BACKGROUND PAPER

FOR THE WORLD DEVELOPMENT REPORT 2008

Agriculture for Development in Sub-Saharan Africa

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Main Message
Agriculture is growing in Subsaharan Africa (SSA), but the growth is precarious. In most countries, it has yet to reach the sustained 6% annual rate estimated by NEPAD as necessary to meet the Millennium Development Goal of cutting poverty in half by 2015. Growth needs to be accelerated, secured and used more effectively to promote broadly shared development. This requires two elements. The first is a reversal in the massive underinvestment and significant mis-investment that has taken place in the past in African agriculture, which has led to a huge cost in forgone development for Africans. There is an opportunity now for increased productive investment and improved efficiency of investment in African agriculture, which can significantly increase productivity and output, especially among certain groups of smallholders. The second element is to capture part of this productivity growth to help finance a set of investments, programs and policies that in the short to medium term will secure the assets and access to services of those smallholders facing severe resource and productivity constraints, while over the longer term provide them or their children with a path out of low-productivity farming.

Abstract

This paper argues that an agriculture-led strategy of economic growth offers most countries of sub-Saharan Africa (SSA) their best chance at rapid economic growth and poverty alleviation. Given the huge heterogeneity of SSA, no single Asian-style green revolution is likely to drive that growth. Rather, SSA will need to develop a series of differentiated agricultural revolutions suited to its varied ecological niches and market opportunities. SSA faces unique organizational challenges in fostering this growth, due to more weathered soils; much weaker infrastructure than other areas of the world; highly heterogeneous social and linguistic systems; poor governance in some countries; and a large number of small countries, which makes it difficult to achieve economies of scale in some of the prime movers of agricultural development, such as agricultural research, higher education, and market development and regulation.

For agricultural growth in SSA to lead to widespread poverty alleviation, it needs to be primarily smallholder-based. Yet smallholders in Africa are very heterogeneous, with many of them (perhaps the majority) lacking the resources to "farm their way out of poverty." For these low-resource farmers, agricultural growth is still crucial to pulling them out of poverty, but its impact is indirect, through increasing the demand for agricultural labor, creating jobs in related sectors

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that service agriculture (forward and backward linkages), providing the resources to invest in education to foster migration out of farming, generating resources that are invested in other sectors to create new jobs, and driving down the price of basic staples, thus increasing real incomes and making it cheaper for entrepreneurs in other sectors to hire workers. This agriculture-led path out of poverty does not occur automatically simply if the agricultural sector grows. It will require that agricultural growth be spread among a broad class of smallholder entrepreneurs (to broaden the demand for labor-intensive goods) and that some of that growth be tapped for investments in education, health, improved infrastructure, and better-functioning labor markets. It will also require African governments and donors to link actions effectively all the way from the local level to the continental level, in order to identify local specificities in needs while capturing economies of scale in provision of key services. It will also require massive resource mobilization, much of which will likely have to come from Africa itself, implying the need for a policy environment favorable to Africans investing more of their own resources in agriculture more productively than in the past in agriculture and the broader agro-food system (referred to hereafter as "extended agriculture.")

1. The critical importance of agriculture in Africa

Capitalizing upon agriculture's potential to drive development in Subsaharan Africa (SSA) is both critically important and urgent for enhancing aggregate economic growth and improving the welfare of hundreds of millions of extremely poor people. Agriculture employs 62% of the population of SSA (excluding South Africa) and generates 27% of GDP of these countries, with the majority of the poor living in rural areas (FAO, 2006, World Bank, 2006a).[1] More than 215 million people, nearly a third of the population, are malnourished, and almost half live on less than a dollar a day. SSA is the only region of the world where poverty—still strongly a rural phenomenon—and undernourishment have been increasing over the past 20 years and where those living on less than $1/day have become poorer (World Bank, 2005c). This weak economic performance is closely linked to slow productivity growth in the agricultural sector, as the agricultural sector is the key determinant of overall economic growth and poverty reduction in most SSA countries (Christiaensen and Demery, 2007) (Byerlee, et al., 2005, Department for International Development, 2005, Dercon, 2006, Diao, et al., 2006, Mwambu and Thorbecke, 2004, Wolgin, 2001). Yet sub-Saharan Africa is incredibly diverse, so sub-continent-wide averages about agricultural performance are often misleading, obscuring localized successes and potentialities.

The arguments in favor of an agriculture-led strategy for economic growth and poverty alleviation in low-income countries in the early stages of structural transformation are well-known and laid out in chapter 1 of the WDR. Agricultural growth contributes to broader economic growth and poverty alleviation through:

- The direct effects of the growth on those who participate in farming, either as farmers or as farm laborers.
- Increased upstream demand for inputs and downstream demand for marketing and processing that accompany expanded agricultural production (production linkages, both backward and forward).

[1] For SSA including South Africa, agriculture employs 59% of the population and generates 17% of GDP.

- Flows of capital and labor from agriculture to other sectors (factor-market linkages), as profits generated in agriculture are invested by individuals and communities in other sectors and in infrastructure to generate increased real incomes and employment (via investment and fiscal linkages) and labor flows, often seasonally, between sectors depending on relative rates of return.
- The impact that expanded agricultural production has on lowering staple food prices and hence wage rates (the wage good effect), which in turn encourages expansion of output and employment in other sectors.[2]
- The increase in incomes and employment in other sectors resulting from increased demand emanating from farmers whose incomes are rising due to expanded agricultural production (consumption linkages).
- Potentially increased productivity resulting from better worker nutrition and increased efficiency of investment resulting from greater macroeconomic and political stability that accompanies a more reliable food system (productivity linkages).[3]

The strength of these direct participation, wage-good, and linkage effects determine the broader economic growth and poverty-alleviation effects of a given increase in agricultural production. They depend on the relative size of the agricultural and non-agricultural sectors, the current concentration of poverty in the various sectors, the type of agricultural growth that takes place (e.g., its relative factor intensities), the consumption habits of the farmers experiencing that growth, the structure and openness of markets they face, and functioning of local institutions (Christiaensen and Demery, 2007). Many of these factors can be influenced by policy, and the challenge facing Africa and its partners is to structure agricultural growth within a policy environment that maximizes both broader growth throughout the economy and poverty alleviation.

In SSA, arguments in favor of an agriculture-led approach to economic growth and poverty alleviation are based on the large absolute numbers of the poor in rural areas, the strong dependence of non-farm activities in most SSA on demand emanating from the agricultural sector, and consequently the evidence that the income and poverty multipliers are greater for the agricultural sector than the non-agricultural sector. Over the period 2000-04, the agricultural sector accounted for 24% of total economic growth in SSA countries excluding South Africa, slightly less than its 27% share of total GDP This contribution to overall growth varied widely by country, from 0.8% in Botswana to 38.2% in Togo and 65.3% in Comoros (World Bank, 2006f). In many of the fastest growing countries, agricultural growth rates were highly

[2] This wage-good effect is larger the more non-tradable the staples are. In a world where staples were purely tradable and domestic prices were equal to world prices, an increase in local agricultural production would have no wage-good effect. In SSA, however, because of high internal transport costs, staples are semi-tradables (particularly the farther one gets away from major ports), implying that there is still scope for wage-good effects. This is discussed in more detail below. In a recent paper, Mellor and Ranade show that even in a completely open economy with respect to staples, agricultural growth is still much more pro-poor if farmers have a consumption bundle that includes a higher share of other nontradables than do those receiving income from the industrial sector (Mellor and Ranade, 2006).

[3] For a discussion of these linkage effects and a review of empirical estimates of their strengths, see (Haggblade, et al., 2007) See also Albert O. Hirschman, "A Generalized Linkage Approach to Development" in (Hirschman, 1981)

correlated with overall GDP growth; in Uganda, for example, between 1991/92 and 2004/05 this correlation was 77% (World Bank, 2006e). For Mali, the R^2 between agricultural sector growth and GDP growth was .92 over the period 1980-99 (Tyner, et al., 2001) While such correlations do not prove causality, they do point to the strong interdependence of agricultural and broader economic growth in these countries.

A strategic question is not just the share of agricultural growth in total growth, but whether growth in the agricultural sector effectively spurs growth in other sectors and poverty reduction throughout the economy. The evidence to support the argument that investing in agriculture can spur faster economic growth *and* poverty alleviation than investment in other sectors comes from case studies (e.g., (Byerlee, et al., 2005)), cross-country econometric analyses of the relationship between growth in different sectors, overall economic growth, and poverty reduction (e.g.,(Christiaensen and Demery, 2007)), simulations involving multi-market and CGE models, econometric and input-output models to estimate the magnitude of growth linkages (Delgado, et al., 1994, Diao, et al., 2006, Haggblade, et al., 2007, Pratt and Diao, 2006), and analyses of food price trends that accompanied periods of both rapid and lagging growth in semi-open African economies (to test the wage-good effect).

The evidence shows that growth in agriculture in SSA, particularly in the lowest-income countries that are most agrarian, leads to both stronger overall growth and more poverty alleviation than growth in other sectors. In part this is simply arithmetic, deriving from the large contribution of agriculture to overall GDP and the heavy concentration of the poor in the sector. Christensen and Demery show that growth in the agricultural sector in SSA reduces the poverty headcount rate in SSA by 4.25 times more than growth in the service sector, even without taking into account linkage effects, because of the large number of the poor in agriculture. Including linkage and wage-good effects would increase the impact even more, especially given that most of Africa's rural poor—including farmers—are net buyers of staples and hence benefit from lower food prices(Christiaensen and Demery, 2007). Thirtle, Lin, and Piesse, in a cross-country econometric study covering 59 countries, find that the elasticity of overall GDP growth per capita with respect to increases in agricultural value added/ha (a measure of how effective agricultural productivity growth is in spurring overall economic growth) was 8% higher in SSA than in Asia and 54% higher than in Latin America. They also found that the cost per person pulled out of poverty (at the $1/day poverty line) through investment in agricultural research was 20% lower in SSA than in Asia and 98% lower than in Latin America, indicating that productivity-led agricultural growth is more effective in spurring GDP growth and poverty reduction in SSA than in the other two regions (Thirtle, et al., 2003).

Linkages between growth in the agricultural sector and the rest of the economy are generally lower in SSA than in developing areas in Asia, due in part to SSA agriculture's lower reliance on purchased inputs and processing (weaker production linkages) but higher than in Latin America (Haggblade, et al., 2007). However, the lower growth linkages for SSA reflect in part the assumption in many of the models used to estimate the linkages that all agricultural products are tradable, which is not the case for SSA. In reality, growth in the tradable portion of agriculture in turn induces increased growth in the large semi-tradable sectors of agriculture through consumption linkages (for staples such as millet, sorghum, and cassava; and many perishables, such as horticultural and livestock products. Thus, the growth linkages are in part *within*

agriculture, rather than between agriculture and other sectors. When these linkages are taken into account, the linkages from growth in SSA agriculture to the rest of the economy are of the same magnitude of those in Asia. For example, Delgado et al. found that a $1 increase in production of agricultural tradables generated $1.96 of extra income in Niger, $1.97 in Senegal, $2.48 in Zambia and $2.88 in Burkina Faso, which are comparable to growth linkages found in Asia (Delgado, et al., 1994).[4]

Three points regarding these linkages deserve special mention. First, the magnitude of the growth linkages from agriculture to non-agricultural growth are generally much higher than the reverse—from the non-agricultural sector to agriculture, due to both the larger base of the agricultural sector and the less-elastic supply of agricultural as opposed to non-agricultural products (Haggblade, et al., 2007). This implies that a vibrant agricultural sector is critical for generating the demand that stimulates the growth of non-farm activities, particularly in the rural areas, yet these activities cannot be expected to "pull agriculture out of poverty" by themselves (e.g., a micro-credit driven model for rural poverty alleviation is not likely to succeed without complementary, and substantial, investments in agriculture). Second, consistent with experience from around the world, the growth linkages in SSA are dominated by consumption linkages. In the Delgado et al. study, they accounted for between 47% of the total effect (in Senegal) to 98% in Zambia; more generally, the modal figure for such linkage studies is about 80% (Christiaensen and Demery, 2007, Christiaensen and Demery, 2006, Delgado, et al., 1994, Haggblade, et al., 2007). Thus, increasing the elasticity of supply of local semi-tradables (e.g., livestock and horticultural products, local services, and local manufactures) and increasing their competitiveness with imports is critical to broadening the induced income, employment, and poverty-reduction effects of a given expansion of agricultural production. If the supply of these products is not elastic, the increased demand for the nontradables will just translate into higher prices, not increased incomes and employment.[5] Third, the lower production linkages of SSA agriculture (compared to Asian agriculture), due to lower reliance on purchased inputs and post-harvest processing and marketing, do not imply that future agricultural growth in SSA will be characterized by such weak production linkages. Indeed, while previous agricultural growth in SSA has been driven by area expansion and increased use of non-purchased inputs to produce unprocessed products, as argued below, future production growth will need to rely much more on purchased inputs and post-harvest processing, which will strengthen production linkages.

In addition to agriculture's impact on stimulating non-agricultural growth, simulation modeling (especially work by Xinshen Diao and colleagues at IFPRI) show that agricultural growth, particularly in staples, is more pro-poor than growth in other sectors. For example, in a study based on economy-wide (CGE and multi-market) models of Ethiopia, Ghana, Rwanda, Uganda, and Zambia found that in all countries, agriculture-led growth was much more effective in reducing the poverty rate than non-agriculture-led growth. For Ethiopia (the poorest country),

[4] The Delgado et al. estimates are, however, probably overestimates, as they are based on a model that assumes a perfectly elastic supply for non-tradables, including crops such as millet and sorghum—clearly a questionable assumption.

[5] It is probable that the supply elasticity of local nontradables, particularly in rural areas, is less elastic in SSA than in Asia due to the higher transaction and transport costs that result from SSA's lower density of population and infrastructure. Thus, the infrastructure improvements discussed below that are needed to spur agricultural growth in SSA are also important for increasing the indirect (linkage-induced) employment and poverty-reduction effects brought about through consumption linkages.

the reduction in the number of the poor for a given increase in GDP was 2.3 times higher if the growth were agriculture-led rather than non-agriculture-led; in Ghana (the richest), it was 1.38 times higher (Diao, et al., 2006). Similar results have been found in simulation modeling for Southern Africa (Pratt and Diao, 2006) and West Africa (International Food Policy Research Institute (IFPRI), et al., 2006).

In their analysis of intersectoral linkages, Haggblade, Hazell and Dorosh emphasize that given the importance of consumption linkages, the degree to which agricultural growth stimulates growth in other sectors depends very much on who receives the initial increase in agricultural income. In their words, "agricultural growth should target farmers who shop in rural areas" if it is to stimulate rural non-farm activities. Equally important is the elasticity of supply of local non-tradables and import-substitutes. If production of these is not easily expandable, the result will be simply price increases and displacement of demand onto imports, a point also made by Delgado et al. (Delgado, et al., 1994, Haggblade, et al., 2007).

Much of the poverty reduction impact of agricultural growth predicted by the economy-wide modeling comes through the reduction of staple-food prices in countries where staples remain nontradable or semi-tradable goods. While there is empirical evidence of a positive relationship between productivity growth in the food system ("extended agriculture") and lower real consumer prices for staples, these reductions are at least in part due to reduced per-unit marketing margins emanating from market reforms that reduced transaction costs and, in some cases, improved market infrastructure that reduced transport costs. For example, between 1977-81 (the 5 years prior to the start of Mali's program to liberalize cereal markets) and 1994-98 (when the reforms were nearly complete), real consumer prices of millet declined by 47% and those of rice fell by 34%. The declines were due in large part to reductions in the marketing margin, but the absolute decline in real price was 33% greater for rice, reflecting also an increase in on-farm productivity due to improved irrigation management (Dembélé and Staatz, 2002, Egg, 1999). In Uganda, consumer prices for staples also declined during the late 1990s as on-farm productivity increased (World Bank, 2006e), and real consumer prices for maize meal have been trended downward in Kenya and Zambia between 1994/95 and 2004/05, although this has been largely due to reforms in the milling sector that have allowed small-scale mills to compete with large industrial mills (Jayne and Chapoto, 2006). In contrast, Ethiopia, real food prices in Ethiopia *increased* by 15% in rural areas and 19% in urban areas between 1995/96 and 1999/2000 (which was a faster rate of increase than for prices of non-food items) during a period of sluggish agricultural growth (World Bank, 2005b).[6]

For agriculture-led growth and poverty-reduction strategy to work, however, agricultural growth has to be robust. The NEPAD/CAADP framework sets a target of a sustained agricultural growth rate of 6% per year, which CAADP estimates is required to reach the Millennium

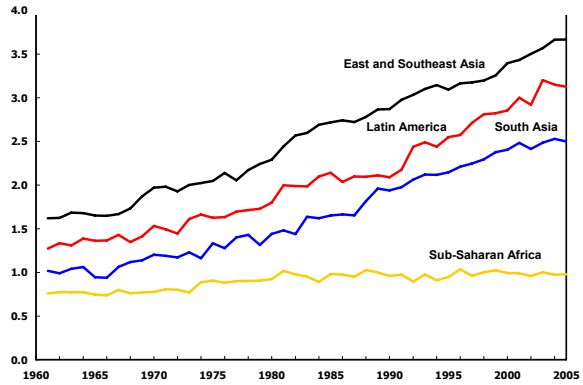
[6] Estimating the impact of productivity growth in staples on real staple food prices over the period 1985-2006 is difficult in part because many countries were liberalizing their trade regimes during this period, leading to much greater regional integration. (For West Africa, see (Yade, et al., 1999)). As a result, many of the lower-cost staple-food producing areas (e.g., southern Mali, eastern Uganda, northern Mozambique) expanded exports to neighboring countries, which tended to bid up local prices. Thus, an analysis of the impact of the impact of productivity growth on prices ought to be carried out by market-sheds, which often transcend national boundaries. Unfortunately, production and price data are collected typically reported on a national or subnational basis, making this type of analysis more difficult.

Development Goal poverty reduction target of halving poverty by 2015 (African Union and NEPAD, 2004). This is a higher sustained rate of agricultural growth than has ever been achieved on the continent. IFPRI analysis shows that West Africa would require an even higher rate, 6.8% per year to meet the MDG goal for the region as a whole, although even this rate would not assure that each country in the region would meet the target (International Food Policy Research Institute (IFPRI), et al., 2006). Thus, a first challenge for SSA is to secure and accelerate its rate of agricultural growth.

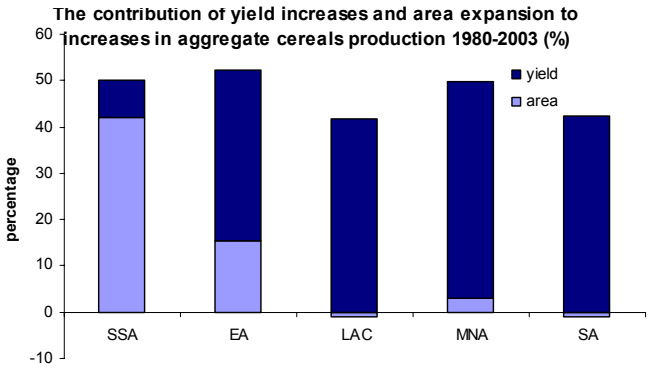
SSA's aggregate history of agricultural performance since 1960 raises doubts about whether such an agriculture-led approach to poverty alleviation is feasible. According to FAO statistics, production has grown over the past 45 years, but more slowly than population, with a resulting decline in per capita energy availability.[7] Production growth has been primarily through area expansion, with yields per ha essentially stagnant, particularly for cereals, in contrast to substantial yield increases in other regions of the world (figure 1). Cereal yields in sub-Saharan Africa increased only 29% in the 43 years between 1961-63 and 2003-05, compared to 177% in developing Asia and 144% in Latin America. Calls to bring a Green Revolution to Africa (e.g., (Djurfeldt, et al., 2006, InterAcademy Council, 2004, Rockefeller Foundation, 2006)) are aimed at reversing this trend, particularly in light of the limited scope for further area expansion in most areas of SSA without serious environmental consequences.

Figure 1. Cereals Production Trends by Region

(a) Yield growth by region, 1960-2005



(b)



Source: (a) FAOSTAT; (b) FAOSTAT as reported in (African Development Bank (AfB), et al., 2006)

As outlined below, agricultural growth in SSA over the past four decades has been constrained by a myriad of factors, including perhaps most importantly a policy environment that discriminated heavily against agriculture at both the sectoral and macroeconomic levels (e.g., overvalued exchange rates) and increased the transaction costs of those involved in agricultural

[7]One of the difficulties in assessing agricultural growth patterns in SSA is the questionable reliability of agricultural statistics, itself a reflection of underinvestment in agriculture. During the course of the preparation of the WDR 2008; for example, it became apparent that FAO and World Bank figures on value added in agriculture varied widely for many countries in SSA, not only in their levels but even in their trends.

trade.[8] Many of these factors have changed significantly since the mid 1990s, offering new opportunities, as well as new challenges to increased agricultural growth. Furthermore, even during the earlier years, the overall averages hid many important localized successes that can be built upon and learned from in order to accelerate agricultural growth in SSA.

Agriculture's capacity to contribute to growth and poverty alleviation in Africa has been greatly constrained in the past by underinvestment and mis-investment, in both physical and human capital, resulting in a huge cost to Africans in terms of foregone well-being. The underinvestment is reflected in high rates of return to key contributors to agricultural growth, such as agricultural research and locally managed irrigation systems. For example, the median economic rate of return (ERR) of 188 agricultural research projects in SSA reviewed by Alston et al. was 34.3% ((Alston, et al., 2000), while the mean ERR of 22 externally funded irrigation projects since 1985 averaged 18%, with smaller, more farmer-managed projects performing better than larger projects (African Development Bank (AfB), et al., 2006).[9] But returns to such investments, while relatively high on average, have also been highly variable, which may in part explain the underinvestment. Large-scale irrigation schemes, particularly in the 1970s and 1980s, had some spectacular failures, in part due to poor design, monitoring, and evaluation (African Development Bank, et al., 2006, World Bank Independent Evaluation Group, 2006)[10]

The mis-investment is also illustrated by large proportions of government budget allocations to agriculture going to input subsidies rather than to investments that would boost productivity, failure to maintain existing agricultural infrastructure, and failure to provide adequate working conditions for well-trained African agricultural scientists, thus reducing their productivity and increasing the incentives to emigrate. Today there is an opportunity for both increased investment and better use of existing investments to remedy these problems. Particularly important is the emergence of fiscal decentralization, which potentially allows local governments to capture some of the gains from agricultural productivity growth and reinvest it more productively in ways that strengthen growth linkages in the local economy.

2. The potential for success is there

The potential for agriculture to grow faster and contribute more effectively to widely shared development in SSA is greater now than at any time since the 1960s due to (a) new opportunities arising from the changing socio-economic and political contexts both within SSA and globally, (b) a new professed willingness on the part of African governments and development partners to

[8] There are a huge number of studies analyzing why agricultural growth in Sub-Saharan Africa has been so disappointing. A sampling includes (African Union and NEPAD, 2004, Christiaensen and Demery, 2006, Collier, 2006, Commission for Africa, 2005, Delgado, 1998, Department for International Development, 2005, Djurfeldt, et al., 2006, Eicher, 2006, InterAcademy Council, 2004, Lele, 1991, Mwambu and Thorbecke, 2004, Otsuka, 2006, Rockefeller Foundation, 2006, Spencer and Badiane, 1995, Wolgin, 2001, World Bank, 2000, World Bank, 2006b)

[9] Dimithe et al. showed that investment in small-scale improvement in lowland inland swamp (*bas fonds*) irrigation in southern Mali was even more economically efficient than the very successful large-scale irrigation in the Office du Niger, which is widely heralded as a major success water management (Dimithe, et al., 2000).

[10] The World Bank's 10 year review of its world-wide experience in lending to agricultural water projects is striking for the degree to which it stresses how poor the monitoring and evaluation of many of these projects were (World Bank Independent Evaluation Group, 2006)

support agricultural development as a pillar of a broader economic development and poverty-alleviation strategy; and (c) the emergence of localized successes in African agriculture that could be broadened and learned from to serve as the basis of more widespread and sustained agricultural growth in SSA. At the same time, over the last 20 years, new challenges to agricultural growth have also emerged, the most notable of which are the HIV/AIDS pandemic and climate change.

2.1 Changing African and Global Contexts

2.1.1 Changes in SSA

Within SSA, widespread economic and political reforms, increased regional cooperation and reduction of conflict all are contributing to a more favorable environment for reignited agricultural growth. At the same time, the HIV/AIDS pandemic, increased population pressure, rapid urbanization, and climate change are creating new challenges for Africa's agriculture and food systems.

Economic reforms. Between 1985 and 2000, most countries in SSA adopted structural adjustment programs and other macro-economic reforms (e.g., the 1994 devaluation of the CFA franc) that broadened the scope for private-sector participation in their economies, improved the relative price of tradables (including most agricultural products) relative to non-tradables, and improved incentives for foreign private investment (World Bank, 2000). An ongoing concern, however, is that the budget austerity and higher real interest rates that accompanied particularly the early phases of structural adjustment were detrimental to the types of public and private investments critical to agricultural growth (e.g., in agricultural research, extension, higher education systems, and infrastructure).

Political reforms. Since 1990, the majority of SSA countries shifted from one-party states to more open democratic regimes, with two-thirds of SSA countries holding multi-party elections since 2002 (Canadian International Development Agency, 2007). Although fraud has marred some of these elections (most notably in Nigeria in 2007), the norm is much more towards elected governments than even a decade ago.[11] There political reforms have the potential to give greater voice to rural areas, where the majority of voters live, and thus put pressure on elected officials to respond more to rural concerns, thereby weakening urban bias. The political reforms have included political and administrative decentralization. A striking, but not unique, example is Mali: in 1991, the country began a transition from 23 years of dictatorship, in which all major government decisions were centralized in Bamako, to a multi-party democracy which, by 1998, had over 760 units of local government (at the township, county, and regional levels) with major responsibilities for local natural resource management, education, health, and infrastructure development. These reforms across SSA created space for much broader participation by the private sector and civil society in the economy and raised increased needs to strengthen analytic and administrative capacities at the local levels. Particularly important has been the rise of independent farmer and trader organizations that are giving voice to rural people to lobby for policies more favorable to agriculture and rural development.

[11] The increasing expectation that governments be elected is illustrated by the willingness of both the African Union and ECOWAS to denounce the results of the April 2007 presidential election in Nigeria as fraudulent.

Increased regional cooperation. Over the past 40 years, SSA has developed a plethora of regional integration organizations (Broadman, et al., 2007) aimed at addressing the problems of balkanization that resulted from the carving up of the continent among the colonial powers during the Berlin Conference of 1884-85. With the emergence of the African Union (AU) in 2001, the effectiveness of regional cooperation has increased, both at the political level (e.g., the emergence of the AU/NEPAD's peer review process for governance) and in terms of articulating, through NEPAD/CAADP, a vision and plan for accelerating agricultural growth on the continent that is implemented through regional economic communities, such as ECOWAS and COMESA, and at the national levels (Box 1).[12] In addition, SSA's two economic powerhouses, South Africa and Nigeria, have played important roles in subregional conflict resolution and (in Nigeria's case) peacekeeping.

Box 1
Developing CAADP Compacts

The Comprehensive Africa Agricultural Development Programme (CAADP) has been endorsed by the African Heads of State and Government and most donors as a framework for spurring agricultural growth, food security, and rural development in Africa. The primary CAADP goal is agriculture-led development that eliminates hunger, reduces poverty and food insecurity, opening the way for export expansion. Specific targets for 2015 include:

- Improve the productivity of agriculture to attain an average annual growth rate of 6 percent, with particular attention to small-scale farmers, especially focusing on women;
- Develop dynamic agricultural markets within countries and between regions;
- Have integrated farmers into the market economy and have improved access to markets to become a net exporter of agriculture products;
- Achieve a more equitable distribution of wealth;
- Be a strategic player in agricultural science and technology development; and
- Practice environmentally sound production methods and have a culture of sustainable management of the natural resource base.

CAADP is built around 4 pillars:

1. **Extending the area under sustainable land management and reliable water control systems;**
2. **Improving rural infrastructure** and trade related capacities for market accesses;
3. Increasing **food supply**, reduce hunger, and improve responses to food emergency crises; and
4. Improving **agriculture research**, technology dissemination and adoption.

[12] Evaluation of the AU's effectiveness is beyond the scope of this paper. The main point that we make here is that the AU has been more effective in addressing issues of regional cooperation and governance than its predecessor, the Organization of African Unity, which viewed issues of internal governance (except for apartheid South Africa) as issues of national sovereignty.

Box 1 (cont'd)
In addition, there are two crosscutting objectives:

Capacity Strengthening for Agriculture and Agribusiness: Academic and Professional Training; and **Information** for Agricultural Strategy Formulation and Implementation.

The CAADP agenda is being implemented at the sub-regional level and the national levels through the regional economic communities, such as ECOWAS and COMESA, and national teams. In West Africa, the CAADP program is integrated with the ECOWAS Common Agricultural Policy (known as ECOWAP), which was adopted by all member states in 2005and which aims to spur agricultural growth and sub-regional integration. Individual countries, with support from the RECS, are developing CAADP country compacts. That process involves national teams that:

- Carry out a diagnostic of past agricultural performance in the country.
- Inventory current programs and investments and assess, using economy-wide (CGE or multi-market models) the likely growth that will result from these investments. IFPRI and the RECS are assisting with the modeling.
- Identify gaps needed to meet the CAADP 6% agricultural growth rate goal, and the MDG 1 goal of halving poverty by 2015
- Coordinate this process with the inventory/goal setting process of the PRSPs.
- Hold national roundtables with national stakeholders and donors to validate the results and develop plans to mobilize the resources needed to fill the investment gaps and carry out the proposed investments and new programs. This plan is the country compact.

The process of developing the country compacts began in 2006, and in March 2007 the first country compact, for Rwanda, was signed. The process began in early 2007 in West Africa, with Mali expected to be the first country in that region to sign a compact in July 2007.

Sources: (Eklu, 2007, NEPAD Secretariat, 2005, Sereme, 2007)

Reduction of conflict. In part because of the increased regional cooperation, since 1994, there has been a reduction in armed conflict in SSA (e.g., in Mozambique, Angola, Burundi, Rwanda, Sierra Leone, the Democratic Republic of the Congo, Liberia, Eastern Sudan), although important hot and simmering conflicts still remain (e.g., Darfur, Côte d'Ivoire). The reduction of conflict opens the scope for faster domestic agricultural growth and increased regional trade. For example, in the 10 years following the settlement of its civil war, per capita GDP in Mozambique increased by 70%, compared with less than 4% in the preceding decade (World Bank, 2006a). The increase was in part due to a 60% increase in agricultural value added (World Bank, 2006b), fueled by growth in both the domestic and regional markets (e.g., maize exports to Malawi).

HIV/AIDS. The HIV/AIDS pandemic poses challenges for agricultural development, particularly in southern and eastern Africa where the disease is most rampant, at several levels:

- Increased morbidity and hence reduced productivity of farmers
- Increased time demands for caregivers and for people to attend funerals
- Diversion of public and private funds for treatment
- Reduced remittances (as family members who have migrated—e.g., young men working in mines—die from the disease) and liquidation of assets (such as livestock) to cover heath care costs, leading to fewer/smaller investments at the farm level and less capacity to weather shocks.
    - At the individual household, the community, and the national and continental level, the disease is also taking a large toll on human capital. HIV/AIDS claims many of its victims in their prime working years. Because of the HIV/AIDS pandemic, the countries with the lowest life expectancies in SSA (Botswana, Lesotho, Zimbabwe, and Zambia) are now no longer those with the highest rates of child morality (Sierra Leone, Angola, Niger and Liberia (World Bank, 2006a). Beyond their impact on the productivity of those currently involved in farming and extended agriculture, these human capital losses threaten the intergenerational transmission of farming knowledge (since many farmers are dying before they can impart their knowledge of farming to their children—a huge potential loss in a continent where parents are the main trainers of the next generation of farmers. In addition, the disease is having major impacts on agricultural extension, research, and higher education systems through loss of staff, reduction of productivity of staff stricken with the disease, and increased work load for remaining staff. For example, the Ministry of Agriculture of Mozambique projects that it may lose 20-24% of its staff to HIV/AIDS over the period 2004-2010 (calculated from data in (Ministerio da Agricultura (Mozambique), 2006); and data from Kenya indicate that between 1996 and 2000, 58% of all deaths in the Ministry of Agriculture were AIDS-related. In Malawi, at least 16% of the staff of the Ministry of Agriculture and Irrigation (MoAI) in 2000 were living with HIV/AIDS and 76% had lost at least one colleague to the disease (Topouzis, 2003). It is likely that similar trends exist in NARS and faculties of agriculture. For example, over the period 1991-2000, the number of researchers in public agricultural research systems in southern Africa grew at only 55% the rate of that for SSA as a whole (0.79%/year compared 1.42%), and actually fell in Malawi, one of the countries hardest hit with HIV/AIDS (Beintema and Stads, 2006).

The impact of HIV/AIDS on rural households and highly differentiated, depending who in the household is stricken with the disease (frequently it is not the head of the household), the initial wealth of the household, the availability of household members off the farm who can return, and the social conventions of the community (e.g., matrilineal vs. patrilineal inheritance systems). While evidence from Southern and Eastern Africa suggests that the disease is still more prevalent among higher-income groups in rural areas than among the poor, its impacts on incomes are greatest among the poor (and especially poor women), who have fewer resources to cope with the disease (Jayne, et al., 2006a, Jayne, et al., 2004, Mather, et al., 2004) (Box 2). By offering few income-earning opportunities, especially to destitute women who sometimes then engage in transactional sex to feed themselves and their children, rural poverty contributes to as well as is exacerbated by HIV/AIDS (Bryceson and Fonseca, 2005, Hallman, 2004).

Box 2
The Heterogeneous Impacts of HIV/AIDS on African Farmers

The growing literature on HIV/AIDS and agriculture in SSA show that the effects of the pandemic on agricultural production largely depend on the initial community and household level characteristics and the interaction of these factors with HIV/AIDS. Some of these factors are the mean education level in the community, the wealth levels, farm size, population density, connectedness to markets and infrastructural access as well as the dependency ratios. HIV/AIDS in SSA has been described as a "long-wave crisis" because of its multiple-phase and far-reaching socio-economic impact on society (Gillespie and Suneetha, 2005). According to UNAIDS/WHO (UNAIDS/WHO, 2006) 24.7million people are infected with HIV/AIDS in SSA and more than 12million children have lost at least one parent to AIDS. With more than two thirds of the affected being poor rural households who are predominantly employed in agriculture, it is no surprise that there are reinforcing linkages among exposure to the pandemic, declining agricultural productivity and general prevalence of poverty in SSA.

The ability of rural households and communities to earn incomes through farming (and other means) as well as to secure food and nutrition has been abridged by HIV/AIDS in a heterogeneous fashion in SSA. In Zambia, a community-level study (Jayne, et al., 2006a, NEPAD Secretariat, 2005) found that a 24.4% increase in HIV/AIDS related prime-age adult mortalities is associated with a 6% reduction in cultivated land area over the three year time frame studied. This directly reduced agricultural output levels and farm incomes, signifying increased technical inefficiency. In addition, communities affected by HIV/AIDS that had larger farm sizes were found to be experiencing greater reductions in crop yields (output per hectare) than those with higher population densities and smaller farm sizes. This showed that, unlike previous generalized hypotheses about labor becoming more constraining due to HIV/AIDS related mortalities, it was not necessarily the case but land-labor ratios were critical determinants of the magnitude of HIV/AIDS' impact on agricultural production. The impact of HIV/AIDS-related mortalities on agricultural labor availability was thus found to be lower than previously thought, especially in communities were farm land sizes are small and population densities are high. In such cases, land continues to be the prime constraint to agricultural production, not labor. In Kenya, households tend to respond to adult mortalities by obtaining additional labor via community social networks or by redirecting absent adults back to farm production and away from off-farm work (e.g. in cities). Thus labor may not show up as the predominant constraint to farm production even when HIV/AIDS related prime age adult mortalities occur (Yamano and T.S. Jayne, 2004).

Hypotheses about households shifting to less labor intensive crops such as cassava because of HIV/AIDS related mortalities and morbidities also appear to be false in the case of small farm holding households but stand true in the case of households that have relatively larger farm sizes. This is especially so if mortalities occurred among household heads and/or spouses (Jayne, et al., 2006a). Similar findings were made in a cross-country study that covered Kenya, Malawi, Mozambique, Rwanda and Zambia (Mather, et al., 2004). For Mozambique, Rwanda and Zambia the percentage of area cultivated to roots and tubers was approximately the same for both households that experienced HIV/AIDS related mortalities and those that did not. In Mozambique 19 percent of cultivated area was under roots and tubers for households that were not affected by prime age adult mortalities and 22 percent for those affected. In Rwanda 42 percent cultivated area was under roots/tubers for non-affected households compared to 40 percent for affected households. Similar differentials were recorded in Zambia; 54 percent for non-affected households

Box 2 (continued)

versus 50 percent for affected households.

However, in Kenya significant shifts in cropping patterns were recorded for households in the lower half of the income distribution which had suffered loss of a household head or spouse. Loss of a household head or spouse translated to a reduction in sugarcane, tea and horticultural production and this surmounted to a 68 percent reduction in the value of net agricultural output. Similarly in Rwanda, households that experienced prime age adult mortalities had reduced production of cash crops such as coffee and beer banana and their crop income per capita was 27 percent lower than that of households that did not experience prime age adult mortalities in 2002. These findings underscore the importance of the household position of the prime age adult casualties in determining the degree of HIV/AIDS' impact on agricultural production and the findings emphasize the heterogeneity of the effects of HIV/AIDS on cropping patterns in SSA. For example, across several countries of Southern and Eastern Africa, only about half of HIV/AIDS related prime age adult mortalities occur among household heads or spouses, implying that the negative impact of HIV/AIDS on agricultural production is somewhat less pronounced than was otherwise thought (Mather, et al., 2004).

The same cross-country study also showed that HIV/AIDS-induced deaths had a variable affect on farm sizes across countries: households affected by HIV/AIDS-related mortalities in Mozambique and Rwanda ended up with lower land ex post, while those in Zambia ended up with higher median total land than the unaffected households. Over time, households affected by prime age adult mortalities experienced a greater decline in farm asset values as well as a greater decline in non-farm income than the non-affected (e.g. in Kenya non-affected households experienced a 20.6 percent decline in the median value of farm assets between 1997 and 2000, compared to a 45.9 percent decline in the same period for households that were affected by HIV/AIDS related prime age mortality.)

Another important issue is that HIV/AIDS has reduced agricultural production time in SSA, as survivors attended more funerals and diverted their labor to care-giving In addition,. the psychological impact of HIV/AIDS on the labor-force has also been negative; reducing productivity of both the infected and uninfected laborers (Gillespie, 2006).

Household level characteristics such as education levels, wealth and dependency ratios also determine the degree to which HIV/AIDS affects rural household welfare and farm production. In Zambia, rural communities with relatively higher mean education levels and higher wealth (as measured by mean value of productive assets) have been more adversely affected by HIV/AIDS related adult mortalities (Jayne, et al., 2006a). Considering that the educated prime age adults are the most productive demographic group in rural communities their agricultural productivity is most curtailed and in turn total productivity, because this demographic group also happens to be the most affected by HIV/AIDS. Consumption linkages of these wealthier and better educated prime age adults are also reduced as mortality within this group increases and expenditures shift to medicine and health care, potentially reducing incomes and employment of poorer households in the community.

Increased population pressure. Between 1985 and 2003, the population of SSA increased by 63%, resulting in a reduction of arable land per capita from 0.33 ha to 0.25 (FAO, 2006). Farm size has been falling in many countries (table 1), leading to two different reactions. In many countries, particularly in semi-arid areas of the Sahel, cultivation has extended into lower-rainfall areas with more fragile soils, leading to natural resource degradation, particularly soil erosion. In a few areas, however, particularly in areas where market access is good increased population pressure has led to the development of more intensive production systems, consistent with the Boserup hypothesis, such as the integrated maize-banana-coffee-dairy production in the highlands of Kenya. In other instances, policy changes have helped induce intensification, as in the Tahoua area of Niger, where granting individuals ownership rights to trees (which previously were officially property of the state) and strengthening women's rights to rehabilitated land led, over a 20-year period, to widespread land reclamation, reforestation and higher agricultural and non-agricultural incomes (Boubacar, et al., 2005).

Table 1. Ratio of Cultivated Lands to Agricultural Populations, 1960-99

	1960-69	1970-79	1980-89	1990-99
Ethiopia	0.508	0.450	0.363	0.252
Kenya	0.459	0.350	0.280	0.229
Mozambique	0.389	0.367	0.298	0.249
Rwanda	0.215	0.211	0.197	0.161
Zambia	1.367	1.073	0.896	0.779
Zimbabwe	0.726	0.664	0.583	0.525

Note: Land to person ratio = (land cultivated to annual and permanent crops)/(population in agriculture)

Source: Calculated from FAOSTAT data, as reported in (Jayne, et al., 2006c)

Rapid urbanization. SSA is urbanizing rapidly: in 1985, only 24% of the population was urban; by 2004 this had grown to 35%, and the absolute number living in urban areas increased by a factor of 2.5. By 2035 over half the population is projected to live in urban areas; West Africa is urbanizing even faster, with 60% of the population projected to live in cities by 2020 (Club du Sahel, 2000). The impact of urbanization on SSA agriculture operates through several channels:

- With the increased opportunity cost of consumers' (particularly women's) time, there is a shift towards more easily prepared staples (e.g., rice and wheat rather than millet) (Boughton and Reardon., 1997) and (as incomes rise), more highly processed products. The shift towards wheat and rice, for which SSA is a net importer, may reduce demand for traditional staples such as millet and yams in favor of imported staples (a situation exacerbated by the high inland transport costs for bulky staples compared with low ocean freight rates).
- The increased demand for processed products opens opportunities for more value-added agricultural products, such as industrially processed cowpea flours that are available in supermarkets in cities like Accra that cater to upper-income consumers.
- Growing urban populations represent an important source of growing demand for higher value, labor-intensive perishable products such livestock and horticultural products, as consumption patterns become more diversified. At the same time, domestic and regional marketing systems for these perishables are characterized by congestion and poor

sanitation around major urban markets for food raise costs and health risks to consumers, constraining demand and shifting demand towards imported substitutes (e.g., frozen turkey necks). [13]

- Increased integration of urban-rural labor markets create off-farm job opportunities (which may reduce use of labor-intensive NRM technologies, such as construction of rock lines and tied ridges), while increasing farm labor costs and the demand for mechanization.

Urbanization also is likely to change the political debates surrounding food prices and investment priorities; as an increasing proportion of voters move a way from rural areas, it may become more difficult to avoid a return of urban bias in government policies (Maxwell, 2004). For example, public opinion polls in Mali have found that reducing hunger is perceived by voters as the number one political issue in the country (Bratton, et al., 2001); to the extent that the population urbanizes, there is an incentive for politicians to cater to this concern through short-term programs such as export restrictions that hold down domestic prices or cheap imports from world markets at the cost of farm incomes.

2.1.2 Changes in the Global Context

Globalization has opened new market opportunities (often through more sophisticated supply chains), increased the potential availability of foreign capital and technology (including from new major players, such as India and China), while at the same time creating new competitive pressures on African agriculture. New biological and information technologies offer the potential for more rapid agricultural growth if the institutions (e.g., biosafety protocols) and organizations (e.g., market information systems) needed to exploit these technologies can be put in place. Among the most important changes over the past 20 years in the global context in which African agricultural development occurs are the following:

- **A sharp reduction in ocean freight rates** (which fell by 30% between 1985 and 2004), air freight rates, and communication costs, which reduced the costs of international agricultural trade. The effect was to put African farmers in much tighter competition, even in African markets, with agricultural producers from outside the continent. At the same time, these changes opened up new market opportunities for African farmers who could meet the standards required to serve high-value markets (e.g., for flowers in Europe) outside of Africa.
- **Trade and investment reforms**, including the WTO, regional trade agreement such as the broadening of the EU, the consequent loss by some Sub-Saharan countries of preferential access into markers of former colonial powers, and the emergence of other preferential agreements, such as the EU's Everything But Arms (EBA) agreement and the US's African Growth and Opportunity Act (AGOA). The net impact of these reforms has been to increase the flows of goods and capital world-wide, opening new potential markets for African goods but at the same time exposing African producers to new competition, even in their home markets. Problems of OECD subisidies for important

[13] A particular problem concerns dairy marketing, where OECD subsidies often undermine prospects for growth of markets for domestically produced dairy products, particularly in West Africa.

African products, such as cotton and dairy. Continued problems of tariff escalation limiting processing within Africa.

- **The emergence of sophisticated supply chains** for agricultural products destined for export and high-end domestic markets, such as supermarkets. These supply chains set standards for quality and traceability that require relatively high fixed costs, making it difficult for smallholders to participate in these markets absent some form of collective action. The high fixed costs (e.g., for assuring security of airfreight at points of embarkation) also make it more difficult for African countries to "learn their way into" export markets gradually, as the minimum scale required to amortize such investments is large.
- **The biotechnology revolution**, which offers the scope for much more rapid conventional breeding (through gene marker technology) as well as transgenic engineering. While sometimes heralded as a key to solving Africa's food crises, the likelihood that genetically modified crops will be adopted by smallholders within the next 10 years is low; as of 2006, GM crops were grown commercially only in South Africa, and adoption in other countries has been slowed by lack of a social consensus about their desirability and the lack of adequate biosafety standards for their testing and regulation (Eicher, et al., 2006). Some of the opposition to GM technology in Africa stems from concerns about the increasing privatization of genetic resources, prompting recent calls for "food sovereignty." (Réseau des organisations paysannes et de producteurs de l'Afrique de l'Ouest (ROPPA), 2006). Nonetheless, over the medium term, biotechnology (which is broader than just genetically modified organisms) offers the potential to accelerate the development of new varieties and traits.
- The information revolution, which has greatly expanded the scientific resources available to African agricultural researchers and reduced their isolation, and immeasurably improved commercial and market information to African entrepreneurs, including many small farmers. The explosion in the use of cell phones, even in rural Africa, for example, is opening new opportunities for farmers and traders to access market information via SMS and toll-free numbers in Kenya, Uganda, Senegal, Ghana, and Mali (see www.tradenet.biz, www.manobi.sn, and www.kacekenya.com), while broadcasts of market news programs on rural radio reach up to 70% of rural households in Mali (Sansoni, 2002). In agricultural research and higher education, e-mail and Internet access are greatly reducing the isolation of African researchers and students and allowing them to build specialized (electronic) libraries at a fraction of the cost of paper libraries. Particularly noteworthy is the FAOs AGORA initiative (http://www.aginternetwork.org/en/), which gives researchers and teachers in low-income countries free on-line access to 918 scientific journals in the fields of food, agriculture, environmental science and related social sciences, thus greatly reducing the investment needed to build up research libraries. The development of the World Wide Web2, with its emphasis on common on-line use of databases by researchers world wide offers the potential for even greater collaboration of African agricultural scientists with partners around the world, if the Africans can get reliable Internet service (still a problem in many NARS and universities in the Sahel).
- **The emergence of growing economic powers in Asia (especially China and India—see Box 3) and in Latin America (especially Brazil).** The growing demand for agricultural raw materials, such as cotton and cashews, in these economies (particularly

in China and India) offers expanded opportunities for African farmers, and has been coupled with a rapid increase in direct foreign investment by these countries in SSA (Broadman, et al., 2007).[14] The growing capacity of national agricultural research systems in China, India, and Brazil (Pardey, et al., 2006) has led to expanded set of agricultural research partners for SSA beyond just the CGIAR system. For example, Embrapa, the Brazilian agricultural research corporation, has cooperative ventures with researchers in Mozambique, Angola, and Nigeria and planned to open a new office in Ghana in late 2006 (CGIAR, 2006). African farmers, agricultural processors, and consumers have also benefited from the availability of inexpensive agricultural equipment (e.g., pumps, hammer mills) and consumer goods from Asia. At the same time, the growing influx of these imports from Asia has put increased pressure on African producers of competing goods. It has also raised concerns that the second-round poverty-reduction impacts (through consumption linkages) of a given increase in agricultural productivity in Africa will be muted, as compared to Asia's green revolution experience, as African farmers experiencing productivity gains may spend their increased income on imports rather than locally produced labor-intensive goods.

- **The worldwide spread of zoonotic diseases**, particularly avian influenza. Even if the H5N1 virus does not widely transfer to humans, it represents a very serious threat to the livelihoods of poor rural Africans, as poultry are the frequently the first (and smallest) assets that poor farmers, particularly women, accumulate and most SSA countries have little capacity to limit the spread of the disease or to compensate farmers for their losses.
- **Global climate change**. Models of climate change in Africa project higher temperatures and lower rainfall in much of the Sahelian and Sudanian areas (see focus G of the WDR 2008), coupled with greater weather instability. This will translate into greater risk for farmers in rainfed areas (over 96% of Africa's cropland). Moreover, the ability to use weather-based insurance to manage this risk will be limited, for if the climate is changing in new ways, there will not be a reliable actuarial base upon which to calculate premiums.[15] At the same time, the increasing demand for carbon sequestration may lead to carbon emerging as a new cash crop for African farmers if institutional rules can be designed to deal with the moral hazard and adverse selection problems inherent in this nascent market.

[14] To date, the bulk of Chinese investment and trade in Africa has focused on mineral and petroleum resources, but raw agricultural products (e.g., cotton) and timber are growing exports. As of 2006, 85% of Chinese trade with Africa came from 5 oil and mineral-exporting countries Broadman, H. G., et al. "Africa's Silk Road: China and India's New Economic Frontier." World Bank.

[15] In practice, this will mean that absent subsidies, insurers will likely include a significant risk premium (to protect themselves against unpredictable weather events) when calculating prices for the insurance policies, thereby increasing the already high mark ups on these policies needed to cover their transaction costs. The net effect is that the policies will be less attractive to farmers and traders.

Box 3
China's and India's Growing Influence on African Agricultural Development

Asia's (particularly China's and India's) trade with and investment in SSA has expanded rapidly since 2000. In 2006, Asia received 27% of SSA's total exports, up from 14% in 2000. To date, exports to Asia and investment from Asia to SSA are concentrated in a few countries, and focus on mineral products and unprocessed agricultural products. Asia's rapidly growing purchasing power, capital markets, agricultural research capacity, and changing agricultural production patterns may offer much greater opportunities for SSA agriculture in the future.

Currently, top exports from Africa to China are unprocessed primary commodities and primary raw materials. The top export to China from Africa is crude oil, which constitutes 62.2% of all exports from Africa to China. 46.8% of the total oil exported to China from Africa comes from Angola, 24.7% from the Sudan and 13% from the Republic of Congo. The second most top export to China from Africa are saw logs and veneer logs while the third most exported commodity from Africa to China is iron ore and concentrates. The top export from Africa to India is gold, which constitutes 52.7% of total exports from Africa to India. Virtually all gold imported by India from Africa comes from South Africa (99.9%). Unlike China, India's second most imported product from Africa is an agricultural product – edible nuts (mainly cashews). .

The top imports into Africa from China and India are processed and value-added products. SSA's top imports from China are woven cotton fabrics (8.45% of total imports), and these are mainly imported by cotton producing countries (Benin, Togo, Gambia and South Africa and Kenya), some of which export raw cotton to China. The top three imports from India are medicines, rice and cotton fabrics. India and China are also the major exporters of agricultural production and processing equipment (e.g., pumps, small mills) to SSA.

Since 2001,FDI from China and India to SSA more than doubled . However, in absolute terms this constituted a small percentage of outward investment flows from China and India. By mid-2006 Indian and Chinese FDI in Africa totaled $US1.18 billion and India's stood at approximately $900million. Much of the investments are focused on the extractive commodity sectors such as oil and mining. For instance, China is the principal investor in the Sudanese oil industry and has also recently invested substantial amounts in other related transport and infrastructure projects in the Sudan. Similarly, in Angola China has channeled approximately $2 billion to the oil industry, plus a $2.4 billion Eximbank credit scheme geared at improving infrastructure and other non-oil industries.

Box 3 – Continued

Longer term prospects may shift Asian-SSA trade, investment and cooperation to include more focus on agriculture. For example, the rapid expansion of China's and India's agricultural research systems and increased commitment of the Chinese to offer training opportunities for greater south-south cooperation in research and human capital building. Chinese firms have already invested in sugar and tea production in Mali, and recently an Indian IT firm diversified into flower production in Kenya and Ethiopia for the export market to Europe. Malaysian firms have sent teams to West Africa to explore the scope for investing in palm oil production in the region. While SSA countries would also like to expand sales of processed agricultural products (rather than just raw agricultural products) to the expanding Asian markets, to date they have faced tariff escalation for processed product in these markets similar to what they have historically have faced in the OECD countries.

Sources: (Broadman, et al., 2007, Pardey, et al., 2006, Yumkella, 2007)

- **Increased demand for biofuels.** The 90% increase in the US price for maize between December 2005 and December 2006 was driven largely by increased demand for ethanol, and increasingly there are concerns that higher demand for grain as feedstock for ethanol plants will price many poor consumers around the world out of the market for basic staples, thereby increasing food insecurity.[16] At the same time, higher staple prices will increase production incentives for those African farmers who are net sellers of grain and cassava (for ethanol). There are also potential opportunities for use of palm oil and jatropha that serve as feedstock for production of biodiesel for both African and European markets offer new income-earning opportunities for farmers in low-resource environments.[17] Over the longer term, SSA is well placed to produce feedstock to the next generation of ethanol via cellulosic technology, but most scientists believe that technology will not be commercially available for about another 10 years (Collins, 2007, Ferris and Joshi, 2007).

[16] Runge and Senauer (cited in (Myers, 2007) calculate that every 1% increase in staple food prices increases the number of hungry in the world by 16 million, and they project that biofuel demand could increase staple food prices by 11 to 40 percent by 2010. For example, meeting President Bush's target of 35 million barrels of alternative fuels by 2017 solely through maize would require 107% of the current US maize crop. By 2017, however, it is likely that the second generation of ethanol technology, based more on cellulose than starch, will likely be on line, reducing pressure on maize as a feedstock for ethanol production.

[17] Jatropha is a woody plant, traditionally planted in semiarid areas as a live hedge. It grows on poor soils, fixes nitrogen, demands little labor, and yields an oily nut that can be transformed into biodiesel. The demand for biodiesel in Europe is being driven by the need to meet clean air and carbon emission standards., A London-based firm, D1 Oils, currently has secured agreements to plant jatropha on 37,000 ha in Burkina Faso, Ghana and the Philippines, and has the option to extend planting to approximately 990,000 further hectares of land in Burkina Faso and 5 million ha in India ((EcoWorld, 2007))

2.2. New Potential Sources of Support for African Agricultural Development

Since the turn of the 21st Century, most African governments (through NEPAD) and donors have expressed their intent to invest more heavily in agriculture as a key element of their strategies to promote economic growth and poverty alleviation. In July, 2003, African heads of state meeting in Maputo endorsed the NEPAD Comprehensive African Agricultural Development Programme (CAADP), which aims to stimulate agricultural growth in SSA through a focus on smallholder agriculture and creation of enabling conditions for greater private-sector involvement. The program emphasizes regional coordination through the regional economic communities, such as ECOWAS and COMESA. At the Maputo summit, the AU heads of state set a target of 10% of their national budgets to support agricultural and rural development, up from an SSA average of 2.4% (see Box 4) (African Union and NEPAD, 2004, FAO, 2004). The NEPAD/CAADP initiative has attracted widespread rhetorical support form donors, in contrast to earlier initiatives such as the Lagos Plan of Action (Organization of African Unity, 1979), and set specific budget targets for each African country to meet, rather than just global Africa-wide targets, as in the Lagos Plan of Action. As discussed below, two key issues are whether the donor rhetorical support will translate into real additional resources for African agriculture, and how effectively increased African and donor resources are invested to stimulate agricultural growth.

In addition to the increased attention to agriculture from African governments, several providers of official development assistance (ODA) have called for increased attention to African agriculture and rural development. These have included, among others, the UK's Blair Commission (Commission for Africa, 2005), the US Presidential Initiative to End Hunger in Africa—IEHA (US Agency for International Development, 2006), and the World Bank's 2002 Africa Rural Development Strategy (World Bank, et al., 2002). The increased donor attention towards African agricultural development marks a sharp change from the 1980s and 1990s, when foreign assistance to Africa from the North shifted strongly to emergency relief, health, environment, and social sectors and away from investments in raising agricultural productivity as an engine of broader based economic growth. Total ODA for agricultural development in SSA fell from roughly US $1.7 billion in 1991 to about $US 1.0 billion in 2000, with the funding decline across almost all donors (Kane and Eicher, 2004). For example, World Bank lending to Africa fell by nearly half between 1990 and 2000 (from $3.8 billion to total $2.05 billion), while the proportion of credits allocated to agriculture fell from 24 % to 7%. US foreign assistance followed a similar pattern; the proportion of US foreign assistance to SSA supporting agricultural development fell from 35% in the late 1980s to less than 15% by 2001 (Partnership to Cut Hunger and Poverty in Africa, 2002). Particularly striking was the donor pullback from long-term post-graduate training of African agricultural scientists in during the 1990s; for example, World Bank funding for graduate training in agriculture fell by 34% between 1990 and 1997, while USAID funding for agricultural training in the US fell by 66% between 1987-89 and 1995-97; by 2000, USAID was financing the US training in agriculture of only a 25% the number of students from developing countries that it had a decade before (Eicher, 2006, World Bank, 1999).

Box 4
The Maputo Declaration

Meeting in July 2003 at the African Union summit in Maputo, African heads of state endorsed NEPAD's Comprehensive African Agricultural Development Program (CAADP) and pledged to use this framework to:

- Revitalize the agricultural sector including livestock, forestry and fisheries through special policies and strategies targeted at small scale and traditional farmers in rural areas and the creation of enabling conditions for private sector participation, with emphasis on human capacity development and the removal of constraints to agricultural production and marketing, including loss of soil fertility, poor water management, inadequate infrastructure, and pests and diseases;
- Implement, as a matter of urgency, the CAADP and evolving Action Plans for agricultural development, at the national, regional and continental levels. To this end, the Heads of State and Government agreed to adopt sound policies for agricultural and rural development, and committed themselves to allocating at least 10% of national budgetary resources for their implementation within five years;
- Call upon the African Union Commission, the Steering Committee of NEPAD, the FAO and other partners to continue their co-operation, providing effective support to African countries and the Regional Economic Communities (RECs) in the implementation of the CAADP;
- Ensure, through collaborative efforts at the national and regional levels, the preparation of bankable projects under CAADP for the mobilization of resources for investment in agricultural growth and rural development;
- Ensure the establishment of regional food reserve systems, including food stocks, linked to Africa's own production, and the development of policies and strategies under the African Union and the RECs, to fight hunger and poverty in Africa.

Source: (FAO, 2004)

Evidence suggests that the renewed expression of donor interest in supporting African agricultural development as a central pillar of broad-based growth strategies has halted the reduction in foreign assistance allocated to African agriculture. It has not yet translated, however into higher funding for activities aimed directly at increasing agricultural productivity. Total ODA from the OECD countries devoted to African agricultural development totaled a little over US $2 billion in 2003, less than a tenth of the $25 billion called for by NEPAD to help agriculture contribute to achieving the MDG poverty goals. Total OECD ODA aimed at increasing agricultural (on-farm) productivity actually declined 2000 and 2003 (Taylor, 2005). When investments in rural development are broadened to include investment in rural roads, however, OECD ODA increased by 24% over the period, due to a large increase in the transport sector. The stagnation in funding was across most donors; among the five major European donors that had reported their 2004 aid levels in 2005, only Sweden and Belgium increased their assistance to African agriculture. This is in contrast with total OECD assistance to SSA

developing countries, which increased by 72% between 2000 and 2003 (with increases of 97% for health and 60% for education) (Ibid.) Real US government assistance to African agricultural development declined by 5% between 2000 and 2004 (Taylor and Howard, 2005).[18] The good news is that the massive declines in funding for African agricultural development seem to have ended, at least for now. There is also evidence that aid may be becoming more performance based, in part in response to evidence that better governed countries are making more effective use of foreign assistance (World Bank, 2006d). The at least partial shift in US government assistance from USAID to the Millennium Challenge Corporation, which has explicit cirtieria for country eligibility (based on performance in economic policy reform and "investing in people") is one reflection of this attempt to make ODA more performance based. [19]

Another striking change has been the emerging interest of the "new philanthropists" such as Gates and Hewlett Foundations in promoting African agricultural development. The $150 million partnership between the Gates and Rockefeller Foundations to promote improved seed systems and trade a new generation of African plant breeders (Bill and Melinda Gates Foundation, 2006) appears to be just the beginning of a growing engagement of this new group of actors in African agricultural development.[20] Thus, whiled the current amounts allocated to agriculture by these new donors to African agriculture is still small relative to ODA, it is likely to grow rapidly.[21]

2.2 Emerging African Successes

2.2.1 Recent Overall Economic Growth

In response to the policy reforms and previous investments in human and institutional capital, overall economic growth in SSA increased since the 1990s. The recent economic performance of sub-Saharan Africa (figure 2) has three striking characteristics (Broadman, et al., 2007, Brooks, 2006, Economic Commission for Africa and African Union, 2007, Kauffmann, et al., 2006, World Bank, 2006a, World Bank, 2006c):

- There has been a solid increase in both aggregate and per capita income growth, in response to the economic and political reforms since the 1980s, the recent recovery of world commodity prices, the introduction of new technologies, and some diversification, particularly in the fastest growing agricultural economies. Overall GDP growth in SSA in 2006 averaged 5.2% (3 percent per capita), down from 5.4% in 2006 but up from 4.7% % in 2004. Only Zimbabwe experienced contraction of its economy in 2006

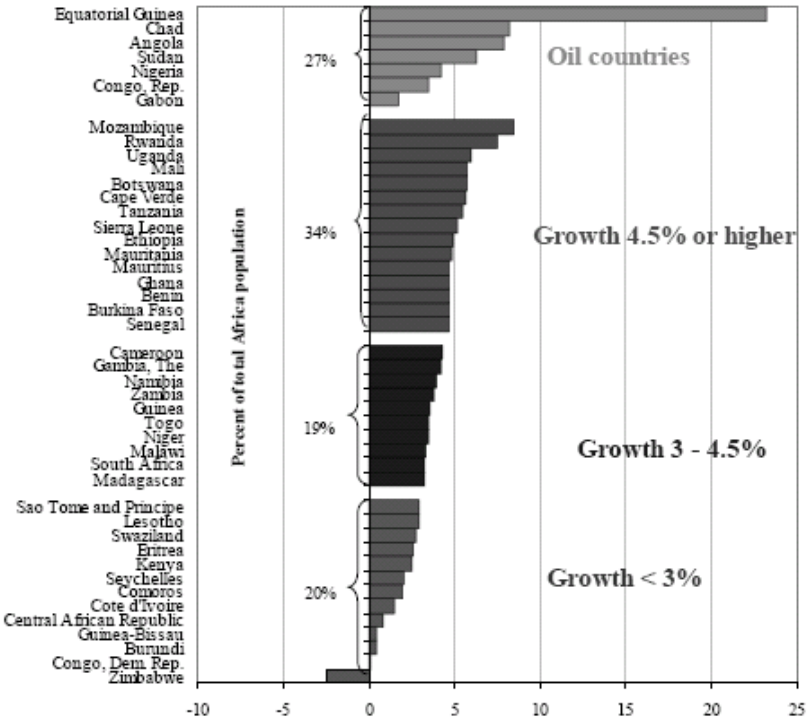
[18] Funding through USAID increased in real terms by 9% over the period, but these increases were offset by declines in funding through other US government agencies.
[19] One of the hopes at the end of the Cold War was that the end of East-West rivalry would allow ODA to be allocated more on the basis of economic performance and need than on geopolitical considerations. The rise of concerns about global terrorism and the rising rivalry between the West and China over natural resources in China may make those hopes short-lived.
[20] The Bill and Melinda Gates Foundation has already announced other initiatives in improving agricultural value chains and is has expressed interest in undertaking work to find more effective models of agricultural extension; Hewlett Foundation is supporting work aimed at strengthening regional agricultural trade in Africa. The
[21] The Bill and Melinda Gates Foundation is reportedly hoping to expand its spending on agriculture worldwide (but with a major emphasis in SSA) to $3 billion/year over the period 2007-2012 (Carl Eicher, personal communication).

(Economic Commission for Africa and African Union, 2007). The overall growth rate, while below the 7% growth rate necessary to meet the MDG goals of poverty reduction, represents the best higher overall growth rate in four decades. Higher oil prices are driving growth in some of the fastest growing economies (figure 2), but there has also been good performance even among many oil-importing countries, including control of inflation in the face of higher oil prices.

- Geography still matters: landlocked countries, where approximately 40% of SSA's population and an even greater proportion of its poor reside and where transport costs strongly influence both input and output prices, were particularly affected by higher petroleum costs. From 2000-2004, per capita income growth by landlocked countries (excluding Zimbabwe, which was in economic freefall) averaged 1.1% compared with 1.7% for coastal, non-island countries (World Bank, 2006a).
- Growth patterns became increasingly diverse across countries, with solid performers like Ghana and Uganda on track to meet the Millennium Development Goals poverty reduction targets(Byerlee, et al., 2005, International Food Policy Research Institute (IFPRI), et al., 2006, World Bank, 2006e), while others, such as Zimbabwe and the Democratic Republic of the Congo were in turmoil. While there is evidence that countries with better internal governance had more sustained growth rates over the past 15 years (Halperin, et al., 2005, Kaufmann, et al., 2005, Siegle, 2006), the increase in oil prices since 2004 have spurred GDP growth in a number of countries (Chad, Equatorial Guinea, Sudan) where governance remains a serious problem.[22]

[22] The SSA country with the fastest rate of GNI growth per capita over the period 2000-2004, with the exception of the Comoros (40%), was Sudan, at 7.5%, during a period when it was in the midst of the crises in Darfur and civil war in the South ((World Bank, 2006a)). On the other hand, Halperin et al. (esp. chapter 2) find that except for the East Asia Tigers, low-income countries that followed more democratic regimes over the past 30 years have performed better than their authoritarian counterparts on a broad array of development indicators, ranging from life expectancy, to growth in GDP per capita to cereal yields (Halperin, et al., 2005).

Figure 2. Average GDP Growth Rates, 1996-2005

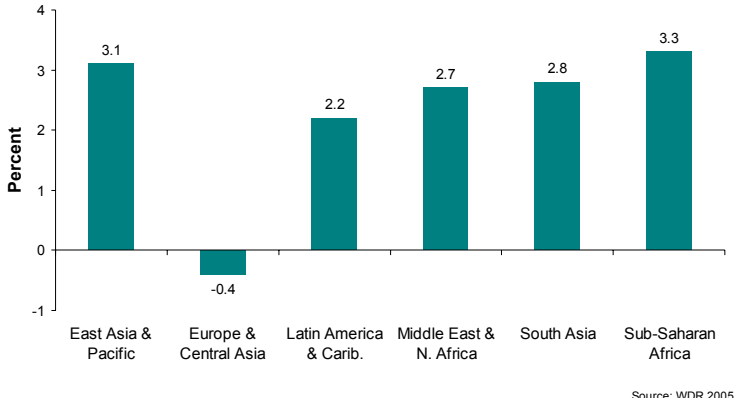


Source: World Bank World Development Indicators, as shown in (Broadman, et al., 2007)

Recent agricultural growth rates

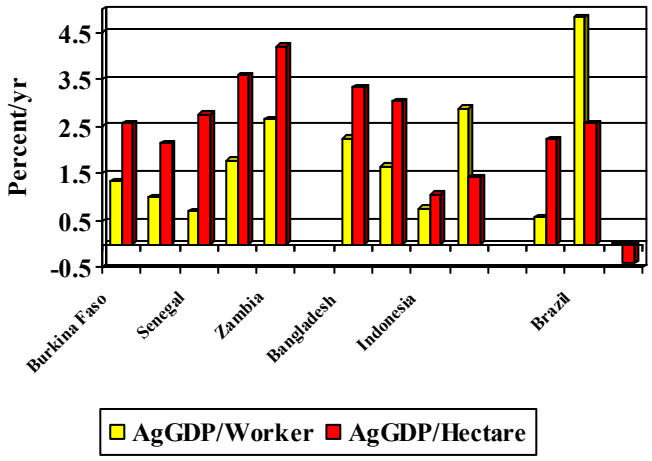
The aggregate agricultural growth rate of SSA between 1990 and 2003, at 3.3%, exceeded that of all other developing regions of the world—figure 3 (WDR 2005 cited in (Brooks, 2006)), although population growth of over 2.4% per year resulted in per capita growth of under 1%. Nor was this growth stimulated uniquely by area expansion, as has been the case for cereals. Throughout the period, value added in SSA agriculture was growing, reaching 3.3% per year (3.6% per year for countries outside of South Africa) between 2000 and 2004 (World Bank, 2006a), in part because of growing agricultural policy reforms helped stimulate diversification into higher valued crops from cereals, whose production had often been encouraged through pan-territorial pricing, as in Zambia (figure 4).

Figure 3. **Average Annual Agricultural Growth, 1990-2003**



Source: WDR 2005 cited in (Brooks, 2006)

Figure 4 – Growth of Agricultural GDP per worker and per ha, reflecting in part diversification of production



Source: (World Bank, 2006e)

The emphasis on stagnant overall cereals yields in SSA (figure 1) that is routinely cited in discussions about why "the green revolution bypassed Africa" overlooks many agricultural success stories in SSA where productivity has grown substantially in both the farm and off-farm segments of the food and fiber systems. These successes have included diversification away from cereals in some countries following market reforms and a consequent increase in value added (figure 4); localized successes with cereals (e.g., the 3-fold increase in rice yields in Mali's Office du Niger, from 2 t/ha in 1987/88 to 6 t/ha in 2003/2004 (Aw and Diemer, 2005, Kelly, et

al., 2006); development of higher-yielding maize varieties (Byerlee and Eicher, 1997), and non-cereal staples (e.g., the cassava revolution sweeping many countries in Western and Southern Africa); cash crops, such as cotton in Francophone Africa from the 1950s through the early 1990s; livestock (such as small-scale dairying in Western Kenya); the ability of Africans to participate successfully in certain high-value export markets (e.g., flowers from Ethiopia, Kenya and Tanzania; high-value coffee from Rwanda); and the reduction in marketing margins for staples, reflecting greater efficiencies in the off-farm segments of the value chains (Gabre-Madhin and Hagglade, 2004, Haggblade, 2004, IFPRI, 2004, InterAcademy Council, 2004, Nweke, et al., 2002).

These successes have been characterized by a demand-driven orientation (export horticulture, livestock intensification around Nairobi, cotton); actions that addressed asymmetric information problems in input markets, either through interlinked markets in integrated commodity chains (e.g., cotton and some of the contract farming in export horticulture and coffee), or development of technologies that were markedly more productive even in the absence of purchased inputs (such as the IITA-developed cassava varieties that doubled farmers yields in Nigeria over traditional varieties with no increase inputs (Nweke, et al., 2002). They also sometimes involved the careful sequencing of technology development, institutional changes, and sectoral and macro-economic reforms, as in the case of rice production in Mali's Office du Niger (Diarra, et al., 2000).[23] Consistent government policy, as in the fertilizer market reforms in Kenya (Nyoro, et al., 2006), have also been an important contributor to successes by creating a secure environment for private investment in development of marketing systems for inputs and outputs. Market reforms that have increased competition in wholesaling and milling of staple and reduced barriers to intra-country and intraregional trade have resulted in declining retail prices in countries such Kenya, Zambia, and Mali (Dembélé and Staatz, 2002, Jayne and Chapoto, 2006) even in the absence of farm-level price declines, emphasizing that the green revolutions in Africa also need to be marketing revolutions.

3. Agricultural development efforts must build upon the uniqueness and diversity of Africa's agriculture

3.1 Unique characteristics of Agriculture in SSA[24]

SSA's agriculture faces structural conditions very different from those that Asia faced at the dawn of its Green Revolution, implying that the path to productivity growth in Africa cannot mirror that of an Asian-style Green Revolution. Distinct characteristics of SSA agriculture include:

[23] In the reform of the Office du Niger in Mali, the technical changes in varietal development and managerial changes in decentralization of the management of the irrigation system were followed by sectoral reforms that abolished the monopoly of the Office du Niger in rice marketing and milling, which created greater incentives for farmer adoption and attention to post-harvest quality control (since the private market rewarded better quality) and much more competition in the rice wholesaling system in Mali. That competition assured that the subsequent increases in prices brought about by the 50% devaluation of the CFA franc in 2004 was rapidly passed back to farmers rather than being captured by the previously highly oligopolistic rice wholesaling system (Diarra, et al., 2000)

[24] For details on many of the points discussed in this section, see (African Development Bank (AfB), et al., 2006, Delgado, 1998, InterAcademy Council, 2004)

- The huge size and agroecological diversity of the continent, which leads to a wide range of farming systems, suggesting that a single path to a green revolution is unlikely. The FAO identifies 14 major farming systems in SSA, ranging from near desert to forest-based systems, with significant variation within each major category (African Development Bank (AfB), et al., 2006). In contrast to the Asian countries that were at the heart of the Green Revolution, few African countries are heavily reliant on rice and wheat (two of the three key Green Revolution crops); and maize (the third Green Revolution staple) is dominant only in Southern Africa (table 2). Africa's diverse agro-ecologies lead to a wide range of farming systems and reliance on a broad number of staples (from cassava in central Africa to millet and sorghum in the Sahelian zone), and significant reliance on livestock in most farming systems.
- The much greater prevalence in SSA of older, weathered soils, as compared with other regions of the world, whose agricultures are largely based on younger, more alluvial soils (InterAcademy Council, 2004). This suggests that for a given intensity of cultivation, there is a greater need for soil amendments (such as chemical fertilizer and organic matter) in SSA than in other regions. At the same time, the high transport costs in most of SSA reduce the profitability of using fertilizer by raising its price and depressing the prices of outputs it is used to produce.

Table 2. SSA's set of staple crops is much more diverse than those of Asia at the dawn of its Green Revolution

Source of Calories	Philippines 1961	India 1961	SSA 2003	DRC 2003	Ethiopia 2003	Kenya 2003	Mali 2003	Nigeria 2003	Zambia 2003
Total Calories available per capita	1745	2073	2218	1606	1858	2155	2236	2714	1975
Percent of total Calories from:									
- Vegetal Sources	89%	95%	94%	98%	95%	87%	90%	97%	95%
- Cereals (excluding beer)	**56%**	**64%**	**47%**	**19%**	**68%**	**49%**	**72%**	**46%**	**66%**
- Rice	47%	35%	8.7%	3%	0%	3%	23%	5%	1%
- Wheat	5.4%	12%	7.2%	4%	20%	9%	3%	10%	7%
- Maize	4%	3%	14.8%	11%	21%	36%	10%	7%	57%
- Millet & Sorghum	0%	13%	14%	0%	12%	1%	36%	24%	2%
-Starchy roots & tubers	**7%**	**1%**	**19%**	**57%**	**12%**	**7%**	**2%**	**19%**	**14%**
- Bananas & Plantain	3%	0%	3%	3%	0%	2%	0%	1%	0%
- Pulses	1%	11%	4%	2%	6%	6%	4%	3%	1%
Number of domestically produced staples accounting for 50% of total Calories	2	3	5	1	4	3	2	4	1
% of Calories accounted for by 4 most important staples	57%	59%	44%	75%	65%	60%	73%	58%	79%
% of Calories from domestically produced rice, wheat, and maize (Green Revolution crops)	51%	49%	20%	12%	30%	38%	33%	36%	63%
Percent of various staples Imported, by country/region:									
Philippines: wheat, 100%									
SSA: rice, 45%, wheat, 79%, maize, 7%.									
DRC: wheat 98%, rice, 28%, maize 8%									
Ethiopia: wheat 55%; maize, 3%									
Kenya: wheat: 57%; rice, 88%; maize, 4%									
Mali, % imported: wheat: 100%; maize, 2%; rice: 5%									
Nigeria: % imported: wheat: 97%; rice, 43%									
Zambia: Wheat, 30%, rice, 70%, maize, 12%									

Source: Calculated from food balance sheets available at (FAO, 2006)

- The overwhelming dependence on rainfed agriculture, which increases vulnerability to weather shocks and limits its ability to exploit the earlier green revolution technology in rice, wheat, and maize. Only 3.5% of SSA's arable land is irrigated, less than a fourth that of India in 1961, at the dawn of its green revolution. Increasing the percentage irrigated land up to that which India had in 1960 would cost approximately US$114 billion, more than 55 times the annual ODA allocated to African agricultural development.[25]
- SSA's low average population density compared to other regions, which increases the per-person cost of providing basic infrastructure, such as roads and rural electrification (crucial in stimulating the growth of rural-based manufacturing). For example, SSA's road density, at 201 km/1000 km^2, is less than a third of that of India in 1950 (703 km/1000 km^2). Even Rwanda, SSA's most densely populated country, does not have the road density of India in 1950. Today, India's road density is 32 times that of Ethiopia and 255 times that of Sudan.
- The fact that nearly 40% of Africa's population lives in landlocked countries, in contrast to other parts of the developing world, where over 88% of the population lives in coastal countries (Collier, 2006, World Bank, 2006a). This landlockedness raises transport costs and makes many staples only semi-tradables, increasing their range of price fluctuations and thereby increasing the risk of farmers and marketing agents.
- The large number (48) of countries on the subcontinent, most of them small (27 have populations under 10 million, and only 4—Nigeria, Ethiopia, Democratic Republic of the Congo and South Africa, have populations greater than 40 million), which makes it difficult to achieve economies of scale in many of the key public goods necessary for agricultural development, such as research, agricultural higher education, market regulation, and policy making. For example, of the 48 national agricultural research systems in SSA, half had fewer than 100 scientists (FTEs--full time equivalents) in 2000, and a quarter had fewer than 50 (Beintema and Stads, 2006). In contrast, in 2005, Malaysia had 188 FTEs working on oil palm alone (Eicher, 2006). In the 1960s, SSA was the world's leading exporter of oil palm, supplying 66% of world exports in 1961; Malaysia exported practically no palm oil until 1970. Today, Malaysia dominates the world market for palm oil, supplying 44% of world exports in 2004, while SSA's share had collapsed to 0.4% (FAO, 2006). The large number of farming systems, combined with the small size of research units, increases research costs in SSA. At the same time, the small size of NARS makes it difficult to capture research spillovers across countries, reducing individual countries' incentives to invest in agricultural research. Similar issues arise with agricultural marketing. Marketsheds often transcend national boundaries, but varying regulatory systems, currencies, and non-official trade barriers greatly increase the costs of trade. These "small-country" problems make the development of effective regional cooperation in trade, research, higher education and harmonization of regulatory arrangements crucial to spurring agricultural growth in SSA.

[25] Author's calculation. The investment figure is calculated at an average cost per ha of new irrigation in SSA of $5,726 (from (African Development Bank (AfB), et al., 2006)) times 19.881 million ha, the area needed to increase the percentage of arable land in SSA that is irrigated to 15.8%, India's share of irrigated arable land in 1961 ((FAO, 2006))

- The Eroding Human Capital Base in Agricultural Science. SSA has made tremendous progress in building its human capital base in agricultural research and higher education since 1960, when 90% of the agricultural scientists in SSA were foreigners, and today, when 90% are African (InterAcademy Council, 2004). The number of full-time-equivalents in public agricultural research systems for 27 countries for which data are available tripled between 1971 and 2000, from 2,818 to 8747. However, the numbers were highly concentrated, with 40% of all scientists working in just 5 out of the 48 countries of SSA (Nigeria, South Africa, Ethiopia, Kenya, and Sudan), with 35 countries having only 20% of the total staff, leading to problems of diseconomies of scale (Beintema and Stads, 2006, Eicher and Rukuni, 2003). Moreover, the first generation of scientists trained after independence have moved towards retirement, and the rate of growth of public research systems (particularly in Southern Africa, where the HIV/AIDS epidemic is worst) and weakening graduate training programs in agriculture. Four factors are contributing to the erosion of the human capital base: (a) weakening of university programs, particularly at the graduate level, in Africa, as universities expanded rapidly in train burgeoning numbers of undergraduates (which reduced the research orientation of the universities), (b) the large decline in funding for overseas graduate training programs), (c) poor salaries in most universities and national agricultural research organizations, contributing to the brain drain, and (d) the HIV/AIDS epidemic. The situation is worsened by the poor integration of universities into the national agricultural research systems in most countries, and the eroding quality of university instructions is raising the question of who will train the next generation of agriculturalists and agricultural scientists (InterAcademy Council, 2004).

Not only is SSA's resource endowment different from that of Asia at the dawn of its green revolution, but the economic environment in which it operates currently is also vastly changed. Some of these changes have been discussed above, but a few deserve special mention, as they will likely have particular influence for the future patterns of agricultural productivity growth in Africa:

- SSA is a relative latecomer to rapid economic growth, which opens the scope for technological leap-frogging (Johnston and Kilby, 1975), for example, in the use of modern information and communication technology to access scientific information for agricultural research and teaching and for making market information more broadly available to farmers and traders. At the same time, being a latecomer means that African economies face much more competition (particularly from low-cost Asian producers of inexpensive manufactured products and certain agricultural products, such as rice) than did the Asian countries at the start of their green revolution. This heightened competition reflects the economies of scale and agglomeration that the Asian economies have achieved in labor-intensive manufacturing (Collier, 2006); major infrastructure investments (e.g., in irrigation) that have made Asian agricultural producers of staples, such as Vietnam, more efficient, and the WTO trade regime which has lowered trade barriers. As noted above, the availability of low-cost Asian consumer goods raises concerns about whether a green-revolution in Africa would unleash, through consumption linkages, the level of employment growth in the nontradable sectors that played such an important poverty alleviation role in the Asian green revolution.

- The ratio of grain prices to fertilizer faced by African farmers has been much more unfavorable to the adoption of fertilizer-responsive modern varieties than was the case in Asia during the green revolution (table 3), due to the long-term decline in world grain prices (itself a product of the Asian green revolution), the increase in world nitrogen prices as a result of higher energy prices, the lack of economies of scale in ordering fertilizer in many SSA countries where demand is limited, and the high inland transport costs which reduce farm-gate grain prices and increase farm-gate fertilizer pices.

Table 3. Nitrogen-Maize Price Ratios in Selected SSA Countries and other Regions of the World during the 1980s and 1990s

Country/Region	**Period**	**Nitrogen : Maize Price Ratio (median)**
Tanzania	1980-85	2.6
	1995	7.0
Kenya	1980-95	7.3
Malawi	1977-87	10.7
	1988-94	7.7
Zimbabwe	1980-94	6.4
Ethiopia	1983	6.4
	1992	1.9
Zambia	1971-89	3.3
	1990-94	5.4
Ghana	1982-87	2.2
	1991-94	10.2
Asia	1980-92	2.7
Latin America	1980-92	3.8

Source: (Heisey and Mwangi, 1997)

The scope for direct government support to and protection of domestic agriculture is much more limited for SSA countries in a post-structural adjustment and WTO-environment than was the case for Asian countries in the 1960s and 1970s. Although the dangers of such protection, in terms of reducing incentives for efficiency, are well known, several of the successful green revolution Asian countries used temporary protective measures to encourage adoption of new varieties (Djurfeldt, et al., 2006), and there are increasing calls from some African farm leaders to do the same, particularly in light of what they perceive to be unfair competition from subsidized OECD agriculture (Réseau des organisations paysannes et de producteurs de l'Afrique de l'Ouest (ROPPA), 2006).

3.2 Diversity of Smallholder agriculture in SSA

Not only is African agriculture highly heterogeneous, but so are African farmers. Although the differences between large commercial farmers and smallholders in countries like South Africa and Zimbabwe are evident, what is often less appreciated is the diversity among smallholders themselves. African agriculture is predominantly smallholder, but those smallholders vary tremendously in terms of their access to resources, such as land; and market access (figure5)(Jayne, et al., 2006c, Jayne, et al., 2001, Weber, et al., 1988, Zezza, et al., 2006). Surveys in Ethiopia, Kenya, Mali, Mozambique, Rwanda, Senegal, Somalia, Tanzania, Zambia, and Zimbabwe between the mid 1980s and 2002 found that in no country were more than half of the smallholders net sellers of staples; the modal figure is closer to one-third. In Ethiopia only 25% of smallholders were net sellers of either teff or maize, and only 25% were net sellers of maize in Mozambique. Up to 72% of smallholders were net buyers of maize and teff in Ethiopia; in the other countries, the number of net buyers ranged from 30% to 67%. Depending on the country, from 5% to 40% of the smallholders neither bought nor sold staples (Christiaensen and Demery, 2006, Jayne, et al., 2006c, Weber, et al., 1988).[26] Data from household surveys in Ghana, Nigeria, Malawi and Madagascar found similar patterns, with the amount of land owned being the strongest correlate of net sales position. (Zezza, et al., 2006). In Ethiopia, approximately a fifth of smallholders can produce only 50% of their families' caloric needs from their plots, although these households are primarily agricultural (World Bank, 2005b).

Land availability per person in agriculture has fallen by roughly half over the past 40 years in many countries in Africa. Not only is the land availability per person falling, its distribution, even among smallholders is highly unequal. Gini coefficients of rural household land per capita among smallholders for Ethiopia, Kenya, Mozambique, Rwanda, Zambia and Zimbabwe range from 0.50 to 0.56 (Jayne, et al., 2006c), comparable to or higher than those estimated for much of Asia during the 1960s and 1970s (Haggblade and Hazell 1988).[27] If these countries' large-scale and/or state farming sectors were included, the inequality of landholdings would rise even further. Frequently, the bottom half of the size distribution of smallholders has less than one-fifth of a hectare per person available, making these households close to landless. These households are frequently also the most constrained in terms of access to capital and improved inputs. Given their constrained resources, it will be difficult for these households to climb out of poverty through solely relying on farming, particularly through the production of lower-value staple crops. Although there may be more scope for raising incomes on limited land through the production of higher-value horticultural and livestock products, these typically require higher levels of management skills and coordination with input and output markets, which may be

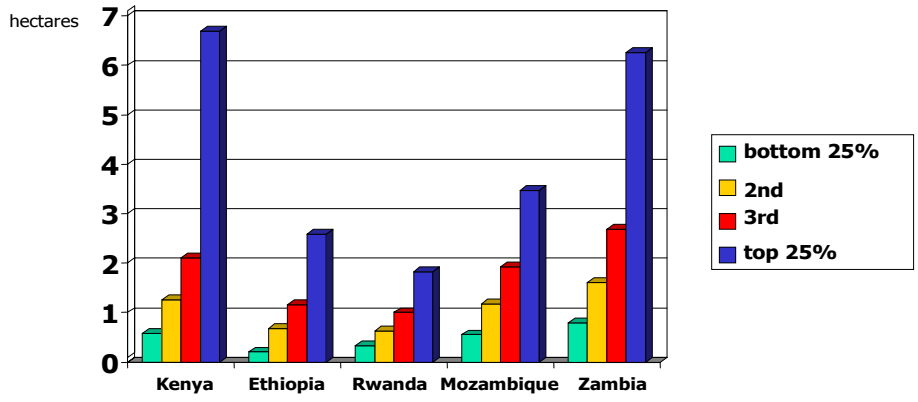
[26] The figures showing the larger percentages of net sellers were from surveys in more grain-surplus areas that were conducted in the 1980s; while the figures showing smaller percentages were nationally representative studies that took place more recently. Thus, it is most likely that in most of these countries, only about a third of smallholders are net sellers of staples.

[27] There is a large discrepancy between Gini coefficients of consumption calculated for Ethiopia, which show the lowest level of inequality among SSA countries for which such data are available (0.30, compared to an mean of 42.5 for the 19 SSA countries reported in the World Bank's 2005 Africa Development indicators) and the Gini computed for rural income (0.59) and land ownership (0.55) reported by (Jayne, et al., 2003). Nonetheless, the World Bank's (World Bank, 2005b)Gini coefficient for land—at 0.47--as opposed to consumption equality—is similar to that of Jayne, indicating high inequality in rural Ethiopia. Note that Devereux et al ((Devereux, et al., 2005a)) argue that income distribution n) may be too equal in Ethiopia to stimulate rapid agricultural growth; the figures presented by Jayne et al. seem to draw that argument into question.

outside the individual very limited resource smallholders. For example, Boughton et al. show that in Mozambique, the low asset levels (especially land, but also livestock) of the poorest smallholders effectively prevents them to bear the risks and transaction costs involved in participating in crop markets, pushing them back towards subsistence and lower incomes. The authors argue that provision of roads and market information alone will probably not suffice to deal with this risk management problem; improved capital markets and other insurance mechanisms are also needed (Boughton, et al., 2007). One of the major risks smallholders face when considering whether to go into higher value products is that of not being able to access a reliable supply of basic staples and relatively stable prices, implying that improving rural staple food markets needs to be an important element of involving more smallholders in production of higher-value products (Poulton, et al., 2006b).

The poor, however, are generally not geographically isolated from the better-off smallholders. Evidence from Kenya, Mozambique, Zambia, Ethiopia, Rwanda show that the lowest-resource smallholders most often are neighbors of the better off rather than living in isolated areas (Jayne, et al., 2006c). Approximately 70% of SSA smallholders are located in areas with good market access--defined as within 5 hours travel to a market of more than 5,000 (WDR 2008, chapter 2). The proximity of many of the poorest smallholders to better-off neighbors and to markets implies that market-driven agricultural growth among the better-off smallholders has the potential to have a stronger indirect effect (through linkage effects) on poverty alleviation than if the poor were more geographically isolated.

Figure 1. Farm size distribution: Small farm sector



Source: :Jayne et al., 2001.

In ex-settler economies, such as Zimbabwe and South Africa, political pressures for land redistribution from large landholders to smallholders remain strong. Such redistributions could potentially increase productivity if accompanied by redistribution of knowledge, capital, and market access, but the experience of Zimbabwe shows how such redistributions, if not carefully

carried out, can turn out to be a disaster in terms of both agricultural production and welfare of the poor (including displaced farm laborers). Given the difficulties of carrying out such redistributions, a more promising interim approach may be attempts to promote outgrower schemes that use the large farms' better connections to factor and product markets to help organize and link smallholders to more lucrative markets and provide them with technical support. Nigeria reportedly required white commercial farmers from Zimbabwe who resettled in Nigeria to behave in this way as a condition of their getting access to land in the country (Byerlee, 2007).

Implications for an Agriculture-for-Development Strategy in SSA

The preceding characteristics of agriculture in Sub-Saharan Africa have the following implications for strategies to boost agricultural growth as an engine of broader economic development and poverty alleviation.

Resource Mobilization: Amounts and Sources

The investment needs for rapid agricultural productivity growth across all of SSA, particularly for infrastructure and human capital, are far beyond current levels. The Blair Commission (Commission for Africa, 2005) examined investment needs for Africa in order to meet the MDG and concluded that continuing past trends (of domestic investment, remittances, Foreign Direct Investment (FDI) and ODI) would not allow much progress in achieving these goals. Even with the doubling of ODI over 5 years called for in the report (which has not been forthcoming since the issuance of the report in 2005), substantial increases in domestic resource mobilization and FDI would be required. As mentioned earlier, raising SSA's share of irrigated area to that of India in 1960 would require an investment equal to over 55 times that of annual ODA funds to African agriculture. If one adds the investment requirements for road and rural power infrastructure, agricultural R&D, extension, and agricultural higher education, the daunting nature of the challenge becomes apparent.

Progress is possible, however, if (a) investment levels increase, (b) the investments become more targeted (in areas where the growth payoffs are likely to be highest), and (c) the efficiency of investment increases.

Investment levels

Investment in SSA agriculture can come from six sources: domestic savings, debt relief, intersectoral transfers, foreign direct investment (FDI), remittances, and Official Development Assistance (ODA).

Domestic savings. The gross domestic savings rate for SSA as a whole, at 16% in 2004, is lower than for any other developing region and, in contrast with other regions, has not increased since 1990[28] lower than LICs on average and for other major areas of the world, and in contrast to other areas, has been stagnant since between 1990 and 2004, while other areas increasing. The

[28] The figures for the other regions in 2004 were 24% for South Asia, 22% for Latin America and the Caribbean, and 39% for East Asia and the Pacific (World Bank, 2006f)

variation across SSA countries, however is huge, ranging from -63% for Ethiopia to 46% in Gabon and 51% in the Republic of the Congo(World Bank, 2006a).[29] Increasing domestic savings involves deferring consumption, which is difficult at very low levels of income. Forced savings through taxation is one option, but SSA's taxation rate as a percentage of GDP, at 19%, is on a par with other developing regions, but is lowest in the poorest, least monetized economies that rely more on indirect taxation (of trade), which is easier to administer. Mali is an example of a country that has increased its taxation rate from 10 to 15% of GDP with more efficient taxation and growing monetization of the economy (Commission for Africa, 2005). Improving tax compliance will need to be an important component of increasing public savings for investment.[30] Given the importance of certain collective investments for agriculture (such as R&D, soft and hard infrastructure, and improved regulation), it is likely that improved public finance systems, especially at the decentralized level where they tend to be weakest, will be an important component of a strategy to mobilize resources for investment in agriculture.

Debt relief. Gross domestic savings can be allocated to investment or debt service; thus, debt relief (e.g., under the HIPC initiative and the Multilateral Debt Relief Intiative--MRDI) offers a potential to increase investment to boost agricultural growth in SSA. At the end of 2006, these initiatives were worth over $63 billion in 2005 net present value terms for qualifying countries, the vast majority of which are in SSA (World Bank, 2007). To qualify for HIPC, the recipient country needs to specify how the savings will be programmed for poverty reduction. In the first generation of the Poverty Reduction Strategy Papers (PRSPs), the focus was heavily on health and education, with few emphasizing agricultural growth. Placing agricultural growth more centrally in the countries' poverty reduction strategies, as some of the newer generation PRSPs are now doing, will be an important step in translating debt relief into increased agricultural sector investment.

Intersectoral Transfers. Transfers of capital from non-agricultural sectors to agriculture can be stimulated as new profitable investment opportunities arise in agriculture, particularly as macroeconomic policies (e.g., overvalued exchange rates), sectoral policies that have discriminated against agriculture, and rules regarding land tenure change. The scope for such changes has been greatly reduced in most countries due to the reforms of the 1990s (see Chapter 4 of the WDR 2008 and (World Bank, 2000)), although policy makers need to continue to monitor how policies affect private actors' decisions about where to invest. The pledge of African heads of state to allocate a minimum of 10% of national budgets to agricultural development (box 4) also represents a sectoral reallocation of public investment; whether it represents a net intersectoral transfer to agriculture depends on whether agriculture generates more or less than 10% of budgetary resources. Such transfers can be helpful in "getting

[29] The gross domestic savings rate is calculated as GDP minus domestic consumption, expressed as a share of GDP. Thus, if a large proportion of the profits of domestic production are expatriated, the savings rate can appear high. In other words, the gross savings rate does not account for capital flight, high levels of debt service, or the expatriation of domestically produced profits outside of the country (e.g., from petroleum exporters). This may account for the consistently high gross savings rates of countries like the Republic of the Congo and Nigeria (40% in 2004). Similarly, countries with very high remittance rates from overseas, such as Cape Verde, and countries with high aid inflows, such as Ethiopia, have consumption that exceeds GDP, resulting in negative gross domestic savings rates.

[30] Whether increased taxation will increase total agricultural growth will depend on whether the marginal propensity to invest in factors that increase agricultural growth is greater in the public sector than in the private sector, the relative efficiencies of investment by the private and public sectors, and the effects of the taxation on farmers' and traders' incentives to produce.

agriculture moving", but in the long run, agriculture needs to be net contributor of capital to other sectors to foster the structural transformation (see chapter 1 in the WDR), not vice versa.
Foreign direct investment (FDI) While increasing in SSA, foreign direct investment is highly concentrated in a few countries (Angola, Nigeria and South Africa account for 59%), and to date mainly in extractive industries (Commission for Africa, 2005, World Bank, 2006f). As noted in box 3, China's growing investment in Africa also follows this pattern. There has been some FDI in export agriculture (e.g., flowers from Ethiopia and Tanzania), although some of this has been intra-African (e.g., South Africans and Zimbabweans investing in flower exports from Tanzania; potential South African investment in sugar production in Mali). Similarly, investment from South Africa to other African countries has been important in downstream food marketing, particularly in the supermarket sector. There has also been some limited FDI in import-substituting agriculture, such as sugar production in West Africa. Over the longer term, how the African investment portfolio of newer actors, such as China, India, and Brazil evolves will also influence the importance of FDI in spurring agricultural growth in SSA.
Remittances to SSA countries from migrants totaled $7.4 billion in 2004 (World Bank, 2006a), although it is unknown what proportion of this flowed into rural areas or agricultural investments. Some of the remittances are for intra-African migrants, but the proportion is not apparent from the data. The amount of remittances to SSA is much less than those to Latin America or South Asia, primarily because SSA has fewer skilled remitters abroad. Further restrictions on immigration, particularly to the North, may limit this source in the future. Another source of remittances, beyond return of wages earned abroad, is capital flows from African diasporas returning "home" when the investment climate improves (or the investment climate where the migrants live worsens—e.g., flows of capital back to the Sahel from Côte d'Ivoire following 2002). Improving the perceived investment climate for extended agriculture will be important to increase these flows.

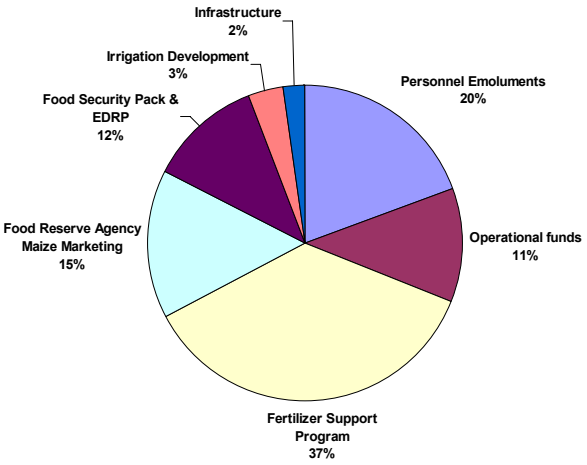
ODI – Official Development Assistance can be expanded in two ways: through expanding the contributions of existing donors (e.g., the Commission for Africa called for a doubling of ODI to Africa from existing donors over the next 3-5 years) and by broadening the number of donors. As noted above, while overall ODI levels to Africa have increased, particularly in the areas of health and education, ODI towards African agriculture has stagnated since 2000, but at least it has halted its previous decline. More recently, the increased involvement of new actors such as China, India and Brazil offers the possibility of increasing ODI investment in agriculture, particularly in the areas of human capital (where China has made major commitments to training Africans) and collaborative research (as evidenced by Embrapa's growing involvement in Africa). A crucial challenge will be to target this ODI in areas where it will likely yield high rates of return and induce ("crowd in") domestic investment, particularly from the African private sector (e.g., through investing in infrastructure).

Efficiency of investment

Because the investment needs are so great, it is imperative that investment that is made be done where it yields high returns in terms of both growth and poverty alleviation. For public investment, the focus needs to go beyond just the 10% NEPAD pledge to examine the efficiency of public investment. For example, recent studies of Zambia by Govereh et al. (Govereh, et al., 2006) and Jayne et al. (Jayne, et al., 2006b) show that with the withdrawal of the state from

heavy involvement in crop and input marketing that accompanied structural adjustment, the share of national budget spent on agriculture fell from 26% in 1991 to 4% in 2005. Although some of this reduction undoubtedly reflects an increase in efficiency, as the state was carrying out many functions, such as grain marketing, that the private sector is now handling more effectively, there was also a reduction in expenditures on public services to agriculture such as research and extension. Furthermore, over 80% of the current budgetary allocation to agriculture goes to the fertilizer subsidy programs, managing the national food reserves, personnel emoluments and departmental recurrent charges, leaving very little to invest in programs aimed at increasing agricultural productivity (figure 5). Data from Malawi show that 70% of the 2007/08 agriculture budget will be allocated to fertilizer subsidies (Imperial College London, et al., 2007).

Figure 5. Public budget allocation to the Agricultural Sector, 2004/05, Zambia



Source: (Jayne, et al., 2006b)

The challenge is to find areas of public investment that "crowd in" rather than "crowd out" private investment. For example, Ethiopia's substantial public investments since the mid 1990s to increase staple crop yields through greatly expanded extension programs tied to fertilizer distribution have had very modest impacts in part because they have crowded out the private sector in input distribution, leading to a relatively rigid set of extension recommendations to farmers and inefficiencies in input distribution (Byerlee, et al., 2006, Dercon and Christiaensen, 2005).[31]

The efficiency of private investment in extended agriculture depends critically on public policies, which if poorly designed policies can distort private investments in remarkably unproductive ways. An example is the emergence of bicycle transport companies on the Mozambique-Malawi

[31] Private sector wholesalers, except those affiliated with the ruling party, are now absent in the fertilizer sector in Ethiopia; private retailers, which dominated local distribution in the 1990s only accounted for 7% of retail outlets in 2004, with the public sector accounting for 70% (and state-organized cooperatives the remainder) (Byerlee, et al., 2006).

border that carry sacks of grain from trucks on the Mozambique side of the border to trucks on the Malawian side because Mozambique requires exports greater than a few sacks to obtain export certification (a costly process that until recently had to be done in Maputo, hundreds of kilometers away) and because both countries have costly certification and tax requirements for trucks crossing the border (Bata, et al., 2005, Whiteside, 2002). The removal of such restrictions as part of the marketing reforms in Mali in the 1980s and 1990s induced significantly more efficient private-sector investment in the grain marketing system (Dembélé and Staatz, 2002). Another example of distortion of private investments by poorly designed policies are the effects that subsidized interest rates for equipment can have in inducing premature tractorization of agriculture, substituting expensive imported capital equipment for relatively inexpensive domestic labor (as seems to be currently occurring in Mali).

Geographically differentiated agricultural revolutions, building on previous successes

The agroecological diversity of SSA implies that successful agricultural productivity growth will likely come from a series of geographically differentiated agricultural revolutions (what the InterAcademy Council (InterAcademy Council, 2004) dubbed "rainbow revolutions" rather than an Asian-style Green Revolution based on one or two commodities. These differentiated revolutions will need to build on existing successes, such as the spread of improved cassava varieties that doubled farmers yields in Nigeria with no increase in purchased inputs and which have subsequently spread to several countries in West and East Africa; highly profitable smallholder dairying in Western Kenya; and lessons learned from the historical successes of cotton in francophone Africa (Blackie, 2005, Gabre-Madhin and Hagglade, 2004, James Tefft, 2003, Nweke, et al., 2002, Poulton, 2006, World Bank, 2006e).[32] It is also likely that livestock, both small stock that are among the most important assets of the poor, and ruminants that are capable of exploiting SSA's vast rangelands more effectively and sustainably than crop agriculture, will play a greater role in SSA's agricultural revolutions than they did initially in Asia (Cite ILRI).

To build on these geographically differentiated successes and develop new ones will require that research systems be decentralized, incorporating participatory research approaches, in order to address local conditions and exploit local knowledge (Snapp, et al., 2003). At the same time, the need to work on several different commodities and production systems, combined with the small size of most national agricultural research systems, implies the need for regional research networks and regional specialization across national systems in order to gain economies of scale. This organizational challenge, which is part of a larger challenge of subsidiarity in the organization of SSA's agricultural development efforts, is discussed below. A challenge is to make these networks effective rather than simply a means for poorly paid national researchers to supplement their incomes through gaining per diems from attending meetings.

Differentiated strategy between agriculture as direct path out of poverty (entrepreneurial class) and "social agriculture"

[32] For a detailed set of case studies of successes in African agriculture, see the papers presented at the 2003 InWEnt, IFPRI, NEPAD, CTA conference on "Successes in African Agriculture" available at http://www.ifpri.org/events/conferences/2003/120103/papers/papers.htm .

A strategy that embraces the uniqueness and diversity of SSA's agriculture and its farmers should focus on promoting growth among higher-potential smallholders—family farmers (and moving as many people into this class as possible) in higher-potential areas where returns to investment in agriculture are greatest. But this approach needs to be coupled with investments and policies to promote broad sharing of the benefits of that growth, through linkage effects that will generate employment opportunities for those smallholders who have access to very little land and other assets. Given the magnitude of investments needed to spur agricultural growth in SSA and the need to concentrate efforts, it is likely that this strategy will lead to both higher growth and more poverty reduction than a strategy that focuses mainly on improving the farming operations of the poorest of poor—subsistence farmers. This strategy is built on two equally important elements: securing agricultural growth among those farmers and regions that have the greatest potential for growth; and putting in place the conditions that assure a broad sharing of the benefits of this growth through reduced food prices, increased employment opportunities for the poor in agriculture and other linked sectors, and strengthening the poor's assets, including access to education. The strategy implies the need for a differentiated set of technologies, policies, and programs: one set for those for whom farming as a business can serve as a pathway out of poverty and another set for those for whom the indirect effects of agricultural growth (through expanded off-farm labor, lower food prices, and demand-induced linkages) offer the most promising path forward.

Correctly identifying who potentially constitutes the group of smallholders who can "farm their way out of poverty," and taking actions to broaden the group as much as possible, requires careful empirical analysis; even very small farmers sometimes have significant entrepreneurial skills and growth potential. In some cases, investments targeted at protecting very small farmers' assets in order to keep these producers from falling into poverty traps can have high rates of return (Santos and Barrett, 2006). In other instances, small farmers who have favorable market access and strong management skills can successfully participate in outgrower schemes for labor-intensive high-value products [Cite (Poulton, et al., 2006b) on outgrower scheme experience and growth of those; also check out Jaffee book). In a few countries, such as South Africa, land redistribution may also be an important element in broadening the class of commercial smallholders. But frequently, the smallest farmers face the biggest constraints in accessing the resources needed to succeed in farming as a business, and will have brighter prospects using agriculture as a base for subsistence while they develop income streams outside of their own farming operations.

The strategy reduces poverty through three ***interdependent*** paths:

- *A commercial smallholder path*, built upon competitive, market-oriented family business enterprises in agriculture and related value chains. This path, open to better-endowed smallholders, focuses on improving farming as a business through increasing total factor productivity in farming, strengthening access to product and factor markets, and improving natural resource management (NRM).
- *A strengthened semi-subsistance path*, which focuses on stabilizing more marginal farm households' production for home consumption (through yield-stabilizing technologies, improved productivity—particularly of its small livestock resources, and improved NRM) and facilitating access to labor markets and non-agricultural opportunities. This path also focuses on enhancing access to education (to ease the next generation's

transition out of farming) and providing social safety nets to avoid loss of assets due to various shocks (e.g., drought, disease, or death of a family member from AIDS). For landless households, the focus is on improving access to labor markets, including migration.

- *A widely shared indirect benefits path*, which affects all groups, but is particularly important for marginal farmers, the landless and urban consumers. This path exploits opportunities from the demand-induced employment stimulated by growth in the smallholder sector and from lower food prices, which raise real incomes and induce job creation in the non-agricultural sectors.

None of the paths can be pursued independently of the others. For example, financing the investments in education and improvements in labor markets that are critical to the strengthened semi-subsistence agriculture path depend on capturing and reinvesting some of the agricultural surplus generated by the commercial smallholder path (fiscal linkages).

First cornerstone of a successful African agriculture-for-development strategy: securing growth

The first element of this strategy of using agriculture for development is to secure agricultural growth among a broad class of **entrepreneurs (**family farmers, other private actors in the value chain), including women. Given the spatial diversity of African agriculture, the commodity focus of this growth will vary substantially by agroecological zone. The growth strategy needs to have both a commodity market focus (for staples) and some traditional bulk exports and a value-chain focus for higher value products, with different groups of smallholders likely participating in each. While exports of non-traditional crops frequently attracts most attention of policy makers, the relative size and growth potential of these different markets need to be kept in mind (table 4). This table highlights how dominant domestic (and regional—although understated by official statistics) markets are for basic staples in terms of volume, and this demand is likely to double by 2015. Non-traditional exports, even if they grow quickly, will have relatively small impact on aggregate agricultural growth and employment just because their relative size in the agricultural economy is still very modest (Diao, et al., 2006, Hazell, 2006). But they and traditional exports are both important, as are regional markets, as the linkage effects described earlier in this paper are engendered most strongly through growth in the tradable sector.

Table 4. Size of Sub-Saharan Africa's Agricultural Markets: 1996-2000 Averages

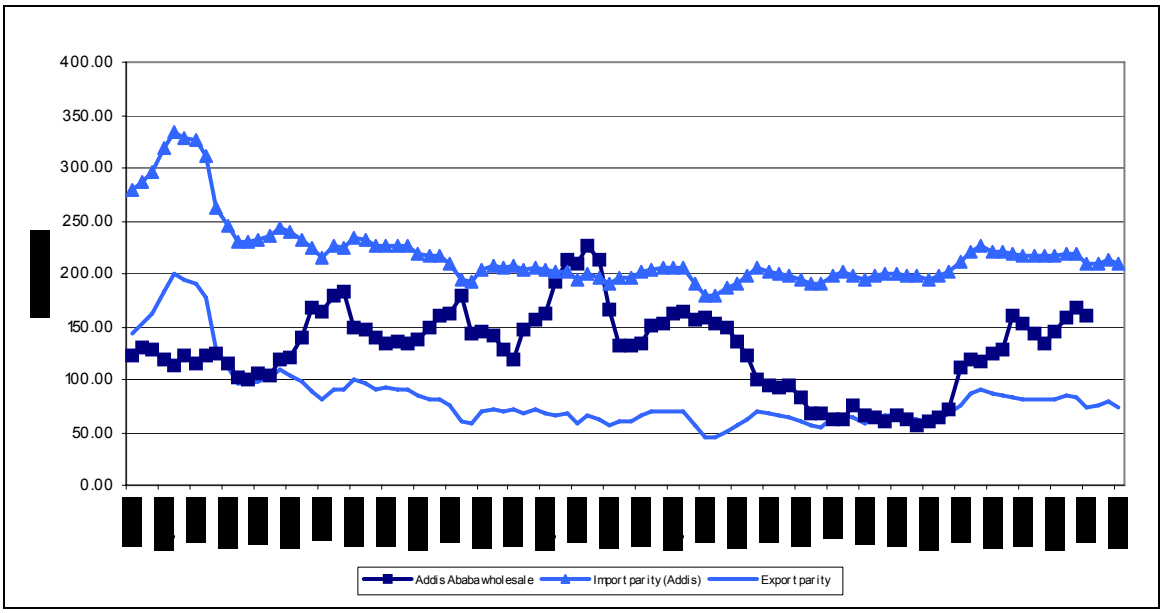
	Market Value (billion US $)			
Type of Market	East Africa	Southern Africa	West Africa	Total Africa
Traditional exports to non-Africa	2.2	2.4	4.0	8.6
Non-traditional exports to non-Africa	1.3	2.8	2.0	6.1
Other exports to non-Africa	0.5	0.7	0.7	1.9
Inter-African trade	0.4	1.1	0.4	1.9
Domestic markets for food staples	17.6	12.1	20.1	49.7

Source: (Diao, et al., 2006). Figures for regional trade are based on official statistics and understate actual flows. Figures for domestic markets include own consumption.

Staples

A focus on increasing the efficiency of staple food production and marketing also derives from the fact that for much of SSA, particularly in inland areas, staples remain a semi-tradable good, with wide differentials between import and export parity prices (figure 6). This implies that there is still a substantial range to reduce the cost of wage goods, which raises real incomes and helps to hold down nominal wages, thus strengthening incentives for employment expansion in non-agricultural sectors. This reduction of wage-good costs was critical to the poverty-reduction effects of the Green Revolution in India (Mellor, 1976). Given high transport costs in much of SSA, transport and handling costs often account for at least half the price that urban consumers pay for these staples, implying that improvements in marketing and transport systems can be important as on-farm productivity increases in reducing these wage good costs. The reduction in marketing margins seen both in countries in southern and Eastern Africa and in West Africa following market reforms of the 1990s and early 2000s (Jayne, 2006, Yade, et al., 1999) are evidence that progress is being made in this regard. A particular challenge and opportunity in some countries, particularly in Eastern and Southern Africa, is how donors and relief agencies, particularly the World Food Programme (WFP), can use local and regional procurement of food aid in a way that strengthens local market development and reduces risk for both traders and smallholders. For example, over the period 2001-05, Ethiopia received over 5.4 million tons of cereals as food aid, of which 21% (1.1 million tons) were procured locally by aid agencies, the largest of which was WFP. WFP is also one of the largest grain procurers in Sudan, Uganda, and Zambia, buying over 20% of Uganda's marketed surplus of maize in 2004 (Tschirley, 2007). The WFP is exploring ways in which it can use its local purchases to promote incentives for local farmers and traders to invest in production and marketing while still allowing WFP to meet its emergency needs without incurring high transaction costs (World Food Programme, 2007a).

Figure 6 .**WHOLESALE MAIZE PRICES (US$/TON) IN ADDIS ABABA RELATIVE TO IMPORT AND EXPORT PARITY PRICES, BASED ON U.S. WHITE MAIZE TRADED VIA DJIBOUTI, 1998-2003**



Source: del Ninno, Dorosh, and Subbarao 2005 cited in (Brooks, 2006)

A further implication of this large gap between import and export parity prices is that farm-level prices for these semi-tradable staples can be extremely volatile, for example fluctuating by a factor of 1 to 4 across crop years in the Sahel and by a factor of 1 to 3 between seasons in Northern Mozambique and Southern Malawi (Dembélé and Staatz, 2002, Whiteside, 2002). Reducing the volatility of these prices through yield-stabilizing technologies (e.g., small-scale irrigation) and improvement in rural marketing systems will be extremely important in reducing risks for both net sellers and net buyers of these staples (the latter often include the majority of smallholders), thereby creating more incentives for specialization and avoiding periodic decapitalization of farm operations that often results from farms having to deal with periodic food price shocks (Dercon, 2004, Dioné, 1989, Hazell, 2006).

A strategy for staple crop improvement needs to be differentiated by type of farmer.[33] For farmers with access to enough resources to produce staples commercially, higher-yielding, more input-responsive varieties (e.g., hybrids) are a priority, with traits sought by consumers, traders, and processors; along with improvements in both input and output marketing systems. For smaller, more subsistence-oriented farmers, production stability and drought tolerance, low input tolerance, open pollinated varieties (whose seed can be stored), good storability and taste to farmers are higher priority. These farmers also need improvements in the functioning of local markets for staples so that they can reliably buy staples when they need them, as well as markets for small livestock and for labor, which they rely on to generate cash income to buy staples.

[33] This paragraph draws on comments provided by David Rohrbach at the WDR consultation in Nairobi in November 2006. See also (Snapp, et al., 2003).

Given the inelastic demand for staples (accentuated by thin markets), large productivity increases in staples could lead to a collapse in staple food markets, undermining incentives for production. Thus, increases in staple food productivity need to be coupled with increases in production of tradable goods in order to stimulate increased income growth to fuel increasing demand for staples, both for human and animal consumption. In many areas of SSA, these tradables include higher value products for regional trade (especially livestock and horticultural products), which have relatively high income elasticities.

Traditional Exports and High-Value Products

A growth-oriented strategy needs to emphasize both traditional exports and high-value horticultural and livestock products, both for export and growing domestic and regional markets. Traditional exports such as coffee and cotton offer some continued growth opportunities, but attention needs to be paid to:

- Being cost-competitive (which implies an "adding up" of market saturation if all countries pursue this strategy)
- Assuring quality control and negotiating strategic alliances with marketing/agribusiness firms in order to capture high-value niche markets (this often requires collective action at the farm level). Furthermore, the high differential between the prices in the niche markets and the commodity markets create large risks for market participants unless quality control and mutual accountability can be assured throughout the value chain.
- For a few commodities, like cotton and sugar, OECD subsidies will likely continue to distort markets, creating incentives to diversify out of these crops. Developing effective input markets for these new products is a challenge, as the input supply in these areas producing the traditional exports is still sometimes organized by integrated supply chains for those exports, making it difficult to find inputs for alternatives. The problem of subsidies on cotton are pushing some of the West African producers to try to promote more processing in country, but high energy costs remain a major barrier.

High-value exports, such as horticultural and floricultural exports are attractive because if quality standards can be met, there are few demand constraints to growth. The challenge is on the supply side: producing products that meet buyers' strict specifications and evolving demands, delivering products in a timely way (for example, the value of a flower varies enormously depending on whether it is delivered one day before Valentine's day or one day after), and delivering them at a competitive price. Among key elements of success are a stable macro-economic environment, which facilitates trade and reduces foreign investment risk; entrepreneurial management that in includes detailed knowledge of foreign buyers specifications and credibility with the buyers (as was played by the Asian community in Kenya in promoting Asian vegetable exports to the UK in the 1980s and 1990s); fast and economical transport links to major markets, which often involves capturing economies of scale; as well as favorable agronomic conditions for production (Jaffee and Morton, 1995, Tyler, 2006). This type of production, while labor intensive, has significant economies of scale in coordination, quality assurance, and marketing, and thus is most frequently produced under either large farms using hired labor or through fairly tightly coordinated outgrower schemes. Capturing economies of scale in air transport has often depended on synergies with the tourism industry. Large tourist traffic via jumbo jets, initially to Kenya and more recently to places like Arusha, Tanzania (near Mount Kilimanjaro), have brought added air freight capacity that allowed these areas to compete

more effectively in European markets for products like green beans and cut flowers than areas in West Africa, which are closer to Europe but which lack the frequent air connections (Tyler, 2006).

While export of high-value products offer relatively few demand constraints on growth, the sector is still small relative to the domestic and regional markets for high value products. For example, in Kenya—a success story in export horticulture— growth in the domestic market for fruits and vegetables accounted for 90% of total growth in the fruit and vegetable sector between 1996 and 2005. Value added in production for the domestic market was 3-4 times that for the export market (Muendo and Tschirley, 2004). Small and medium-sized dairy farms in the Kenya highlands employ 735,000 people, more than the 500,000 employed in the flower industry; in addition, dairy marketing in this area creates an additional 1.7 jobs per 100 liters sold (Sere, et al., 2007). Local and regional markets for higher value horticultural and animal products, especially those passing through traditional as opposed to supermarket channels, have received much less attention from policy makers and develop agencies than modern supply chains. Yet these markets carry many times the volume of modern supply chains, are easier for smallholders to participate in (due to more lax quality requirements) and show strong growth potential in many countries. While supermarket growth has been important in South Africa, in most other parts of the continent, its market share of these higher value products has been much more limited than in other regions of the world. Fore example, in Nairobi, the city outside of South Africa where supermarkets have made their greatest inroads in SSA, only about 4% of fruit and vegetable sales went through supermarkets in 2004, with 92% going through "wet markets" and kiosks (Tschirley, et al., 2004)

Regional trade in produce is also growing strongly in many areas. For example, following the CFA franc devaluation in 1994, onion and potato exports from Niger, Burkina and Mali largely displaced exports from the Netherlands in major coastal markets, such as Abidjan (Kelly and Chohin-Kuper, 1998). The regional markets are also easier for African countries to capture, serving as training grounds for developing the skills to compete in more quality-demanding overseas markets. Similarly, urban and regional markets for livestock products are growing, driven by high income elasticities, [34] a trend seen in other regions of the world as well (Sere, et al., 2007).

With rapid urbanization and even modest increases in household income, growth prospects in these "traditional" channels are exceptional. Smallholders and small-scale traders, many of them women, dominate the channels. Thus, the potential for achieving the twin goals of poverty alleviation and improved gender equity is great. Success in serving these markets will also assist some smallholders to gain the skills needed to move up to high-end domestic and export markets.

Unfortunately, these domestic and regional value chains face many growth constraints and have remained largely invisible to most governments and donors. At the farm, horticulture and improved small stock (e.g., poultry) production places intensive demands on smallholder knowledge, management, labor and access to genetics and other inputs. Downstream, the perishability of fresh produce places great demands on post-harvest technology and marketing systems; the constant flow of produce and live animals through public markets too often leads to

[34] E.g., Camara estimates the income elasticity of demand for meat and fish in Bamako at +1.76 (Camara, 2004).

congestion and unsanitary conditions; and human health is further threatened when peri-urban producers use waste water to irrigate their crops. Market information systems (MIS) face major challenges measuring product quality and assuring more rapid information dissemination than is needed for non-perishable staples. If these challenges can be addressed, millions of small farmers and traders can gain from more profitable, reliable, and diversified markets; employment in horticultural production and marketing will expand; and millions of poor consumers will benefit from a more reliable supply of safer and more nutritious food.

In contrast to the export market, value chains for high-value products destined for national and regional markets are rarely organized by a single large firm. Thus, group action by stakeholders (e.g., farmers, traders, MIS, public policy makers, urban planners, NGOs) and innovative public-private partnerships in the value chain will be critical in identifying problems and opportunities, mobilizing resources, and accessing the technology, markets, capital, and risk management needed to seize new opportunities. This implies much more attention to marketing and coordination, including intra-regional marketing. Traders' organizations have the potential to help improve the performance of the regional markets through improved regional coordination and reduced non tariff trade barriers (see box 6).

Input and Factor Markets

Making factor and product markets work more effectively is critical to securing growth throughout extended agriculture, with much more attention needed to building on successful public-private partnerships. Very significant progress was made during the 1990s in reforming product markets in Africa (World Bank, 2000), and continued progress is needed to consolidate and build upon those gains (particularly in facilitating regional trade). In many countries, however, poorly functioning or missing factor markets now present at least as great a constraint to increasing agricultural productivity as do poorly functioning product markets. Weak or absent land markets in countries such as Ethiopia impede the emergence of larger commercial farms by limiting investors' ability to consolidate very small parcels, a problem that is worsening as population pressure leads to more land fragmentation, and prevent farmers from using land as collateral to obtain loans (Devereux, et al., 2005b). Very small farm size in turn results in small marketed surplus per farm, raising per-unit assembly and marketing costs. Input and credit markets, which are subject to serious problems of asymmetric information, often fail; as a result, the only way farmers can get critical inputs is to pay for them in cash (which excludes many poor farmers) or through interlinked agreements, such as in cotton, that lock the farmer into selling her output to a single merchant. When such interlinkage of markets is broken through liberalization of output markets, input supply systems often falter because the automatic credit recovery through output marketing no longer exists (Poulton, et al., 2006a). Poorly functioning input markets also often constrain farmers' access to inputs for new crops not covered by interlinked markets, thereby limiting their ability to diversify into new, potentially profitable activities. In part, markets for inputs such as fertilizers and seeds in SSA are hindered by the small-country problem, which creates multiple regulatory environments, which discourages private-sector investment and the achievement of economies of scale in procurement (Crawford, et al., 2003, Rohrbach, et al., 2003).

Strengthening markets requires strengthening of both "hard" (physical) and "soft" (institutional) infrastructure, with particular attention to roads, communication, the regulatory environment, risk management, critical service provision (e.g., extension) and other public goods such as market information. High transport costs depress the prices farmers receive for their products while increasing purchased input costs; consequently, farmers have fewer incentives to adopt fertilizer and other productivity-enhancing inputs. Risk, emanating from unstable public policies, production uncertainties of rainfed agriculture, and price volatility resulting from thin markets, limit incentives to invest in production and marketing throughout the value chain. One way in which actors deal with this uncertainty is to diversify their activities, which leads to higher unit costs of production due to the failure to capture economies of scale. Better market information, improved water control, and marketing extension programs can help mitigate these risks, but additional tools, such as weather-based insurance, also need to be developed further.

Achieving this **differentiated agricultural revolution** requires innovation and investment in sustainable water and soil management, sustainable institutional services (particularly those focused on risk management), improved technologies (seeds, fertilizer, livestock) and key public goods. Given the overwhelming importance of rainfed agriculture in SSA, improved agricultural water management (AWM) is particularly important, both to increase production and mitigate risk. Smaller scale technologies (e.g., treadle pumps) and improved soil/water management techniques such as water harvesting, offer less capital-intensive, more gender-neutral options that sometimes have greater or equal rates of return as investments in larger scale irrigation systems (African Development Bank (AfB), et al., 2006). Another key challenge is developing sustainable new models for extension, as many of the models tried to date, such as the Training and Visit system have had disappointing results (Gemo, et al., 2005). See Eicher refs on farmer field schools, etc.

Equally important is the development of professional organizations that give this broad class of entrepreneurs political voice to lobby for more pro-growth policies, rather than simply rent-seeking. The political reforms of the last 15 years have opened the door to more independent farmer and professional organizations throughout the value chain. These organizations, through giving voice to rural interests, have been effective in many countries in reducing the urban bias in government investments, and in some cases they have worked effectively to reduce barriers to regional trade. They have also, however, often been vocal in arguing for protection from "unfair" foreign competition; in some cases, this has led to calls for food self-sufficiency enforced through import restrictions (Réseau des organisations paysannes et de producteurs de l'Afrique de l'Ouest (ROPPA), 2006).

Second cornerstone of a successful African agriculture for development strategy: assuring a broad sharing of the benefits of growth

A minority of smallholders in SSA currently have the assets needed to "farm their way out of poverty." To assure that demand-driven agricultural growth leads to broad-based poverty reduction, it is therefore necessary to develop a strategy that shares the benefits of such growth as broadly as possible. This will involve (a) increasing as much as possible the number of

farmers who can participate in productivity-driven growth as entrepreneurial farmers themselves, (b) creating increased employment opportunities in demand-driven farming (as farm laborers) and through expanding rural non-farm employment through linkage effects; and (c) expanding the capacity of those who cannot "farm their way out of poverty" to acquire the assets, including human capital, needed to successfully compete for higher return non-farm jobs, either locally or through migration (see chapter 9 of the WDR). This is frequently an intergenerational process, requiring stabilization in the income streams of the poor, including provision of safety nets, while they invest in their children's education.

Broadening the size of the entrepreneurial farmer class involves investment in public goods such as roads and market information to connect farmers to market opportunities, as well as fostering group action to allow them to capture the economies of scale involved in marketing, input and credit supply, and meeting increasingly stringent market demands. It also involves the issues of improving security of tenure and improved factor markets (including working to remove gender biases in the credit and land rental markets) so that those who are more entrepreneurial can expand production and accumulate assets. Volatile rural staple food markets often discourage farmers from expanding market-oriented production, as they have a high incentive to first assure their households' staple food supplies, so making those markets more predictable is also necessary to broaden smallholder market-oriented production ((Jayne, 1994, Poulton, et al., 2006a, Poulton, et al., 2006b).

Reardon et al. show that rural African households have very diverse income strategies; they reviewed 23 studies covering 13 SSA countries in the 1990s and early 2000s and found that nonfarm income accounted for an average of 37% of total income of farm families, of which remittances and transfers accounted for 11% and local nonfarm income accounted for 26% (Reardon, et al., 2007). The general pattern is for greater diversification of income streams with households than across individuals, as rural households will often send one or more members to seek employment off the farm, while other household members continue farming. Thus, addressing both the farm and non-farm elements of these households' portfolios is necessary to help them transition out of poverty. As mentioned above in the discussion of staple-food production, the technology needs of these farmers differ from those of the more entrepreneurial farmers with more assets. Here, the need is for risk reduction (e.g., through reduction in the variance of yields), maximizing returns from small (frequently credit-constrained) amounts of purchased inputs, and acquisition of small assets (e.g., chickens) that help them to bear risk more effectively (Boughton, et al., 2007, Rohrbach, 2006, Snapp, et al., 2003).

For the off-farm elements of these households' portfolio, the challenge is to expand the number of jobs and improve the returns to them. Within the agricultural labor market, avoiding premature motorization of farming (which can result from subsidies on tractors and similar equipment) will be critical in ensuring that the poor have job opportunities in more successful farms. Nor is there necessarily any opposition between a smallholder-based strategy and certain types of large-scale, labor-intensive farming and processing operations (e.g., of flowers for export) that generate a large number of semi-skilled jobs. The returns to nonfarm employment (including migration) vary widely, with those having the fewest assets (including human capital) typically stuck with low-return "refuge" jobs that offer little prospect of exiting poverty. Thus, investment in health and education are critical to improving the prospects to using the nonfarm

employment as a pathway out of poverty, and evidence from Ghana to Ethiopia shows high returns to education for those participating in these activities (Reardon, et al., 2007, World Bank, 2005b). Education is also extremely important to facilitate the intergenerational movement out of poverty agriculture into nonagricultural employment. Improving labor market flexibility and reducing costs of remittances (through more secure money transfer mechanisms) also strengthen household income diversification strategies to move out of poverty.

Expansion of employment in forward linked agroprocessing has been a minor contributor to employment growth in most SSA countries, raising questions of how it can be expanded. A major constraint to expansion involves the high cost and irregular supply of energy, especially electricity. For example, UNIDO studies of food processing firms in Nigeria found that because of high losses of product associated with power cuts, most companies had to install their own generators, which raised their costs at least 20% above what they would have been with a reliable power supply from the electrical grid. At the higher costs, many of the firms could not compete against imports with out tariff protection (Yumkella, 2007). But at the higher prices occasioned by protection, demand will be limited, limiting employment opportunities. Textile processing is further constrained by Asia's scale and agglomeration economies, for which trade preferences like AGOA have provided some relief, but these have been too limited in time and scope to allow these industries to take off sustainably (Collier, 2006). This, combined with the more open nature of SSA economies, at least along the coasts, leads Spencer to argue that relative to Asia, the creation of employment through the agricultural labor market may more important that agricultural-led nonfarm employment (Spencer, 2007).

A key element of this strategy is designing effective safety nets that protect the assets (including human capital) of the poor and near-poor to help assure that they avoid falling into poverty traps as the result of various types of shocks, such as drought, disease, and death of a family member. For example, food for education programs (box 5) have played an important role in maintaining school enrollments in the Sahel during periods of drought. Another critical dimension is empowerment/voice for the vast numbers of rural poor so they can gain political influence over access to the benefits of economic growth. Fostering such voice requires greater democratic representation, especially at the local level where demands for sharing in the benefits of growth and redistributive measures can be bargained. Developing such voice is not an easy task, as many of the marginalized are marginalized precisely because they are "invisible", having little social capital and often low social status (Poulton, et al., 2006a)

Box 5
Food for Education

For the majority of smallholders who lack the resources to "farm their way out of poverty", there is the need to capture part of the agricultural productivity growth of other more successful smallholders and other rural entrepreneurs to fund alternative pathways out of poverty. Education constitutes such a pathway that allows the children of the resource-poor farmers to migrate out of agriculture for non-agricultural rural or urban occupations as workers or self-employed.

Although education is a powerful means to break the intergenerational transmission of poverty, the short term costs of school fees and loss of the child's labor tend to outweigh any potential long-term benefit of education to resource-poor farmers and thus discourage them from sending their children to school. Governments can capture part of the agricultural productivity gains to change the cost-benefit calculation of the resource poor farmers in favor of school enrollment of their children in many ways. For example, instead of handing out food aid for free, governments can use food as an instrument to promote education for all through food-for-education interventions, while also reducing hunger among the poor, who in rural Africa are mainly the resource-poor farmers.

Food-for-education interventions, typically implemented through support from donors like the World Food Program, have two components: **School Feeding Programs,** where meals are provided in schools; and **Food-for-schooling programs,** where poor families are given food if their children attend school. These programs need to be implemented together, as they both use food as an incentive for parents to send their children to school and tend to offset the problem sometimes encountered in school feeding programs, where the children's' rations at home are cut back as a result of their receiving food at school. Food for education interventions potentially constitute powerful means to break the intergenerational transmission of poverty, as they empower future generations by educating today's poor children.

Research by IFPRI shows that, if the resource transfer through the food for education programs reduce the cost of schooling, "poor children will go to school." In Bangladesh, IFPRI found that "by providing the fortified biscuits to schoolchildren, Bangladesh has raised school enrollment by 14.2 percent, reduced the probability of dropping out of school by 7.5 percent, and increased school attendance by about 1.3 days a month. Most studies from other countries show similar increases."

Today, the World Food Program (WFP) is by far the biggest implementer of food-for-education in the world. In 2005, WFP School feeding programs covered 21.7 million children in 74 countries, up from 11.9 children in 52 countries in 1999. The steady increase of schoolchildren and countries shows the potential of using part of the agricultural productivity growth to achieve the Millennium Development Goals of primary education for all and cutting poverty in half in developing countries.

Box 5 (cont'd)

The impact of food for education interventions can be even greater if these interventions are used to provide markets for smallholders in the participating countries rather than using imported food aid. Indeed, they can constitute an alternative to price stabilization programs by reducing producer high price instability and collapse at harvest during glut years. This is done through the expansion of local effective market demand during years of surplus production as locally produced agricultural products are substituted for the agricultural surplus from the North currently used in most food for education interventions. However, food aid will be needed during years of shortages.

When food-for-education interventions are linked to smallholders, they usually use farming contracts to secure the needed supplies and quality from farmers. Such farming contracts include a floor price to farmers that reduces downward price risks. Despite the potential contribution that such institutional arrangements can make in the development of stable agricultural markets for African smallholders, the link between food-for-education interventions and local food markets has not been researched. Such research is needed to identify success stories that can be scaled up to provide predicable and remunerative market outlets to farmers while also reducing price instability and broadening school attendance and performance.

SOURCE: (Fritschel, 2004, World Food Programme, 2007b)

Not by agriculture alone

This strategy will not succeed if it focuses exclusively on the agricultural sector, as capitalizing on the poverty-reducing potential of agricultural growth depends on complementary investments in education, health, decentralization (including community driven development, or CDD), and strengthening rural-urban linkages and territorial development (including rural electrification to create more competitive non-farm enterprises). Investments in education and health are critical to expanding labor productivity in both agriculture and non-agriculture, fostering collective action, and providing a pathway out of poverty agriculture for those smallholders and landless laborers who have meager agricultural resources. For that pathway to be effective, however, the poor have to have access to these services (frequently a problem in an era of increased emphasis on user fees); decentralization coupled with effective participation and systems of local public finance can help mobilize local resources to improve access of the poor to these systems (World Bank, 2003). Placing agriculture in its geographic context is also important. Focusing on agriculture solely as a source of supply of agricultural products, rather than as a potential engine for growth in surrounding areas, can lead to enclave approach that ignores potential urban-rural linkages in the context of regional (territorial) growth (Quan, et al., 2006).

While investments to improve health, education, and local services are critical to building a vibrant economy and a pathway out of poverty, they are sustainable only if there is an expanding tax base and increased individual capacity to pay user fees; in most African countries, this

requires a vibrant, growing agriculture. Thus, an issue of the sequencing of investments arises. Focusing investment initially primarily on human capital and social services, while giving little attention to increasing agricultural productivity, runs the risk of expanding these activities beyond the capacity of the economy to support them, as was the experience of many of the community development and integrated rural development programs of the 1960s and 1970s (Holdcroft, 1984, Lele, 1979, Staatz, 1998). It is essential, however, that once productivity-led agricultural growth begins, tools be in place at the individual, local and national levels to tap that growth effectively for investment in these vital complementary activities.

Need to move away from a centralized approach

Concentrating decision-making on agricultural development policies, programs, and investments at the national level has not worked in SSA. A more diversified approach is needed, involving **decentralization, regionalization, participation and public-private partnerships** in order to respond to local specificities, capture regional synergies and scale economies, and build on the comparative advantages of different types of organizations. The guiding principle should be subsidiarity—dealing with issues the lowest possible level they can be addressed, while taking into account comparative advantage, spillovers from one locality to another (e.g., in the management of irrigation systems) and capturing economies of scale. The issue of subsidiarity permeates a broad range of critical issues—agricultural research and education, policy making and implementation, finance, and marketing to name a few—that require actions to be taken and coordinated at local, subnational, national, regional, continental, and global levels.

The challenge is that, in contrast to Asia during its Green Revolution (which had much of its infrastructure, substantial human capital, administrative capacity and other institutions in place), SSA is weaker in all these dimensions. Therefore, SSA needs a more **comprehensive** approach to address many of the challenges that require coordinated actions by different actors to spur productivity and rural income growth (Poulton, et al., 2006a). Yet, top-down integrated rural development approaches to address these multiple challenges all at once have not worked well in SSA (Lele, 1979), nor is the record of decentralized approaches entirely rosy (Bardhan, 2002, Platteau and Abraham, 2002). The challenge is how to design institutional approaches that balance the risks of market failure, government failure, and community failure.

How, then to assure consistency and coordination among decisions made at various levels in the agricultural economy? To the extent that the private sector is involved, market mechanisms can help assure some of this coordination. A large task of coordinating roles and responsibilities among public entities will remain, however—for example in the area of agricultural research (among the CGIAR, regional research networks, national agricultural research systems, and their local research stations and decentralized user advisory groups)(InterAcademy Council, 2004).

Attempts to deal with these challenges of coordination and scale have had mixed success in SSA. Some networks, such as the African Economic Research Consortium, have been effective in building capacity, promoting cross-country learning, dealing with regional economic issues and influencing the policy debate (more initially on macroeconomic issues than agricultural development). Efforts at regional integration have been hindered by organizations with overlapping mandates (e.g., 45 different organizations working on regional economic integration

in West Africa), leading to what Broadman et al. describe as a "spaghetti bowl of regional organizations (Broadman, et al., 2007).

The organization of agricultural research and higher education illustrate the issues of subsidiarity. In research, what should be the roles of the CGIAR, subregional research organizations (SROs) like CORAF and ASARECA, the Forum for Agricultural Research in Africa (FARA), which acts as a coordinating body among the SROs and various funding organizations such as the World Bank, national agricultural research organizations (NAROs), including their decentralized farmer advisory groups, universities, NGOs, farmer organizations, and the private sector?

In SSA, the research coordination issues to date have involved mainly public and donor-funded efforts, as only 2% of agricultural research in the subcontinent is financed by the private sector (Pardey, et al., 2006). The CGIAR has historically focused on strategic knowledge generation (particularly breeding and germplasm enhancement) and development of research networks among NARS to facilitate knowledge transmission, strengthen capacity, and help overcome the scale diseconomies in the small NARS that characterize SSA (Eicher and Rukuni, 2003, Pingali and Kelley, 2007). The SROs— ASARECA (East Africa), CORAF and INSAH/CILSS (West and Central Africa for CORAF, the Sahel for INSAH), and SACCAR (Southern Africa) expanded their research networks in the 1980s and 1990s, fostering collaborative research across NARS on common themes. In the CILSS countries of West Africa, promoting specialization, where different NARS were designated as the "poles of excellence" for different commodities, in an attempt to capture scale economies. In some cases, such as the development of the NERICA rice varieties, these subregional networks proved very productive (Narteh, et al., 2006). NARS increasingly decentralized research their research programs to respond better to local priorities and expanded participatory research with farmers in order to take better advantage of local knowledge. In some cases, they have received funding directly from farmer organizations, and NARS and the CG centers have also developed collaborative research programs with NGOs.

Implementation of this interlinked system has frequently come up against questions of who should do what and who sets the research agenda for what. Funding from donors have pushed CGIAR research "downstream" into varietal development and local natural resource management issues, which are more location-specific and hence may be more appropriately the domain of NARS. This has sometimes led to conflicts with NARS that saw themselves as simply executing agents of the CGIAR center programs (Eicher and Rukuni, 2003, Hall and Yoganand, 2002, Pingali and Kelley, 2007, Sereme, 2007). Rivalry for resources across NARS and lack of confidence in neighboring countries' NARS to execute programs have reduced willingness of some countries to support regional specialization in research. Low salaries in the NARS create incentives for researchers to allocate more of their time to regional meetings (even if not socially productive) in order to benefit from per diems. And often, the regional programs are duplicative and have poor monitoring and evaluation (Sereme, 2007).

In addition, African universities typically have been poorly integrated into the agricultural research system, a situation exacerbated by financing for universities and national agricultural research organizations coming from different ministries at the national level and different departments within donor organizations (such as the World Bank). Frequently, the universities

have been the "weak sisters" in the system in terms of funding, receiving only 10% of public agricultural R&D funding despite their having more PhDs in agricultural sciences than the NAROs (InterAcademy Council, 2004). Their capacity to contribute to research has been further weakened by the increasing demand on faculty time for undergraduate education, as African universities have expanded rapidly. As a consequence, universities and NAROs have frequently seen each others as rivals for funding rather than complementary organizations. The move towards allocating research funding on a competitive basis (rather than formula funding) has opportunity for university faculty to participate more in agricultural research and in some cases, as in Mali, facilitated greater collaboration between university and NARO researchers. Nonetheless, the failure to solve the organizational puzzle of how African university researchers can contribute more effectively to agricultural R&D raises serious questions about the who educate, at the graduate (i.e., research-intensive) level, the next generation of African agricultural scientists and policy makers, especially in light of donors' retreat from funding graduate training outside of Africa (ibid).

Solving the organizational puzzle of agricultural research, including taking advantage of new possibilities for sharing information and collaborative research (including with new partners, such as NARS from the south, such as EMBRAPA) using by new information technologies that allow greater capturing of scale economies, represents a remaining challenge for SSA. Similar organizational challenges face agricultural higher education and policy development and implementation.

The expanding space for private sector in most SSA is leading to professional organizations (of farmers, input dealers, and agricultural traders) to play an increasing role in helping expand commercial contacts and reduce the high transaction costs that arise from non-tariff trade barriers (especially harassment of traders at the borders) and unreliable systems of contract enforcement. An example is ROESAO, the West African Network of Economic Operators in the Food Industry, which has been effective in expanding trade and market opportunities for farmers and traders in West Africa (Box 6).

Box 6
Facilitating Regional Trade through an Effective Traders' Organization

Agricultural traders in West Africa face the same dilemma that faced traders in Europe and the Mediterranean area in the 13th through 16th Centuries: how to develop reliable trade relations and contract enforcement in trade areas that span different countries and in which credit ratings and formal contract enforcement mechanisms are weak or non-existent. The medieval traders solved the problem by developing networks that featured private contract adjudication and information systems regarding traders' reputations, enforced through blacklisting or fines for those who engaged in unscrupulous business practices. The West African agricultural traders have recently developed a similar system, but which also takes advantage of modern information and communication technology (ICT).

The West African Economic Operators Network in the Food Industry, known by its French acronym ROESAO, was created in 2001. Traders from Burkina Faso, Ivory Coast, Guinea, Mali, Niger and Senegal had participated over the two previous years in annual West African agricultural outlook conferences organized under a USAID-funded project implemented by Michigan State University (MSU). The conferences allowed the traders from the various countries to get to know each other and discuss trade opportunities and impediments to regional trade. They took the initiative to create a regional network and national affiliate organizations in each country; the organizations are funded through member dues and marketing assessments on exchanges organized through the network. The network received organizational help from the MSU project and the national market information systems in each country, which are organized in a parallel regional network. ROESAO subsequently was broadened to include Togo and Ghana.

The bylaws of ROESAO set out a code of conduct and sanctions for non-compliance. The strength of the network derives from two characteristics. First, being a member serves as a signal to other members of the network, even those who don't know a particular trader, that he/she adheres a common set of norms and is therefore likely to be a reliable trading partner. This speeds trade, as ROESAO members frequently send goods to network members in other countries on consignment rather than having to accompany their goods personally to the final destination, as they did in the past. Second, each national organization has contacts with customs and police officials in its own country; thus, the national affiliates working together have become very effective in resolving disputes with customs and police officials that often arise when a trader from one country brings products into a neighboring country and is faced with disputes in a country where he/she may have few personal contacts with local officials. A few examples illustrate the effectiveness of ROESAO in its first few years of existence:

- In 2001, a convoy of 28 trucks, carrying 40 metric tons each, of cereals purchased by Malian traders in Burkina was stopped at the border by Burkinabe customs agents. The agents stated that Burkina's government had prohibited grain exports from the country. However, no traders, either Malian or Burkinabe, were aware of the alleged export ban. The Malian traders contacted the Malian ROESAO affiliate, which in turn contacted its Burkinabe counterpart. The Burkinabe affiliate brought the case to the highest Burkinabe authorities in charge of trade, and the trucks were quickly released (as the trade ban violated ECOWAS trade conventions).

Box 6 (cont'd.)

- In 2001, Malian authorities seized some Guinean merchants' products. These merchants then contacted the Malian affiliate of ROESAO. After determining that these products were not prohibited, the Malian affiliate resolved the issue with the government, and the Guinean merchants were allowed to return home with their products.

- During the Ivorian civil war in 2002-03, Côte d'Ivoire was cut in half, with rebels holding the northern half of the country and the government holding the south. The cutting in half of the country completely disrupted Côte d'Ivoire's trade with its northern neighbors and threatened both the northern and the southern parts of the country with food shortages. In response, the local ROESAO affiliate in the north successfully negotiated with the rebels for the authorization to import fish from Mali to supply the population. The affiliate then contacted Malian fish exporters who were members of the network, and 40 truckloads of dried fish were delivered to the north, and escorted from the border to Bouaké by the rebels. At the same time, the two networks were able to negotiate with the rebels to authorize export of maize from northern Côte d'Ivoire to Mali, helping alleviate a grain shortage in Mali. Similarly, the ROESAO affiliate in the government-controlled area negotiated with Malian counterparts for the import of 60 truckloads of cattle, and the Malian, Ivorian, Burkinabe and Ghanaian affiliates worked together with officials in their countries to arrange safe passage for the animals and prompt payment for the exporters.

More recently, a second USAID-funded project (MISTOWA) implemented by the International Fertilizer Development Center has worked with ROESAO to provide them with market information over cell phones and provide other ICT tools to facilitate trade contacts among members. Members sign up for SMS alerts for markets that interests them, can access information from 400 markets across Africa, and post bids and offers on the system. The system is a public-private partnership involving USAID funding, a private internet lab that developed the software and contracts with cell phone providers, and private actors. GAPTO (the Ghanaian Agricultural Producers and Traders Organization— the national affiliate of ROESAO in Ghana) has used these ICT tools and contacts and the strong reputation of ROESAO to establish production and marketing contracts with cooperatives in Burkina Faso to supply GAPTO members with onions and tomatoes, GAPTO is also using its widely recognized membership card to help facilitate traders' crossing borders with their goods.

Sources: (Agesheka, 2007, Botty, 2007, de Waal and Whiteside, 2003, Debrah, 2007, Grief, 1993, Michigan State University and (APCAM), 2004, Milgrom, et al., 1990, MISTOWA, 2007)

Decentralization is essential both for tailoring agricultural development actions to local conditions and priorities and for **empowering** local populations to ensure a broad sharing of the benefits of growth. Decentralization is necessary for more accurate identification of local priorities and mobilization of local resources for investment in agriculture and its supporting institutions. However, decentralization is not a panacea; without effective participation of the poor in local government (which requires organization, effective representation, and accountability), decentralization will likely just substitute the priorities of local elites for those of national elites or foreign donors (Bardhan, 2002, World Bank, 2003). Yet effective participation by the poor (to help bargain for a broad sharing of the benefits of agricultural growth) is not simple in situations where marginalization is deeply rooted in systems of caste and ex-slavery. The World Bank has strongly supported such efforts through Community Driven Development (CDD), but there has not been systematic evaluation of these programs. The programs appear to have been more effective than non-CDD approaches in developing infrastructure, and qualitative assessments on the Bank's CDD website are generally positive. In one of the few carefully designed evaluations of CDD programs in Africa, Arcand and Bassolé found that while CDD approaches in rural infrastructure program development in Senegal had no measurable effects on household expenditures (a proxy for income), it had significant positive effects on villagers' access to clean water and health services as well as two standard anthropometric indicators of child malnutrition (Arcand and Bassole, 2006). Yet the projects often are not sustained after donor funding leaves. The project cycle also may be too short to reach and improve the status of the poorest members of the community (World Bank, 2005a). As in all things, the devil is in the details of institutional design and implementation. For example, Arcand and Bassole highlight the important role that local chiefs play in determining which communities received investment under the program, suggesting that a phenomenon of "village capture", based on local leadership, may be at least as important as the problem of "elite capture" often discussed in the literature on decentralization.

Regionalization is required to broaden markets, ensure policy harmonization (critical to expanding trade and investment) and to capture significant economies of scale and spillovers in agricultural research, education, and policy analysis. SSA is plagued by the "small country problem", with only 4 of its 48 countries (Nigeria, Ethiopia, the Democratic Republic of the Congo, and South Africa) having more than 40 million inhabitants. Natural market sheds often transcend national boundaries, but non-tariff barriers (frequently unofficial barriers that result from failure to enforce existing regional trade agreements), border formalities, and problems of currency transfer limit the scope of the market. National efforts at agricultural research, higher education, trade negotiation and policy often lack critical mass. In addition, there are large potential spillovers from these efforts to neighboring countries, but unless regional arrangements are in place to share the costs, underinvestment at the national level is likely. Many efforts, from NEPAD/CAADP at the continental level to subregional efforts such as the development of regional agricultural policies in ECOWAS and COMESA and the strengthening of regional agricultural research networks, are attempting to address these challenges, but important issues

of trust, coordination, and sustainable financing remain. At the policy level, a lack of harmonization of policies across countries discourages foreign investment and the introduction of new technologies. While progress has been made in many areas (e.g., in adopting common standards for pesticides in the Sahelian countries (Institut du Sahel and Comité sahélien des pesticides, 2006)), much remains to be done, particularly in enforcing existing agreements.

Commitments needed from African governments and donors

Putting in place the process to create this **differentiated agricultural revolution** for Africa will require a firm commitment from African governments (at the national and local levels) and donors to mobilize resources with a long term perspective, including creating incentives for the private sector to do so as well. The level of investment needed to bring about this revolution far exceeds the $2 billion annual flows of ODA to African agriculture(Taylor, 2005). Meeting the investment challenge will require better targeting of existing investments (reflected in the greater emphasis on growth in the new generation of PRSPs), more mobilization of local public and private resources, and attraction of new sources of foreign capital. Creating an environment that will increase private investment in agriculture will also require **policy consistency** (both over time and within and across countries) as well as **strengthening capacity** at the local, national, subregional and continental levels to design and **implement** the needed policies, programs, and investments. In the past, a "stop/go" approach to agricultural policy in individual countries, a lack of consistency across neighboring countries, and a failure to implement existing policies have all discouraged private investment or skewed it towards rent-seeking rather than productivity enhancement.

Particularly important will be a commitment to work through African structures and home-grown initiatives in the private and public sectors rather than creating parallel projects and programs. Africa's agriculture has not been blocked by a lack of external reports diagnosing its problems and suggesting the broad outlines of solutions, nor to a shortage of externally funded projects that create parallel structures to go around poorly functioning government entities. Rather, a key problem has been the weak human and institutional capacity to tailor and implement local solutions to local problems, in an ongoing, evolving manner (Jayne, et al., 1997). This problem of capacity has only grown worse as a result of the HIV/AIDS pandemic. Broad policy reforms have led in recent years to emerging home-grown successes in agriculture, often involving the private sector and innovative public-private partnerships. Building on these successes will require African government and donor support to strengthen human and institutional capacity to generate the locally needed technologies and design the institutional details that are critical to sustaining and building upon such efforts. Given that different problems need to be addressed at different levels (local, national, regional, and continental levels), capacity strengthening is needed at all levels, with particularly strong needs at the local levels as decentralization plays a greater role in the development strategies of most SSA, and at the regional level to capture important spillovers and economies of scale.

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