

**KENYA AGRICULTURAL MARKETING
AND POLICY ANALYSIS PROJECT**

**TEGEMEO INSTITUTE OF AGRICULTURAL POLICY AND
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**TRENDS IN REGIONAL AGRICULTURAL PRODUCTIVITY IN
KENYA**

by

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1. INTRODUCTION

Agriculture in Kenya remains a dominant sector in the economy (PAM 1995). Agriculture's contribution to rural employment, foreign exchange earning and rural incomes are so important that any broad-based improvement in rural living standards will almost certainly require substantial productivity growth in agriculture.

Agriculture in Kenya has undergone major changes over the past decade since the implementation of structural adjustment and sectoral reform. The effects of these policies and programs on agricultural productivity continue to be debated. Much donor-supported analysis presents evidence of a broad economic turnaround in Africa, and finds support for increased agricultural productivity growth, in contrast to the gloomier picture commonly painted about stagnating African agriculture (e.g., Block 1994; Sahn and Sarris 1991; USAID 1993; World Bank 1994). Macro-economic and agricultural sectoral reforms are identified as major factors explaining the rise in productivity growth. By contrast, analyses supported by UNICEF, FAO, and other donor agencies have strongly questioned the effects of structural adjustment and/or food sector reform on agricultural productivity growth and household food security (see, for example, Cornia, Jolly, and Stewart 1987; Mosley 1994; Cheru 1999). Understanding the national and regionally-disaggregated movements in crop production and input use over time is a critical component step in clarifying the discussion, identifying which policies have worked and which haven't, and formulating an empirically-based agricultural development strategy for the future.

The objectives of this paper are threefold: (1) to assess the direction and magnitude of changes in agricultural productivity in Kenya in the last 25 years for five of the most important agricultural provinces in Kenya, with particular focus on the period since the initiation of agricultural policy adjustment in the 1990s; (2) to identify the major factors affecting changes in crop productivity; and (3) to identify cost-effective strategies likely to promote future agricultural intensification and productivity growth in Kenya's crop sector in the post-reform period. A regionally disaggregated approach is taken in order to identify variations in the patterns of growth across high-potential and low-potential areas and develop possible implications for policy about where the focus of future efforts should be. Section 2 discusses the data and methods used in the analysis. Section 3 assesses the broad trends in the value of agricultural output per hectare and per agricultural laborer. Section 4 disaggregates these trends by province to compare the trends not only by the geographical location of the regions but also by crop mix. We also examine how policy changes in the agricultural sector may have affected patterns in input use on various crops. Lastly, Section 5 discusses the conclusions, policy implications, and outstanding knowledge gaps for future research to support policy makers' efforts to raise agricultural productivity in Kenya.

2. METHODOLOGY AND DATA SOURCES

2.1. Methodology

A conventional agricultural productivity index is a measure of output divided by a measure of inputs. Total factor productivity (TFP) is defined as the ratio of value of output over the value of all inputs used. However, TFP measures are difficult to construct in the absence of

data on prices and costs of key inputs. An alternative approach is partial factor productivity (PFP). The main indicators in this analysis are partial land and labor productivity. The PFP indicators are calculated as Q / X_i , where Q is the value of output and X_i is physical factor input.

The main weakness of partial factor productivity indices is that they do not account for all the inputs used in production/marketing system. Discussions about single factor productivity can be misleading if interpreted as total factor productivity. On the input side, improvements in labor and land productivity are usually due to changes in other inputs. New technology, infrastructure, extension, supplies of other inputs (water, for example) are not costless and need to be taken into account in assessing total factor productivity.¹ On the output side, the mix of farm and non-farm activities undertaken by the rural population may have shifted over time. For example, if a larger percentage of rural households' time has gone into non-farm activities over time, the analysis presented in the figures will understate increases (or overstate decreases) in agricultural labor productivity.² Nonetheless, the measures of labor and land productivity can indicate important changes in agricultural systems performance, especially if kept in context of the changes in the use of other factors.

Only five out of the eight provinces were analyzed in the analysis, leaving out Nairobi, North Eastern and Coast provinces due to data limitations. The provinces included in the analysis thus are Central, Eastern, Rift Valley, Western and Nyanza. In each province, the key commodities were modeled (including maize, wheat, sorghum, sugarcane, coffee, tea, pyrethrum, tomatoes and French beans). Lack of reliable data required other crops to be excluded from the analysis, and for this reason, there is variation across provinces in the extent to which all relevant crops are included.

2.2. Data Sources

The main data source for this study was the Ministry of Agriculture Livestock Development and Marketing (MOALD&M), the Planning Division and the Central Bureau of Statistic of the Ministry of Planning and National Development and several publications. Initial data was collected from the provincial and district agricultural offices by Tegemeo Institute and its predecessor the Policy Analysis Matrix Project on all agricultural commodities in each district. Districts level Farm Management Reports, Development Plans and district annual reports also were referred to. Data on specific crops like coffee, tea, pyrethrum sugar and rice was collected directly from their respective regulatory and marketing bodies including the Coffee Board of Kenya, Tea Board of Kenya, Pyrethrum Board, Kenya Sugar Authority and the National Irrigation Board. The district data was compiled to the provincial level and was compared to the provincial data already compiled at the MOALD&M headquarters.

¹ Unfortunately, data is seldom available to measure total factor productivity in Africa (see Thirtle et al. 1993 for an exception), and there is also considerable disagreement about how TFP should be measured.

² A more accurate indicator of labor productivity would have been value of crop output per unit of agricultural laborer, but time series data on agricultural labor force was unavailable. Use of rural population data will give similar trend results to those using agricultural labor data as long as the proportion of rural population engaged in agriculture was relatively constant over the sample period. Productivity trends will be biased upward (downward) if the share of the rural population in agriculture increased (decreased) over the sample period.

The production data for the entire period (1970-95) was converted to the value of production by multiplying the production by average of the last 5 years' national and regional producer prices (1991-1995). These average prices were used to overcome the problem of introducing price based fluctuations into the data that have little to do with changes in physical input-output relationships. Three year centered moving averages were constructed from both the labor and land productivity indicators to smooth out the effects of random variation such as that caused by abrupt weather changes. The result were then averaged in five year segments from 1970-74 to 1990-95. This approach roughly follows the methods in Block (1994).

The land and labor units are physical units based on the MOALD& M data. Land is the area cultivated and thus includes sections planted though not yet in production. The labor variable is the population in rural areas as reported in the 1969, 1979 and 1989 national population census.

The quality of official data from the MOALD&M is widely criticized as inaccurate and unreliable. There is however no alternative national and regional time series production and area data available for the period and commodities covered. For the purpose of this analysis, therefore, the MOALD&M data was used, realizing that the results are to be considered rough indicators of trends. What is important in this analysis is the direction of change in the partial productivity measures over time rather than the levels of the variables themselves. The challenge in Kenya today is how to invest in good quality data collection to ensure that the future analysis of the agricultural sector is based on more reliable and accurate data.

3. RESULTS

3.1. Productivity and Area Trends

Relative growth rates in area for some of the key agricultural commodities for the period 1970 to 1995 are shown in Table 1. Most crops have expanded in area in the last 25 years. But the rate of area expansion for most of the crops was higher between 1970 and 1985 than it was between 1985 and 1995. Coffee and sugar area expanded most between 1980 and 1985 because of better producer prices and in response to the coffee boom of 1977-79. Wheat area declined in the 1970-80 period following the change the sub-division of large-scale farms to small-scale farmers who substituted from wheat into maize and dairy (Hassan, Mwangi, and Karanja 1993). The substantial growth in wheat area in the period 1980-85 reflects substantial expansion of wheat into the low potential areas of Narok, Trans Mara and Samburu. Pyrethrum area fell drastically in the period 1980-90 period following the long delays in payments to farmers in 1981 and subsequent substitution to other crops. Growth rates in cropped area since 1990 reflect a shift out of maize and coffee area and an expansion in horticultural area such as the tomatoes and French beans.

Area expansion of most crops was driven by explicit government support in the 1970s and 1980s to encourage small-scale producers to adopt and expand the production of selected export and food crops. The government thus expanded crop buying and processing capacity to service new areas in production, provided credit and extension support to producers, and maintained a relatively extensive network of collection points and depots for encouraging smallholder marketing of cereals.

Area expansion has slowed considerably since 1990. No crop has registered a higher rate of growth in the 1990s than in the 1980s except french beans (and marginally pyrethrum). The limited expansion that has occurred since 1990 has been generally toward the low potential arid and semi arid areas because of population pressure in the high potential and the resulting shortage of additional fertile land. This implies that future production growth in Kenya will rely on increasing crop intensification, i.e., raising the value of agricultural production through more intensive use of productivity enhancing inputs and/or shifting to higher-valued crops.

Table 1. Relative Rates of Area Expansion Average (% Growth per Year)

	1970-80	1980-85	1985-90	1990-95
Coffee	4.3	8.2	4.1	0.6
Tea	6.5	3.4	1.5	1.2
Sugar	3.7	10.9	2.3	1.6
Pyrethrum	2.0	0.4	-1.1	0.4
Maize	2.3	0.2	2.1	0.4
Wheat	-3.1	0.9	5.0	1.7
Sorghum	0.5	5.8	3.2	3.0
Tomatoes	1.4	1.7	3.3	2.5
French Beans	0.7	3.3	3.1	4.2

3.2. Trends in Rates of Yields

The relative growth rates in the physical yields of the major crops over various periods are summarized in Table 2. The most alarming trend is that yields are actually declining for most of the crops considered during the 1990-95 period. This is especially true of the grain crops and sugarcane. The negative growth in yields does not appear to be driven by weather conditions, since the 1990-95 period has not been subjected to more frequent drought than other periods. The decline in yields for the major cereal crops has been associated with a stagnation in fertilizer use (both DAP and CAN), a major contraction in agricultural credit disbursed to smallholder farmers, and a decline in both the quantity and quality of hybrid maize seed used in production. The reasons behind these trends in input use are interrelated. First, AFC credit for grain crops has been substantially reduced in real terms, and this contraction has not been offset by any notable increase in private lending to smallholders. It appears to be the case that procurement of inputs for use on grain crops (such as fertilizer and hybrid seed) is increasingly self-financed by smallholders, and that liquidity constraints may constrain demand for key productivity-enhancing inputs. Simultaneously, fertilizer prices have risen in recent years, and DAP prices in Kenya's western regions are among the highest in the world (1,400 to 1,500 Ksh per bag in 1997, which translates to roughly \$450-\$500 per ton). Problems with quality control in improved seed generation and marketing have discouraged farmers in some areas from purchasing hybrid maize seed, and higher fertilizer prices impede the profitability of its use, which in turn reduces the profitability of using even high-quality fertilizer-responsive seed.

In addition to the cereals, coffee and sugar have also recorded negative growth rates in yields since 1990. Ironically, these are the same crops that recorded high growth in yields during the 1970-80 period. French beans and tomatoes have however maintained their growth in yields.

Table 2. Relative Rates of Physical Yields Growth (% Growth per Year)

	1970-80	1980-85	1985-90	1990-95
Coffee				
Tea	1.7	2.1	7.8	2.0
Sugar	0.6	1.2	(1.4)	(3.6)
Pyrethrum	1.6	0.9	(0.3)	1.4
Maize	5.7	3.5	3.0	(2.2)
Wheat	0.4	4.2	1.0	(3.3)
Sorghum	2.8	2.4	4.8	(1.1)
Tomatoes	2.5	3.1	5.3	6.9
French Beans	4.2	2.7	4.3	3.7

The rapid growth in maize yields during the 1970-80 period was as a result of the introduction and subsequent adoption of the high yielding hybrid maize varieties and the general government policy then to support extension service. The decline in coffee yields was caused by drought, poor producer incentives due to delays in coffee payments and high processing costs. The decline accelerated after 1990 despite the various policy reform in the production, processing and marketing of coffee.

3.3. Trends in Crop Production

Rates of growth of crop production for some of the major selected crops is shown in Table 3. Production, just like area and yield, grew at a faster rate during the 1970-80 period than during the 1980-90 period. The growth rate in production has actually been negative in the period 1990-95 except for tea, pyrethrum, tomatoes, French Beans and sorghum. Coffee, maize, wheat and sugar have had the largest decline. The decline in wheat production, as stated earlier, is partly attributed to the change in the crop production structure from large-scale to small-scale production systems. Lack of huge declines in the value of production during the 1980-85 period indicates that despite the decline in yields as a result of the drought during this period, prices to producers continued to be favorable.

Table 3. Relative Rates of Growth in Crop Production (% Growth per Annum)

	1970-80	1980-85	1985-90	1990-95
Coffee	6.3	4.8	3.1	-4.4
Tea	8.2	5.5	9.3	3.2
Sugar	4.3	12.1	0.9	-2
Pyrethrum	3.6	1.3	-1.4	1.8
Maize	8	3.7	5.1	-1.8
Wheat	-2.7	5.1	6	-1.6
Sorghum	3.3	8.2	8	1.9
Tomatoes	3.9	4.8	8.6	9.4
French Beans	4.9	6	7.4	7.9

The decline in the value of coffee, maize, and wheat output in 1990-95 could be attributed to the poor producer incentives due prevailing low prices despite the market reforms implemented on these commodities. Maize and wheat experienced profit squeeze when the fertilizer prices were liberalized in 1991 but maize and wheat marketing continued to be government controlled. Maize and wheat production costs grew when revenues were declining. This was also exacerbated by the reversals in the maize market liberalization process, which made it difficult for the private sector to invest in maize marketing activities.

In coffee, production continued to decline despite the continued high coffee prices at the world market and the partial liberalization of coffee marketing. The liberalization of coffee marketing has been incomplete and is concentrated at the apex marketing and milling level. Little attention has been given to the restructuring of the coffee cooperatives and factories. These institutions are inefficient in coffee processing and are characterized by poor financial management so, coffee farmers continue to receive low payments. They also lack sufficient credit. Only tea and tomatoes have continued to maintain high rates of growth in the value of production.

3.4. Trends in Rural Population

Trends in the rural population have followed closely the growth rates of the total population. The rural population grew at average rates of about 4% per annum between 1970-80 that have declined slightly to about 3% per annum in the 1990s. Except in Rift valley province, the rural population grew at a lower rate after the 1970-79 period. Rift valley, Eastern and Western provinces have the highest growth rate in rural population as shown in Table 4.

Table 4. Trends in Rural Labor (% Growth per Annum)

	1970-79	1980-85	1985-90	1990-95
Central	4.6	4.1	3.4	3.3
Eastern	4.5	4.7	4.1	3.8
Rift valley	5.0	6.2	5.6	4.9
Western	4.0	5.3	4.6	3.7
Nyanza	3.1	3.6	3.9	3.2

3.5. National Land and Labor Productivity

The graphical representation of land and labor productivity through time follow Hayami and Ruttan (1985) and more recently Block (1994). The value of total agricultural production is developed as a product of production and the average producer price for each year. The total value of each crop was summed across all crops to get the total value of production for the whole sector and for each region. Land productivity, measured in Figure 1 on the y axis, is defined as the inflation-adjusted value of crop output per hectare. Labor productivity, measured in Figure 1 on the x axis, is defined as the inflation-adjusted value of crop output per rural person. Three-year centered moving averages were constructed from both series to smooth out the effects of random variations such as weather, and then averaged in five-year time periods, as shown in Figure 1.

Interpretation is as follows: A movement in the coordinates over time from the lower-left to the upper-right portion of the figures represents increases in both land and labor productivity. Movement from the upper-right to lower-left parts of the figure represents a decline in both productivity measures. Shifts from the lower right to upper left would indicate a decline in labor productivity but an increase in land productivity. Such a case could arise if, for example, the value of crop output per hectare were rising over time due to either yield gains or shifts to higher-valued crops, but under conditions of a rapidly growing agricultural labor force. Note that in these figures, increases in these measures of partial productivity can occur from either shifts in crop mix (e.g., from millet to higher-valued cotton) or from increases in crop output per unit of input, or both. Figure 1 shows the path taken by the Kenyan agriculture from the period 1970 to 1995.

Land productivity has stagnated at around Ksh 3,000 1991-95 constant prices. It increased slightly between 1970-74 and 1974-79, then declined in the following period, improved slightly but has since 1990-95 declined by about 23 percent of the 1985-90 level. Land Productivity increased initially by about 12 percent between 1970-74 and 1974-79 period. It then declined slightly and recovered after the 1980-85. Land productivity then declined by about 12 percent between 1985-90. The decline in land and labor productivity in 1980-85 period could be attributed to the two droughts that occurred during that period. Labor productivity has generally stagnated because the rural labor force has grown faster than the value of agricultural production per hectare.

The increase in land productivity between 1970 and 1980 was in response to the adoption of high yielding varieties of maize and increased use of fertilizers and other yields enhancing inputs as shown in Table 5. A large proportion of smallholders benefitted from the expansion of state marketing infrastructure and transport subsidies inherent in the state marketing board's pan-territorial pricing structure. These pricing and market support policies clearly encouraged the adoption of newly available hybrid maize seeds and stimulated the growth in smallholder grain area and yields during the 1970s. However, this state-led model of service provision to smallholder farmers has proven politically and economically unsustainable. Evidence in some areas indicates that the production growth was achieved at a cost greater than the value of the output. While there is some opinion that the cutbacks in state transfers to smallholder grain producers have gone too far, there are rarely concrete

proposals for who should be taxed to pay for the recurrent costs of these transfers (Jayne and Jones 1997).³

Figure 1. Land and Labor Productivity Ratios for the Period 1970-1995

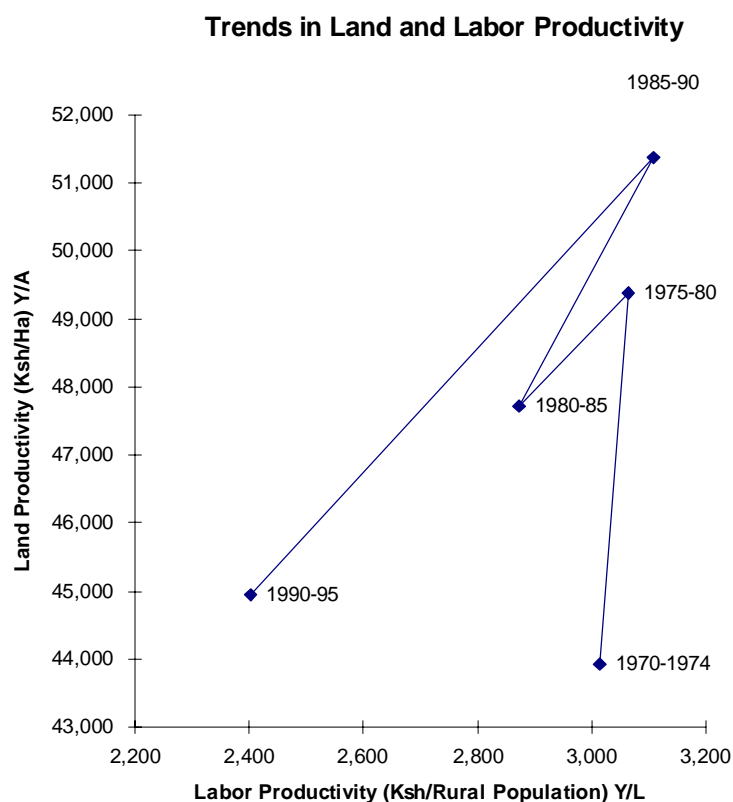


Table 5. Quantities of Seed and Fertilizer Used in Maize

	Maize Hybrid	Purchased Fertilizer	Total Credit AFC	Credit on Maize
	Kgs	'000 Tons	Million Ksh	Million Ksh
1970-74	7,494	141	2,087	877
1975-79	11,054	124	1,778	747
1980-84	14,788	139	2,183	917
1985-89	20,486	223	1,057	444
1990-95	19,272	245	371	157

³ While data on the sources of treasury revenue are unavailable for these specific countries, an interesting study by Gersovitz and Paxson (1996) shows that the revenue base of most African governments is narrow, depending primarily on taxation of imports and exports. The production and income foregone resulting from taxation of other sectors to transfer resources to grain producers is seldom accounted for in assessments of the benefits of state-led growth strategies.

During this period use of hybrid maize seed increased by about 160 percent. Fertilizer use increased by about 50 percent. The government also supported producers through the provision of extension service and credit to farmers supported the increases in yields. Seasonal credit including that in the Guaranteed Minimum Returns Scheme from Agricultural Finance Corporation increased by more than 5 times between 1970 and 1980.

After 1980 due to high population densities in the high-potential areas, crops expanded to low and marginal areas. However, to a large extent, the production technologies adopted were borrowed from the medium and high potential areas and are tend to be less suitable. Though the rate of adoption of hybrid maize seeds remained high, there is a widespread belief that the quality of maize and wheat seed has declined. Use of maize hybrid seeds dropped by 6 percent between 1990 and 1995. Quantities of DAP and CAN fertilizers used in maize production have also declined. Yields thus have declined. The seasonal credit from AFC for maize and wheat production also have declined and became unreliable. The drop in land productivity could also be attributed to the poor performance of government support services in extension.

These results are consistent with the earlier findings (Block 1992) that the living standards of agricultural workers have not only stagnated in the past 20 years but that it has declined over the last 5 years. Unless off-farm income per person has risen to compensate for this decline, the welfare of the rural population is likely to be lower today than in the previous several decades. The decline in the value of agricultural production per hectare also implies the slackening in the rate of the economic growth due the importance attached to agriculture in the economy.

4. REGIONAL LAND AND LABOR PRODUCTIVITY

Level and growth in land and labor productivity is influenced by the crop mixes in each region. Table 6 shows the relative importance of crops in each region. In Central Provinces, coffee, tea and horticulture dominate the value of agricultural production. Maize and other minor crops thus are less important. In Eastern, maize production is as important as coffee production is. Horticulture is also a major enterprise. The crops in the rift valley province are dominated production of maize and wheat. Coffee and tea are less important crops. Maize and sugar are the most important crops in Western and Nyanza provinces. Horticulture, coffee and tea are of secondary importance.

Table 6. Crops Contribution to the Regional Total Value of Production (%)

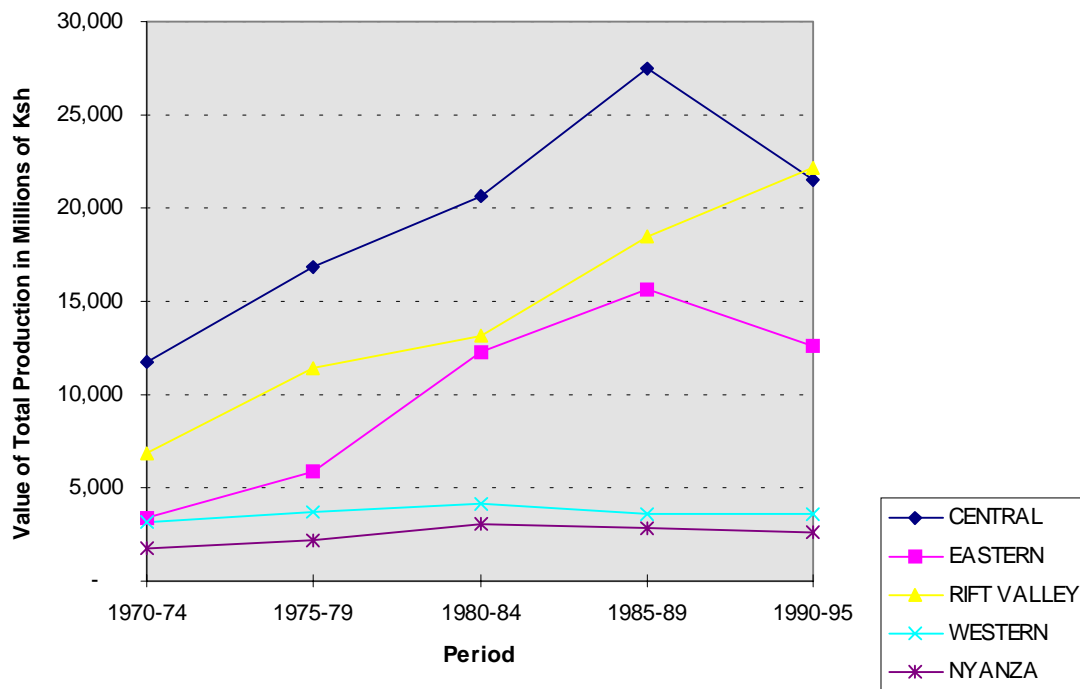
	Central	Eastern	Rift Valley	Western	Nyanza
Coffee	52	36	2	3	6
Tea	11	6	8	1	1
Maize	9	36	62	53	49
Wheat	1	1	14		
Horticulture	24	16	10	2	4
Pyrethrum			2		3
Sugar	-			36	28
Others	3	5	2	3	9
		100	100	100	100

The relative growth in the total value of agricultural production by regions is shown in Figure 2. The value of agricultural production grew in all regions until 1990-95 after which it then declined. Central Kenya has the highest total value of production because of the dominance of the production of high-valued crops. The rapid increase in the value of agricultural production in central was as a result of the shift towards high value crops such as tomatoes, French beans and other horticultural crops (floriculture was not included in this analysis). Rift valley and Eastern Province have also high value of agricultural production because despite the dominance of maize and wheat which are lower value crops, the province agriculture is boosted by the production of some coffee, tea and horticulture. The value of agricultural production has however stagnated in Western and Nyanza mainly because of the poor performance of maize and sugar.

4.1. Regional Partial Productivity Ratios

The partial productivity ratios for each province are shown in Figures 3 to 6. In Central Province (Figure 3), labor productivity is high at Ksh 6,341 in the 1990-95 constant average prices. However, labor productivity has declined and only increased substantially by about 13 percent between 1985 and 1990. It declined between 1990 and 1995. There were more rapid gains in land productivity, which increased by about 27 percent between 1970-75 and 1974-79. Land productivity has also declined after 1990-1995 period. Labor productivity has increased less rapidly in Central Province because of the high growth in the rural population.

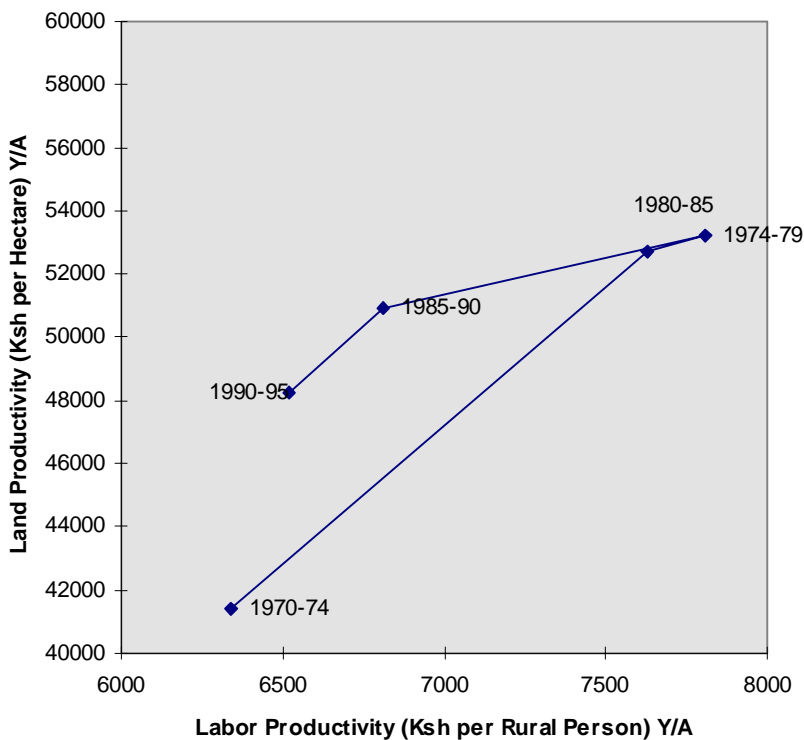
Figure 2. Trends in the Total Value of Production by Provinces



The growth in land productivity in Central between 1970 and 1980 could be attributed to the high adoption of fertilizers and maize varieties. Also, because of the good blend of crop mixes and the shift to the high value horticultural crops the land and labor productivity increased. The poor performance in coffee, which contributes about 52% of the value of production in this area, has caused a decline in the land and labor productivity during 1990-95.

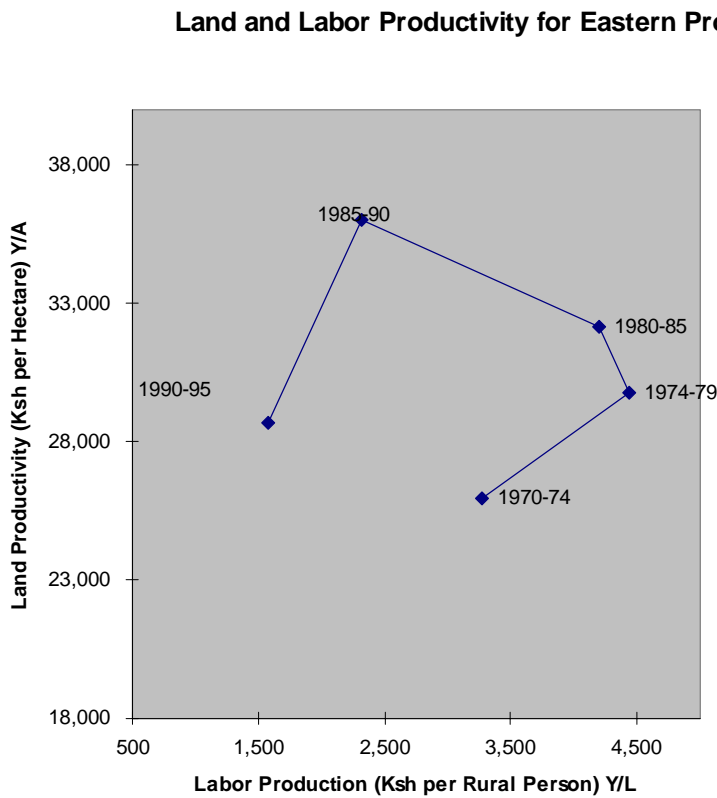
Figure 3. Trends in the Total Value of Production by Provinces

Land and Labor Productivity For Central Province



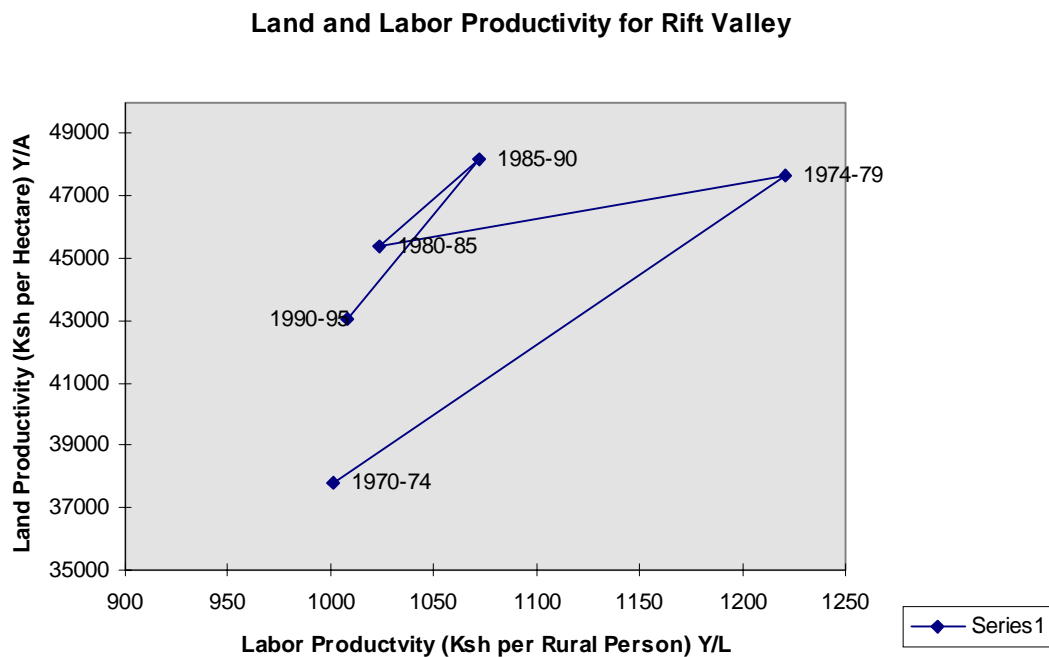
In Eastern Province (Figure 4), labor productivity is low at Ksh 1,585 per rural person. It more than doubled between 1970-74 and 1974-75 but has declined after 1990. But land productivity has decreased after the initial increase between 1974-75 and 1975-79. By 1990-95, for example land productivity was lower than it was in the 1975-80 period thus again depicting the deteriorating state of the welfare of the rural population.

Figure 4. Land and Labor Productivity Ratios for Eastern Province



In the Rift Valley province (Figure 5), labor productivity has stagnated at Ksh 1000 per rural person. Between 1970-75 and 1974-79, the productivity increased slightly after which it has declined to the 1970-74 levels. Labor productivity has declined in the 1990-95 period. Land productivity in the Rift Valley province increased by 26 percent between 1970-74 and 1974-79 period. It stagnated and then declined by 11 percent after 1990.

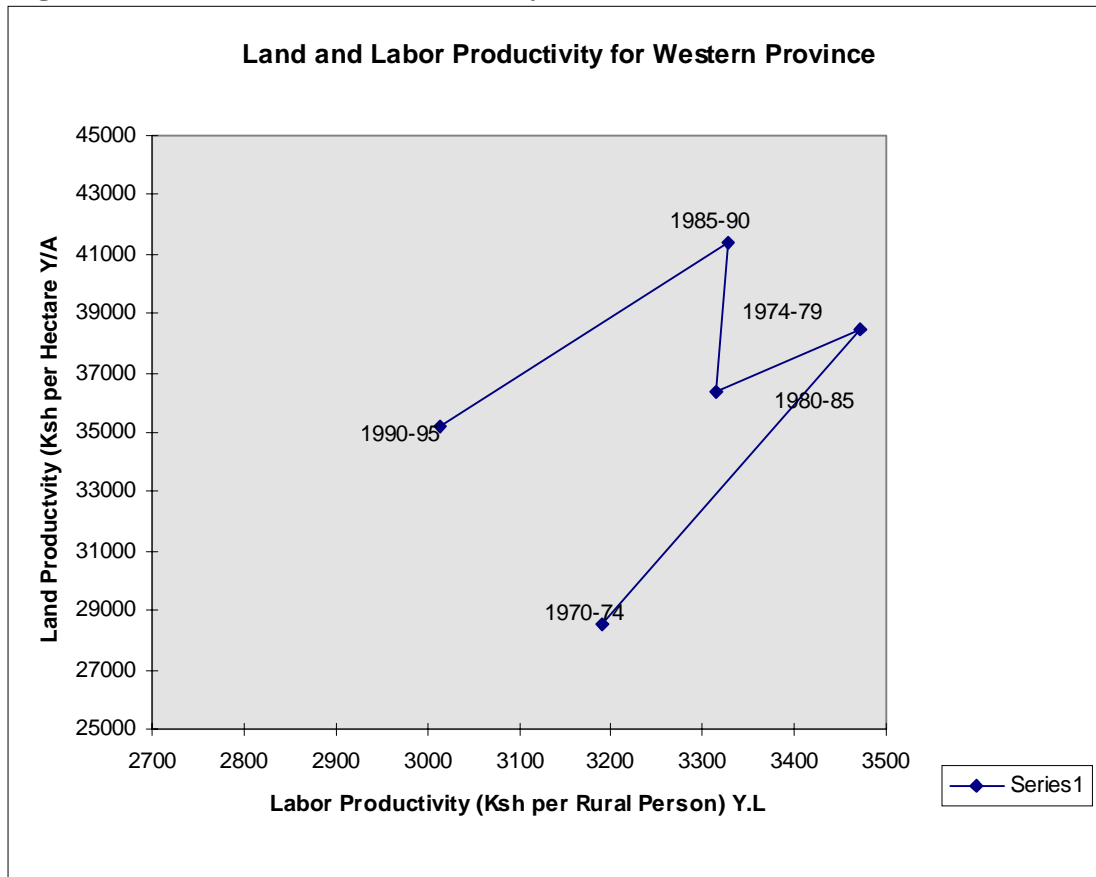
Figure 5. Land and Labor Productivity Ratios For Rift Valley Province



The increase in land and labor productivity in this province is attributed to the adoption of the high yielding maize and wheat varieties around the 70s and increased use of fertilizers during that period. The decline during the 1990-95 period is attributed to the reduction in use of fertilizers and other inputs following the profit squeeze caused by the reduced maize and wheat production incentives during the liberalization period. Maize prices in selected Rift Valley markets (as well as most of Kenya) have declined roughly 25 percent in real inflation-adjusted terms between the 1985-92 period and the 1993-98 period.

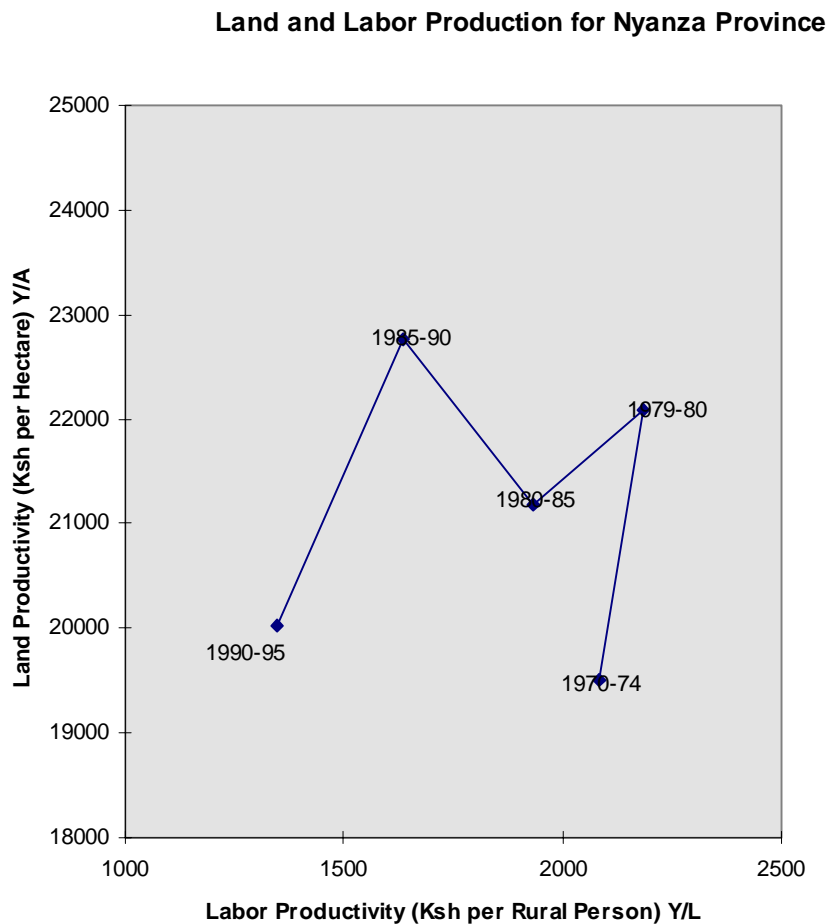
Land and productivity for Western Province (Figure 6) increased slightly between 1970-74 period after it declined and has stagnated for the rest of the time until 1990-95 when it declined by a further 9 percent. Land productivity also increased initially by 34 percent between 1970-74 and 1974-79 period. It then declined following the droughts of the 1980s. Land productivity in Western Province has after recovering slightly in 1985-90 has declined by about 15 percent after 1990. Land productivity has increased more rapidly than the labor productivity because rural population in western province grew faster than the land productivity. Poor maize prices and mismanagement of sugar factories have resulted in the decline in production and the subsequent fall in the labor and land productivity.

Figure 6. Land and Labor Productivity Ratios for Western Province



In Nyanza Province (Figure 7) was initially higher than that in western province about Ksh 2,000 per rural population. After increasing slightly between 1970-74 and 1974-79 period, labor productivity in Nyanza decreased by 15 percent between 1974-79 and 1979-80 and by 15 percent between 1985-90 and 1990-95 period. Labor productivity in 1990-95, was only 65 percent what it was in 1970-74 period. Land productivity in Nyanza increased initially by about 13 percent between 1970-74 and 1974-79. It declined during the drought years, improved slightly after 1985 and has decreased further by 12 percent between 1985-90 and 1990-95 period. Like Western province, Nyanza lacks the production of high value crops. Both sugar and maize whose performance has been poor dominate the production in this province.

Figure 7. Land and Labor Productivity Ratios for Nyanza Province



4.2. Factors Influencing Land and Labor Productivity

It is difficult to discern clear and consistent trends in productivity changes within regions because Kenya does not have specific regionally-based agricultural policies. Weather patterns and crop cultivation patterns can differ widely across regions. The crop mixes in each zone thus influence regional agricultural productivity. In Central Province for example labor productivity increased during the period 1970-1980 when it mainly stagnated in the other provinces during the same time. The land productivity also increased more rapidly in Central Province than in other provinces. This is due to shifts in crop mixes from crops like maize towards high value horticultural crops. In Nyanza and Western provinces particularly, the land and labor productivity has not only been low but has also declined faster than in other areas. The results thus implies that except in central, the welfare for the rural population in all the other provinces stagnated until 1990 when it has started to decline. The contribution of the provinces to the general economic growth in the country has also decline following the decline in the value of agricultural production. A higher proportion of rural families thus are likely to be more food insecure than they were in 1990, have less job opportunities and have less family incomes.

Land productivity and labor productivity growth have corresponded to the periods when area expansion of high-value crops was taking place. Area expansion, particularly of maize,

coffee, and wheat, has extended to marginal areas due to increasing population pressure in the high potential areas. A higher proportion of the population has moved to the lesser potential and more marginal areas. But crop varieties and other production technologies used in these areas remain those designed for the high and medium potential areas. It is increasingly clear that viable technology packages for marginal areas will be needed to appreciably raise aggregate agricultural productivity in Kenya and alleviate rural poverty.

Limited technical progress in Africa has fostered an active debate over the performance of technology generation and dissemination systems. For example, questions are frequently posed whether viable food crop technology packages exist for medium and low potential areas that are relevant for smallholders (but aren't being fully utilized for other reasons) or whether the available on-shelf food crop technologies simply aren't viable enough to appreciably stimulate agricultural growth. Another question that may be posed is why, despite an empirical record indicating very high rates of return to agricultural research in Africa, has food crop production growth remained mostly stagnant in these same countries in which the empirical investigations were carried out.

The partial productivity analysis depicts a very volatile and fragile agricultural system where productivity gains in a few years can be eroded almost immediately. This underscores the need for high quality agricultural research systems to generate continuous improvements in farm technology over time. The decline in land and labor productivity corresponds to the time when market reform policies were implemented. The partial, stop-go nature of market liberalization and poor sequencing of the liberalization policies during the 1990s has mitigated some of the important potential benefits of reform to producers. The policies were also poorly timed (Nyangito 1998). For example, fertilizer prices were liberalized in 1990 when the maize, wheat and sugar prices and marketing continued to be regulated by government until 1994. This squeezed profits and thus reduced producer incentives to use productivity-enhancing inputs. The inflationary conditions of the 1990s, fueled by the depreciation of the shilling, increased the prices of imported fertilizer and pesticides at a higher rate than the rise in commodity prices, which thus squeezed the profits and reduced the producer incentives. On top of this, problems in developing viable systems of private farm finance have left a vacuum in the agricultural credit system after the contraction of the AFC system. As a result, maize and wheat area and production have declined, use of fertilizer has stagnated, and use of hybrid maize seed has actually declined.

The extension delivery to farmers is poor and farmers may not be aware of the improved technologies. Farmers have increasingly been unable to access credit through the formal credit market. For many smallholders, the purchase of yield enhancing inputs such as fertilizers, pesticides, seed and payment of labor (PAM 1995). Seed quality particularly that of maize and wheat is poor because of the poor distribution system, which restricted the availability of preferred seed. Lack of a reliable seed quality control service also contribute to the poor quality seed (Nyoro 1995).

5. CONCLUSIONS AND IMPLICATIONS FOR POLICY TO STRENGTHEN AGRICULTURAL PRODUCTIVITY

This section summarizes the findings above, and draws from a wider range of experience in Sub-Saharan Africa on identifying cost-effective strategies for increasing agricultural productivity.

5.1. Summary of Main Results

The partial productivity measure for labor (in constant 1991-95 terms) has declined from roughly 3,000 Ksh per rural person in 1970-74 to 2,400 Ksh per person in 1990-94 -- about a 20 percent decline. Land productivity had increased greatly up to about 1990 and has fallen since. The decline has occurred because fertilizer use has stagnated, use of hybrid maize seed has declined because seed quality has declined. Contraction of credit schemes by the AFC has also left a vacuum in the agricultural credit system. On the policy side, the stop-go policy environment, poor sequencing of the liberalization policies has mitigated some of the important potential benefits of reform to producers. The poor management of coffee cooperatives and sugar factories have reduced payments to farmers. Due to increasing population pressure in the high potential areas, a high proportion of population has moved to lesser potential and more marginal area without appropriate technologies suitable for these fragile areas. This has caused decline in crop production in these areas.

Large increases in the land and labor productivity such as that achieved in Central Province are due to the changes in crop mixes. In crops like coffee, tea maize and wheat, the growth in productivity was as a result of area expansion rather than intensification of the existing farming systems. Growth in land productivity has also resulted from the development and adoption of new varieties of maize and wheat crops. But crop yields have also declined because crop varieties and other production technologies adopted in the low potential and marginal areas are inappropriate for them.

A major challenge in Kenya now is to adopt policy reforms that could induce technical change in agriculture.⁴ Policies adopted should solve the broader problems relating to the generation, dissemination and adoption of new technologies and thus stimulate changes in crop mixes towards the production of high value crops.

Market policy reforms and technology development therefore need to be viewed as different facets of the same problem. Marketing strategies will need to refocus their emphasis from the liberalization of markets to the sustainable promotion of productivity growth for the millions of low-input semi-subsistence rural households in Kenya. This implies a major role for future marketing research in identifying public and private investments and activities that will intensify input use on smallholder farms. Can such research activities be financed within the constraints of available budgets, and involve greater coordination between the public and private sectors in providing smallholders with access to integrated input, credit, and output markets. The most promising scenarios are likely to involve farmer organizations

⁴ Important steps that the government could take to in this direction to raise productivity have been recommended by Tegemeo in the proceedings of the conference on improving agricultural performance towards 2000 (PAM 1995). These includes the following:

(accountable to farmers), multinational input and commodity trading firms, improved technology development, a supportive public sector. An expanded role for commodity exchanges, forward contracting, and other mechanisms could also be used to reduce the costs and risks of investing in the entire food system (Jayne and Jones 1997).

Given the fiscal restrictions imposed by the need for structural adjustment, there will be increased emphasis in the foreseeable future on developing financially sustainable market-oriented mechanisms and exploiting the potential gains from regional trade. Important steps that governments could take to raise the productivity and stability of the food systems include the following:

1. Improve Road, Rail, Port, and Communication Infrastructure: Donor support in this area would make the market liberalization measures they advocated more successful. High transportation costs in Kenya contribute to higher fertilizer prices, lower output prices for farmers and hence lower incentives to invest in productivity-enhancing technologies. Improved market infrastructure also requires further policy change to remove remaining import tariffs on grain, vehicles and spare parts.

One important role for research is to identify where such infrastructure investments would have the highest payoffs. For example, by analyzing food production, consumption, and price dispersion patterns in a country, researchers can provide insights into where investment in a road would do the most to improve food security or increase production potential through raising farm output prices and lowering farm input prices. Given the high cost of such infrastructure investments, such targeting is extremely important.

2. Invest More in Market-oriented Agricultural Research: In market-oriented growth strategies, well tested and improved cultivars and management practices for commodities for which there are viable markets, work synergistically with improved input and output markets to create sustainable conditions for intensification and productivity growth. Yet national research budgets and donor funding of technology development are in many cases declining. KARI faces numerous problems including low salaries, dismal conditions of service for their researchers, and continued reliance on donor finance for funds whose sustainability cannot be assured. The history of agricultural research in Uganda shows the impossibility of turning research off and on. It takes only a short lapse in research support to result in massive losses in human and physical capital that requires painful and expensive new investments to rebuild. And despite claims that fertilizer/seed technologies are on the shelf that can double or triple farm yields in Africa, there remains a dearth of research on the profitability and riskiness of those technologies under farmers' actual control, and under current input and output market conditions or those foreseeable under alternative sustainable input and output marketing arrangements. KARI could also expansion the generation of technologies that are more suitable to the medium and lower potential areas as is happening in wheat and maize. Priority setting process should also included in these crops.

The boundaries between production and marketing activities are becoming increasingly blurred, as the agricultural product specification becomes more complex. For example, the rising importance of biotechnology will create a variety of new opportunities for applying new scientific discoveries toward practical use in the food and fiber system and working out intellectual property rights for the product (Zilberman, Yarkin, and Heiman 1997). An increasingly important role of the interrelated research, marketing, and legal systems is to work out the details of use and exchange of information and knowledge.

3. Invest More to Nurture the Political, Legal and Economic Foundations of Private Marketing Systems: A well-functioning legal and political framework for market activity reduces the risks and transactions costs of private trade. Strengthened mechanisms for specifying and enforcing contracts, raising the costs of contract non-compliance, and more pluralistic procedures for developing the rules governing market activity are important adjuncts to developing reliable markets, and inherently involve strengthening the regulatory abilities of the state rather than "getting the state out of market regulation." In general, this means a reorientation of the state from "control" activities to "facilitation" activities designed to reduce farmers' and traders' costs of transacting across inputs, credit, and commodities. This would include, for example, the removal of existing legal and institutional constraints that have impeded the establishment of efficient management of the smallholder tea factories and coffee cooperative societies.

The timely dissemination of market information can also help policy makers monitor the evolving effects of market liberalization better, identify problems that require mid-course correction, and respond to impending supply fluctuations in a more timely way. Such an approach also includes more public support for the development of fledgling commodity exchanges, which have the longer-run potential to improve the dissemination of market information, reduce search costs to link buyers and sellers substantially, and lower supply and price risks through forward contracting and hedging.

4. Coordinate Policies and Investments to Gain Complementary Benefits from Higher-Valued Cash and Food Crop Production: With most of Kenya's poor residing in regions of significant agricultural potential, and in light of severe land constraints in many of these regions, developing strategies to increase the value of agricultural production per unit of land and labor is a top priority. Smallholder commercialization, particularly into higher-value export crops, generally has produced significant and positive effect on food crop fertilizer use and productivity, however, this varies by crop and region. A major avenue for future research is to understand better how successful commercialization arrangements linking smallholders and marketing/processing firms have been structured so that their successful ingredients can be replicated and incorporated more broadly into commercialization strategies in other regions. This is likely to yield high payoffs in terms of increasing agricultural productivity and food security.

5. Increase Business Skills Training and Related Support for Grass-roots Farmer Organizations: While the benefits of existing farmer organizations have derived mainly from reducing the transaction costs of acquiring and repaying credit through group schemes, these benefits can be potentially extended into a broader range of input and output marketing activities. For example, in Mali, such organizations handle most of the bulking and initial grading of cotton and the management of local savings and loan associations. Future roles for farmer organizations include greater involvement in the gathering and dissemination of market information, the diffusion of technical advice, and the bulking of farmer surpluses to facilitate smallholder participation in local and regional markets, thereby opening up a number of market-oriented mechanisms (e.g., commodity exchanges, forward contracting) for reducing the risks of price and supply instability.

Moreover, there are very different economies of scale at various stages of the food system. Multinational firms may have certain advantages in international trade (acquiring fertilizer and other inputs, hedging on futures markets, having a wider trade portfolio to reduce risks) and accessing technologies from around the world. But given the small size of most African

markets, such large firms are likely to have substantial market power and may not have incentives to pass on all these benefits to smallholders. The development of strong farmer groups may mitigate the potential for actors at highly concentrated stages to exert market power to the detriment of smallholder production growth. Such organizations may even act as subcontractors or partners to multinationals, thereby creating a system that captures the benefits of scale economies in international trade while tailoring specific services to local farmers' conditions.⁵

6. Invest in Local Analytical Capacity: The payoffs to market reforms have been most effective when as part of the reform process, there has been a concerted effort to strengthen domestic capacity for ongoing research and analysis to inform the reform process. Because of the paucity of data on food systems in most African countries, most reforms are necessarily designed initially on the basis of scanty empirical information. The strengthening of domestic analysis capacity allows a mechanism for on-going monitoring of food system performance in response to the reforms and provides a mechanism for mid-course corrections as researchers uncover new empirical information. Given the ongoing nature of the reforms, it is unlikely that outside consultants alone can assure the continuity of monitoring, analysis and evaluation needed to help guide the reforms.

Lasting market and related policy change depends critically on governments' actual belief in the analysis supporting the reforms. There is ample evidence that governments that have reluctantly undertaken market reform programs have reversed them and reimposed the old system of price and trade controls with the advent of drought or other shocks (Jayne and Jones 1997). Local analytical units are often seen as bringing more local knowledge to the analysis, being less ideologically driven, and having greater sensitivity to domestic policy concerns than analysis conceived and driven by donor interests using expatriate analysts. At the same time, cooperative analyses involving both local units and external researchers is often valued, as the involvement of an internationally known research organization often gives local decision makers greater confidence in the scientific soundness of the analysis. The demand for, and credibility of, food policy analysis to guide market development is enhanced by a collaborative research process driven by local researchers and government analysts who take "ownership" of the research agenda and findings.

⁵For example, in Mali the union of cotton farmers, the multinational cotton company, and the state are all signatories to the contract-plan governing the management of the cotton subsector in the country and all receive a share of the cotton company's profits.

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