

Review

Understanding the performance of food production in sub-Saharan Africa and its implications for food security

M. Demeke¹, F. Di Marcantonio¹ and C. Morales-Opazo^{1,2*}

¹Agricultural Development Economics Division, Food and Agriculture Organization of United Nations, Rome 00153, Italy. ²European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Edificio Expo, c/Inca Garcilaso 3, 41092 Seville, Spain.

Accepted 27 July, 2013

The performance of the food production sector in Sub-Saharan Africa (SSA) is critical for a number of reasons. Domestic production is the principal avenue to ensuring access to affordable food in poor countries with limited capacity to import food. The multiplier effect of sustainable food production on the economy is considerable as it has direct linkage with other activities such as transportation, marketing, tourism and local trade. In countries where the growth of food production outpaces demand, social and political harmony as well as macroeconomic stability can be maintained, paving the way for sustained economic growth. This paper examines changes in food production performance among 30 SSA countries over the period of 1968 to 2008. The results support previous findings that not many countries have managed to achieve a food production growth rate in excess of 3% per annum. Annual food production performance averaged 3% or more in 60% of the sample countries following the policy reforms. Nevertheless, rates of output growth varied from one period to the other and the recent improved performances were achieved not only through unsustainable expansion of land under cultivation, but also failed to satisfy the rapidly growing food demand. With domestic supply lagging behind, most countries have experienced unaffordable food import bills. Addressing political instability and building institutions that foster partnership between governments, farmers, traders and other operators along the food value chain to address market failures and inefficiencies in input, output, credit and risk management is critical to ensure food availability, accessibility and stability in SSA.

Key words: Sub-Saharan Africa, food production performance, food security.

INTRODUCTION

Over the past thirty or forty years, there has been a growing concern over poverty and food insecurity in Sub-Saharan Africa (SSA). Various attempts and commitments have been made to address the problem both at global and continental levels. At the global level, the most prominent commitments include the 1996, 2003

and 2009 World Food Summit which pledges to achieve food security; the 2000 Millennium Development Goals (MDGs) declaration of the UN which specifically sets the objective of halving the proportion of the world's poor and hungry people by the year 2015; and the 2009 L'Aquila Food Security Initiative (G8, 2009) that announced a goal

*Corresponding author. E-mail: cristian.moralesopazo@fao.org. Tel: +39-0657054172. Fax +39- 06 5705 3699.

of mobilizing US\$20 billion over a period of three years for increasing G8 assistance to Agriculture and Food Security (GAFS). Priority is often given to SSA countries in the global initiatives. At the continental level, there have been numerous commitments from as far back as the 1980s in the Lagos Plan of Action for the Economic Development of Africa (UNECA, 1979) and in the early 1990s in the African Economic Community initiative (AEC, 1991). One of the more recent ones include the Maputo Declaration on Food Security (African Union, 2003); the committed member countries to allocate at least 10% of national budgetary resources to agriculture and rural development policy implementation within five years. Nevertheless, the reform institutionalized under the name Structural Adjustment Programs (SAPs) is by far the most significant and far-reaching policy initiative (Rono, 2002; FAO, 1999; Zawalinska, 2004; Munthali, 2004; Maxwell, 1999; Lele, 1990).

On the basis of this framework, many SSA countries implemented, to varying extents, reforms which included, among others, macroeconomic stabilization, trade liberalization and reduction in the public sector. It was expected from the outset that through an implementation of a set of macroeconomic and microeconomic policy reform measures, SSA countries would see enhanced food production as well as sustainable growth and development.

The aim of this paper is to contribute to the understanding of food production performance of SSA countries and its implications for food security. This analysis is carried out by paying particular attention to good and poor performing countries and assessing differences between growth trends across three different periods: before the SAPs or pre-reform period (1968 to 1983), the introduction of SAPs or transition period (1984 to 1993), and after SAPs implementation or post-reform period (1994 to 2008). Thus, the study performs an indirect assessment of the impact of these reforms in different countries, with also documenting available research evidences on key challenges in addressing the long standing concerns over sustainable increase in food production and food security objectives. To analyze the performance of different SSA countries, the paper uses the Food Production Index (PIN) of the FAO statistics (FAOSTAT). The food PIN measures the value of the final food output in 'international dollars', which are the same in all countries, implying that the weight given to each commodity is the same across different countries¹. The analysis covers the performance of 30² SSA countries over four decades (1968 to 2008).

The least-squares growth rate is used to measure food

production performance. The least-squares growth rate, r , is estimated by fitting a linear regression trend line to the logarithmic annual values of production in the relevant period (OECD, 2005; Kakwani, 1997). Least-squares growth rates are used whenever there is a sufficiently long time series to permit a reliable calculation. No growth rates are calculated if more than half the observations in a period are missing. The regression equation takes the form:

$$\ln X_t = a + b_t.$$

This expression is equivalent to the logarithmic transformation of the compound growth equation,

$$X_t = X_0 (1 + r)^t,$$

Where: X is the variable, t is time, and $a = \ln X_0$ and $b = \ln (1 + r)$ are parameters to be estimated. The calculated growth rate is an average rate that is representative of the available observations over the entire period. It does not necessarily match the actual growth rate between any two periods³. On the basis of their food production performance, the countries have been grouped into three: better performers [with a food PIN average annual growth rate (AAGR) greater than 3%], medium performers (with a Food PIN AAGR between 2 and 3%) and poor performers (with a food PIN AAGR for 1968 to 2008 of less than 2%).

FOOD PRODUCTION PERFORMANCE IN SSA: BETTER, MEDIUM AND POOR PERFORMERS

As a region, SSA relies heavily on agriculture. The sector accounts, on average, for close to 20% of total gross domestic product and about 60% of the region's total labour force – although many countries in the region depend on agriculture to a much greater extent than indicated by these regional averages (FAO, 2008; World Bank, 2009). Traditionally, the agricultural sector has been the overwhelming driving force for Africa's economic growth and development (World Bank, 2008; IFPRI, 2011; AFDB, 2010; ECOWAS, 2009; Kydd et al., 2007). The output and employment multiplier effects of food production on the economy are considerable as it has direct linkage with other activities such as transportation, marketing, warehousing, food processing, tourism and local commerce. Figure 1 presents the challenge facing SSA countries. The net value of production doubled more than in the period of 1968 to 2000, increasing from about I\$35,000 million to about I\$100,000 million. However, the net per capita production decreased by about 10% during this period indicating that food production did not keep pace with population

¹The food production index number (PIN) includes commodities that are considered edible and that contain nutrients. As such, cocoa is included in the food PIN but excludes coffee and tea, although edible, along with inedible commodities, because they have little to no nutritive value.

² We considered countries with significant agricultural sector and with complete or nearly complete food production index (PIN) database in the FAOSTAT of FAO.

³The World Bank website:
<http://data.worldbank.org/about/data-overview/methodologies>

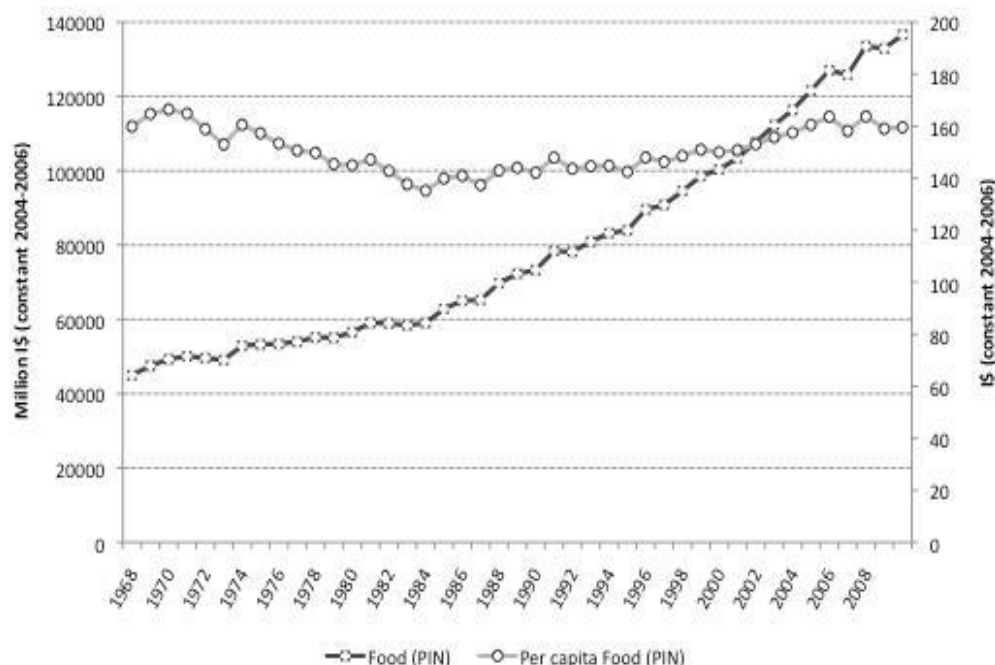


Figure 1. Production indices (PIN) - trends in net production and net per capita PIN base.
Source: Authors' elaborations based on FAOSTAT data.

growth in the region. However, this general trend conceals many differences between countries and periods. Table 1 in the annex compares the growth of food production in the pre-reform, transition and post-reform period, and also presents a ranking of the good and poor performing countries.

As indicated earlier, this ranking of 30 countries, which is obtained by looking at food production performance for the whole period (1968 to 2008), gave rise to three groups referred to as better, medium and poor performers. Over the last 40 years, only nine of the 30 countries (30%) (group one) were able to achieve a food production average performance of 3% or more per annum. The majority of these better performing countries (six of them) are from West Africa (Benin, Burkina Faso, Nigeria, Cote d'Ivoire, Ghana and Niger). The other three countries, namely Sudan, Malawi and Kenya, are from eastern and southern Africa. Nevertheless, growth rates varied between countries and across the different periods. In Malawi, for instance, negative growth was registered during the transition period but very high growth in the post-reform period (Chilowa, 1998; Harrigan, 2003, 1997). Growth during the pre-reform period was poor for group one as a whole (2.2%) with negative growth rate in Ghana -possibly due to macroeconomic instability (Weissman, 1990)- and almost zero growth in Nigeria (Moser et al., 1997). Benin had one of the highest growth rates, especially during the transition and post-reform periods and this could be attributed to the dramatic increase in rice production following the 1994 currency devaluation which made

imported rice expensive and raised domestic prices for farmers (Noameshi et al., 2007). In addition, the increase of manioc production, in response to increasing commercialization and cross-border exports, has contributed to the country's agricultural growth (Kherallah et al., 2001). In countries such as Ghana and Nigeria, good performance in the transition and post-reform period was partly related to a sharp increase in cassava production, resulting from widespread adoption of high-yielding varieties and improved pest management practices (Ugwu, 1996; Nweke, 2004; Camara, 2000). This has contributed in making Nigeria the world's top producer of cassava.

For the second group of nine countries (medium performers), the growth rate of food production averaged 2.6% per annum over the period of 1968 to 2008. The group, which includes Central African Republic, Mali, Cameroon, Guinea, Chad, Togo and Congo from central and western Africa, and Tanzania and Zambia from eastern and southern Africa, had an average growth rate of food production which fell well short of population growth rate in the pre-reform period and barely caught up with it in the transition period. Within the group, the performance of Congo was particularly poor in the pre-reform and transition period, probably because of the Marxist policies and political/macroeconomic instabilities during this period (Clark, 2002). Tanzania also performed poorly in the transition period probably due to disruptive policies such as villagization program, removal of fertilizer subsidies and bad weather (Skarstein, 2005; Wobst, 2001). On the other hand, annual growth rate of food

Table 1. Country performance ranking based on food (PIN) average annual growth rate (AAGR) (1968 to 2008) - net production value (constant 2004 to 2006 1000 I\$).

Country	Annual average growth rate food PIN			
	Pre-reform	Transition	Post-reform	Whole period
	1968-1983	1984-1993	1994-2008	1994-2008
Better performers				
Benin	1.8	3.8	4.6	4.1
Burkina Faso	1.5	6.1	3.8	4.1
Nigeria	0.1	8.0	3.5	4.0
Côte d'Ivoire	4.9	3.3	2.3	3.8
Ghana	-1.4	5.7	4.4	3.5
Niger	2.6	4.7	6.4	3.3
Sudan	3.7	2.8	3.0	3.2
Malawi	3.2	-0.1	6.9	3.1
Kenya	3.6	4.4	3.5	3.1
Mean	2.2	4.3	4.3	3.6
Medium performers				
Central African Republic	2.8	3.1	3.0	2.8
Mali	2.7	3.1	4.4	2.8
U.R. of Tanzania	3.8	1.1	4.4	2.8
Cameroon	2.2	2.3	3.4	2.6
Guinea	1.3	3.4	2.9	2.6
Chad	0.9	3.9	3.3	2.6
Togo	0.9	3.2	2.7	2.5
Zambia	2.5	3.8	2.7	2.3
Congo	1.1	0.5	3.0	2.1
Mean	2.0	2.7	3.3	2.6
Poor performers				
Rwanda	3.8	1.1	6.4	2.0
Ethiopia	1.5	1.0	4.9	2.0
Uganda	0.5	4.0	2.7	1.8
Mauritania	0.7	2.3	2.3	1.6
Senegal	0.2	2.4	2.2	1.5
Madagascar	1.5	1.5	1.6	1.5
Liberia	2.9	-3.6	3.5	1.2
Mozambique	-0.7	-1.0	2.6	1.2
Sierra Leone	1.2	0.2	3.8	1.1
Somalia	2.3	-2.4	1.2	1.1
Democratic Republic of Congo	2.0	3.1	-1.2	1.0
Burundi	0.7	2.8	1.1	1.0
Mean	1.4	1.0	2.6	1.4

Source: Authors' calculations based on FAOSTAT database, Note*: All selected African countries.

production among poor performing countries averaged only 1.4% in 1968 to 1983 and 1.0% in 1984 to 93. There has been a recovery in the post-reform period of 1994 to 2008 (2.6%) but the growth was mainly driven by strong performance in Rwanda, Ethiopia, Sierra Leone and Liberia.

Following the introduction of the policy reforms, food

production performance has improved in most countries in all the three groups. Annual growth rates in group one countries averaged 4.3% during the transition and post-reform period, compared to 2.2% during the pre-reform period. In group two countries, average annual growth rates increased to 2.7% in the transition period and 3.3% in the post-reform period, compared to 2.0% in the pre-

reform period. Growth rates declined to 1% in the transition period but increased to 2.6% in the post-reform period in group three countries. Overall, growth rates averaged or exceeded 3% in 18 of the 30 countries (60%) between 1994 and 2008.

IMPACT OF FOOD PRODUCTION PERFORMANCE ON FOOD SECURITY

The impact of food production performance on food security is assessed in terms of per capita food supply, number of undernourished people and food self-reliance. Although, a direct correlation between food production performance and food security has not been proven, it is observed that domestic production plays a critical role in food security, particularly for regions like sub-Saharan Africa where it represents the main source of food consumption (FAO, 2012; O'Connell, 2008; Boon, 2007). Our results confirm that better food production performance is correlated with food security as measured by per capital food supply and FAO's estimations of undernourished people (Table 2 annex). Among the three groups, better performing countries experienced a longer period (1968 to 2007) of sustained increase in per capita food supply, increasing from 2,077 kcal/capita/day in 1968 to 1983, to 2,118 in 1984 to 1993 and 2,337 in 1994 to 2007 (Table 2 Annex). In the case of medium performers, average per capita food supply declined in the transition period and slightly improved in the post-reform period. The situation rather worsened in the case of poor performing countries, which lessen the level of food supply from 2,145 in 1968 to 1983 to 2,042 kcal/capita/day in 1994 to 2007. The difference between the three groups is more striking in terms of undernourishment. The prevalence of undernourishment in the total population averaged 14% in 2006 to 2008 among better performers, compared with 30% of medium and poor performing countries (Table 2). However, there are again marked variations between countries within each group.

Kenya and Malawi have the highest prevalence rate of undernourishment among the better performers while Niger, Cote d'Ivoire and Burkina Faso have the lowest rate (8% or less). The dominance of maize in daily diets and low rates of dietary diversity among low-income groups may explain the high rate of undernourishment in Kenya and Malawi (Smale et al., 2011). Levels of undernourishment are particularly high in Burundi, Ethiopia and Mozambique (among poor performers) as well as Zambia, Central African Republic and Chad (among medium performers). Over the years, there has been a steady decline in the proportion of undernourished people in most SSA countries over the past 18 years (2008 as compared to 1990) (FAO, 2011a), but the decline is more significant in better performing countries (-40%) than in medium (-23%) or poor

performing countries (-8.5%) (Table 2). It is also evident that here are countries that are still at risk in better as well as medium and poor performing countries. For some countries such as Kenya (group one), Zambia (group two), and Uganda, Liberia and Burundi (group three), the proportion of undernourished people has changed very little or even increased (Table 2). Many SSA countries are not food self-sufficient and are expected to have export earnings that allow them to meet their food import needs (Fafchamps, 1992; Kasfir, 1986). This study compared the food trade balance and share of food import in total merchandise export to determine if SSA countries are exposed to food security risks emanating from trade. The results show that the food trade balance of good performing countries is better than medium or poor performing countries but the trend over time is one of a growing deficit in nearly all cases. For instance, the average food trade balance of the first group, which was positive for six of the nine countries during the pre-reform period (1968 to 1983), turned negative for all countries except Cote d'Ivoire and Ghana in 1994 to 2008. It should be noted that the positive food trade balance in

Cote d'Ivoire and Ghana is mainly due to the fact that the two countries are the first and second biggest producers and exporters of cocoa in the world (ODI, 2007). For the first group as a whole, food trade balance changed from surplus in the pre-reform and transition period to negative in the post-reform period (Table 3a).

The food trade balance in group three countries as a whole worsened considerably over the years: the food trade deficit increased sharply in the transition and post-reform periods, averaging 1.65 billion USD per annum. No group three country registered a positive food trade balance in 1994 to 2008. The deficit also increased considerably in group two countries in the post-reform period. In general, the number of net food exporting countries declined from 15 in 1968 to 1983 to only 4 in 1994 to 2008 (Table 3a). The negative food trade balance on its own may not signify any danger to self-reliance in SSA countries. It is thus important to check if a country has sufficient export earnings to meet its food import needs. Indeed, with few exceptions, SSA countries have very limited importing capacity. Even among group one countries, food imports accounted for about 28% of the total value of export earnings during the period of 1968 to 2008, compared to a threshold share of 8.8% or less which is considered as food self-reliant or food secure at national level (Breisinger et al., 2010). For the poor performing countries, the share increased from 25% in the pre-reform period to 74% in the post-reform period, averaging 49% for the entire period. Food imports are relatively more affordable for the second group of countries, mainly because they have significant foreign exchange earnings from export of oil and other minerals [for example, Central Africa Republic (diamonds), Cameroon (petroleum), Chad (petroleum) Guinea (bauxite), Zambia (copper) and Congo (petroleum)]. For

Table 2. Performance in terms of food supply and undernourishment.

Country	Average food supply (kcal/capita/day)				Prevalence of undernourishment in total population
	Pre-reform	Transition	Post-reform	Whole period	(%)
	1968-1983	1984-1993	1994-2007	1968-2007*	2006-2008
Better performers					
Benin	1929	2127	2398	2143	12
Burkina Faso	1723	2260	2574	2155	8
Nigeria	1808	2097	2588	2154	11
Côte d'Ivoire	2690	2539	2459	2572	6
Ghana	1964	2074	2633	2226	14
Niger	1979	1987	2136	2036	5
Sudan	1956	1952	2155	2025	16
Malawi	2322	1960	2052	2137	22
Kenya	2319	2070	2042	2160	33
Mean	2077	2118	2337	2179	14
Medium performers					
Central African Republic	2335	1878	1900	2069	40
Mali	1650	2094	2379	2016	12
U.R. of Tanzania	2007	2174	1964	2034	34
Cameroon	2199	2024	2142	2135	22
Guinea	2283	2393	2460	2373	16
Chad	1773	1638	1940	1798	39
Togo	1969	1866	2053	1973	30
Zambia	2314	2037	1908	2103	44
Congo	1992	2037	2267	2099	
Mean	2058	2016	2113	2067	30
Poor performers					
Rwanda	2180	1973	1898	2029	32
Ethiopia	1644	1579	1794	1680	41
Uganda	2296	2202	2254	2258	22
Mauritania	2091	2555	2746	2436	8
Senegal	2230	2206	2190	2210	19
Madagascar	2536	2304	2089	2322	25
Liberia	2402	2361	2140	2300	32
Mozambique	1844	1761	1960	1864	38
Sierra Leone	2086	1950	2050	2040	35
Somalia					
Democratic Republic of Congo	2227	2171	1649	2011	13
Burundi	2056	1873	1689	1882	62
Mean	2145	2085	2042	2094	30

Source: Authors' calculations based on FAOSTAT database, Note*: Data for 2008 not available.

Table 3a. Food trade balance (US\$).

Country	Trade balance (1000\$)			
	Pre-reform 1968-1983	Transition 1984-1993	Post-reform 1994-2008	Whole period 1968-2008
Better performers				
Benin	-9140	-68966	-143027	-72715
Burkina Faso	-14428	-57204	-104203	-57706
Nigeria	-493362	-491904	-1444114	-840843
Côte d'Ivoire	340521	860851	1621715	936160
Ghana	376707	280625	335236	338100
Niger	13358	-38972	-78001	-32830
Sudan	32330	-27196	-191886	-64219
Malawi	19649	-23950	-18576	-4969
Kenya	18401	-13060	-144584	-48901
Mean	31560	46692	-18605	16898
Medium performers				
Central African Republic	-10432	-13403	-10087	-11030
Mali	26896	18126	-64715	-8760
U.R. of Tanzania	7474	-25004	-150318	-58176
Cameroon	117333	53850	3308	60133
Guinea	-8263	-75225	-153763	-77827
Chad	27048	19656	2088	16113
Togo	3168	-29923	-26493	-15754
Zambia	-51739	-38047	-36647	-42878
Congo	-19711	-71296	-137883	-75526
Mean	10197	-17919	-63834	-23745
Poor performers				
Rwanda	-10609	-41481	-63831	-37610
Ethiopia	10857	-169683	-195155	-108547
Uganda	-15016	-15891	-153927	-66051
Mauritania	-27990	-72881	-171876	-91580
Senegal	-34469	-174660	-533891	-251377
Madagascar	44039	61294	-12443	27583
Liberia	-39736	-65931	-95452	-66509
Mozambique	31748	-150614	-213827	-102575
Sierra Leone	-25483	-62621	-122084	-69883
Somalia	18115	-28758	-68211	-24900
Democratic Republic of Congo	-89502	-187735	-316656	-196567
Burundi	-11499	-20409	-35305	-22382
Mean	-12462	-77447	-165222	-84200

Source: Authors' calculations based on FAOSTAT database., Note*: Data for 2008 not available.

most of the non-mineral exporting countries, the share of food in total merchandise export is much higher.

Overall, only three countries, namely, Nigeria (better performer), Zambia and Congo (medium performers) registered a share below the critical threshold of 8.8% from the entire sample countries. SSA has become a net importer of food and of agricultural products, despite the region's vast agricultural potential and improved

performance in recent years. For instance, Nigeria has a considerable agricultural potential, its food production performance averaged 3.5% in 1994 to 2008, and the country became the largest producer of cassava. At the same time, Nigeria's import of wheat increased from 675,282 tons in 1994 to 3,079,637 tons in 2008. Rice import increased from 350,000 to 971,815 tons over the same period. By 2010, wheat and rice import further

Table 3b. Share of food import on total merchandise exp.

Country	Pre-reform	Transition	Post-reform	Whole period
	1968-1983	1984-1993	1994-2008	1968-2008
Better performers				
Benin	73.6	33.9	56.6	57.7
Burkina Faso	87.3	67.9	45.0	67.1
Nigeria	9.8	7.2	6.9	8.1
Côte d'Ivoire	13.6	12.4	9.1	11.7
Ghana	11.4	13.1	19.3	14.7
Niger	19.8	30.2	42.5	30.6
Sudan	24.4	41.0	23.9	28.2
Malawi	9.7	17.9	17.8	14.7
Kenya	9.5	13.8	20.0	14.4
Mean	28.8	26.4	26.8	27.5
Medium performers (AAGR for 1968-2008 greater than 2% and less than 3%)				
Central African Republic	20.7	18.2	16.2	18.4
Mali	37.1	31.4	17.8	28.7
U.R. of Tanzania	16.9	20.6	31.9	23.3
Cameroon	9.4	12.8	12.0	11.2
Guinea	14.2	14.1	22.5	17.2
Chad	20.8	17.4	11.5	16.6
Togo	17.3	27.3	18.7	20.3
Zambia	5.6	5.4	8.9	6.8
Congo	13.6	8.4	6.2	9.6
Mean	17.3	17.3	16.2	16.9
Poor performers (AAGR for 1968-2008 less than 2%)				
Rwanda	21.7	43.5	70.9	45.0
Ethiopia	11.6	65.8	48.6	38.3
Uganda	6.8	10.8	27.5	15.3
Mauritania	30.5	27.5	37.1	32.2
Senegal	41.5	40.4	53.6	45.6
Madagascar	18.5	16.6	28.1	21.5
Liberia	11.8	19.4	55.2	29.5
Mozambique	30.6	165.0	53.1	71.6
Sierra Leone	33.1	56.8	330.9	147.8
Somalia	60.2	99.3	84.9	78.8
Democratic Republic of Congo	13.2	25.2	34.3	23.8
Burundi	22.1	22.7	64.3	37.7
Mean	25.1	49.4	74.0	48.9

Source: Authors' calculations based on FAOSTAT database.

increased to nearly 4 and 2 million tons, respectively. Wheat import in Ethiopia (with one of the fastest production growth in recent years) increased from about 0.55 million tons in 1994 to 1.74 million tons in 2009⁴. It is also estimated that a significant proportion of sugar and sugar products, vegetable oils and milk products

consumed in the countries of sub-Saharan Africa comes from abroad (OECD, 2008). Despite the recent improved performance, Africa's agricultural GDP per capita is the lowest in the world (one-fourth of world's average) (Rakotoarisoa et al., 2011), resulting in stagnat or declining per capita food production as shown earlier.

Various studies (Omamo et al., 2006; Diao et al., 2008; FAO, 2011a, 2010; UNCTAD, 2009) have documented the persistent rise in net food imports in Africa, and we will examine some of the key structural bottlenecks

⁴ FAOSTAT:
<http://faostat.fao.org/site/535/DesktopDefault.aspx?PageID=535#ancor>

subsequently.

SOURCES OF GROWTH AND THE KEY CHALLENGES TO SUSTAINABLE PRODUCTION INCREASE

Some experts agree that population growth, rising incomes, and urbanization will continue to drive demand growth for some foodstuffs, especially vegetable oils and livestock, with a higher derived demand for feed and industrial products (FAO, 2009; USDA, 2007; WHO, 2008). To cope with the rapidly growing demand, food production would need to increase significantly (Von Braun, 2008). The traditional response is expanding area under cultivation but a more sustainable option is yield improvement. The World Bank's report suggests that without improving technologies and raising yield levels, the "land rush" is unlikely to slow (Deininger et al., 2010). SSA countries have relied more on land expansion than on intensification to increase food production.

Sources of growth - area under cultivation and yield levels

Expansion of area under cultivation has remained the main strategy of increasing production in SSA countries. On average, area under cultivation expanded by 2.2% per annum over the last 40 years for better performers (Table 4a). The rate of expansion was greater than 3% per annum in the case of Sudan and Niger (Mosley, 2011). The pattern is similar in the medium performing countries, with an average expansion rate of 1.7% per annum. By contrast, growth in area under cultivation was slow (1.1%) among poor performers. Area growth rates were negative in Ethiopia [pre-reform and transition), Mauritania (pre-reform and post-reform), Liberia (transition), Somalia (transition and post-reform)]. While there is a substantial difference in the average growth rate of area harvested between the three groups, this rate drops to no significant difference when yield growth is considered. Yield growth averaged 0.6% in group one (better performing) countries, compared to 0.3% in group two and -0.3% in group three countries over the period of 1968 to 2008 (Table 4b). Within the first group, Benin experienced a negative yield growth rate over the 40 year period, while Malawi managed a relatively better performance (1.8%) and this is largely due to a significant yield improvement in the post-reform period (6.1% per annum). The yield performance of Chad (1.8%) and Mali (1.6%) is better than the other countries within medium performers, while Togo is the only country with negative growth rate (-2.9) among the group. On the other hand, within the poor performing countries, yield growth was negative for five out of the 12 countries and almost zero for further four countries (Table 4b). It is important to note that the performance of yield in Africa compares very

unfavourably with the Green Revolution of Asia.⁵

African farmers have traditionally depended on shifting cultivation in response to the challenges of population growth and declining soil fertility. As shown earlier, opening new land is still a common strategy to increase production in nearly all the sample countries. The advantages of extensification are clear: new land means additional output at a lower cost than purchasing fertilizers and other inputs to increase yield on already cultivated lands. However, extensive agriculture is unsustainable for most countries (Dorward et al., 2004; Reardon et al., 2002). Average farm sizes are small (less than 1 ha for over 50% of the farms) and declining in sub-Saharan Africa, due to population pressures and an exhaustion of the arable land frontier, especially in the productive highland regions (Jayne et al., 2003). Extensive agriculture has also got major environmental drawbacks: extensification into permanent pasture, forest and watershed lands may lead to loss of biological diversity and land degradation (UNEP, 2012). On the other hand, increasing productivity on existing land enhances the economic value of food and agricultural production through forward and backward linkages in the form of input and output marketing, transport, export and processing increases. Increasing productivity also avoids greenhouse gas emissions and the large-scale disruption of existing ecosystems due to bringing new land into production (Edgerton, 2009). As discussed as follows, improving yield on a sustainable basis has eluded SSA countries.

Challenges to sustainable increase in food production

Sustainable intensification is producing more output from the same area of land while reducing the negative environmental impacts. It is commonly achieved through the use of high yield crop varieties along with fertilizers (both organic and inorganic) and management practices which conserve and improve soil and water productivity (FAO, 2011b). A number of challenges have made it very difficult for SSA countries to achieve a sustainable increase in food production.

Limited utilization of inputs and irrigation

There are no reliable data on the use of improved seeds but available evidences indicate adoption rates are very low in SSA. For instance, the adoption of improved open-pollinated varieties and hybrids of maize is estimated at 44% of maize area in Eastern and Southern Africa in 2006 to 2007, excluding South Africa. Some 56% of

⁵Between 1965 and 1982, average rice, maize and wheat yields increased by 2.54, 3.48 and 4.07% per year, respectively in Asia countries that adopted Green Revolution technologies. Cultivated area expanded by only 0.7, 1.09 and 1.3%, respectively, over the same period (Thapa and Gaiha, 2011).

Table 4a. Performance in terms of area harvested (average annual growth rate).

Country	Annual average growth rate			
	Pre-reform	Transition	Post-reform	Whole period
	1968-1983	1984-1993	1994-2008	1968-2008
Better performers (AAGR for 1968-2008 greater than 3%)				
Benin	0.8	2.5	2.6	2.5
Burkina Faso	0.6	3.7	2.3	1.9
Nigeria	-5.0	8.1	1.4	2.6
Côte d'Ivoire	1.8	3.3	-0.7	0.9
Ghana	-0.1	0.6	2.5	2.2
Niger	3.3	8.4	2.5	3.9
Sudan	5.2	1.1	0.5	3.2
Malawi	0.8	1.9	2.6	1.5
Kenya	0.6	4.0	0.5	1.0
Mean	0.9	3.7	1.6	2.2
Medium performers (AAGR for 1968-2008 greater than 2% and less than 3%)				
Central African Republic	1.2	0.3	2.3	0.3
Mali	1.5	7.7	3.1	2.8
U.R. of Tanzania	2.8	0.6	5.3	2.3
Cameroon	1.1	2.4	3.8	1.2
Chad	-1.5	3.5	3.8	2.4
Guinea	1.6	3.5	4.0	3.0
Togo	1.9	3.5	0.7	2.9
Zambia	-4.6	4.2	0.7	-0.4
Congo	-0.2	-1.2	1.9	0.5
Mean	0.4	2.7	2.8	1.7
Poor performers (AAGR for 1968-2008 less than 2%)				
Rwanda	3.6	2.5	5.2	2.2
Ethiopia	-2.0	-1.1	3.0	1.3
Uganda	-0.2	3.1	1.9	1.3
Mauritania	-3.8	1.4	-1.2	1.3
Senegal	-0.6	-0.7	1.1	0.5
Madagascar	1.7	0.8	0.9	1.0
Liberia	2.1	-7.8	5.3	-0.3
Mozambique	2.4	0.4	0.4	1.8
Sierra Leone	1.6	2.1	8.1	1.6
Somalia	2.4	-6.2	-0.6	0.6
Democratic Republic of Congo	2.2	3.4	-0.8	1.3
Burundi	1.1	1.3	0.6	0.8
Mean	0.9	-0.1	2.0	1.1

Source: Authors' calculations based on FAOSTAT database.

smallholders have no access to improved varieties (Smale et al., 2011; Langyintuo et al., 2008). The situation is relatively better in West Africa where the adoption rate of improved seeds was estimated at 60% in 2005 (Smale et al., 2011). As already indicated, most of the better performing countries are from West Africa. Several factors have hampered the emergence of an efficient seed market in Africa: i) inadequate certification,

licensing and enforcement capacity, ii) lack of knowledge on varietal characteristics and performance, iii) lack of credibility and adulteration of seed, and iv) limited access to credit facilities. These problems are clear indications of market failure, market inefficiency and institutional weaknesses. Adoption is often constrained by lack of finance. Lack of partnership and collaboration between public and private seed companies is a major gap in SSA

Table 4b. Performance in terms of yield (average annual growth rate).

Country	Annual average growth rate			
	Pre-reform	Transition	Post-reform	Whole period
	1968-1983	1984-1993	1994-2008	1968-2008
Better performers				
Benin	0.7	-3.0	1.9	-1.6
Burkina Faso	n.a	n.a	n.a	n.a
Nigeria	0.5	2.2	0.3	0.6
Côte d'Ivoire	1.7	-1.0	1.3	1.1
Ghana	0.0	5.2	0.6	1.5
Niger	1.7	1.0	2.5	0.0
Sudan	0.5	0.4	-1.1	0.3
Malawi	0.4	0.7	6.1	1.8
Kenya	1.2	3.5	1.0	1.3
Mean	0.7	1.0	1.4	0.6
Medium performers				
Central African Republic	1.0	0.3	0.1	0.5
Mali	-0.9	3.5	3.8	1.6
U.R. of Tanzania	3.2	0.2	0.5	0.5
Cameroon	1.0	0.2	-1.0	0.3
Chad	0.6	1.8	1.1	1.8
Guinea	0.1	-0.1	-0.1	0.0
Togo	-0.7	-3.6	0.0	-2.9
Zambia	0.5	0.3	-0.2	0.1
Congo	1.5	1.1	0.3	1.0
Mean	0.7	0.4	0.5	0.3
Poor performers				
Rwanda	-0.1	-4.1	1.8	-1.0
Ethiopia	1.8	0.2	0.9	0.6
Uganda	0.2	0.8	0.9	0.5
Mauritania	-0.6	-0.6	-3.4	-0.9
Senegal	0.3	-2.8	-0.2	-1.0
Madagascar	0.1	0.6	0.4	0.2
Liberia	1.0	-0.1	0.1	0.3
Mozambique	-0.2	-0.6	0.7	0.3
Sierra Leone	0.3	-3.7	-0.4	-2.6
Somalia	-0.9	-1.6	-1.4	-0.9
Democratic Republic of Congo	0.2	0.2	-0.2	0.2
Burundi	0.0	1.5	1.0	0.6
Mean	0.2	-0.9	0.0	-0.3

Source: Authors' calculations based on FAOSTAT database. , n.a = not available or reliable.

(Erenstein et al., 2011; Odame and Muange, 2011; Scoones and Thompson, 2011). As far as fertilizer is concerned, FAOSTAT data shows that consumption is slightly higher among the first group: on average, better performing countries used 8 kg of fertilizer (plant nutrients) per ha, compared to 6 and 3 kg/ha among medium and poor performing countries, respectively (Table 5a). Despite the inherently low soil fertility, the quantity of fertilizer consumption per unit of farmland in

SSA is the lowest in the world and well below the level that sustains rapid yield increases. Fertilizer application rates in SSA as a whole is only 10 kg of nutrients per hectare (ha) of arable land, compared with 86 kg/ha in South Asia, 118 kg/ha in Latin America, 198 kg/ha in an average middle-income country, and 288 kg/ha in a high-income country (Hernandez and Torero, 2011).

Apart from shortage of complementary inputs such as high yield varieties and irrigation, both supply and

Table 5a. Fertilizer consumption nutrient per ha of arable land.

Country	Kilograms fertilizer nutrient per hectare of arable land			
	Pre-reform	Transition	Post-reform	Whole period
	1968-1983	1984-1993	1994-2008	1968-2008
Better performers				
Benin	2	5	8	5
Burkina Faso	1	4	7	4
Nigeria	2	9	6	5
Côte d'Ivoire	9	9	23	14
Ghana	6	3	6	5
Niger	0	0	0	0
Sudan	4	5	4	4
Malawi	9	21	23	17
Kenya	13	20	28	20
Mean	5	8	12	8
Medium performers				
Central African Republic	1	1	0	0
Mali	4	9	9	7
U.R. of Tanzania	3	5	4	4
Cameroon	3	4	6	4
Guinea	2	1	2	2
Chad	1	1	1	1
Togo	1	4	5	3
Zambia	23	33	26	27
Congo	2	2	4	3
Mean	4	7	6	6
Poor performers				
Rwanda	0	1	2	1
Ethiopia	2	6	12	6
Uganda	1	0	1	1
Mauritania	3	8	3	4
Senegal	5	4	7	6
Madagascar	3	2	3	3
Liberia	8	2	0	4
Mozambique	5	1	3	3
Sierra Leone	3	3	1	2
Somalia	2	2	0	1
Democratic Republic of Congo	1	1	0	1
Burundi	1	3	2	2
Mean	3	3	3	3

Source: Authors' calculations based on FAOSTAT database.

demand constraints have made fertilizer expensive in Sub-Saharan Africa. The cost of importing fertilizer is high because of the small volume that many countries import and inadequate port facilities. Transport and logistics costs in Africa are often very high, making fertilizer in Sub-Saharan Africa at least double more expensive than in Asia and the US (Smale et al., 2011; Morris et al., 2007). Market failures and inefficiencies

affecting seed markets (discussed earlier) have also constrained the emergence of a viable fertilizer markets in SSA. Turning to irrigation system, it is clear that SSA countries have made little effort to expand area under irrigation. The share of arable land under irrigation showed no change over the past 40 years and stayed at an average of 2.3% among group one or better performing countries (Table 5b). The only country with

Table 5b. Share of total area equipped for irrigation in total arable land.

Country	Period average (%)			
	Pre-reform	Transition	Post-reform	Whole period
	1968-1983	1984-1993	1994-2008	1968-2008
Better performers				
Benin	0.4	0.6	0.5	0.5
Burkina Faso	0.3	0.5	0.6	0.5
Nigeria	0.7	0.7	0.8	0.8
Côte d'Ivoire	1.8	2.5	2.6	2.2
Ghana	1.0	1.0	0.8	0.9
Niger	0.2	0.5	0.5	0.4
Sudan	13.9	13.9	10.9	12.8
Malawi	0.6	0.9	1.7	1.1
Kenya	1.0	1.1	1.7	1.3
Mean	2.2	2.4	2.2	2.3
Medium performers				
Central African Republic	0.0	0.0	0.1	0.0
Mali	3.2	3.2	4.1	3.6
U.R. of Tanzania	1.0	1.6	1.8	1.4
Cameroon	0.2	0.4	0.4	0.3
Guinea	8.8	11.4	6.9	8.7
Chad	0.3	0.5	0.7	0.5
Togo	0.1	0.3	0.3	0.2
Zambia	0.7	1.5	5.6	2.7
Congo	0.2	0.2	0.4	0.3
Mean	1.6	2.1	2.3	2.0
Poor performers				
Rwanda	0.6	0.5	0.8	0.7
Ethiopia	1.2	1.6	2.6	1.8
Uganda	0.1	0.2	0.2	0.2
Mauritania	16.2	13.6	10.2	13.4
Senegal	2.2	2.7	3.4	2.8
Madagascar	21.3	34.9	37.1	30.4
Liberia	0.5	0.7	0.8	0.6
Mozambique	1.6	3.0	2.8	2.4
Sierra Leone	3.2	5.8	4.2	4.2
Somalia	11.8	19.7	18.2	16.1
Democratic Republic of Congo	0.0	0.1	0.2	0.1
Burundi	1.5	1.7	2.2	1.8
Mean	5.0	7.0	6.9	6.2

Source: Authors' calculations based on FAOSTAT database.

significant level of irrigated agriculture is Sudan and the trend over time is a decline instead of an expansion. In Zambia, area equipped for irrigation increased from 46,000 in 1996 to 156,000 ha in 2008. The level of irrigation is relatively better among poor performing (Group 3) countries with an average of 6.2% of arable land under irrigation over the period of 1968 to 2008. The proportion also increased over time, from 5% in 1968 to

1983 to 6.9 to 7.0% in the transition and post-reform period (Table 5b). However, the extent of irrigation in the group is influenced mainly by three countries, Madagascar, Mauritania and Somalia. The latter two countries are arid and rely on irrigation for much of their agricultural production, while Madagascar has a traditional irrigation-based rice cultivation system. Given the poor performance of the three countries, it appears

that irrigation systems have not been effectively utilized probably due to lack of complementary inputs and effective management practices. Lack of technical expertise, inconsistent and poor government policies and programs, weak research capacity, and underdeveloped markets, among others, seem to have hampered the emergence of productive irrigation agriculture in SSA (ICID, 2010).

Inadequate policy support to intensification

Between the mid-1980s and early 1990s, several African countries adopted the structural adjustment programs (SAPs) that included liberalization of output and input prices, devaluation of local currency, removal of subsidies and dismantling of parastatals. Most SSA countries moved to market-determined exchange rates and open trade regimes. Net taxation of agriculture decreased, which, together with competition in the market place, created a more positive environment for agricultural investment (Anderson and Masters, 2009; Jayne et al., 2002). However, the fact that the production increase was obtained largely through area expansion indicating that the reform has not provided sufficient incentive to intensify production even in better performing countries. Besides, currency devaluations and subsidy removals tended to temporarily reduce fertilizer consumption in nearly all regions of SSA (Kelly, 2006). The cost of inputs such as fertilizer rose sharply, making it unaffordable for many smallholders. As a result, some countries were forced to re-introduce subsidy programs. For instance, Malawi (from group one) implemented a large scale input subsidy program known as 'starter pack' in the 1998/1999 and 1999/2000 agricultural seasons.

The program was scaled down to 'targeted input program' in 2000/2001 but expanded as large scale

Agricultural Input Subsidy Program in 2005/2006 (Dorward, 2009). Malawi's exceptional performance in the post-reform period (1994 to 2008) could be related to the fertilizer and hybrid seed subsidy program of the government that has been in force since the late 1990s (Buffie and Atolia, 2009).

In Nigeria (group one), the Developing Agricultural Inputs Markets in Nigeria (DAIMINA) project introduced vouchers in 2004 to support agro-dealer development and improve producer access to and use of inputs. Other countries, including Burkina Faso, Ghana, and Kenya from group one as well as Mali, Tanzania and Zambia from group two, and Rwanda and Senegal from group three have implemented input subsidy programs since 2007/2008 (Druilhe and Barreiro-Hurlé, 2012). Inadequate rural financial services following the economic reform and the poor performance of state-owned agricultural development banks have also constrained farmers' access to input loans and discouraged intensification. Private commercial banks have shown limited interest in expanding their operations in rural areas,

following the financial liberalization programs (Gonzalez-Vega, 2003). The failure of special credit lines to agriculture has left gaps in financial services in many countries (World Bank, 2008). In Nigeria, for instance, agricultural financing has a long history and various attempts to supply loans to farmers was met with limited success (Mafimisebi et al., 2010; Ugwu and Kanu, 2012).⁶ State-owned agricultural development banks were allowed to operate in some countries but they performed poorly, although, there have been some notable exceptions. The reformed Banque Nationale de Développement Agricole of Mali is currently operating as a second-tier institution offering refinancing facilities and savings products (Making Finance Work for Africa Secretariat, 2012). Liberalization of output markets was expected to raise producer prices and improve the incentive to use inputs. However, the performance of food staple markets in SSA is often hampered by poor infrastructure, limited capacity of grain traders, inadequate support services, and weak institutions, thus giving rise to high transaction costs and price volatility.⁷ In Ethiopia, for instance, maize prices collapsed from 150 Birr/quintal to 20 to 30 Birr/quintal in 2001 to 2002. Ethiopian farmers could not repay their production loans and a major crisis occurred. Farmers generally consider such price collapse a principal factor discouraging new technology introduction (Sanders and Shapiro, 2006). In Tanzania, for instance, producer prices have shown considerable seasonal variability after market liberalization, falling to very low levels immediately after harvest (when most farmers sell their produce) and rising to very high levels just before the next main harvest. Price uncertainty has not encouraged investment in inputs (Skarstein, 2005). Unpredictable government operations in grain markets, lack of quality standards with respect to moisture content, and threat of grain confiscation, among others, have discouraged investment in market stabilizing activities such as grain storage (Jayne et al., 2010).⁸ A major problem in SSA is the absence of risk management tools to deal with price and

⁶ Agricultural loans were given at concessionary interest rates and beginning in 1972 commercial and merchant Banks were mandated to extend a prescribed minimum percentage of their loan portfolio to agriculture. However, such measures were found inconsistent with financial-sector reform and the policy was abolished in 1996. Cooperatives, friends, and family members dominate the sources of farm credit among small farmers in Nigeria, and the total amount obtained from these sources is often very limited compared to the amount that formal financial institutions would have offered (Phillip et al., 2009).

⁷ In Africa, high transport costs due to poor roads, high fuel prices, administrative procedures which cause delays, etc. have resulted in high marketing costs which lower grain prices for producers and raise prices for consumers. In East Africa, for instance, prices [per ton-kilometer (tkm)] on the Mombassa – Kampala (linking Uganda with Kenya) are more than two times higher than in Brazil and four times higher than in Pakistan (Teravaninthorn and Raballand, 2009).

⁸ Jayne et al. (2010) Patterns and Trends in Food Staple Markets in Eastern and Southern Africa: Towards the Identification of Priority Investments and Strategies for Developing Markets and Promoting Smallholder Productivity Growth, MSU International Development Working Paper No. 104.

Table 6. Average number of conflict-related deaths.

Country	Number of people			
	Pre-reform	Transition	Post-reform	Period
	1968-1983	1984-1993	1994-2008	1968-2008
Better performers				
Benin	0	0	0	0
Burkina Faso	0	100	0	100
Nigeria	60484	0	124	60608
Côte d'Ivoire	0	0	1265	1265
Ghana	74	0	0	74
Niger	0	172	1284	1457
Sudan	23380	35389	21030	79799
Malawi	0	0	0	0
Kenya	318	0	0	318
Mean	9362	3962	2634	15958
Medium performers				
Central African Republic	0	0	546	546
Mali	0	150	247	397
U.R. of Tanzania	0	0	0	0
Cameroon	0	500	0	500
Guinea	19643	12402	5257	37302
Chad	0	0	1174	1174
Togo	0	262	0	262
Zambia	0	0	0	0
Congo	0	660	9945	10605
Mean	2183	1553	1908	5643
Poor performers				
Rwanda	0	10000	14454	24454
Ethiopia	224065	126882	9802	360749
Uganda	63613	50880	8137	122629
Mauritania	2615	0	0	2615
Senegal	0	384	889	1273
Madagascar	128	0	0	128
Liberia	27	15298	3469	18794
Mozambique	41253	123751	0	165005
Sierra Leone	0	1400	12812	14212
Somalia	1828	60761	12339	74928
Democratic Republic of Congo	919	0	151618	152537
Burundi	0	1984	9563	11547
Mean	27871	32612	18590	79073

Source: Encyclopedia of the Nations, <http://www.nationsencyclopedia.com/WorldStats/WDI-poverty-conflict-fragility-deaths.html>

production risks. Price and market stabilization schemes or commodity exchange systems with futures and options for price risk management are largely non-existent in SSA (Demeke et al., 2012).

High incidence of external shocks

Apart from deficient policies and inadequate economic incentives, external shocks in the form of conflict and

uncertain rains have affected investment in farm inputs and technology. The majority of the 12 countries within the poor performers are known to have gone through some armed conflict and severe political instability during the period under consideration, namely: Rwanda, Ethiopia, Uganda, Mauritania, Senegal, Madagascar, Liberia, Mozambique, Sierra Leone, Somalia, Democratic Republic of the Congo and Burundi (Tables 6 and 7). Strong production performance in Rwanda, Ethiopia, Sierra Leone and Liberia in the post-reform period is also

Table 7. Average annual rainfall (mm).

Country	Average rainfall in mm			
	Pre-reform	Transition	Post-reform	Whole period
	1968-1983	1984-1993	1994-2000*	1968-2008
Better performers				
Benin	994	1002	1051	1017
Burkina Faso	745	715	771	747
Nigeria	1114	1097	1172	1131
Côte d'Ivoire	1309	1280	1326	1308
Ghana	1143	1137	1146	1143
Niger	151	145	166	155
Sudan	404	396	438	414
Malawi	1098	1034	1091	1080
Kenya	619	603	669	633
Mean	842	823	870	848
Medium performers				
Central African Republic	1335	1293	1350	1330
Mali	293	276	313	296
United Republic of Tanzania	1016	995	1014	1010
Cameroon	1581	1539	1598	1577
Guinea	1646	1542	1690	1636
Chad	325	298	351	328
Togo	1150	1139	1172	1156
Zambia	992	926	993	976
Congo	1603	1582	1605	1599
Mean	1105	1065	1121	1101
Poor performers				
Rwanda	1139	1036	1091	1096
Ethiopia	782	725	765	762
Uganda	1171	1120	1168	1157
Mauritania	79	77	92	83
Senegal	649	643	712	671
Madagascar	1418	1479	1481	1456
Liberia	2399	2264	2481	2396
Mozambique	983	938	1016	984
Sierra Leone	2460	2287	2403	2397
Somalia	235	238	274	250
Democratic Republic of the Congo	1510	1499	1480	1496
Burundi	1248	1215	1205	1224
Mean	1173	1127	1181	1164

Sources: Country aggregated rainfall time-series dataset was created by Hideki Kanamaru, NRC, FAO from CRU TS 3.1 of University of East Anglia Climate Research Unit (CRU). [Phil Jones, Ian Harris]. CRU Time Series (TS) high resolution gridded datasets 3.1, [Internet]. NCAS British Atmospheric Data Centre, 2008. Available from http://badc.nerc.ac.uk/view/badc.nerc.ac.uk__ATOM__dataent_1256223773328276, accessed April, 2011.

associated with the end of serious civil wars (Collier et al., 2002). Persistent conflict has resulted in poor or negative food production performance in Somalia, Democratic Republic of the Congo and Burundi. Among the first group of countries, Sudan is the most affected by

violent conflict but it has managed to sustain its better performance because production is concentrated in irrigated areas where the problem of conflict is limited (Keen, 1994, 1998, 2000). Similarly, the recent conflict in Cote d'Ivoire can be considered as a major contributing

factor to the slow growth in the post-reform period, which lowered the growth of food production to 2.3% compared to 3.3% recorded during the transition period (Table 1).

Comparably, Nigeria's poor growth during the pre-reform period could also be associated with the violent – the Biafra War – of 1967 to 1970 (Richards, 2006).

The impact of conflict on food production and food security has been documented by other studies. Messer et al. (1998), for instance, estimated that food production in 13 war-torn SSA countries during 1970 production in 13 war-torn food security has been compared to peace years. FAO study also estimated that conflict induced losses of agricultural output totalled \$121 billion in real terms (or an average of \$4.3 billion annually) during the period of 1970 to 1997 (FAO, 2000). Climate variability is another major risk constraining the adoption of improved technologies and inputs in many parts of Africa (Barret, 2002). Globally, Africa faced the highest frequency during the period of 1960 to 2006 with a total of 382 reported drought events, compared to 165 in Asia, the region the next highest frequency (Gautam, 2006). It is reported that about 60% of SSA is exposed to drought and 30% so extremely. Part of the Sahel as well as Eastern and Southern Africa are among the most affected (Benson and Clay, 1998). African countries are also affected by floods that cause loss of life, damage to property, and promote the spread of diseases such as malaria, dengue fever and cholera. Rainfalls accompanying tropical cyclones often result in flood disasters in Mozambique. Many parts of Ethiopia, Kenya and Somalia are also vulnerable to flood. Madagascar and Mozambique are among countries most often affected by cyclones (ICSU Region Office for Africa, 2007). With little or no access to insurance or other production risk management tools, hazards related to weather, pests and diseases have impeded technology adoption, resulting in poverty traps in SSA.

CONCLUSION

The performance of the food production sector in Sub-Saharan Africa (SSA) is critical for a number of reasons. First domestic production is the principal avenue to ensuring access to affordable food in poor countries with limited capacity to import food. The multiplier effect of sustainable food production on the economy is considerable as it has direct linkage with other activities such as transportation, marketing, warehousing, food processing, tourism and local commerce. In countries where the growth of food production outpaces demand, social and political harmony as well as macroeconomic stability can be maintained, paving the way for sustained economic growth. This paper examines changes in food production performance among 30 SSA countries over the period of 1968 to 2008. The countries were grouped into three: the comparatively better, medium and poor

performers – based on their food production performance. Three different periods, representing the pre-reform, transition and post-reform, were also identified to pay particular attention to the impact of policy reforms. The results support previous findings that not many countries have managed to achieve a food production average growth rate in excess of 3% per annum. Indeed, only 9 or 30% of the sample countries achieved such growth rates over the period of 1968 to 2004.

Annual food production performance averaged 3% or more in 60% of the sample countries following the policy reforms. Nevertheless, rates of output growth varied from one period to the other and the recent improved performances were achieved largely through unsustainable expansion of land under cultivation. At an average application rate of 10 kg of nutrients per ha of arable land, fertilizer use levels in SSA are only 5% of the level in an average middle income country. Not surprisingly, Africa's agricultural GDP per capita is only one-fourth of world's average and per capita food production is stagnant or declining. Better food production performance is associated with better availability of food supply and lower rates of undernourishment. The prevalence of undernourishment in the total population averaged 14% in 2005 to 2008 among better performers, compared with 30% among medium and poor performing countries. However, most countries have failed to achieve food self-reliance. With domestic supply lagging behind rapidly expanding demand, most countries have experienced a substantial increase in their food import spending in recent years (1994 to 2008) and have faced serious food security concerns following the hikes in international food price and high levels of volatility that began in 2007/2008. The deficit in food trade balance has sharply increased in nearly all cases, and with few exceptions, SSA countries have very limited capacity of financing their food import bills. Even among better performing counties, food imports accounted for about 27% of the total value export earnings during the period of 1994 to 2008. The share averaged 74% among poor performing countries over the same period. Imported food items are also expensive in the local markets owing to high cost of freight, port charges, domestic transport and marketing margins. Locally produced staples are cheaper, but a more sustainable and higher growth of domestic production is constrained by lack of public support programs and absence of effective measures to address market failures and inefficiencies in input, output, credit, land and risk management markets. Weak institutions, which are often aggravated by conflict and political instability, have hampered investment in the food value chain and made it very difficult for farmers to access inputs and new technologies.

Building institutions that foster partnership between governments and farmers, traders, processors and other

stakeholders along the value chain and facilitate the emergence of a stable and competitive markets is critical to ensure food availability, affordability/ accessibility and stability in SSA. Without a significant increase in budgetary allocations to build institutional capacity, develop market infrastructure, expand irrigation schemes, ensure sustainable natural resource utilization, transform agricultural research and development, and build capacity for climate change mitigation and adaption, as rightly advocated by the Comprehensive Africa Agriculture Development Program (CAADP) of the African Union, the food security situation is likely to worsen further for many SSA countries. The views expressed are purely those of the writers and may not in any circumstances be regarded as stating an official position of FAO and the European Commission.

REFERENCES

- AEC (1991) 'Treaty of African Economic Community'.
- AFDB OECD, UNECA (2010). African Economic Outlook – Public Resource Mobilisation and Aid, OECD Development Centre and ADB, Paris.
- African Union (2003). "Maputo Declarations", Assembly of the African Union, Second Ordinary Session. Addis Abbaba, P. 10.
- Anderson K, Masters W (2009). Distortions to Agricultural Incentives in Africa, Washington DC: World Bank.
- Benson C, Clay E (1998). The Impact of Drought on Sub-Saharan African Economies: A Preliminary Examination. Washington, DC: World Bank. Technical 401:1998.
- Boon EK (2007). Food Security in Africa: Challenges and Prospect, Report for Regional Sustainable Development Review: Africa.
- Breisinger C, van Rheenen T, Ringler C, Pratt A, Minot N, Aragon C, Yu B, Ecker O, Zhu T (2010). Food Security and Economic Development in the Middle East and North Africa Current State and Future Perspectives. IFPRI Discuss. P. 00985.
- Buffie EF, Atolia M (2009). Agricultural input subsidies in Malawi: Good, bad or hard to tell? FAO Commodity and Trade Policy Research Working Paper No. 28, August.
- Camara Y (2000). Profitability of cassava production systems in West Africa: A comparative analysis (Cote d'Ivoire, Ghana and Nigeria), CAB. P. 200.
- Chilowa W (1998). The Impact of Agricultural Liberalization on Food Security in Malawi. Paper presented at a seminar on Economic Liberalization: A review of Policies, Chancellor College, Zomba, Malawi.
- Clark J (2002). 'The neo-colonial context of the democratic experiment of Congo-Brazzaville'. *Afr. Affairs* 112:446.
- Deininger K, Byerlee D, Lindsay J, Norton A, Selod H, Stickler M (2010). Rising Global Interest in Farmland. Can It Yield Sustainable and Equitable Benefits? Washington, D.C: World Bank.
- Diao X, Fan S, Headey D, Johnson M, Nin Pratt A, Yu B (2008). Accelerating Africa's food production in response to rising food prices: Impacts and requisite actions. IFPRI Discuss. P. 825.
- Dorward A, Shenggen F, Kydd J, Lofgren H, Morrison J (2004). 'Institutions and Policies for Pro-poor Agricultural Growth'. *Dev. Pol. Rev.* 22:611-622.
- Dorward A (2009). Rethinking agricultural input subsidy programmes in a changing world, Paper prepared for the Trade and Markets Division, FAO, April.
- Druihe Z, Barreiro-Hurlé J (2012). Fertilizer subsidies in sub-Saharan Africa, ESA Working paper Num 12:04, FAO, July.
- ECOWAS (2009). Ecowas Agricultural Policy Compressive African Agriculture- Report Ghana.
- Edgerton MD (2009). Increasing Crop Productivity to Meet Global Needs for Feed, Food and Fuel'. *Plant Physiol.* 149:7-13.
- Erenstein O, Kassie GT, Mwangi W (2011). Challenges and opportunities for maize seed sector development in eastern Africa, Paper presented at the conference: Increasing Agricultural Productivity and Enhancing Food Security in Africa: New Challenges and Opportunities, 1-3 November 2011, Africa Hall, UNECA, Addis Ababa, Ethiopia.
- Fafchamps M (1992). 'Cash Crop Production, Food Price Volatility, and Rural Market Integration in the Third World'. *Am. J. Agric. Econ.* 74:90-92.
- FAO (1999). The Impact of the Structural Adjustment Programmes on Family Farms. Working Paper Investment Center. Rome, Italy
- FAO (2009). The State of the Food Insecurity in the world 2009: Economic crises - impacts and lessons learned. Rome, Italy.
- FAO (2010). The State of the Food Insecurity in the world 2010: Addressing food insecurity in protracted crises. Rome, Italy.
- FAO (2011a). The State of the Food Insecurity in the world 2011: How does international price volatility affect domestic economies and food security? Rome, Italy.
- FAO (2011b). Save and Grow: A Policymaker's Guide to Sustainable Intensification of Smallholder Crop Production. Rome, Italy.
- FAO (2012). The State of the Food Insecurity in the world 2012: Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. Rome, Italy.
- FAO (2000). The state of food insecurity in the world. Rome, Italy.
- G8 (2009). 'L'Aquila' Joint Statement on Global Food Security.L'Aquila Food Security Initiative (AFSI) declaration.
- Gautam M (2006). Managing Drought in Sub-Saharan Africa: Policy Perspectives, Invited paper prepared for an Invited Panel Session on Drought: Economic Consequences and Policies for Mitigation, at the IAAE Conference, Gold Coast, Queensland, Australia, August 12-18.
- Gonzalez-Vega C (2003). Deepening Rural Financial Markets: Macroeconomic, Policy and Political Dimensions, paper prepared for the conference "Paving the Way Forward: An International Conference on Best Practices in Rural Finance". Washington, D.C., 2-4 June.
- Harrigan J (1997). 'Modeling the impact of World Bank policy-based lending: the case of Malawi's agricultural sector'. *J. Dev. Stud.* 33:6.
- Harrigan J (2003). 'U-Turns and Full Circles: Two Decades of Agricultural Reform in Malawi 1981–2000'. *World Dev.* 31:847-863
- Hernandez MA, Torero M (2011). Fertilizer Market Situation: Market Structure, Consumption and Trade Patterns, and Pricing Behavior, IFPRI Discuss. P. 01058.
- ICID (2010). Irrigation development challenges for the least developed countries in Africa, International Commission on Irrigation and Drainage (ICID).
- ICSU Region Office for Africa (2007). Natural and Human-induced Hazards and Disasters in sub-Saharan Africa, International Council for Science (ICSU).
- IFPRI (2011). Agricultural Productivity and Policies in Sub-Saharan Africa. IFPRI Discuss. P. 01150.
- Jayne TS, Yamano T, Weber M, Tschirley D, Benfica R, Chapoto A. and Zulu B (2003). 'Smallholder Income and Land Distribution in Africa: Implications for Poverty Reduction Strategies'. *Food Policy*, 28:253-275.
- Jayne TS, Govereh J, Mwanaumo A, Nyoro J, Chapoto A (2002). 'False Promise or False Premise? The Experience of Food and Input Market Reform in Eastern and Southern Africa'. *World Development*, 30:1967-1985.
- Kakwani N (1997). On Measuring Growth and Inequality Components of Poverty with Application to Thailand', The University of New South Wales. School Econ. Discussion Paper.
- Kasfir N (2008). 'Are African Peasants Self-Sufficient?', *Dev. Change* 17:335-357.
- Keen D (1994). The Benefits of Famine: A political economy of famine and relief in south western Sudan, 1983-1989. Princeton, NJ (USA): Princeton Univ. Press.
- Keen D (1998). Aid and Violence, with Special Reference to Sierra Leone'. *Disasters* 22:318-327.
- Keen D (2000). Managing Armed Conflicts in the 21st Century. 'War and Peace: What's the difference?', *International Peacekeeping* 7:1-22.
- Kelly V (2006). Factors affecting demand for fertilizer in Sub-Saharan

- Africa, Agriculture and Rural Development Department, World Bank, Washington D.C.
- Kherallah M, Minot N, Kachule R, Soule BG, Berry P (2001). Impact of agricultural market reforms on smallholder farmers in Benin and Malawi, IFPRI Collaborative Research Project: <http://www.ifpri.cgiar.org/sites/default/files/pubs/divs/mtid/dr/200102/v1.pdf>.
- Kydd J, Dorward A, Morrison J, Cadisch G (2007). Agricultural development and pro-poor economic growth in sub-Saharan Africa: potential and policy'. *Oxford Dev. Stud.* 32:37-57.
- Lele U (1990). Structural adjustment, agricultural development and the poor: Some lessons from the Malawian experience'. *Word Dev.* 18:1207-1219.
- Mafimisebi T, Oguntade A, Mafimisebi O (2010). Re-engineering Agriculture For enhanced Performance through Financing. *J. Econ. Finan. Admin. Sci.* 15:35-49.
- Making Finance Work for Africa Secretariat (2012). Policy brief on agricultural finance in Africa, ADB, Tunisia.
- Maxwell D (1999). The Political Economy of Urban Food Security in Sub-Saharan Africa'. *Word Dev.* 27:1939-1953.
- Messer E, Cohen MJ, D'Costa J (1998). Food from peace: breaking the links between conflict and hunger. In: 2020 Vision for Food, Agriculture, and the Environment. Discussion, IFRI, Washington DC. P. 24.
- Morris M, Valerie A, Kelly, Ron J. Kopicki, and Derek Byerlee (2007). Fertilizer Use in African Agriculture: Lessons Learned and Good Practice Guidelines. Washington DC: World Bank.
- Moser G, Rogers S, Reinold van Til (1997). Nigeria: Experience with Structural Adjustment, IMF Occasional P. 148, Washington: IMF
- Munthali T (2004). The Impact of Structural Adjustment Policies (SAPs) on Manufacturing Growth in Malawi, Macroeconomics 0410002, EconWPA
- Nweke F (2004). 'New Challenges in the Cassava Transformation in Nigeria and Ghana', EPTD Discussion paper No 118, IFPRI, Washington, DC.
- O'Connell S (2008). 'The Political Economy of Economic Growth in Africa, 1960-2000: An Overview' in B. Ndulu, A. O'Connell, J.P. Azam, R. Bates, A. Fosu, J. Gunning and D. Njinkeu (eds.) *The Political Economy of Economic Growth in Africa, 1960-2000. Vol. 2. Country Case Studies.* Cambridge: Cambridge University Press.
- Odame H, Muang E (2011). 'Can Agro-dealers Deliver the Green Revolution in Kenya?'. *IDS Bull.* 42:78-89.
- OECD (2005). 'Data and Metadata Reporting and Presentation Handbook', Paris.
- OECD (2008). *African Economic Outlook 2008.* Paris, France.
- Omamo S, Diao X, Wood S, Chamberlin J, You L, Benin S, Wood-Sichra U, Tatwangire A (2006). 'Strategic Priorities for Agricultural Development in Eastern and Central Africa', Research Report no. 150, IFPRI, Washington, DC.
- Phillip D, Nkonya E, Pender J, Oni OA (2009). Constraints to Increasing Agricultural Productivity in Nigeria: A Review, IFPRI/NSSP.
- Rakotoarisoa MA, Lafrate M, Paschali M (2011). Why has Africa Become a Net Food Importer: Explaining Africa agricultural and food trade deficits, Trade and Markets Division, Rome: FAO.
- Reardon T, Barret Ch, Valerie K (2002). 'Policy Reform and Sustainable Agricultural Intensification in Africa'. *Dev. Policy Rev.* 17:375-395.
- Richards P (2006). The History and Future of African Rice: Food Security and Survivalian in West African War Zone', *African Spectrum*, 41:77-93. (Not cited in the article)
- Rono JK (2002). The impact of structural Adjustment Programs on Kenyan Society. *J. Soc. Dev. Afr.* 17:81-98.
- Sanders JH, Barry S (2006). 'Policies and market development to accelerate technological change in the semiarid zones: A focus on Sub-Saharan Africa' in Payne et al (ed.), *Dryland Agriculture*, 2nd Edition, Agronomy Monograph No. 23. American Society of Agronomy, Inc. Crop Science Society of America, Inc. Soil Science Society of America, Inc. 677 South Segoe Road Madison, Wisconsin 53711:879-900
- Scoones I, Thompson J (2011). The Politics of Seed in Africa's Green Revolution: Alternative Narratives and Competing Pathways', *IDS Bull.* 42:1-23.
- Skarstein R (2005). 'Economic liberalization and smallholder productivity in Tanzania: From Promised success to real failure, 1985-1998'. *J. Agrar. Change* 5:334-362.
- Skarstein R (2005). 'Economic Liberalization and Smallholder in Tanzania. From Promised Success to Real Failure, 1985-1988'. *J. Agrarian Change* 5:334-362.
- Smale M, Byerlee D, Jayne T (2011). 'Maize Revolutions in Sub-Saharan Africa', Policy Research Working Paper, 5659, The World Bank Development Research Group Agriculture and Rural Development Team.
- Teravaninthorn S, Raballand G (2009). 'Transport Prices and Costs in Africa: A Review of the Main International Corridors', African Infrastructure Country Diagnostic, Working P. 14, The World Bank.
- Thapa G, Gaiha R (2011). Smallholder farming in Asia and the Pacific: Challenges and Opportunities', Conference on New Directions for Smallholder Agriculture, 24-25 January, Rome, IFAD HQ.
- Ugwu B (1996). Increasing cassava production in Nigeria and prospects for sustain the trend'. *Outlook Agric.* 25:179-185.
- Ugwu DS, Kanu IO (2012). Effects of agricultural reforms on the agricultural sector in Nigeria', *J. Afr. Stud. Dev.* 4:51-59.
- UNCTAD (2009). Food security and agricultural development in times of high commodity prices, Geneva.
- UNECA (1979). Lagos Plan Action for the Economic Development of Africa 1980-2000', Addis Abbaba.
- UNEP Year Book (2012). Emerging Issues in our Global Environment.
- USDA (2007)- 'The Impact of Agricultural Research in Tropical Africa', Study P. 21.
- Weissman S (1990). 'Structural adjustment in Africa: Insights from the experiences of Ghana and Senegal'. *World Dev.* 18:1621-1634.
- WHO (2008). 'Global and regional food consumption patterns and trends'. Working P. 3.
- Wobst P (2001). 'Structural Adjustment and Intersectoral Shifts in Tanzania: A Computable General Equilibrium'. *International Food Policy Research Institute, Working, Washington, DC, P. 109.*
- World Bank (2008). 'World Bank Assistance to Agriculture in Sub-Saharan Africa', Washington DC: World Bank.
- World Bank (2009). 'African Agriculture—What Do We Not Know? What Do We Need to Know?', Washington DC: World Bank.
- Zawalinska K (2004). 'What has been an economic impact of Structural Adjustment Programs on households in Transition countries?', Essay no. 1 for P. 2 Institutions and Development Submitted in part-fulfilment of the requirements for the MPhil in Development Studies at the University of Cambridge.