based on the assumption that the man is always head of the household, men tend to be favored in the allocation of agricultural land. Even if theoretically available, land

accessible to women may be less fertile, more distant, or need clearing (without labor, this land is, in fact, restricted). As good land becomes scarce and more valuable, and traditional inheritance customs begin to break down, women are left landless or with small plots of poor quality land. The new Law of Succession and Inheritance sets out to eliminate unfair practices against surviving female spouses and children and to equalize rights of succession for males and females.

4.156 Access to Extension. Women are not served well by the extension service. During the past 10 years, efforts have been made to build a more efficient, well trained, and relevant extension service, but services have focused heavily on commercial farmers and cash crops that are mostly grown and managed by male farmers. Also, male agents have culturally resisted contacting female farmers, and the number of female extension agents is low. In 1987, female agents comprised only 7 percent of the total; by 1989, 8.4 percent of camp officers and 16 percent of block supervisors were women. Many of these women are commodity demonstrators with little training, and many are stationed at headquarters rather than in the field.

4.157 The assumption that extension information given to male farmers will be passed on to other members of the farming household does not usually hold. Interviews with women in Kayambi and Mwamba in Northern Province confirmed that women had never seen an extension officer and that they receive no extension information from their husbands.

4.158 Women do not have the same access as men to the various farmer educational programs such as those offered at the Farmer Training Centers and Farm Institutes; nor when they do participate, do they have access to the same information. In addition, women do not have equal access to the institutions which train agricultural extension workers.

4.159 More systematic efforts have been made during the past few years to provide women with better access to extension services. During the 1987/88 crop season, 976 farmers' field days were held with 18,500 participants, including 40 percent women. Similarly, female farmers accounted for 40 percent (3,800) of the participants in a number of mobile and residential training courses for farmers. Mobile training courses are particularly helpful for women, who lack transportation and cannot afford to be away from home for a residential course.

4.160 Research Revelance. Previously agricultural research was heavily biased toward large commercial farming and maize production. During the last decade, emphasis has shifted to support small-scale commercial and traditional producers, resulting in more resources being devoted to food crops such as sorghum, millet, cassava, beans, and vegetables -- crops that women are more likely to produce.

4.161 The advent of ARPTs better serves the needs of small-scale farmers, including women. The regionally based teams collect information on farming systems, undertake adaptive research, improve the research-extension linkages, and develop appropriate recommendations. Particular attention has been given to gender roles in different farming systems and more suitable farm and household technology to improve women's efficiency and productivity.

4.162 The Luapala ARPT concluded that solutions to labor constraints in the farming system must focus specifically on constraints facing female farmers. The result has

been more systematic attention to food crops such as cassava and intercropping, including trials to identify groundcover that will reduce women's weeding burden. ARPTs are also giving increased attention to local food security issues; testing new varieties of traditional food crops is a high priority.

4.163 Access to Credit. Credit is indispensable to adoption of better technology, improved seeds, and extended production. In Zambia, there are no legal constraints to women's access to agricultural credit and it is widely believed that women have equal access. Yet there are many examples of administrative discrimination, such as commercial banks which will not often grant a loan to a woman without her husband's consent.

4.164 The Women's Participation in Rural Development Program (WPRDP) was established to improve women's access to resources and to facilitate more equitable distribution of benefits and responsibilities among the rural population. The cooperative movement has been a key institution for inputs and credit in rural Zambia, and membership for women in cooperatives has been an important objective of WPRDP.

4.165 Through a revolving fund under WPRDP and administered by ZCF-FS, female farmers can apply for seasonal loans. They apply as individuals, but collateral is provided through membership in a women's group. After three years in WPRDP, members are eligible for cooperative membership, including regular access to credit.

4.166 Since the program was introduced in 1982, 3,620 female farmers (181 groups) in 15 districts have participated. Participants from approximately 14 groups have joined or formed primary credit societies. The motivation for most women has been to gain access to agricultural inputs, mostly fertilizer.

Land Tenure System

4.167 Land ownership in Zambia is vested in the State. All categories of farmers enjoy usufruct rights either under the leasehold system or customary land tenure systems. There are no freehold rights on land. Zambia's colonial heritage is clearly visible in the dualistic nature of its land tenure system. Under the leasehold tenure system, agricultural land in State Land (formerly Crown Land) is leased mainly to large-scale commercial farmers for 99 years. Under customary land tenure systems, farmers enjoy usufruct rights on Trust and Reserve Land granted by traditional authorities. With the consent of a traditional authority (i.e., a chief), Government can lease Trust and Reserve Land to individuals for an initial period of 14 years.

Major Issues

4.168 Land tenure arrangements are important to agricultural development as they determine access and, hence, income-earning opportunities; in part, the type and extent of investment in agriculture; and whether land is adequate security for borrowed funds, hence facilitating or hindering agricultural credit.

4.169 Zambia's traditional system emphasize access to land for all to grow food for one's family, with an effort to ensure equal opportunity. Customary land tenure has thus served to provide broad, if not strictly equal, access to subsistence opportunities. However, under changing conditions of agriculture, it is not providing a tenurial regime that meets the

needs for security in land and credit facilitation generated by commercial agriculture. Since commercial production is largely the domain of private individuals utilizing their labor and capital, it is necessary to provide a system of private rights in land which provides incentives for investment. It is possible to modify the traditional tenure system and continue providing broad access to development opportunities. As experience in Tanzania, Kenya, and Uganda, shows, with more agricultural development, customary tenure systems either adjust or disintegrate under the force of market pressure. The choice is therefore between planned and unplanned change. Zambia would not be alone in instituting reforms. In Africa a wide variety of experimentation is underway: Kenya has been converting traditional tenures into individual leaseholds; Ethiopia is pursuing the establishment of communal/cooperative holdings for communal production; Botswana is introducing a system of better management of land under customary law, coupled with limited introduction of common law leasehold for specific land uses. These programs, however, are still too new to permit conclusive evaluation.

4.170 The major policy issues implied in the Land Act (1975) relate to the concept of "land without value." While this concept causes little difficulty in subsistence agriculture, it poses serious problems when the agriculture sector relies on entrepreneurs (commercial and emergent farmers) operating in a mixed economy and motivated mainly by prospects of earning a living from the production on land individually leased and privately improved, as in Zambia. Land, a critical input in agriculture, like all other inputs that have values and costs is not a free good. The uniform rental fee (of 8 ngwee per hectare and presuming equal quality and location) has unfavorable effects on agricultural development. The most efficient means of achieving more optimal land use would be a pricing system that fully reflects quality and scarcity. This could be achieved through rent differentials that reflect the potential, rather than the current use of each piece of leased State Land. They would also constitute a good source of Government revenue.

V. AGRICULTURAL STRATEGY AND PUBLIC INVESTMENT PRIORITIES

Strategic Challenges

5.01 The foregoing analysis of strategic issues in Zambian agriculture provides a reasonable basis for identifying some strategic challenges, policy options, and public investment priorities for agricultural development in the country for the decade or two ahead. The challenges facing Zambia in its effort to develop agriculture and transform it into a major source of economic growth are many. They include the development of an internationally competitive agriculture sector capable of: (i) increasing employment and income opportunities for the rural population to alleviate rural poverty; (ii) efficient import substitution within the domestic market; (iii) ensuring internal food security and generating substantial exports for earning foreign exchange; and (iv) sustaining the physical resource base for agricultural development.

5.02 A pattern of agricultural development that successfully meets these challenges can be achieved if Government implements policy and institutional changes and restructures its investment program to focus on sectoral priorities. These changes must be executed in a complementary manner through appropriate sequencing. Implementation of just a few elements of the proposed strategy will not lead to the desired effects.

Proposed Policy and Institutional Framework for Growth

5.03 Proposed changes in policy and the institutional framework for agricultural development will result in: (i) improving the incentive structure for all farmers; (ii) enabling smallholders to participate in growth by increasing their access to rural infrastructure and human capital facilities and services; (iii) encouraging the use of labor on which most rural Zambians depend for their income (from work on their own land and farm wages); (iv) encouraging increasing use of land, the most readily available resource to most Zambian farmers; and (v) promoting the production and use of adaptive technology to increase farm productivity among smallholders, including the disadvantaged (e.g., women and resource-poor farmers).

5.04 Changes are needed in *macroeconomic* and *agricultural* policies. Most macroeconomic policy changes required for this purpose are being implemented under the Government's structural adjustment program outlined in the country's Policy Framework Paper covering 1991-93. Of critical importance to agricultural growth will be the maintenance of appropriate exchange rate policy and reduction in the domestic rate of inflation. The necessary agricultural policy measures are outlined in Appendix 1. These measures constitute the sector's policy reform agenda. They essentially focus on improving agriculture's incentive structure in the short and medium term by: (i) reducing the level of taxation in agriculture through elimination of price controls and introduction of relatively undistorted (liberalized) product and factor markets; and (ii) developing a floor pricing system with a buyer of last resort (e.g., Strategic Maize Reserve) which guarantees border price equivalents to producers; (iii) eliminating import/export restrictions for agricultural imports and exports; (iv) allowing private sector participation and development in the liberalized marketing system; and (v) restructuring public expenditures for agriculture by eliminating maize and fertilizer subsidies and concentrating limited budgetary resources on priority programs intended to improve farmers' incentives and production efficiency.

5.05 In the short run, institutional changes needed to improve the participation of all categories of farmers, particularly disadvantaged smallholders, should focus on liberalizing the provision of crucial services, namely marketing, input distribution, agroprocessing, and rural financial services, most of which are monopolized by cooperatives and parastatals. The options for achieving institutional changes include: (i) elimination of cooperative and parastatal monopolies in marketing inputs and produce; (ii) reduction in state monopolies in agroprocessing for key products (e.g., maize, cotton, oilseeds, and stockfeed); (iii) development of private sector participation in marketing and agroprocessing; (iv) improvement of rural infrastructure to attract private sector investment; and (v) formulation and implementation of plans to improve the performance of agricultural cooperatives and credit institutions.

5.06 Further institutional changes are required in basic agricultural research and extension services in the medium and long term (5-20 years). Such changes should focus on improving efficacy and access of smallholders to them. Options for improving agricultural research include action to: (i) integrate all agricultural research institutions and activities within the framework of the National Council for Scientific Research (NCSR), with specific programs contracted to individual institutions, including the Commercial Farmers' Bureau; (ii) establish medium- and long-term research priorities, with emphasis on demand-driven adaptive research in the medium term, leaving much basic commodity research to regional and international institutes; (iii) improve the organizational structure of NCSR and management of the national research program through appropriate staffing, delegation of responsibility, and accountability; (iv) ensure appropriate design of research projects by making them more problem-solving and result-oriented within specific time-frames; (v) devise mechanisms for cost and finance sharing of research by, for example, contracting project financing and management to relevant commercial agriculture; (vi) focus the adaptive research program on crop and animal husbandry practices as well as livestock feed supply; and (vii) improve delivery of rural financial services via establishment of flexible financial institutions with sound operating policies and procedures.

5.07 Finally, future extension work should be based on the training and visit (T&V) system as the basic management tool. This should, however, be modified to take into account special conditions prevailing in some parts of the country (e.g., low farm population density) without changing the basic tenets of T&V. Whenever T&V is introduced or reintroduced, the extension staff should be retrained in the basics of the system and its application. Other options for improving extension services include: (i) providing adequate budgetary resources; (ii) strengthening the linkages of extension service with other programs (especially research and credit) by, for example, attaching subject matter specialists to the ARPTs (Agricultural Research Planning Team) whenever and wherever field trials are conducted or enabling ARPT researchers to participate in training days; (iii) reducing the number of donor-driven extension projects to a core of few high-priority projects; and (iv) instituting annual workplans with specific targets for extension at national, provincial and district levels and providing for periodic evaluation of such workplans to permit identification of operational problems and opportunities for improvement.

5.08 An improved incentive structure, resulting from implementation of policy and institutional measures of the overall adjustment program and those specific to agriculture, should lead to overall agricultural growth in the long run, although this will be less significant in the short run. In the short run (i.e., 3-5 years), they are likely to result in a shift in production from nontradables to tradables or from one tradable to another without substantial

increases in aggregate agricultural production. This is more likely in smallholder than in large-scale agriculture, largely due to the inelasticity of labor supply in the former. Critical to the nature and extent of trade-offs between crops will be crop-specific incentives and smallholders' access to profitable technology (especially improved seeds and inputs), extension services, and credit. Smallholder access to these should be increased, particularly for priority crops.

5.09 While large-scale farmers will benefit most from the implementation of policy and institutional changes in the short and medium term, smallholders will remain more efficient producers in general, except in high-input and management-intensive commodities. Increased production in smallholder agriculture would, however, be long term. It would also require, in addition to policy changes, substantial public investment in basic agricultural services and rural infrastructure. In this view, an agricultural strategy that ensures support to smallholder and large-scale farmers would appear fully justified. Nevertheless, targeted support to smallholder agriculture should remain at the center of Zambia's agricultural development strategy for the next decade, if poverty reduction among the rural population is to take place.

Public Investment Priorities

5.10 In addition to implementing the above policy and institutional changes, Zambia will have to design special programs in the medium and long term specifically to increase agricultural growth. Three priorities should underpin this design: (i) increasing sustainable productivity in smallholder agriculture; (ii) developing new sources of agricultural growth; and (iii) ensuring wider participation of the poor in agricultural growth. Programs incorporating these priorities should be formulated and implemented in several phases over the next two or three decades. Each phase, representing a time slice, will build on and incorporate the previous stages. This is consistent with the country's resource constraints which dictate prioritization and sequencing of programs.

Increasing Agricultural Productivity

5.11 Increasing farm productivity will be critical to agricultural growth and will present the most daunting challenge in the next decades. Increase in yields has not been a significant source of growth for most agricultural commodities, except wheat and sunflower, both of which are largely produced by commercial farmers. Much of the sector's growth has been due to expansion in cultivated land. While land expansion has worked in the past and, perhaps, remains critical to future growth, yield increases are vital. Not only will simultaneous increase in yields and cropped land ensure better efficiency in resource use and increased production, it will reduce the amount of land required to meet demand resulting from rapid population growth. For example, a four percent annual increase in the average yield of maize would be sufficient for the decade to meet Zambia's incremental demand for maize without expansion in land cropped. Also owing to acidity and deforestation problems, expansion in maize production through increases in cultivated land alone is not environmentally sustainable in most parts of Zambia in the long run. Improvements in maize productivity are therefore critical. Similarly, increased land use for other crops and livestock production will generally have adverse environmental effects.

5.12 Increasing agricultural productivity will critically depend on smallholder access to improved agricultural research, extension, and credit services, as well to increased

provision of rural infrastructure and human capital services in rural areas. Increased yields for maize and other crops will come from the adoption of sound husbandry practices and labor-saving technologies (e.g., intercropping and on-farm transportation). In livestock, improved productivity is possible with the adoption of better animal health and nutrition practices.

5.13 Agricultural Research. Improvements in crop research will require a substantial increase in public investments, managerial changes, establishment of an efficient breeding program, reconciliation between food security and trade objectives, and designing workable strategies to overcome soil acidity. These will interact with farmer investments to improve productivity. Public investments in the research program should aim to: (i) upgrade staff morale and quality by satisfactory compensation packages and infusion of accountability; (ii) improve the research infrastructure (i.e., research stations and projects); and (iii) strengthen the annual research operation budgets. Measures to reform the management of the national research program have been identified earlier. Increasing smallholder access to research output can best be achieved by gearing adaptive research activities to the relevant needs and constraints of smallholders, possibly by designing a **participative on-farm research program**, and by strengthening the linkages between research and extension.

5.14 An efficient local seed multiplication or breeding program, with strong links to the extension program, is necessary to connect the adaptive research program with farmers. At present, Zambia prudently contracts the production of improved varieties to the large-scale commercial farmers who have the technical and financial capacity to produce improved seeds. This strategy should be continued and extended to the livestock breeding program.

5.15 The linkages between food security and trade objectives in the research program need reconciliation. Traditional food crops (e.g., sorghum, millet, cassava, and finger millet) have begun to attract attention within the commodity research program but are outside the adaptive research program. Industrial crops (i.e., tobacco, cotton, soyabean, and groundnuts) have received reasonable research attention, while maize and wheat have been the centerpieces of the agricultural research program. Maize is, perhaps, the only crop with appropriate technical packages for all types of farmers in the country. Consequently, both research and extension, supported with pricing and marketing policy, have expanded maize production at the expense of other crops. This bias in research and extension for maize needs to be altered to permit diversification in the sector. In particular, increased attention should be directed toward suitable crop varieties that make maximum use of the large land resource with acidic and low-fertility soils on which smallholders practice shifting cultivation.

5.16 Research on alternative strategies for the problem of increasing soil acidity on permanently cultivated land is also needed. The following deserve priority: the use of acid-tolerant crops such as millet, sorghum, cassava, and finger millet; "fundikila" cultivation (i.e., burying organic matter during cultivation); alternative crop husbandry; and liming. Research breakthroughs in these areas could have significant impact on both agricultural productivity and growth in smallholder agriculture. Underlying their development should be efforts to maximize the use of abundant land and to optimize the use of limited labor supply and foreign exchange. DRC and/or economic rate of return analyses should be used to determine and monitor research priorities over time. Finally, continued research into fertilizer response curves, especially for cereals, in different agroecological areas would be justified.

5.17 Changes in livestock research should emphasize: (i) adaptive strategies for integrating animal genetics, diseases, nutrition with animal husbandry; (ii) research and breeding in native cattle; (iii) limiting Government's role to provision of support services; and (iv) financing arrangements for supply of dairy stocks to smallholders. In the livestock subsector, the main emphasis of the research program has been supply-determined and placed on disease prevention and cure. Adaptive animal research, integrating animal genetics, disease cure, nutrition, and husbandry, remains unknown in Zambia. Despite the critical role of animal nutrition and feed supply in improving livestock productivity in Zambia, little attention and effort have been focused on these areas. Feed production and conservation, which are crucial to improving animal feed supply in the country are yet to be addressed.

5.18 The animal breeding research program has achieved some success in cross-breeds, to the neglect of animal nutrition research and improving productivity among native cattle breeds. Animal nutrition research is critical to improving livestock production in Zambia and should go beyond the analysis of roughage nutrients. It should explore the integration of: (i) improvements in the use and quality of agricultural waste; (ii) production of on-farm feeds/fodder; and (iii) improvements in the quality of commercial feeds.

5.19 Research on native cattle can have considerable payoffs since these animals are numerous and distributed among smallholders in many parts of the country. Key elements in a strategy for improving productivity in native cattle breeds consist of (i) increased use and quality of agricultural byproducts; (ii) genetic improvements; and (iii) improvements in herd management. These are complementary to and reinforce one another.

5.20 Livestock breeding in Zambia is limited to purebred and crossbred cattle on state farms and private commercial farms, which stocks constitute a considerable resource. Few exotic animals have gone into the smallholder sector for two reasons: Incentive for an effective public breeding program is minimal as a result of human and financial resource constraints; and Government policy has not allowed commercial stocks to become a major source of breeding material for smallholders; breed importation is preferred. Private sector livestock breeding is limited to some large-scale operations, mainly within the beef subsector. Secondly, interactions between commercial farmers and smallholders have been discouraged by distortions created by state interventions (e.g., subsidized supply of imported or locally bred heifers and bulls) and the absence of a well-organized credit program for smallholders to purchase breeding stock.

5.21 To be more effective, animal breeding strategy should aim at increasing smallholder participation by: (i) ensuring effective interactions between commercial farmers and smallholders through credit facilities to the latter and removal of state interventions; (ii) establishment of group breeding associations or cooperatives in which farmers contribute top-performing females to a nucleus herd, decide on the location and management of the nucleus herd, and make further selection of top performers with the assistance of extension workers. The advantages associated with breeding associations include ensuring breeding of different types of crossbred (native) animals for various ecological conditions in the country (regional orientation) and permitting the limited technical expertise of the Ministry of Agriculture to be concentrated on the nucleus herd where screened females can be given back to contributors.

5.22 The role of the Government in livestock breeding should be limited to providing support to private farmers by creating the necessary incentives and establishing

neutral regulations. Elimination of existing market distortions and setting quality standards and control via certification of marketed breeding animals should be accorded priority.

5.23 Zambia is fortunate that an improved dairy stock is already available in the commercial sector. What is missing is a way to organize and finance the purchase and distribution of surplus stock to smallholders. If, for example, 500 selected bull calves per year were sold to selected potential dairy farmers, this would have a powerful long-term impact on milk production at little cost. The Dairy Products Board (DPB) should encourage large-scale commercial farmers to raise dairy bull calves for sale to smallholders. DPB should arrange credit facilities to smallholder buyers of bull calves. Apart from the purchase value of a bull calf, the total amount of credit and investment required at the farm level is likely to be minimal.

5.24 Agricultural Extension. The basic organizational framework for delivery of agricultural extension services is in place because the Ministry of Agriculture has prepared a National Extension Action Plan, with T&V as the basic management system. Some elements of the strategy proposed in this report are derived from this plan. Increasing the participation of smallholders in agricultural extension is key to improving their agricultural productivity. Ensuring that the extension program is demand-driven, rather than supply-driven, as present, requires implementation of some of the following:

- (i) Integrating adaptive research with extension services, as has been done under the ARPT approach in some regions. It should be continued and adequately funded.
- (ii) Determining commodity-specific extension priorities based on comparative advantage or economic rate of return, modified to take into account the commodity's impact on the environment and poverty alleviation among the poorest of the poor.
- (iii) Focusing extension advice to smallholders on technologies or technical packages that address real problems such as ways to counter soil acidity, conservation-based farming (e.g., soil and water conservation), labor-minimizing technologies (e.g., phased intercropping), participation of local groups in control and management of natural resources, improved husbandry practices (e.g., early planting, proper weeding, and correct plant population), integration of crops and livestock, and human capital development (e.g., food security, nutrition and health programs).
- (iv) Paying high priority by extension workers to improved husbandry practices for both crops and livestock. Fertilizers and genetic improvements do not improve productivity unless husbandry practices are optimal. Lack of effective and appropriate extension for animal husbandry and health has suppressed better utilization of the genetic potential of the native cattle herd.

5.25 Investments in improved technology by both farmers and Government can have high returns, but this is constrained by resources and poor management of extension. Recent reductions in Government budgets for agricultural research and extension have been

contrary to Zambia's economic growth and, possibly, the sector's comparative advantage in the economy. Due to persistent budget cuts over the past decade, the agricultural research and extension programs face similar issues: inadequate budgetary funding, shortage of staff with appropriate experience as a result of high staff turnover, lack of priorities within the program, and poor management. These problems have limited the program's coverage and quality of services to smallholders.

5.26 Efforts to improve the agricultural extension program should concentrate on removing the above constraints, especially management and delivery of services to farmers. Reallocation of budgetary resources to extension activities with high priority should be pursued within the framework of the public investment program and annual budgets.

5.27 Rural Financial Services. Increasing smallholders' access to credit is critical to farm investment and adoption of new technology to increase agricultural productivity, but Government credit programs have been less successful in this. Zambian experience in providing rural financial services has demonstrated that extending credit to smallholders is costly to lenders; transaction costs are high and the risk is great due to lack of collateral; subsidized public credit programs are detrimental to the development of sustainable and viable rural financial markets; and cheap credit has not necessarily reached target groups. In short, past Government interventions in the rural financial markets have damaged the rural financial sector and failed to expand credit to smallholders and the rural poor.

5.28 Development of viable rural financial markets that can help make the best use of farm investments by both the public sector and farmers is a vital priority. This can be achieved by developing more innovative programs targeted at smallholders, including women. To sustain viability of future credit programs, financial institutions should be permitted to charge positive interest rates. The first step in this direction should be to make ZCF-FS (Zambia Cooperative Federation-Financial Services) revert to its original concepts and practice as a smallholder farmer savings and loan association operating with a high degree of autonomy and flexibility. In addition, the development of less formal financial institutions--such as rotating associations (like the Susu in Ghana), women's savings clubs (as in Zimbabwe), and farmers' credit clubs (as in Malawi) should be encouraged. These informal financial institutions may: (i) have participating members pay an agreed sum into a fund, out of which loans are made to members, thus providing both credit and saving facilities; (ii) link repayment to future lending; (iii) reduce intermediation costs to both lenders and borrowers; (iv) train staff and borrowers; and (v) engage in group lending under which one member's failure to repay jeopardizes the group's access to future credit (joint liability to reduce risk of default).

5.29 Existing financial institutions must be strengthened. Both the Lima Bank and ZCF-FS urgently need organizational and financial restructuring in addition to reform of their operating procedures and policies. Both institutions should reorient their operating policies toward lending mainly to groups and examine the possibility of promoting the establishment of groups. Although initially the overall costs of group lending are likely to be higher than the costs of lending to individuals, in the long run the benefits should exceed the costs. In some cases, however, group lending may not be necessary. For example, individual loans without collateral to women farmers may be justified if the loans are initially low and can be made on the basis of character references from local women or NGO officials.

5.30 Both the Lima Bank and ZCF-FS should also consider using local and international NGOs for disbursing loans to farmers participating in NGO-supported activities. Loan disbursements through NGO village outposts could be made on the basis of agreed principles which include, among other things, linking repayment to future lending. NGOs could also be used for mobilizing and establishing credit and savings groups in areas under their jurisdiction.

5.31 In order to minimize the shortcomings associated with informal finance, namely its separation from larger financial markets and their funds, the Lima Bank and ZCF-FS could use informal financial institutions as intermediaries for lending and savings mobilization purposes. Care should, however, be exercised to ensure that such linkages do not stifle or damage group initiatives or result in excessive control of groups by formal financial institutions.

5.32 **Rural Infrastructure.** Improvements in rural infrastructure are critical to expanding smallholder access to the opportunities created by the improved policy and institutional framework and public investment in basic agricultural services. They are also key to the nature of response to opportunities created by the private sector. One of the best strategies for improving rural infrastructure in Zambia appears to lie in involving target groups, local institutions, and NGOs in the planning, design, and implementation of specific infrastructure. This ensures that projects respond to local needs and are demand-driven (i.e; owned and managed by the people for the people). This approach ought to be adopted for developing local markets, agroprocessing, rural roads, and transportation services.

5.33 The role of local institutions (e.g., local authorities) and local NGOs should be to mobilize the target beneficiaries and provide them with necessary technical support. The development of infrastructure will also provide non-farm employment opportunities to the target group, thereby improving incomes and human capital development, particularly of the rural poor (e.g., wage laborers), in some cases in slack seasons. For example, the construction and maintenance of feeder roads, rural storage, and lime extraction can be done after crop harvesting.

5.34 **Human Capital Development.** Efforts to improve agricultural productivity in Zambia are unlikely to succeed in the long run without greater investment in human capital. Improvements in farmer training, health, nutrition, and family planning will directly and indirectly have a positive impact on agricultural productivity in smallholder agriculture. Social services are therefore an essential element of any long-term strategy for improving agricultural productivity.

5.35 Zambia needs to devise better ways of increasing the rural poor's access to basic social services. For this purpose a number of options can be pursued to:

- (i) Increase the availability of physical facilities and services for training, health, and family planning in rural areas.
- (ii) Improve the quality of rural services by allocating more funds and staff, making better use of available resources, and ensuring greater accountability in their administration.

- (iii) Increase the participation of target groups in the planning, design, and implementation of social service programs.
- (iv) Ensure Government commitment, with international cooperation, to providing new social services to the rural poor and to making existing services more effective.

5.36 It is clear that the principal beneficiaries of public investments and changes in basic agriculture services and improvements in infrastructure will be smallholders. It will take time for these changes and improvements to be translated into significant output growth. Considerable improvements in agricultural productivity can only be expected over the medium and long term. The key to maximizing agricultural growth through productivity increases will be the coordination of public investment in agricultural services and infrastructure, rather than the strengthening of individual components. Equally important, a precondition will be the coordination of these investments with policy and institutional changes. This can be achieved through the perspective and annual planning process (e.g, the traditional five-year plans) of Government, in which optimal sequencing of the measures can be achieved. Annual Policy Framework Papers (PFPs), prepared jointly by Government, Bank and IMF, can also be used as a mechanism for coordination. At the sectoral level, it is proposed to initiate annual Agriculture Framework Papers (AFPs), to be prepared jointly by Government and Bank, in which the priorities and timing of adjustment changes will be set out. The AFP will be a vehicle for encouraging greater government participation and commitment to key changes in policy, institutions and investments. By reviewing and agreeing annually with the Bank on the specifics of the agricultural adjustment program, Government will be able to coordinate such changes in a mutually supportive manner. The AFP will thus be a vital document for coordinating external support to sectoral adjustment and growth.

Developing New Sources of Growth

5.37 The predominance of maize in sectoral output is a major strategic issue in Zambian agriculture. There is need to diversify agricultural production. Zambia's resource base and agroclimatic conditions permit production of a wide range of commodities. Zambia needs to make better use of its considerable soils, water, livestock, fisheries, forestry, and wildlife resources -- all of which have high-growth potential. Increased production in non-crop subsectors would result in diversifying the entire sector.

5.38 Implementation of the proposed policy and institutional changes, strengthening of the research and extension services, and improvements in infrastructure will play key roles in developing new sources of growth in all subsectors. Similarly, participation by smallholders in fostering these new sources of growth will be critical to agricultural development that reduces poverty and increases farm or rural incomes in the long term. Opening up international trade will also encourage diversification.

5.39 **Crop Subsector.** Considerable differences in resource use efficiency and marginal productivity (value added) among crops indicate crop substitution possibilities among all categories of farmers in Zambia. It is possible that production of a specific crop or group of commodities can be expanded at the expense of other crops, while at the same time improving the efficiency of resource use at the farm level.

5.40 In Zambia, it is possible to increase the production of other crops without replacing maize. This can be achieved by expanding land planted to other crops without reducing the area under maize. Environmental and labor supply constraints, however, are likely to pose major problems to a strategy that relies entirely on land expansion. Given the severe environmental and labor constraints, the best option may entail lagged intercropping or changes in farming systems that permit saving labor and land at the same time. For example, lagged intercropping between maize and cowpeas/beans, sunflower and groundnuts/beans/soyabean can result in diversification of farm production even under severe labor constraints.

5.41 Elimination of market distortions (especially maize-related subsidies) is a precondition for diversifying production. The financial profitability of maize, in terms of return to land and labor, has been artificially exaggerated by the subsidies on fertilizers and maize consumption.

5.42 Zambia's crop diversification options are many. They include wheat, cassava, and paddy rice for food crops and cotton, groundnuts, sunflower, tobacco, and soyabean for industrial/export crops. Comparative advantage appears quite strong in the production of cotton, tobacco, oilseeds, and maize for export. These crops should receive high priority in the allocation of public resources for extension and infrastructural development.

5.43 Zambia appears to have exceptionally good comparative advantage in producing maize for export within the PTA (Preferential Trade Area) and SADCC (Southern Africa Development Coordinating Committee) arrangements. The chronic illegal transfers of maize from Zambia to Zaire and Malawi should be legalized, promoted, and expanded. Surplus maize production in Northwestern, Luapula, and Northern provinces can be earmarked for export to Zaire and Angola. The Eastern Province could export maize to Malawi and Mozambique. Maize supply and food production in general are likely to remain constrained in these neighboring countries for the foreseeable future. Zambia has the potential to become the "grain basket" for the region and it should seize this opportunity without delay. The best strategy would be to achieve significant increases in maize yields and other crops as possible.

5.44 Although it should be Government policy to encourage all farmers to produce any crop of their choice, some public policies and programs may be justified to steer commercial farmers from maize production into crops in which they have better comparative advantage than smallholders. Such crops are irrigated wheat, soyabean, tobacco, sunflower, and horticultural crops. Policies and programs that promote irrigation development among commercial farmers would be a necessary condition. This can be supported by establishing a public and donor-supported irrigation fund from which commercial farmers borrow for irrigation development. Irrigation will permit intensification and diversification of large-scale agriculture in Zambia. Economically viable irrigation development is feasible in large-scale agriculture only.

5.45 Smallholder irrigation development is extremely limited. Traditional tenurial systems can hardly support long-term investments in irrigation development. Thus, irrigation is unlikely to become the prime mover for diversification in smallholder agriculture. Changes in farming systems, supported by crop-specific development programs (e.g., coffee and soyabean production schemes by Lintco), and tenurial reform may offer the best options for

diversifying smallholder agriculture. The Lintco schemes should be carefully studied and, if found replicable, be adopted for other commodities of high priority.

5.46 Smallholder diversification can be facilitated by rural agroprocessing that provides a ready market for new crops. Local processing of traditional food crops and oilseeds is also likely to spur production in many parts of the country and thereby facilitate widespread diversification of farm production. The development of a dynamic rural processing industry should therefore receive high priority.

5.47 **Livestock Subsector.** Increased production in the livestock subsector would increase its relative contribution to agricultural growth and production. Slow growth in this subsector, however, has prevented significant structural change in the sector's output. Livestock production is dominated by beef, largely dependent on native breeds that also have the highest potential for growth. The genetic potential of native breeds of sheep and goats, along with that of exotic breeds, is also not fully exploited. The economic costs of doing so are likely to be lower than the importation of purebred cattle and semen material.

5.48 Full exploitation of native herds and flocks requires improvements in feed supply and animal husbandry practices. Similar improvements pertain to exotic herds in smallholder agriculture. Dramatic productivity gains, up to 30 percent, are possible in smallholder livestock without technological (breed) change. Future programs, especially livestock research and extension, should emphasize existing genetic potential over technological change.

5.49 Livestock production expansion, particularly among smallholders, is severely constrained by diseases and tsetse infestation, which have attracted considerable public investment, largely in disease campaigns. Serious cause of mortality and loss, include East Coast Fever (ECF), contagious bovine pleuropneumonia (CBPP), and trypanosomiasis. Although past Government effort has emphasized controlling tsetse infestation, re-infestation has occurred in trust lands where smallholders graze. An alternative strategy is to focus measures directly on the disease through the use of prophylactic drugs rather than the vector. While likely to be more cost-effective, the effort requires substantial improvements in the delivery of veterinary services, coupled with a sound arrangement for cost recovery from farmers. This strategy should become the main thrust of Government policy to increase livestock production. Long-term research should be directed at biological control of the tsetse fly, possibly within SADCC countries.

5.50 The long period required to develop smallholder dairying is rarely appreciated or fully understood in Zambia. It takes up to 15 years to upgrade a given herd to first generation crossbreeds and 20 years to upgrade to 75 percent improved breeds. Upgrading, although slow, is perhaps the cheapest and least risky strategy for dairy development in Zambia. A major constraint, however, has been an almost exclusive reliance on the purchase of crossbred heifers rather than upgrading bulls. Bull upgrading has multiplier effects on the growth of the upgraded herd. Future smallholder dairy development projects should be based on this strategy and less emphasis should be placed on the supply of crossbred heifers.

5.51 Zambia's poultry industry has export potential for chicks and eggs within a regional trade context. Availability of quality feed, vaccines, and chicks is critical to such expansion. The poultry industry has shown its ability to expand rapidly in response to

increased demand. The following measures would, however, be necessary before rapid expansion in the industry can be envisaged in the short and medium term:

- (i) Removal of entry barriers in the production and compounding of poultry feeds so that the market concentration, enjoyed by INDECO mills, can be reduced to make the industry more competitive.
- (ii) Promotion of traditional crops (e.g., cassava, sorghum, and millet) in feed production, instead of maize, which is more expensive and has a relatively elastic demand.
- (iii) Encouraging cooperatives and private entrepreneurs in outlying rural areas to establish small feed compounding plants using pre-mixes prepared by large-scale feed producers.

5.52 Due to supply constraints for quality feeds, vaccines, and vitamins, the production of broiler meat for the domestic market is currently not resource-use efficient. This is soon expected to change with availability of more foreign exchange for importing these items under the open general license system recently adopted by Government.

5.53 Natural Resources. Management and utilization of natural resources, though critical to sustainable agriculture, have not been accorded proper attention in public policy and program formulation. Indeed, inappropriate policies (e.g., fertilizer subsidies and pricing policies), as well as weak institutional capacity, have been at the heart of Zambia's natural resource degradation. An effective strategy for increasing the contribution of natural resources to economic growth and diversification must begin with improving public policy and program formulation and strengthening institutional capacity. Equally important will be the involvement of target beneficiaries in policies and programs.

5.54 Soils. Maize price decontrol and the removal of fertilizer subsidies will help reduce fertilizer use in areas prone to soil acidity. In these areas maize production will decline as the returns to production above local requirements are lowered, and acid-tolerant crops might become more profitable than maize. Fertilizer use is therefore likely to be concentrated in agroecological zones in which its use provides the highest returns.

5.55 Policy incentives are needed to encourage environmentally sound agricultural practices. Policies that set low fixed interest rates and charcoal prices need to be reconsidered. Incentives could, for example, be offered to establish lime-crushing plants that are labor-intensive, easy to operate, and close to the many deposit sites located in most provinces. An incentive structure could also be developed to encourage small-scale farmers to utilize lime, e.g., temporary subsidies. In addition, tax rebates for conservation tillage should be introduced among medium- and large-scale farmers. Tenurial reforms would also encourage smallholders to invest in long-term conservation measures.

5.56 Research and extension should be devoted to developing and disseminating technological options to counter soil acidity, including liming. Improved crop husbandry and land use practices such as organic farming, crop rotation, and intercropping should also be explored. Research into the rotation of maize with legumes, such as soyabbeans and groundnuts, to help increase maize yields without a heavy application of fertilizers could also be undertaken. Conservation tillage, involving the retention of stubble and residue on the

land, minimum soil tillage, and direct planting of seed with fertilizer into the soil could similarly be promoted. The cultivation of acid-tolerant crops on acidic soils should be promoted by the extension service.

5.57 Water. Irrigation will be key to agricultural diversification, export orientation, and yield increases in medium- and large-scale agriculture. In the medium and long term, Zambia should focus on four components to develop its irrigation potential: (i) institutional improvements, (ii) staff development, (iii) adaptive irrigation research and extension, and (iv) promotion of irrigation development in medium- and large-scale agriculture.

5.58 The Irrigation and Land Husbandry Division (ILHD) in the Ministry of Agriculture needs to be strengthened. This should entail defining its responsibilities, appropriate staffing at national and provincial levels, and adequate funding for its irrigation development activities. ILHD should be responsible for formulating irrigation policy and determining irrigation priorities and for providing irrigation advice to the farming community. The Division should focus on providing services to farmers rather than controlling or managing public irrigation schemes. ILHD should also be responsible for managing or carrying out major irrigation studies (e.g., water inventory, water master plan) intended to facilitate its services to farmers. For this purpose, the Division's organizational structure should be such that it is capable, in an integrated manner, to undertake or manage the following tasks: (i) preliminary investigations or studies; (ii) planning and designing major construction and maintenance works; (iii) establishing guidelines and standards; and (iv) providing technical backstopping to provincial agricultural staff and individual farmers or irrigation scheme participants.

5.59 ILHD is currently understaffed. More established positions should be provided for an irrigation engineer, irrigation agronomist, and an irrigation economist to assist the divisional head. Irrigation technicians and agronomists need to be recruited for provinces with high irrigation potential in the medium term. The senior appointments in the Division would initially be in the form of technical assistance since Zambians with the requisite qualifications and experience are not likely to be available. Adequate funding at both the head office and provincial levels would be necessary for the provision of equipment, housing, and operating expenditures.

5.60 As part of its long-term strategy, ILHD needs to develop a staff training program centered on recruiting graduate engineers and agronomists to undergo graduate training in irrigation engineering and agronomy, respectively. Since both specialties are not offered at local universities, external training will be necessary.

5.61 Zambia's infant adaptive research and extension systems do not include irrigation aspects of crop production. As technical staff in irrigation become available to priority provinces, the system should be expanded to include irrigation. At the same time, more results-oriented basic research in irrigation engineering, soil mechanics, hydrology, and irrigation agronomy should be undertaken. Such basic research would provide the launching pad for adaptive irrigation research.

5.62 An appropriate investment strategy for developing Zambia's irrigation potential should focus on mobilizing and supporting private initiatives for irrigation development. Medium- and large-scale farmers' investment in irrigation schemes should be

encouraged through development of profitable export crop technologies by the research system and of export markets. Attention should particularly focus on irrigated horticultural varieties, oilseeds, and coffee. Higher yields than current ones in these crops would be required to justify farmers' investment in irrigation. Public investments should be aimed at providing support and financial services to the private sector. Direct public investment in irrigation schemes or projects should be avoided, since such past investments have been disappointing and unjustified (e.g., in state farms managed by parastatals). Areas in which direct public investment would be instrumental to irrigation are: irrigation knowledge; credit facility for irrigation development; and reforms in traditional tenurial systems.

5.63 Given an information void, investment should initially concentrate on improving knowledge about the sector's potential and viability, including: (i) resource inventory; (ii) water balance studies, and (iii) water master plan. Investment by the Government in the above studies would require donor support to provide both financial and technical assistance. These will be provided under the Japanese Grant Facility during 1992-93.

5.64 Public investments also should be earmarked to provide "seed money" for facilitating private investment in irrigation development. Shortage of medium-term credit has, to a large extent, constrained the development of irrigation by commercial farmers. Establishment of an Irrigation Development Fund, proposed by Government, would facilitate and stimulate private participation. This facility should be administered on a commercial and self-sustaining basis by an appointed financial institution.

5.65 **Fisheries.** This subsector has high-growth potential and one of the best opportunities for diversifying agriculture's output in the medium term. To date, its performance has been poor. Fish production in the last five years has been static. Per capita consumption of fish has declined by more than 100 percent since 1970, from about 17 kg (fresh fish equivalent) to about 8 kg. Fish traditionally constitute 55 percent of annual protein consumed.

5.66 Broadly, problems in the fisheries subsector have been identified as inefficient practices in harvesting due to poor knowledge; lack of technology; inadequate supply of materials; and inefficient marketing system. Issues such as technology, institutional support, stocks, marketing, and rural infrastructure need to be addressed.

5.67 Small-scale traditional production and marketing are by far the most important. Small-scale fishermen operate from more than 2,100 fishing settlements. They generally fish at night using dug-out canoes and some wooden plank boats and a small number of motorized boats. Most of these fishermen paddle boats a short distance from shore and use lamps to attract fish. Day beach seining and set nets are also common. Although fishing throughout the country continues all year, the catch varies seasonally.

5.68 Industrial fisheries operate under license and use pontoon rigs, purse seine, and lift nets, mainly in Lake Kariba and Lake Tanganyika. The Copperbelt and Lusaka markets are important to both fisheries. Many industrial fisheries are vertically integrated operations with cold storage, freezing, ice-making, and transport facilities.

5.69 Primary fish resources are concentrated in eight areas. These fish resources consist mainly of kapenta (a sardine-like fish), nile perch, bukabuka, and bream. Fish

production averaged about 60,000 tons a year during 1987-88. The safe production limit in all waters is estimated at about 80,000 tons. Greater exploitation of these resources is possible on a sustainable basis.

5.70 An important first step in developing the fisheries subsector is the formulation of a long-term strategy. A sector study supported by short-term plans for implementation needs to be prepared. Such a study should identify high-priority programs and formulate a short- to medium-term strategy for the sector. Several attempts have been made to do such a study, but none has been completed and no clear strategy has been established. It is expected that the study will be prepared under the approved Japanese Grant Facility.

5.71 **Forestry.** Zambia's forestry resources have considerable potential to contribute to overall agricultural growth. About 50 percent of the land is covered by forest and bushes, one of the highest rates of coverage in sub-Saharan Africa. The miombo forests, accounting for 80 percent of the country's forests, support diverse wildlife. Teak, mahogany, ebony, mukwa, and other high-value tropical woods are interspersed in the miombo forests.

5.72 As with other natural resources, a strategy for improved management and utilization of forestry resources must entail policy and institutional changes, as well the implementation of specific programs. User charges (e.g., stumpage and charcoal prices), for example, must reflect the long-term costs of replacing trees. The institutional capacity for implementing such policy measures must be strengthened. While the Forest Department has authority to ensure sustainable management and utilization of forestry resources, it has no implementation capacity.

5.73 Several institutional options for improving growth in the forestry subsector, include:

- (i) Allocating more budgetary resources for forestry research, extension, and conservation.
- (ii) Involving the beneficiaries of forestry products in the planning and management of forest use, through local institutions.
- (iii) Designing and implementing forestry projects with special emphasis on improved management and conservation of existing natural forests in state and trust lands.
- (iv) Designing and implementing projects for fuelwood production and efficient techniques of charcoal production and use in proximity to major urban centers.
- (v) Implementing more effective forestry control and stumpage revenue collection systems, particularly in national forestry reserves.
- (vi) Integrating improved and yield-increasing crop husbandry practices with agroforestry.

5.74 The export ban on forestry resources, including timber, is not necessary and should be removed. Instead, Zambia should embark on export promotion of its forestry

resources. There are good export prospects for Zambian timber in the Republic of South Africa. ZAFFICO, a forestry management and timber-producing parastatal, is capable of producing exotic timber of export quality. Removal of the timber export ban should attract private investment in timber production.

5.75 A forestry development strategy needs to be formulated to guide future investments in the sector. This will be done under the Japanese Grant Facility in the next two years.

5.76 **Wildlife.** Zambia has one of the richest and most diverse wildlife resources in the world, although its utilization and contribution to overall economic growth, have remained depressed. Zambia's 19 national parks and 32 game management areas (GMAs) are not effectively protected and managed. Wildlife could become a major source of foreign exchange earnings through tourism. Tourism in Zambia is, however, not well developed, with only two national parks so utilized.

5.77 The National Parks and Wildlife Services (NPWS), responsible for the protection and management of wildlife, has developed the ADMADE (Administrative Management Design for Game Management Area) framework for managing wildlife resources on a sustainable basis. This approach involves local people in conservation of wildlife, while permitting them to enjoy the benefits of utilizing the wildlife resources under their jurisdiction.

5.78 ADMADE is based on grassroots participation in which local leaders are responsible for designated wildlife management units. Local people are selected and trained as village scouts to control illegal hunting in their game management area (GMA). Village scouts work closely with the unit leader who, in turn, is linked to the NPWS local staff. ADMADE also ensures that most revenue generated from tourism or other forms of wildlife utilization is used for local community improvements and wildlife management costs of the local GMA.

5.79 Reportedly, poaching has been dramatically reduced where ADMADE is in operation. For example, poaching of rhinos and elephants in Lupande area of the Luangwa Valley has been reduced by 90 percent since the introduction of village scouts in 1985.

5.80 A tourism development strategy is an essential component of any strategy for wildlife conservation and management in the country. Both are still lacking, but it is expected that they will be developed under the Japanese Grant Facility. Promotion of private game farming or ranching, in infancy among a few large-scale farmers in Zambia, should be examined during preparation of the wildlife development strategy.

Ensuring Wider Participation in Agricultural Development

5.81 Wider participation of the rural poor and women can be achieved by: facilitating access to rural infrastructure and human capital facilities and services; greater private sector role in the development process; and strengthening the cooperative movement. Central to Zambian policymakers in the next 10-15 decades should be the equity of economic growth resulting from the economic adjustment program. Employment and income opportunities are essential components of economic equity.

5.82 Participation of Rural Poor in Growth. Increasing participation of and access by the rural poor and women to basic agricultural services, human capital facilities and services, rural infrastructure, and other public programs will be critical to poverty reduction in the medium and long term. Concern over poverty issues is likely to intensify under the adjustment program due to:

- (i) Inadequate and poor supply and quality of public services programs in rural areas;
- (ii) A temporary decline in real incomes, eroding purchasing power of the poor;
- (iii) Unstable producer prices for farm inputs and products, jeopardizing income gains and access to food by low-income consumers in the short and medium term;
- (iv) Sudden increases in prices of basic foods causing nutritional vulnerability among the poor; and
- (v) Increase in absolute number of the poor, albeit currently unknown, as the result of emerging structural changes.

5.83 Zambia's primary focus should be on recovery of economic growth and achieving diversification to provide additional income and employment and to generate resources for poverty alleviation programs. Recent empirical evidence from many developing countries, however, indicates that economic growth alone is insufficient to reduce poverty rapidly. Zambia, therefore, needs to supplement its growth- and diversification-oriented policies with clearly defined poverty alleviation initiatives. Within agriculture, the proposed shift in emphasis from maize to other crops (especially export crops) will help to direct the attention of research, extension, and other development programs to groups of poor farmers who have been neglected in the past. There is also scope for broadening the effects of some ongoing programs (such as crop-specific and livestock programs) to reach smallholders.

5.84 In addition, focusing rural investment on projects and programs (e.g., rural infrastructure and agro-industries) that stimulate demand for unskilled labor and raise real wages and provide incentives for rural investment in human capital may help to reduce rural poverty. In pursuit of social justice, however, Zambia should avoid its past mistakes of implementing poverty alleviation programs that cannot be sustained in the long run. Instead, Government should pursue the following options:

- (i) Gradual devolution of responsibility for finance and implementation of services intended for the rural poor to the local level to improve efficiency and equity. Programs with community participation coordinated by village-level officials or local NGOs are likely to be more successful than those without such participation. Such programs are likely to be demand-driven and at appropriate standards.
- (ii) Help to rural communities to organize themselves by focusing on training, regulating, and financial support to the poorest of the rural poor. Since Government is unlikely to provide much financial

support, self-financed community schemes that match needs to available resources should receive priority. For example, villages should be encouraged to form rural road crews to ensure effective maintenance.

- (iii) Payment for services provided by public programs by all recipients except subsidy target groups. This would give users an incentive to consume economically and to monitor efficiency. User charges, covering development as well as operational costs, would reduce the bias in favor of expansion over maintenance.
- (iv) Emphasis on maintaining and improving existing systems, making them more accessible to the poor and developing small community-controlled facilities. Public spending to expand services should only be considered if it creates employment and income opportunities for the poor on a sustainable basis.

5.85 In addition to liberalizing the maize marketing system as a strategy to minimize the impact of rising food prices during adjustment, Government should also promote the rehabilitation of small hammer mills in outlying districts and establishment of additional hammer mills for maize, millet, sorghum, finger millet, and cassava and vegetable oil processing. Due to local processing and marketing, grain meal and vegetable oils would become increasingly available in outlying markets at reasonable prices (in part because of reduced transport costs). The availability and proximity of such processing facilities should also release a substantial amount of female labor for farming activities. Similarly, the establishment of private grain mills in and around major urban centers should be encouraged. This would enable urban consumers to purchase grain directly from producers or in local markets and have it milled at cheaper prices than those of industrial millers. Although prevalent in East African, this alternative is lacking in Zambian cities, because of Government interventions in grain marketing and pricing.

5.86 The coupon subsidy system should be retained as safeguard to vulnerable maize consumers in urban areas. The system should also include traditional grains (especially sorghum, millet, finger millet, and cassava) to encourage their processing and consumption in urban areas. Grain meal made available through the coupon subsidy scheme should be milled at a single extraction rate which produces a meal (in its bran content) between roller meal and breakfast meal (i.e., at an extraction rate of 83%). This, together with the introduction of meal from local grains and cassava, would improve the nutritional quality of subsidized meal intended for the poor and undernourished.

5.87 **Women.** The role of women in agriculture and their responsibilities as food producers and providers needs to be explicitly recognized in the formulation of agricultural policies and in designing better targeted programs to address the key constraints they face in improving their agricultural productivity and reducing rural poverty. While effort has been made to overcome some of the key constraints women face, it has not gone far enough to enhance women's access to land, technology, extension, credit, and human capital services. For this purpose the following policy options and strategies could be helpful:

- (i) Legal recognition of women's rights to land through reforms in the traditional land tenure systems.

- (ii) More attention to female time- and labor-saving technologies by agricultural adaptive research, with special attention to intercropping and on-farm processing technologies.
- (iii) Extension services targeted on female-headed households and women in general. More female extension agents are needed.
- (iv) Better access by women to credit and human capital services.

5.88 Private Sector Development. Private sector participation in agricultural marketing, input distribution, and agroprocessing has been stifled by Government policy even though it has clear comparative advantage over direct public involvement. For instance, large- and medium-scale flour milling by the private sector was nationalized in 1987, following the food riots. Private sector participation in maize marketing and fertilizer distribution has been discouraged as a matter of policy. It is increasingly being recognized, however, that investment, growth, and a non-copper export drive will hinge crucially on the ability of the private sector to play a leading role in the economy.

5.89 In agroprocessing, for example, almost all the increment in productive capacity will have to come from the private sector rather than the cooperative or parastatal sectors dependent on Government financing. Deregulation measures under the adjustment program will be key to improving economic efficiency and private sector incentives. The major challenge in the future will be to deregulate, while ensuring that the financial system and the monetary policies under adjustment are compatible with credit needs of the private sector. In this regard, the level of interest rates and, hence, rate of inflation, will be important to private sector borrowing and investment.

5.90 Government will also have an important supportive role to play in four areas: (i) improving physical and social infrastructure; (ii) expanding technology development and export marketing; (iii) developing an autonomous and efficient cooperative movement; and (iv) creating a legal framework (e.g., investment code, tariff and taxation reforms) conducive to private sector involvement in agriculture-related activities.

5.91 Some of the most difficult and complex regulatory issues affecting the private sector lie in the area of agricultural policy. In order to facilitate private sector participation in grain marketing and processing, for example, Government will have to eliminate fertilizer subsidies for maize, maize consumer subsidies, maize marketing restrictions, and existing restrictions in transport tariffs.

5.92 The ability of private enterprises to respond to policy and institutional changes and public investments in rural infrastructure will depend critically upon complementary rural financial sector development. Rural credit markets are highly fragmented, with large differences in access to credit by individual borrowers. Financial innovation in rural finance is totally lacking and there are insufficient instruments for risk dispersion. At the institutional level, there is need to improve portfolios and financial practices and to reduce intermediation and transaction costs, particularly in agricultural credit institutions. There is also need to increase the volume of term finance and equity for the Lima Bank to provide more stable sources of investment capital. These rural needs should be considered in overall financial context and, hence, proposed reforms should be made contingent upon the preparation of a financial sector strategy to be followed by sector restructuring.

5.93 Cooperative Development. The cooperative movement in Zambia has played a significant role in agricultural marketing and input distribution and its prospects are good, provided its current problems can be overcome. In both cases, the cooperatives have been used as instruments to achieve specific Government policy objectives. Government price controls and subsidies have been implemented largely through the cooperatives in recent years. As a result, cooperatives have been intimately associated with the problems of the country's produce marketing and input distribution systems.

5.94 Unbalanced development within the cooperative system is, perhaps, one of its most serious structural deficiencies. Primary, secondary, and tertiary cooperatives are not at the same level of development. The top-down approach to developing cooperatives has resulted in a cooperative constellation in which the primary cooperative societies (PCSSs) are the weakest. These are usually managed by untrained and non-professional staff and their membership is equally untrained and uninformed. Most of the PCSSs are small and in a weak financial position.

5.95 Provincial cooperatives unions (PCUs), at the secondary level, have been the focal point for most economic activities of the cooperative movement. They are relatively well developed and managed by trained semi-professionals and professionals. Both Government and donor efforts and support have been largely concentrated on PCU development. PCUs do not perceive PCSSs as integral to the cooperative movement and its basic economic mandate, but as collection or distribution points of PCU marketing and input distribution systems.

5.96 PCUs also have had a poor relationship with the Zambia Cooperative Federation (ZCF), the tertiary or apex body, resulting in minimal vertical integration of PCU activities with those of ZCF. ZCF has enjoyed considerable external support from several donors and it has developed as a provider of specialized services (e.g., financial and accounting). It has not succeeded in eluding Government interventions, however. For example, upon abolition of Namboard in 1988, its entire staff was transferred to ZCF, thus burdening the movement with unnecessary overheads.

5.97 Consequent to Government pricing and subsidy policies in agriculture, cooperatives at all levels have suffered and continue to suffer from: (i) financial undercapitalization; (ii) dependence on Government financial support and subsidies; and (iii) Government control and directives. In summary, the cooperative movement in Zambia lacks autonomy, as reflected in the Cooperative Societies Act which provides for extensive interventions by the Government through the registrar of cooperatives and the minister responsible for cooperatives.

5.98 Yet, cooperatives, if autonomous and viable, represent a vital option for increasing participation of the rural poor in overall economic growth in the country. Sustainable development of the cooperative movement in Zambia is possible under a fully liberalized market economy, provided the following policy actions are implemented:

- (i) Minimize Government interventions in the day-to-day management of all cooperatives. This would require amending the Cooperative Societies Act to grant full autonomy to all cooperatives.

- (ii) Restrict Government promotion of cooperatives to training for staff and members and supervision to ensure that the cooperatives operate within the provisions of the law.
- (iii) Encourage direct Government support and promotion of PCSs, the legitimate basis of a successful cooperative movement. While providing such support, Government should recognize that cooperatives are essentially self-help organizations which can only be sustained by active participation of members and not by Government spoonfeeding.
- (iv) Focus government and donor support to PCUs on technical assistance to strengthen managerial capacity. Critical areas of assistance include: operational planning and control, financial planning and control, internal auditing and cost control, and management of transport operations.
- (v) Remove public subsidies on all cooperative operations; instead, cooperatives should be left to operate on a commercial basis and in accordance with the cooperative mandate determined by members of individual cooperatives.

Agricultural Growth Prospects

5.99 Three alternative scenarios incorporating essential elements of the strategic framework presented in this report were developed to examine its impact on agricultural growth and diversification during 1991-2000. The methodology uses the projection of past trends, modified to incorporate "best estimates" of the impact of changes in policy, institutions, and public investments in agricultural services, rural infrastructure, and human capital development.

5.100 A few caveats must be posited concerning the projected impact of proposed strategy on agricultural growth. These effects are projections. They are basically conditional forecasts, since the relationships between policy and technical variables are not certain, nor are they likely to remain stable over the projection period. Subsectoral performance will depend critically on smallholder response to improved incentives and infrastructure. In most cases, subsectoral growth rates have been conservatively estimated, given the difficulties and uncertainties associated with implementation of changes. However, in most subsectors, initial levels of production relative to demand are extremely low, so subsequent higher rates of growth would not substantially affect domestic demand.

Projection Scenarios

5.101 Three scenarios are presented: (i) high growth based on effective and systematic implementation of the proposed strategy; (ii) medium growth based on effective, but less systematic implementation; and (iii) low growth based on partial and uncoordinated implementation. For each scenario, relatively low growth rates have been assumed to reflect substitution effects in the initial stages of implementation and higher growth rates have been assumed in the second half of the decade to capture cumulative effects of implementation. The critical measures underpinning these growth scenarios are summarized below. Expansion

in cultivated area is expected to continue playing a significant role in increasing production of most crops in smallholder agriculture during the first decade of implementation. Increases in yields would be significant in irrigation-based crop production and in livestock production.

5.102 High Growth. Under this scenario, annual growth rates are postulated to be: 9 percent between 1991 and 1995 (compared to 7.2 percent for 1984-88) and 12 percent during 1996-2000.

5.103 To achieve and sustain these growth rates, the following measures need to be implemented in a fully coordinated fashion within the proposed annual Agricultural Framework Paper: (i) policy and institutional changes to improve the price incentive structure for all farmers; (ii) technical and managerial changes in agricultural services and rural financial services and changes in public investments for rural infrastructure and human capital development to improve the non-price incentives for smallholders; (iii) improvements in investment strategies and programs for non-crop subsectors; and (iv) the macroeconomic adjustment program, particularly adjustments in the exchange rate and reduction in domestic rate of inflation.

5.104 Medium Growth. This scenario postulates annual average growth of 6 percent between 1991 and 1995 and 10 percent during 1996-2000. This set of growth rates is conditional upon implementation of the measures in the high-growth scenario, but implementation would not be systematic nor adequately synchronized to optimize their collective impact on agricultural growth and diversification. For example, poor coordination between macroeconomic adjustment and agriculture-specific measures would result in suboptimal effects.

5.105 Low Growth. For this scenario, the average annual growth rates are 3 percent between 1991 and 1995 and 7.5 percent during 1996-2000. Implementation of both macroeconomic and sector-specific reforms necessary for improved sectoral growth would be ad hoc and lag. The sector's average growth rate during 1984-88 could not be sustained and would significantly decline. Some key reforms in the second half of the decade, however, would allow growth to recover to the 1984-88 level.

Results of Scenarios

5.106 Results of the alternative scenarios are presented in Tables 5.1 and 5.2. The difference between the high- and medium-growth scenarios is small. Both scenarios convey the possibility of almost tripling agricultural real GDP by the turn of the century. Major sources of growth would be crops, livestock, and forestry which together would account for almost 93 percent of total agricultural GDP. Increased production in crops and forestry would be due to area expansion, while increased productivity would be the major determinant for livestock, namely beef production in large-scale agriculture (mainly for export), and poultry. Increased beef production in smallholder agriculture would be significant but relatively slow in the initial years, reflecting the need for increased public investment in extension and private investment in improved feed supply before productivity can be increased. The difference between low growth and the other scenarios represents the substantial costs of delayed and unplanned change or no change at all.

5.107 The impact of the alternative scenarios on the sector's structural change (diversification) over the decade is evident in Table 5.2. Under high and medium growth the

crop subsector's share in agricultural GDP gradually declines from 54-55 percent during 1986-91 to 35-37 percent in 2000. Under low growth, the subsector's share also declines, but less significantly, to 41 percent in 2000. The livestock subsector, with high productivity potential, is expected to be the most dynamic subsector. Its share in real GDP would increase from 27-28 percent during 1986-91 to 46-49 percent in 2000. The relative share of natural resources would remain static at 17 percent, despite expected higher rates of growth throughout the period.

5.108 The extent to which projected growth under different scenarios would affect incomes and employment of the rural poor critically depends on the policies and strategies pursued. Emphasis on increasing participation of the rural poor in development programs and services should ensure reduction in rural poverty. In addition, the proposed strategy emphasizes policies which seek to maximize agriculture as an employer.

Table 5.1: Actual and Projected Gross Agricultural Production by Subsector of Origin, 1991-2000
(K Million at 1977 Prices)

Year	Actual	High-growth					Medium-growth				Low-growth			
		1988	1991	1993	1995	2000	1991	1993	1995	2000	1991	1993	1995	2000
Crops	244.00	254.00	283.00	329.50	412.80		241.30	269.80	313.50	387.00	241.00	245.00	282.60	301.60
Livestock	121.00	133.10	171.40	242.80	582.50		126.36	153.90	218.70	483.40	126.00	128.00	197.10	262.80
Forestry	39.00	40.60	45.40	57.40	116.80		39.00	42.75	57.90	109.10	39.00	40.00	48.30	98.25
Fisheries	23.00	23.70	26.00	30.00	38.70		23.28	25.48	27.00	35.90	23.00	23.00	27.00	32.25
Wildlife	13.50	13.80	15.20	18.00	42.40		14.00	14.55	17.10	40.50	14.00	15.00	16.00	36.75
Total	440.50	465.20	541.80	677.70	1193.20		443.93	506.48	634.20	1055.90	443.00	451.00	572.00	731.65

Source: Mission estimates for 1991-2000.

Table 5.2: Actual and Projected Percentage of Gross Agricultural Contribution by Subsector of Origin, 1991-2000
(percent)

Year	Actual	High-growth					Medium-growth				Low-growth			
		1988	1991	1993	1995	2000	1991	1993	1995	2000	1991	1993	1995	2000
Crops	0.55	0.55	0.52	0.49	0.35		0.54	0.53	0.49	0.37	0.54	0.54	0.49	0.41
Livestock	0.27	0.29	0.32	0.36	0.49		0.28	0.30	0.34	0.46	0.28	0.28	0.34	0.36
Forestry	0.09	0.09	0.08	0.08	0.10		0.09	0.08	0.09	0.10	0.09	0.09	0.09	0.13
Fisheries	0.05	0.05	0.05	0.04	0.03		0.05	0.05	0.04	0.03	0.05	0.05	0.05	0.04
Wildlife	0.03	0.03	0.03	0.03	0.04		0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.05
Total	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Rate	20.00	6.00	8.00	13.00	24.00		1.00	7.00	13.00	20.00	1.00	1.00	13.00	6.00

Source: Mission estimates for 1991-2000.

POLICY AND INSTITUTIONAL FRAMEWORK
FOR
AGRICULTURAL GROWTH IN ZAMBIA

Macro Adjustment Policy^{1/}

1. Decontrol of all prices of products and inputs, except for maize which will be decontrolled in 1993.

<u>Objectives and Targets</u>	<u>Complementary Agricultural Strategy and Policies^{2/}</u>	<u>Expected Specific Impact on Agriculture</u>
<ul style="list-style-type: none">a. Increased prices for inputs and products to market clearing levels.b. Improved incentives for private sector participation in marketing system.c. Improved incentives for efficient resource allocation and increased investments.	<ul style="list-style-type: none">1. Price Policy Reform2. Eliminate price controls for agricultural inputs, transport rates and products (internal price deregulation).b. Remove maize-related subsidies and bias for maize in agricultural research.c. Set floor producer prices in line with international market prices.d. Eliminate interprovincial and intraprovincial transport and handling subsidies on maize and fertilizer.	<ul style="list-style-type: none">a. Reduced demand for inputs and products.b. Increased supply of products with less requirement for commercial inputs.c. No significant increase in aggregate product supply in the short-term.d. Significant increase in aggregate input and product supply in the long-run.e. Significant commodity-specific supply response by commercial farmers in the short-run but rather little by smallholder farmers.f. Because of protection granted to food crops before adjustment, increase in producer prices (especially maize) would be moderate.

Appendix 1

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2. Adjust exchange rate in real terms and eliminate exchange rate restrictions.

- a. Increased prices of tradables (i.e. exports and imports).
- b. Expansion in supply of export subsectors.
- c. Decline in supply of non-tradables and in demand for imports.
- d. Improved comparative advantage of domestic production of exports in world markets.

2. Trade and Marketing Reforms:

- a. Allow private sector's participation in competition with parastatals and cooperatives.
- b. Initiate a reform program to improve efficiency and competitiveness of both parastatals and cooperatives.
- c. Identify and give priority to exportable subsectors (commodities) with high supply response to improve incentive structure in the short-run.
- d. Provide investment facility to promote private sector's response in agricultural marketing, input distribution, processing and development of natural resources.

a. Supply of individual export commodities may expand rapidly in the short-run at the expense of non-exportables (including food).

b. Aggregate supply of agricultural commodities may increase in the long-run, but not significantly in the short-run.

c. Increased farm incomes and employment only restricted to export subsectors, while they may well decline in non-exportable subsectors in the short-run.

d. Supply of import-substituting commodities (including food) may increase as a result of higher prices and, hence, reduced demand for imports.

3. Liberalize export and import trade regimes and provide export incentives.

- a. No quantitative restrictions (and equal tariff treatment) on exports of all sectors.
- b. Reductions in barriers to imports.

3. Agricultural Technology and Infrastructure:

- a. Strengthen investments in agricultural research to produce technology to enable smallholder farmers respond to improved incentive structure in the long-run.
- b. Provide financial resources (credit) to commercial and emergent farmers to enable them to utilize existing technology to respond to improved incentive structure in the short-run.
- c. Improve the provision and coverage of rural financial services (especially credit and savings) in the long-run.
- d. Establish priority expenditure program for the agricultural sector, emphasizing agricultural extension, adaptive research, credit input supply and marketing, rural transportation and human capital development.

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- a. Unrestricted export trade in agricultural products may increase supply of export commodities in both the short and long-run.
- b. Further diversification in production by commercial and emergent farmers in crops, livestock.
- c. Reduction in protection for agriculture leading to economic import-substitution.
- d. Producer prices of food commodities may not increase in the presence of food imports.

4. Fiscal austerity measures to reduce budget deficit and domestic inflation, followed by a public expenditure reform.

- a. Reduced input subsidies.
- b. Reduced public investment and expenditure.
- c. Reduced consumer subsidies and higher consumer prices.
- d. Reduced rate of inflation.
- e. Increased public expenditure on high priority programs.
- f. Decline in real incomes
- g. Increased revenue from tax reform.

4. Human Capital Development and Poverty Alleviation:

- a. Formulate a food security strategy as an integral component of the adjustment program.
- b. Implement strategy for targeting both consumer and production subsidies to vulnerable and needy groups as part of the adjustment program.
- 5. Intensify extension services focussed on improved crop husbandry practices to optimize use of fertilizers.
- 6. Formulate and implement rural programs which emphasize smallholder farmer access to essential agricultural services and technology.
- 7. Devolution of financial and implementation responsibility to local grassroots institutions.

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- a. Reduced demand for fertilizer leading to production of crops using less fertilizer (diversification from maize) in commercial agriculture.
- b. Improved budgetary allocation to key agricultural support services.
- c. Reduced demand for previously subsidized food stuff resulting in lower producer prices and eventually lower consumer prices.
- d. Reduced inflation rate may lower commodity prices and encourage traders to hold relatively large inventories of agricultural commodities.
- e. Better utilization of agricultural land as a result of a fee on idle lands.
- f. Elimination of substitution of fertilizer for labor-intensive crop husbandry practices by smallholders, leading to reduction in cropped land under maize.

5. Adjust interest rates to positive real interest rates and tightening credit to reduce growth in M2.

- a. Rise in real interest rate.
- b. Reduction in commodity inventories by traders.
- c. Reduced availability of credit to traders (including Cooperatives).
- d. Improved financial viability of credit institutions and increased domestic resource mobilization.
- e. Increased availability of credit to non-government sectors.

8. Eliminate interest subsidies to smallholder farmers existing in Lima Bank and Cooperative credit program.

9. Reduce volume of borrowing of cooperatives by reducing their role in agricultural marketing and inputs distribution by allowing private sector's participation.

10. Improve smallholder farmer (including women) to rural financial services (including credit).

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a. Increase in cost of credit and of holding inventories by traders (including Cooperatives) leading to lower commodity prices (for producers and consumers).

b. Reduced credit availability may constrain commodity purchase by cooperatives and parastatals which are dependent on bank credit.

c. Improved viability of rural credit and saving schemes by commercial parastatal, cooperative banks, and informal institutions.

d. Improved credit availability to private sector leading to increased participation in agricultural marketing and input delivery system.

e. Improved access to credit by the rural poor.

6. Public investment program reform to allocate resources to priority programs.
- a. Increased budgetary resources to priority sectors critical to economic growth.
 - b. Increased efficiency in resource use resulting from better capacity utilization and targeted utilization.
 - 10. Provide adequately for funding of recurrent costs to raise capacity utilization and efficiency in agricultural services.
 - 11. Reduce size and funding for ongoing non-priority programs, especially those which involve public sector directly in production.
 - 12. Provide adequate funding for human capital development in rural areas.
 - 13. Increase public expenditures in non-crop subsectors to facilitate increased participation of smallholder farmers in these new sources of growth.
 - a. Increased public investments in research, extension, credit, infrastructure, and human capital.
 - b. Limited supply response by commercial farmers in the short-run, but more significant in the long-run.
 - c. Greater supply response in smallholder agriculture in the long-run resulting from technological change, commercialization, increased demand for inputs (especially fertilizer and seeds), increased credit coverage and investment, improved rural infrastructure and human capital services.
 - d. Improved access to human capital services for the rural poor.

1/ These are proposed macroeconomic adjustment measures for the period 1991-5

2/ These are agriculture-specific measures intended to complement or moderate adverse impact of macroeconomic policies.

Factor Distortion Coefficient Analysis

A. Introduction

1. The purpose of this Appendix is to provide a framework for analyzing the effects of market distortions (e.g., taxes, subsidies, and price controls) on the utilization of labor and land in Zambian agriculture. It is important to try and understand the effects of Government policies on labor and land utilization as a basis for analyzing a number of development issues in Zambian agriculture. These issues include unemployment and underemployment of rural labor and land resources, rural poverty, food insecurity, and rural-urban migration.

2. Following Idachaba's model (1972), a multicrop production function model was constructed to analyze the effects of distortions on resource allocation in a static framework in which the quantities of resources available to the farmer are utilized up to the point where their off-farm acquisition prices equal their marginal value products (MVP's).

B. A Multicrop Production Function

3. Labor and land account for the bulk of the value added in farming activities in Zambian agriculture. Much of the land and most of the labor is not crop specific since most farmers produce at least two crops in a cultivation season. Most farms can therefore be represented by a multicrop production function with the following general form:

$$F(Y_1, \dots, Y_m, X_1, \dots, X_n) = 0$$

Where Y_j , $j = 1, \dots, m$ is a product of the j th crop and X_i , $i = 1, \dots, n$, is quantity of the i th input where some of X_i 's represent service flows per unit of stock or per unit of stock per unit of time deriving from changes in the rates of utilization of durable resources (e.g., ploughs or hoes).

4. The taxes, subsidies, and price controls on crops are viable. The direct taxes consist of crop levies; the indirect taxes are represented by the price differential between free market prices and officially controlled prices. Assuming that the direct and indirect taxes are converted to a tax rate as a proportion of the expected market value, we can now express the producer price as follows:

$(1-r_j)P_{j*} = U_j P_{ji}$, where P_{j*} is the market producer price of the j th crop in the absence of taxes; r_j is the tax rate for the j th crop. However, the government also subsidizes inputs (fertilizer, chemicals and information supplied by extension staff, etc.) so that:

$(1-t_i)P_{xi} = \lambda_i P_{xi}$ where x_i is the i^{th} input, t_i is the subsidy rate for the i^{th} input, P_{xi} is the acquisition (purchase) price of x_i , and λ_i is the input coefficient.

5. The profit equation for a representative farm in the presence of these distortions (taxes and subsidies) can now be written as follows:

$$\Pi = \sum_{j=1}^m U_j P_{yj} Y_j - \sum_{i=1}^n \lambda_i P_{xi} X_i$$

6. The necessary conditions for profit maximization are:

$$\frac{F_j}{F_r} = \frac{\partial Y_r}{\partial Y_j} = \frac{U_j P_{yj}}{U_r P_{yr}} \quad j, r = 1, \dots, m$$

and $P_{yj} \frac{\partial Y_j}{\partial x_i} = \frac{MVP_{xi} y_j}{u_j} = \frac{\lambda_i P_{xi}}{u_j} \quad i = 1, \dots, n$

7. This implies that the marginal values of outputs equals the ratio of their expected producer prices, each weighted by the proportion of unit crop price received by the producer net of taxes. In this sense, it follows that:

$$\frac{U_j P_{yj}}{U_r P_{yr}} \geq \frac{P_{yj}}{P_{yr}} \text{ as } \frac{U_j}{u_j} \geq 1$$

it also follows that

$$\frac{MVP_{xi} y_j}{u_j} \geq P_{xi} \text{ as } \frac{\lambda_i P_{xi}}{u_j} \geq 1, j = 1, \dots, m \quad i = 1, \dots, n \quad (18a)$$

8. Both land and labor, although accounting for the bulk of value added in Zambian agriculture, are hardly subsidized. We can therefore assume that subsidies on them are zero (i.e., $\lambda_1 = 1$) for both land and labor). Thus, for example, whenever tobacco and maize were taxed, $\frac{\lambda_i}{\mu_j} > 1$, implying that both land and labor were, through induced responses to taxes, being used in lesser amounts than they would have been in the absence of taxes. The underlying assumption of this conclusion is that Zambian farmers achieve allocative efficiency with respect to the use of their land and labor as advocated by Schultz.

C. Empirical Results

9. The effects of distortions on real prices of land and labor employed in the production of selected crops in Zambia between 1966/67 and 1989/90 are detailed in Tables 1-7. A ratio $\lambda_1/\mu_1 > 1$ implies that less of labor and land were being used than would have been the case in the absence of distortions. Less resource use refers to both the reductions in investments in land and labor that would have occurred and disinvestment in quantities of land and labor in the farm sector.

10. Since farmers pay the full cost of hired labor or bear the full real cost of family labor (which may be represented by the market acquisition prices or the on-farm opportunity costs of resources), i.e., then for any crop and for given prices of other inputs, quantities of other inputs, and product prices, farmers would, in equilibrium, be demanding less hired labor and/or deploying less family labor than they would have done in the absence of government taxation or salvaging some

if salvage values exceed MVPs. Under our stated conditions, this means that for crops in Zambia less labor (family and hired) is being used than would have been the case in the absence of distortions. Assuming that rates of utilization of family and hired labor were explicitly incorporated in the production function, then farmers would be induced by distortions to work less intensively than they would otherwise have done in the absence of such distortions. Assuming further that the imputed real costs (rents, customary dues, etc.) of land are fully borne by farmers (i.e. $\lambda_1 = 1$), then for given input prices, quantities of other inputs and product price, government policy would induce the use of less land than would have been the case without such government policies.

11. The following conclusions may be drawn using the assumptions of the model. First, Table 1-7 show that consequent to government price-distorting agricultural policies (taxation, price control, and subsidies) the quantities of both land and labor (both family and hired) used in the production of crops over the period were generally smaller than the amounts that would have been employed in the absence of such government policies. The above unity distortion coefficients in Tables 1-7 strongly support this conclusion. Second, following from the above conclusion is the observation that it has not generally been profitable for farmers to invest in crop production because of price-distorting policies and this has tended to reduce investments and possibly has led to disinvestment in the crop sector. This was particularly manifest in substantial rural-urban migration witnessed during the 1970's in the country and idle farms which were formally under crop cultivation

(especially cashewnuts and tobacco farms). Third, since the distortion coefficients in Tables 1-7 can also be interpreted as MVPs for the various crops, it is obvious that the Zambian crop sector could not be considered production efficient (i.e. in which the supply of any product would not be varied without affecting the supply of other products). Not only were producers of various crops facing different market prices (MVPs), but also such prices were not equal to efficiency prices (scarcity values). The sector was similarly inefficient because the country was not able to make the best use of its foreign trade possibilities. Fourth, our results on the allocative distortions of government policies with respect to land and labor used in the crop sector have limited validity because a large number of farmers producing export crops use fertilizers and pesticides, both of which are subsidized. However, our determination of price differentials for crops was made after taking account of such subsidies. Bias due to subsidies in estimating the effects of taxes on resource use in crops is therefore insignificant.

Table 1: MAIZE: Effects of Price Distortions on Land and Labor Use

Crop Season	Input Subsidy	Produce Levy	(K/kg)		Actual Producer Price	(6) as % of (6+6)		(7) as % of (6+6)	d/uj
			1.00	2.00		3.00	4.00		
1986/67	-0.11	0.02	0.01		-0.08	0.03		-0.60	12.00
1979/80	-0.22	0.07	0.04		-0.11	0.13		-6.10	225.00
1984/85	-0.29	0.20	0.04		-0.05	0.31		1.19	4.58
1985/86	-0.32	0.25	0.10		0.03	0.11		0.15	1.48
1986/87	-0.56	0.30	0.20		-0.08	0.87		1.07	1.32
1987/88	-0.87	0.35	0.26		-0.26	0.89		1.41	2.24
1988/89	-0.97	0.40	0.32		-0.26	1.20		1.26	1.33
1989/90	-0.84	0.45	0.14		-0.26	1.98		1.14	0.66

1\ Price differential between actual producer price and border producer price equivalent at shadow exchange rate.

Table 2: VIRGINIA TOBACCO: Effects of Price Distortions on Land and Labor Use

(K/kg)

Crop Season	Input Subsidy	Produce Levy	Price Differential 1\	Total Tax	Producer Price	(5) as % of (5+6)	Uj:(7) as % of(5+6)	d/Uj
1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
1968/69	-0.11	0.03	0.00	-0.08	0.94	0.08	0.08	12.50
1979/80	-0.22	0.05	0.00	-0.17	1.47	1.13	0.87	1.15
1984/85	-0.29	0.09	-0.49	-0.69	3.25	1.27	0.50	2.00
1985/86	-0.32	0.24	2.70	2.62	5.12	0.66	0.09	11.11
1986/87	-0.56	0.35	3.62	3.31	6.26	0.67	0.07	14.20
1987/88	-0.87	0.45	5.12	4.70	14.01	0.76	0.04	25.00
1988/89	-0.97	0.47	6.11	5.61	14.41	0.72	0.04	25.00
1989/90	-0.93	0.67	7.14	6.88	23.61	0.77	0.03	33.33

1\ Price differential between actual producer price and border producer price equivalent at shadow exchange rate.

Table 3: SEED COTTON: Effects of Price Distortions on Land and Labor Use

Crop Season	Produce Price		Total Taxes	Actual Producer Price	(4) as % Uj : (6) as % of (4+5)		d/Uj
	Levy ¹	Differential ²			of (4+5)	7.00	
	1.00	2.00	3.00	4.00	5.00	6.00	8.00
1986/87	0.23	0.12	0.35	0.15	0.70	1.40	0.71
1979/80	0.22	0.00	0.28	0.46	0.38	0.51	1.90
1984/85	1.15	0.50	1.65	0.67	0.71	0.31	3.23
1985/86	0.47	0.67	1.14	0.99	0.54	0.25	4.00
1986/87	0.34	0.35	0.69	1.00	0.36	0.13	7.69
1987/88	0.56	0.56	1.12	3.00	0.27	0.07	14.29
1988/89	0.46	0.89	1.29	3.00	0.26	0.05	20.00
1989/90	0.42	0.95	1.37	3.00	0.19	0.03	33.33

1\Difference between go -vernment guaranteed price and private trader price

2\Price differential between actual producer price and border producer price equivalent at
' shadow excange rate.

Table 4: SUNFLOWER: Effects of Price Distortions on Land and Labor Use

Crop Season	Produce Levy	Price Differential	Total Tax	(5) as % Uj : (7) as % of (5+6)			d/Uj
				Producer Price	(5) as % Uj	(7) as % of (5+6)	
1986/87	0.02	0.04	0.06	0.05	0.45	4.09	0.24
1979/80	0.07	-0.09	-0.02	0.33	1.06	3.42	0.29
1984/85	0.20	0.13	0.33	0.56	0.03	0.71	1.41
1985/86	0.26	1.55	1.86	0.84	0.32	0.12	8.33
1986/87	0.38	1.12	1.42	1.46	0.56	0.17	5.88
1987/88	0.35	3.18	3.53	1.00	0.34	0.06	16.67
1988/89	0.40	2.76	3.16	3.25	0.61	0.08	12.50
1989/90	0.45	1.79	2.24	4.94	0.69	0.10	10.00

Table 5: SOYABEANS: Effects of Price Distortions on Land and Labor Use

Crop Season	(K/kg)							
	Produce Levy	Price Differential	Total Tax	Producer Price		d/Uj		
				1.00	2.00	3.00	4.00	5.00
1986/87	0.02	0.03	0.05	0.04	0.44	4.89	0.26	
1979/80	0.07	0.09	0.16	0.28	0.64	1.45	0.89	
1984/85	0.20	0.08	0.28	0.68	0.71	0.74	1.35	
1985/86	0.25	1.16	1.46	1.26	0.47	0.18	5.56	
1986/87	0.30	0.98	1.28	1.64	0.58	0.19	5.26	
1987/88	0.35	2.58	2.93	2.42	0.45	0.08	12.68	
1988/89	0.40	2.99	3.39	3.11	0.48	0.07	14.29	
1989/90	0.45	1.90	2.35	4.93	0.68	0.09	11.11	

Table 6: SHELLLED GROUNDNUTS: Effects of Price Distortions on Land and Labor Use

Crop Season	(K/kg)							
	Produce Levy	Price Differential	Total Tax	Producer (5) as % Uj:(6) as		d/Uj		
				4.00	5.00	6.00	7.00	8.00
1966/67	0.02	0.00	0.00	0.12	0.00	3.00	0.33	
1979/80	0.07	0.70	0.77	0.44	0.36	0.36	3.33	
1984/85	0.20	0.89	1.09	1.15	0.51	0.28	4.35	
1985/86	0.25	-0.10	0.07	1.04	0.96	0.56	1.70	
1986/87	0.30	-0.48	-0.18	2.03	1.16	0.59	1.69	
1987/88	0.35	-0.21	0.14	3.63	0.96	0.25	4.00	
1988/89	0.40	0.73	1.13	4.21	0.79	0.15	0.67	
1989/90	0.45	1.43	1.88	6.11	0.76	0.10	10.00	

Table 7: Producer Prices and Border Price Equivalents, 1987-1990

Crop Session	Sunflower						Soyabean						Shelled Groundnuts					
	Producer Price	Border Price	Producer Tax	Producer Levy	Total	Producer Price	Border Price	Producer Tax	Producer Levy	Total	Producer Price	Border Price	Producer Tax	Producer Levy	Total			
1988/87	0.05	0.09	0.04	0.02	0.06	0.04	0.07	0.03	0.02	0.16	0.12	0.18	0.06	0.02	0.08			
1979/80	0.33	0.24	-0.09	0.07	-0.02	0.28	0.37	0.09	0.07	0.81	0.44	1.14	0.70	0.07	0.77			
1984/85	0.56	0.69	0.13	0.20	0.33	0.68	0.76	0.08	0.20	1.72	1.15	2.04	0.89	0.26	1.09			
1985/86	0.84	2.39	1.55	0.25	1.86	1.26	2.46	1.16	0.26	5.05	1.64	1.46	-0.18	0.26	6.07			
1986/87	1.40	2.52	1.12	0.30	1.42	1.64	2.62	0.98	0.36	6.54	2.03	1.55	-0.48	0.30	-0.18			
1987/88	1.80	4.98	3.18	0.35	3.53	2.42	5.00	2.58	0.35	10.35	3.63	3.42	-0.21	0.35	0.14			
1988/89	3.25	6.00	2.75	0.40	3.15	3.11	6.10	2.99	0.40	12.66	4.21	4.94	0.73	0.40	1.13			
1989/90	4.94	6.73	1.79	0.45	2.24	4.93	6.83	1.90	0.45	14.11	6.11	7.54	1.43	0.45	1.88			

Appendix 3

Summary of Crop NPC, EPC and EPC/NPC Ratios
With and Without Currency Devaluation, 1989/1990

BEFORE DEVALUATION	MAIZE			RAINFED WHEAT			IRRIGATED WHEAT			COTTON			MILLET			SORGHUM			G'NUT (CHAL)		
	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM
NPC (%)	0.6	0.33	0.15	-0.15	-0.78	-2.62	-	-	0.19	0.09	0.11	-	-0.08	0.04	-	2.56	2.12	-	-0.06	-0.1	-
EPC (%)	-0.4	-0.67	-0.85	-1.15	-1.78	-3.82	-	-	-0.81	-0.91	-0.89	-	-1.08	-0.96	-	1.56	1.12	-	-1.06	-1.10	-
EPC/NPC	-0.67	-2.03	-5.87	7.67	2.28	1.35	-	-	-4.26	-10.11	-8.09	-	13.50	-24.00	-	0.61	0.53	-	17.67	11.00	-
IMPROVED	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM
NPC (%)	0.66	0.54	0.41	0.11	-0.31	-0.07	-	-	0.15	0.11	0.09	-	0.04	0.06	-	2.14	1.82	-	-0.11	0.11	-
EPC (%)	-0.34	-0.46	-0.59	-0.89	-1.81	-1.07	-	-	-0.85	-0.89	-0.91	-	-0.96	-0.94	-	1.14	0.82	-	-1.11	-0.89	-
EPC/NPC	-0.52	-0.85	-1.44	-8.09	4.28	15.29	-	-	-5.67	-8.09	-10.11	-	-24.00	-15.67	-	0.53	0.45	-	10.09	-8.09	-
AFTER DEVALUATION	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM
NPC (%)	0.66	0.51	0.42	0.33	0.12	-0.22	-	-	0.5	0.14	0.15	-	3.14	3.66	-	0.3	0.23	-	0.48	0.41	-
EPC (%)	-0.34	-0.49	-0.58	-0.87	-0.88	-1.22	-	-	-0.5	-0.86	-0.85	-	2.14	2.66	-	-0.7	-0.77	-	-0.52	-0.59	-
EPC/NPC	-0.52	-0.98	-1.38	-2.03	-7.88	5.65	-	-	-1.00	-6.14	-5.67	-	0.68	0.73	-	-2.33	-3.35	-	-1.08	-1.44	-
IMPROVED	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM
NPC (%)	0.69	0.62	0.65	0.44	0.27	0.37	-	-	0.36	0.15	0.14	-	3.66	3.99	-	0.25	0.12	-	0.41	0.47	-
EPC (%)	-0.31	-0.38	-0.45	-0.56	-0.73	-0.63	-	-	-0.64	-0.85	-0.86	-	2.66	2.99	-	-0.75	-0.88	-	-0.59	-0.53	-
EPC/NPC	-0.45	-0.61	-0.82	-1.27	-2.70	-1.70	-	-	-1.78	-5.67	-6.14	-	0.73	0.75	-	-3.00	-7.33	-	1.44	-1.13	-

BEFORE DEVALUATION	G'NUT (NR)			RICE			TOBACCO (B)			TOBACCO (V)			SUNFLOWER			CASSAVA			SOYBEANS		
	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM
NPC (%)	0.44	0.33	0.45	2.44	3.04	-	-	0.7	0.78	-	0.78	0.8	0.41	0.5	0.67	2.37	-4.75	-	0.88	-	1.26
EPC (%)	-0.56	-0.67	-0.55	1.44	2.04	-	-	-0.30	-0.24	-	-0.22	-0.20	-0.59	-0.50	-0.33	1.37	-5.75	-	-0.12	-	0.26
EPC/NPC	-1.27	-2.03	-1.22	0.59	0.67	-	-	-0.43	-0.32	-	-0.28	-0.25	-1.44	-1.00	-0.49	0.58	1.21	-	-0.14	-	0.21
IMPROVED	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM
NPC (%)	0.39	0.28	0.48	3.99	-5.82	-	-	0.76	0.77	-	0.81	0.83	0.44	0.37	0.62	-4.75	-0.77	-	1.99	-	1.26
EPC (%)	-0.67	-0.72	-0.57	2.99	-6.82	-	-	-0.24	-0.23	-	-0.19	-0.17	-0.56	-0.63	-0.38	-5.75	-1.77	-	0.99	-	0.26
EPC/NPC	-2.03	-2.57	-1.33	0.71	1.17	-	-	-0.32	-0.30	-	-0.23	-0.20	-1.27	-1.70	-0.61	1.21	2.30	-	0.50	-	0.21
AFTER DEVALUATION	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM
NPC (%)	0.58	0.51	0.58	1.91	2.04	-	-	0.8	0.83	-	0.84	0.85	0.6	0.64	0.71	1.74	2.14	-	2.53	-	1.32
EPC (%)	-0.42	-0.49	-0.44	0.91	1.04	-	-	-0.2	-0.17	-	-0.16	-0.15	-0.4	-0.36	-0.29	0.74	1.14	-	1.53	-	0.32
EPC/NPC	-0.72	-0.98	-0.79	0.48	0.51	-	-	-0.26	-0.20	-	-0.19	-0.18	-0.67	-0.56	-0.41	0.43	0.53	-	0.60	-	0.24
IMPROVED	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM	SH	ENER	COMM
NPC (%)	0.51	0.49	0.58	2.09	2.70	-	-	0.83	0.83	-	0.86	0.92	0.68	0.68	0.76	2.14	2.5	-	1.43	-	1.31
EPC (%)	-0.49	-0.51	-0.44	1.09	1.70	-	-	-0.17	-0.17	-	-0.14	-0.08	-0.32	-0.32	-0.24	1.14	1.5	-	0.43	-	0.31

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