

# Improving Quality of Life through Agricultural and Nutritional Policy in Sub-Saharan Africa: An Informed Platform for Post-2015 Development

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**A food security based approach to development did not develop as quickly in Sub-Saharan Africa in the 1970s as it had in Asia, but over the past decade and a half, especially, a cumulative wealth of evidence has led to conclusions that suggest developmental efforts focusing on food systems and nutrition are the most cost-effective and far reaching of efforts to combat poverty and improve health. While hunger indicators have improved over the years, malnutrition remains the most significant challenge to development in the region. The poverty trap caused by malnutrition, and the broader impacts of inadequate nutrition, mean that policy targeting agriculture and nutrition have higher benefits-to-cost than any other policy measures. During the past 40 years, research and developments in agriculture, nutrition, and human development in Sub-Saharan Africa suggest the need for focus in several areas: funding and supporting sustainable intensification of agricultural productivity; promoting women's economic involvement; coordinating multi-pronged programs centered around food security, which include smart input subsidies and safety nets; urging the dissemination of agricultural diversity, which includes further funding of and research in improving seeds; instituting equitable infrastructure development; working towards the removal of barriers to trade; and improving accountability through national government reforms in the region.**

## FOREWORD AND INTRODUCTION

Food systems-based approaches to economic development and welfare promotion in Sub-Saharan Africa have traditionally taken a back seat to other structural reforms and policy targets. It was not until the 1970s, in the wake of Asia's Green Revolution, that developmental efforts in the region began to recognize the value of food security oriented development approaches. Sparse data and inadequate results from agricultural and nutritional research and development held back this food-centric policy approach for many years to the detriment of Sub-Saharan Africa—a trend that has only begun to dramatically change over the past decade and a half. A food security based approach to human development is now respected as the most promising primary focus for poverty alleviation in the region for the foreseeable future. As the United Nations (UN) approaches setting a global development policy follow-up in 2015 to the Millennium Development Goals set in 2000, it is an apt time to present the reasoning behind this development approach and argue specific, promising measures that may enable a more food secure future for Sub-Saharan Africa.

Poverty is both an underlying cause and effect of food insecurity. Current consensus recognizes developmental efforts that focus on food systems and

nutrition to be the most cost-effective and far reaching of efforts to combat poverty and improve health. Food security, defined by the World Food Summit in 1996, as “when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life,”<sup>1</sup> alludes to the necessity of adequate nutrition in promoting vitality and thus economic and societal engagement. Achieving food security by acquiring access to an adequate nutritious food supply and making healthy choices has proven no easy task due to the complex nature of food and economic systems. This paper serves to tie together the collective knowledge gained from agriculture policies and data on nutrition over the past four decades to provide a summary of starting points for further development of food security policies and research. Nutrition plays an important role in economic development in Sub-Saharan Africa. By looking at specific policy options that promote nutrition, through which poverty alleviation may be driven, and the obstacles that have, and continue to stand in the way of such developments, this paper recommends concentrating developmental resources towards policies that boost agricultural sectors, encourage seed research, and promote public spending on efforts that influence nutrition in Sub-Saharan Africa.

## THE HISTORY OF FOOD SYSTEMS POLICY ANALYSIS IN SUB-SAHARAN AFRICA

In the first decade or so of independence for many Sub-Saharan African nations, agricultural and overall growth may have been stagnant, partially due to rising agricultural taxes into the 1970s<sup>2</sup>, but it was not until the mid-1970s that hunger crises became significant in the region and beyond, especially in Asia. It is at this time, when global food shortages led to hundreds of thousands of deaths and global surplus rationing, that the Green Revolution occurred in Asia. The Green Revolution was a combination of aggressive policy measures and the development of higher yielding crop varieties that intensified agricultural production and improved quality of life in the region—the same kind of focus that is only now working its way to Sub-Saharan Africa. The World Food Conference in 1974 was the first significant effort to bring together international institutions to address food policy, and was the birthplace of the most preeminent institution in the field today, the International Food Policy Research Institute (IFPRI). Since then, many major milestones pertaining to the establishment of viable food security based approaches to development have occurred.

Sub-Saharan African countries faced continuously decreasing agricultural taxes following their peak in the mid-1970s. This was perhaps due in part to the recognition of the hunger crises at hand, though can likely mostly be attributed to the structural adjustment programs imposed on many Sub-Saharan African countries by donor countries, the International Monetary Fund (IMF), and the World Bank in the 1980s as austerity and market liberalization conditions on desperately needed loans, following the neo-liberal political economy framework established by the Washington Consensus. However, while structural adjustment did ease agricultural taxes—in accordance with market liberalization measures, which were serving as disincentive for agricultural shareholders to invest in the sector—they did nothing to focus on actually promoting agricultural development. In fact, the austerity measures taken under structural adjustment programs by many Sub-Saharan African countries in the 1980s meant less spending in areas that would target agricultural centric development, leaving a legacy of ignoring agricultural sectors that persists to this day. This neglect is visible in the inadequate spending levels directed toward most agricultural sectors relative to other sectors, running counter to cost-benefit calculations that suggest agricultural spending would produce greater returns than most other government spending. The market liberalization

and austerity measures taken under these foreign-imposed policy regimes—which meant rolled back government spending, reduced tax income, and removed subsidies—actually undermined the ability of Sub-Saharan Africa to pursue spending on swift and pointed state-driven food security policy efforts that Asian nations applied to drive the Green Revolution. Therefore, the region did not enjoy the developmental benefits that Asia had received from the agricultural and nutritional boom. While agricultural output has risen over the years, historically attributed to the cultivation of more land rather than any major improvements in policy or productivity on the whole, it has long struggled to even keep pace with population growth due to a high population growth rate and lack of strong policy efforts across the region to drive a Green Revolution of its own.<sup>3</sup> Another factor that has specifically minimized agricultural development in Sub-Saharan Africa is government misallocation of public funds, which many times has been tied to corruption, and other times, tied to bureaucratic and institutional restraints. Inept governments have posed a significant challenge at times to the establishment of larger, more effective responses to malnutrition and the establishment of food security based development.

Broader food policy developments in the decades following the 1970s have been invaluable in establishing the foundations of current agricultural and nutrition development theory and practice. The success of Asia's Green Revolution prompted research into the prospects of the very concept of agriculturally based developmental efforts rather than industrialization focused development. In review of IFPRI Research, IFPRI researchers Joachim von Braun and Rajul Pandya-Lorch claim that internal research conducted in the 1980s was first to show that a primary focus of developmental efforts on industrialization rather than on agriculture tends to restrain rather than encourage broader economic growth.<sup>4</sup> Contrary to traditional belief that cash cropping, which is the growing of high value crops not typically consumed by the farmer, was hazardous from food security stand point, it was actually determined that cash cropping tends to be a way out of poverty and malnutrition. This revelation opened the door to policy that could enable greater economic involvement from smallholders, or farmers owning small farms. However, while smallholder farming had been the model for success in Asia, it was unclear whether it could transfer to Africa as a model for growth as easily because there was a prevailing preference in the agricultural community for larger, more plantation-like farming. Research into farming scale in Sub-Saharan Africa led to a consen-

sus by the late 1980s that smallholder farming emphasis would have a profound impact on growth as surplus labor could participate, creating more demand for goods in the broader economy. One of the long time challenges to agricultural productivity in Africa, south of the Sahara, was intensification of productivity without degrading land and demanding new land. The establishment of investment strategies for sustainable intensification by the early 1990s provided a promising new area of research to promote high returns on investment in decreasing poverty and increasing health.

Key research\* from the 1990s through the early 2000s, established the importance of micronutrients, and the policies based around them, to improving health conditions.<sup>5</sup> Such research has been the backbone of more recent policy actions. At the same time, microfinance was emerging as a promising new safety net option for smallholders. Additionally, the development community began recognizing that the role of women in the food system and could be a potential route to developmental success—with the IFPRI projection that gender equality would decrease childhood malnutrition by three percent.<sup>6</sup> By the 2000s, the basics of the relationships between food systems, health, and development were well understood, and served as a launching ground for taking more significant policy action and more targeted research into food security, which has led to a vast accumulation of knowledge on the subject that serves to inform the future of agricultural policy in Sub-Saharan Africa.

#### THE PREVALENCE OF MALNOURISHMENT AND THE PHYSIOLOGICAL IMPORTANCE OF NUTRITION

The importance of nutrition, especially for women and young children, to long-term health and productivity is now widely understood. Sub-Saharan prospects for food security have increased since 1990, though severe challenges remain. Over the past two and a half decades, every country with data other than Burundi and Swaziland in Sub-Saharan Africa's Global Hunger Index score has improved. At a closer look of the index, the combined score for under five mortality, prevalence of underweight children, and the proportion of undernourished, or those not eating enough, has decreased ten points since its peak in 1995.<sup>7</sup> The percent of undernourished individuals in Sub-Saharan Africa has decreased from 33 percent in 1991 to 24 percent in 2014, according to a recent peer reviewed IFPRI publication.<sup>8</sup> This has been indicative of

an increase in access and consumption of food per capita, signaling some success in efforts to increase calorie consumption, though this has not necessarily carried over as an increase in access to nutrients in all places. Undernourishment refers simply to not having access to an adequate caloric intake, which has been an important policy target over the years, but an increase in consumption has not translated to consuming nutrients in all instances. Even though there may have been an increase in the consumption of staple foods in some areas, many of these foods, such as maize, do not provide adequate micronutrients (vitamins and minerals). Therefore, the biggest challenge to food security today is micronutrient malnutrition, the consumption of too few of the essential nutrients to lead a healthy life.<sup>9</sup>

With many of the highest indicators of malnutrition in the world the region still faces tremendous challenges in absolute terms. Amongst lower middle income countries in Africa, there is an incidence of child stunting greater than 40 percent,<sup>10</sup> the indicator of chronic malnutrition that is identified as a “height-for-age more than two standard deviations below the [WHO Child Growth Standards] median.”<sup>11</sup> Stunting can cause reduced cognitive capacity and increased susceptibility to disease—often irreversible effects. Sub-Saharan Africa also faces the highest overall incidence of low birth weight outside of South Asia,<sup>12</sup> and has among the highest incidence of wasting, being more than two standard deviations below the WHO median weight for a certain age, of any region in the world.<sup>13,14</sup> The region still has the highest anemia levels in the world, primarily caused by severe iron deficiency, and by far the highest incidence of vitamin A deficiency among children under five.<sup>15</sup> The societal cost of micronutrient malnutrition, beyond the obvious health impact on individuals, is the loss of human productivity, which constrains the developmental success of the region.

The implications of micronutrient deficiencies and chronic malnutrition can be profound, which is why investing in nutrition is vital to support human capital. The greatest, and most lasting harm is seen in young children, especially during the “first of 1,000 days,” which refers to the time between conception and a child's 2<sup>nd</sup> birthday. It is vital that policy targets women, in addition to children, in order to provide steady nutrition throughout a mother's pregnancy. This two-targeted approach has been adopted by entities addressing early childhood malnutrition, and most directly addressed by the 1,000 Days Partnership established in 2010. The four nutrients considered most essential, and often missing from Sub-Saharan African

\* Research includes: Kennedy and Bouis (1993), Alderman and Garcia (1993), and Ruel (2001).

diets are iodine, iron, vitamin A, and zinc. Iodine deficiency leads to brain damage in infants, reduced mental capacity, and goiter; iron deficiency leads to anemia, diminished motor and cognitive development (including ability to learn), increased risk of pregnancy related death, premature births, underweight births, weakness, and fatigue; vitamin A deficiency leads to vision loss/blindness, increased risk for and severity of (common) infections especially in young children, night blindness in pregnant women, stunted growth, and general increased risk of death; and zinc deficiency leads to a compromised immune system, increased rate of infection, and stunting.<sup>16,17</sup> A deficiency in one or more micronutrients—especially iron, iodine, vitamin A, or zinc seriously impacts personal wellness, which in turn, causes a broader ripple effect on the standard of living in an entire community, as such deficiencies decrease strength, cognitive ability, and overall productivity.

Undernourished and malnourished mothers give birth to underweight children, predisposed to health conditions and further micronutrient deficiencies. Diminished brain and immune system functionality compromise health and inhibit learning capabilities, reducing the capabilities of mothers and their children to live healthy, productive lives. Those who suffer from malnutrition during their first 1000 days are likely to live shorter lives, and earn less due to related health complications. With diminished earning capacity within a community, development is held back not only for those caught by malnutrition, but for the broader population in which they reside.

Malnutrition becomes a self-perpetuating problem since physiological consequences lead to economic consequences. This is known generally as the malnutrition poverty trap. Food insecure and malnourished families tend to earn less because of impediments to productivity, which also means they have less purchasing power to seek health care and consume nutritious foods. Malnourished women have malnourished children, who repeat the cycle again. This is why the critical foci of enhancing food security center around women and children who have just been born, as those are the most opportune times to alter the course of individuals' lives such that they can break free of the cycle and potentially bring themselves out of poverty and contribute to their community.

#### IMPROVED AGRICULTURAL PRACTICES AND POVERTY REDUCTION ECONOMICS

The cycle of poverty and continuation of food

insecurity due to chronic factors or food shortages have very real costs on the development of Sub-Saharan African nations. A 2006 study in Zimbabwe of children exposed to drought and violence (and subsequent food insecurity) in the early 1980s by Alderman, Hoddinott, and Kinsey concluded that, had they grown up at a different time or place, would have grown taller and completed more school, adding up to a lost opportunity for an additional 14 percent in lifetime earnings.<sup>18</sup> A similar study by Dercon and Porter (2010) of Ethiopia looking at a 1984 famine reached comparable conclusions, including eight percent in lost earnings.<sup>19</sup> One conservative estimate of the impact of these lost earnings from lack of food security amongst developing countries globally, according to the World Bank in 2006, is a loss of up to three percent from GDP annually. In many countries in Sub-Saharan Africa, this is likely significantly greater. In the case of Ethiopia, GDP losses to malnutrition from 2006-2015 are estimated at ten percent.<sup>20</sup> With such dramatic developmental setbacks under historic food security climates apparent, it has been vital to conduct benefit to cost ratio calculations to inform policy solutions. Policies which promote increased agricultural productivity growth can be seen to have four times the effect on poverty reduction as other methods of achieving growth.<sup>21</sup> By area, Sub-Saharan Africa's land ownership is distributed amongst households more equitably any other global geopolitical region, though women alone have the least ownership of anywhere in the world, so investments in agricultural productivity have a very evenly distributed effect in increasing household incomes, and by way of lower food prices, acquire more money for saving, spending, or investing. Increased spending capabilities build demand for products in diversified sectors (and productivity building agriculture endeavors such as irrigation, better inputs, or post-harvest storage) in addition to the initial boost to smallholders at alleviating their poverty. Though women do not have access to land generally, they are still very involved in the agricultural sector, so they do benefit from this process. Because of their already active role, they have the prospect of achieving significant empowerment were they to achieve greater land access themselves.

Policies, which focus specifically on nutrition, can have more profound benefits on human development than government and organizational actions that target economic development without consideration of food security. The median benefit-cost ratio for investment in nutritional policy has been found to be 16 according to a peer reviewed 2014 IFPRI publication. Many countries in Sub-

Saharan Africa face even more favorable investment conditions, with a ratio of 27 in Nigeria, and a ratio as high as 53 in South Africa, meaning that for every one dollar spent on nutrition policy, an astonishing 53 dollars in benefits can be expected.<sup>22</sup> Various micronutrient-specific dissemination policies for Sub-Saharan Africa show the degree to which the nutrients are valued in developmental efforts. The low estimate for policies that enable the dissemination of iron alone, to have a per capita benefit per investment of 176 and a high of the remarkable ratio of 200.<sup>23</sup> Investment in nutrition and agricultural policy in Sub-Saharan Africa is so promising from a developmental standpoint that it would be foolish to invest in any other sector as a development tool without first investing in food security. Comparatively, agricultural GDP growth is a better investment than growth in any other sector by a fairly large multiple. A group of Nobel laureate economists with the Copenhagen Consensus Center have concluded that broad food security programs could be implemented for under ten dollars per capita.<sup>24</sup> Ten dollars per capita, when weighed with the long-term benefits received on that investment, should be perceived as a nominal expenditure for any policy in Sub-Saharan Africa.

### IMPROVED CROPS, BIOFORTIFICATION, AND FOOD DIVERSIFICATION

Successful dissemination of biofortified and augmented seed and the promotion of diverse crops have proven to be some of the most promising specific concepts in assuring food security in Sub-Saharan Africa. These techniques provide enhanced nutritional benefits and potentially higher yielding capacities. Food diversity inherently provides increased nutritional opportunities because a wider variety of crops are more likely to include foods that cover various nutritional needs. Malawi continues to face nutritional challenges, and thus developmental stagnation, even with increased crop yields because food diversity has been lacking, and maize has prevailed as the staple crop regardless of its meager nutritional value.<sup>25</sup> Biofortification, the breeding of micronutrients in crops, delivers a nutritional promise because it is a guaranteed delivery mechanism. Although some processed foods have been fortified with micronutrients and have been proven to reduce some micronutrient deficiencies in countries with mandated fortification programs, distribution can still be challenging to poor rural areas. Supplementation has proven a viable nutrition delivery system under some circumstances, but is not a sustainable solution for assuring long term nutrition to broad populations, requires continu-

ous capital flow and distribution, and can be problematic because supplements can cause harsh side effects in individuals who suffer from undernutrition or undernourishment. Therefore, in the long-term, biofortified produce has the prospect of providing greater access to nutrients. Several cost-benefit analyses have shown the value of biofortified and yield enhanced seed. Higher yield varieties in general can have a benefit to cost ratio of 8.8 to 14.7.<sup>26</sup> In Sub-Saharan Africa where the nutrition challenges are often acute, it seems likely that the high research and development expenses for biofortified crops are justified, as the dissemination of such seeds has proven so beneficial. Cost-benefit analysis including the research and development of biofortified crops elsewhere in the world have been less conclusive, and suggested that there is a degree of risk in investing in biofortification.<sup>27</sup> Iron and zinc fortified rice and wheat have been seen to have a dissemination benefit-cost ratio of at least 11.6, and vitamin A rice a ratio of at least 8.5. A more comprehensive and conclusive cost-benefit analysis approach to biofortification should be pursued to help justify further investments and policy prescriptions in this promising and emerging area in the future.

The face of the proliferation of biofortified crops in recent years has been Harvest Plus, an institution under CGIAR<sup>†</sup>, which was started as a collaboration of 70 organizations and 40 countries.<sup>28</sup> Over the past few years, the organization has taken significant steps to begin to combat micronutrient deficiencies through the dissemination of biofortified seed. In Uganda, where 33 percent of children under five have a vitamin A deficiency, 145,000 households have already adopted vitamin A enhanced orange sweet potato<sup>‡</sup>, nearly doubling vitamin A intake for women and children there.<sup>29,30</sup> Other crops being disseminated in Sub-Saharan Africa include iron beans, vitamin A cassava, and vitamin A maize. Iron beans have already made it to 15 percent of rural households in Rwanda and 175,000 households in the Democratic Republic of the Congo, bringing with them the hope of decreasing the harm of iron deficiency (providing 45 percent of the daily requirement per serving), and increasing yields due to improved seeds that are resistant to virus, heat, and drought.<sup>31,32</sup>

<sup>†</sup> CGIAR is the overarching institution in the field of agricultural development, of which IFPRI is a member, formerly known as the Consultative Group on International Agricultural Research.

<sup>‡</sup> The mentioned vitamin A enhanced sweet potato is a variety with 50-100 percent daily need of vitamin A per serving, in addition to having improved yields, virus and drought resistance.

### KEY VARIABLES IN FOOD SECURITY BASED DEVELOPMENT: GENDER EQUALITY AND ASSET DISTRIBUTION

Over the past two decades, the role of women in promoting food security and income growth has become readily apparent through a number of studies<sup>§</sup>. Sub-Saharan Africa has seen relatively few concentrated policy efforts over this period to bring about broad change in the menial economic role of women. Efforts to involve women in society, and empower their decision making, would enable them to be more productive and to play a transformative role in enabling nutrition and standard of living. Currently in Sub-Saharan Africa, men make up 85 percent of agricultural landholders, with even more substantial discrepancies in some countries.<sup>33</sup> Inheritance laws in Sub-Saharan Africa tend to be among the most slanted toward favoring men of any in the world, often times perpetuating the disparities in land ownership. In this way, many women south of the Sahara in Africa have been systematically excluded from playing a larger role in an economically and nutritionally productive decision making capacity. With inadequate ownership of land, the primary productive asset beyond human capital in the region, and restrictive access to education, women have long played a less productive role in the agricultural economies, perhaps dissuading further investment in the promotion of women from the prospective of leaders in a traditional mindset. These setbacks to women's equal involvement in society in Sub-Saharan Africa have proven a bigger overall problem than anywhere else in the world, made worse by the sheer magnitude of the opportunity cost of their diminished involvement. Women already play a significant, yet silent role in the agricultural labor force, and thus already contribute significantly to the largest sector in Sub-Saharan African economies. Because land is so evenly distributed amongst men (and some women) in property size (as opposed to gender equality), and women are already heavily involved, investment and policy that serves to enhance their role has massive returns on economic and nutritional development. A study in Burkina Faso, which targeted nutritional choices by women with infants resulted in greater access to productive assets, increased food production, and an increase in consumption of diverse and nutritious foods.<sup>34</sup> In fact, the results of women empowerment globally have been estimated to have the potential to decrease undernourishment by 12-17 percent.<sup>35</sup> Increased education for women has been found

to have an even greater impact in decreasing rates of underweight children and increasing food security more than a standalone increase in wealth.<sup>36</sup> The developmental impact of such focused growth in food security can be profound. It has been determined that between 1960 and 1990, Sub-Saharan Africa missed out on .6 percent of annual growth to lack of equality in education alone,<sup>37</sup> which, including equality outside of the classroom, could have gone a long way in contributing to preventing development in the region from falling so far behind other regions such as Asia.

Land tenure may be distributed evenly by area south of the Sahara in Africa, but the quality of those plots, and access to water, vary dramatically from sub-region to sub-region and locale to locale. This has led to inherent imbalances in productive potentials, which have at times made distributing genetically viable seed for a specific region difficult due to the number of agro-ecological zones. One of the key developments of recent years and going forward will be the idea of sustainable intensification, where environmental and climate change considerations are accounted for increasing the productivity of land, such that equitable and sustainable yields can be had across different areas and over time. Varying land qualities, combined with the complexities of tenure law in the region pose a challenge for what should happen in terms of expanding land under production. As Africa's population continues to grow, and incomes continue to rise, demand for food will increase. Sub-Saharan Africa has enough unprotected arable land that it could effectively double the area of land under production to expand agricultural capabilities.<sup>38</sup> However, this land is unevenly distributed among countries. It must be noted that this fact should not justify land depletion. Physical expansion may be necessary as a compliment to productivity increases to keep pace with rising demand, but disregard for existing land with the hopes of cultivating new land will only bring about limits to productivity and a damage the environment in the long-run. The land currently under cultivation must experience increased productivity as well. Poorly written and enacted land tenure legislation in the region calls into question the legality of expansion and proper ownership of land under cultivation. This can imperil the livelihood of smallholders who rely on their land or may need access to new land in order to acquire or maintain food security. Land tenure laws have caused additional challenges for smallholders over the years in questions of land ownership under acquisitions. When larger foreign or domestic firms or investors purchase large plots of land for plantation

§ Some of the most notable such research includes: Smith, Ramakrishnan, Ndiaye, Haddad, and Martorell (2003), Smith and Haddad (2000), and Klasen (1999, 2002).

agriculture or otherwise, smallholders can find themselves at the mercy of their governments acting on arbitrary land ownership settlements. Crowded out and ejected from their land, smallholders face losses in food security and the potential to contribute to economic growth.

### MARKET CONSTRAINTS AND FAILURES AS AN OBSTACLE TO FOOD SECURITY

Market underdevelopment in Sub-Saharan Africa and complex globalized commodities markets are perhaps the largest remaining roadblocks to the proliferation of food security and broader development in the region. Amartya Sen's 1981 work, *Poverty and Famines*, was an early introduction of this concept of an entitlement approach to agricultural development, arguing that food insecurity arises from lack of market access.<sup>39</sup> Through the years, market access has actually become established as a key indicator of poverty. As opposed to some regions where land access may inhibit food security, in Sub-Saharan Africa land tends to be plentiful despite the aforementioned tenure concerns. It is rather the region's thus far inability to establish viable production chains that hampers its agricultural development. Many countries in Sub-Saharan Africa have experienced very peculiar trade imbalances in relation to food security. These have been mostly attributed to failures in getting goods to market and efficiently distributing them. In the 1990s and then again in 2008, Namibia was exporting crops while it underwent famine. In 2005, Niger had a slight deficit in agriculturally productive capacity which was comparable to nearby countries, but continued to export crops while its own farmers could not afford food due to low wages in prior years.<sup>40</sup> The key sources of these market failures and setbacks to nutrition and development are likely informational and infrastructural. Governmental attitudes towards agricultural market information system establishment for smallholders and investment in infrastructure can be partially attributed to the period of austerity introduced by structural reforms in the 1980s on many countries in the region. Price and consumer information would allow for much more efficient markets to become established, the bigger obstacle likely remains the physical one. Most of Sub-Saharan Africa has historically suffered from utterly inadequate transportation infrastructure beyond resource-to-port investments, and for many years, with rolled back spending, and limited understanding of its importance to agriculture, it was unlikely to develop. There is, however, now a general understanding that steps must be taken to establish supply

chains for agriculture. A first step in the right direction has been the Ghana Highway Authority, which seeks equitable distribution of new transportation infrastructure investments.<sup>41</sup>

Even if products are able to get to market and are informed enough to theoretically reach those demanding nutritious food, the market systems face more structural and environmental challenges. In Sub-Saharan Africa, verbal contracts have proved hazardous to farmers reliant on relations with buyers to move their produce. Pineapple farming expanded in Ghana to take advantage of European markets in the 1990s, based almost entirely on verbal contracts. However, in 2004, a large negative demand shock hit the market and verbal contracts were broken without consequence, putting many farmers out of business.<sup>42</sup> Legal and informational framework are needed to prevent breaches of contract in the region to assure a less risky environment for smallholders to expand their production and protect their livelihoods with food security. Market shocks provide further problems in the establishment of sustainable and efficient markets. Conflict has historically been a setback to development in Sub-Saharan Africa where weak institutions have made way for civil disorder. One of the many ways in which they can set back food security objectives and societal development is through market shocks. Inability to reliably get food to market or purchase it causes dramatic volatility in the market that prevents people from receiving the nourishment they need. There are interdisciplinary approaches available to try to limit conflict, food security being one itself ironically. Environmental market shocks have proven more complicated to fix. Famines in Sub-Saharan Africa have often been triggered by events such as droughts, and with climate change, environmental catastrophes such as these will wreak havoc more and more on food security based development by tampering with crop yields. This is why in recent years there has been not only a focus on biofortification, but also on crops bred or genetically modified to be viable in volatile environmental conditions, reducing sway from season to season in production levels due to unforeseen circumstances.

Beyond the inherent problems in markets within Sub-Saharan African nations, the region is severely afflicted by foreign barriers to trade. The General Agreements on Tariffs and Trade (GATT), and later, the World Trade Organization (WTO), have been based largely upon the principal that barriers to trade are overall harmful to

the global economy, so this is not a new development.<sup>41</sup> Agricultural subsidies and other protectionist measures used by developed countries enable farmers to grow excessive quantities at a lower cost without experiencing the consequences of market fluctuations, and therefore allow them to sell goods at artificially low prices, preventing farmers from countries without similar measures in place from competing. When such subsidized agricultural products end up in the markets of Sub-Saharan Africa, or in markets in which African farmers could sell, the unsubsidized farmers are crowded out. African producers can rarely match those prices, so they miss out on larger sales and income, which in turn, creates a disincentive for further investment in agriculture. This problem has contributed to the migration to cities, since farming, beyond the subsistence level, seems futile. However, cities do not necessarily offer more opportunity and often people from rural areas may end up unemployed, resulting in setbacks to both rural and urban nutritional and economic development. Barriers to trade have been recognized in recent years as valuable to development in some limited forms to protect the growth of agriculture and some industry that would not be able to compete with prices or quality globally otherwise. The barriers to trade that remain in wealthy countries are purely products of special interest groups, however, giving little quantifiable assistance to their economies, at a big cost to trade opportunities in developing countries whose subsidies can't keep pace. A 1980 study found that a 50 percent reduction in barriers to trade within the Organization of Economic Cooperation and Development (OECD), a club of rich countries, would boost global trade by \$8.5 billion through the opening of markets, 36 percent of which would occur in least developed countries (LDCs).<sup>43</sup> Perhaps the most egregious and severe of these barriers to trade that set back Sub-Saharan African economies are those in agriculture because of agriculture's importance to the region.

#### TARGETS FOR AFFECTING NUTRITION AND DEVELOPMENT THROUGH POLICY

Policy focuses have shifted throughout the years,

<sup>41</sup> While there is debate over market liberalization the general consensus is stated by the WTO that "Lowering trade barriers is one of the most obvious ways of encouraging trade; these barriers include customs duties (or tariffs) and measures such as import bans or quotas that restrict quantities selectively." And "Discouraging 'unfair' practices, such as export subsidies and dumping products at below cost to gain market share; the issues are complex, and the rules try to establish what is fair or unfair, and how governments can respond, in particular by charging additional import duties calculated to compensate for damage caused by unfair trade."<sup>45</sup>

with a focus on food subsidies in the 1970s, famine, drought and assistance to the poor in the 1980s and 1990s, and social protection later in the 1990s and into the early 2000s<sup>44</sup>—from which prevalent policies today descend. While these have been the prevailing focuses of agricultural policy, agricultural policy by and large has, and continues to, take a back seat to focuses on other sectors by Sub-Saharan African governments such as defense and health as well as support for non-agricultural industries. There are a broad array of potential policy objectives, including those in education and infrastructure, which could serve to promote nutrition and development through food systems, the most effective of which would be programs directed at mothers and young children, to break the malnutrition poverty cycle. Some of the most successful policy efforts have been partnerships between governments, international institutions, and nongovernmental organizations. The most promising agricultural policy objectives include: changing nutrition-related behavior practices, changing crop choices, expanding biofortification, presenting expanded post-harvest options, establishing food safety practices, enlarging intensification of agricultural production, and providing market access and efficiency. From a policy standpoint, one or more of these targets can be approached best according to contemporary understandings of food security dynamics by means of: agricultural extension/rural advisory services, farmer field schools, technology and input distribution facilities, microcredit, insurance schemes, market fixes, smart subsidies, cash transfers, mobile tie-ins, and infrastructure.<sup>46</sup> On the other hand, import taxes have proven an ineffective policy option in promoting food security because of the higher domestic prices they encourage, which prevent access to adequate nutritious food, especially in urban areas and among net buyers.<sup>47\*\*</sup> While the most effective policy approaches incorporate multiple of these features in a cross-sectoral approach, many more concentrated policy efforts have found success as well, such as those solely focused in agriculture. As individual and interrelated connections have been established between specific policy measures and quantifiable benefits to agricultural and nutritional development, more and more efforts have followed suit.

\*\* Protectionist barriers to trade in Sub-Saharan Africa thus have the potential to work against consumers, while supporting producers, though it is unclear at this point which effect is greater in the long run at promoting overall well-being in the region. As such, policymakers must approach barriers to trade with caution, until further research can help answer the relationship between agricultural protectionist measures, consumers, and producers.



**SOCIAL AND NATIONAL SAFETY NETS**

By the end of the 1990s, the idea of providing safety nets as a means of encouraging the establishment of food security in Sub-Saharan Africa was gaining appeal amongst African governments as well as international governmental and nongovernmental organizations. The most traditional form of safety net, one that remains prevalent throughout Sub-Saharan Africa, is the very simple concept of income sharing within communities where community members have any earnings beyond subsistence. An early nationwide effort to bring the potential benefits of secure agricultural income to more people was Ethiopia's Productivity Safety Net Programme (PSNP), established in 2005, supported by IFPRI, the World Food Programme and the international donor community. The program has included cash and food transfers of around \$350 million yearly, directly affecting 1.3 million people. As a result, 7.6 million fewer people have needed emergency food aid. Analysis of the program concluded that those involved were more likely to have food security, productive borrowing practices, better agricultural technology, and conduct non-agricultural business.<sup>48</sup> In the same year, Malawi established the first of its insurance projects with only the support of the World Bank. It was a weather based system established to provide cheap insurance coverage to groundnut farmers with a payout automatically following inadequate seasonal rainfall in their region, avoiding moral hazard and assuring the potential for food security even in times of drought. In 2008, Malawi expanded this weather index insurance coverage on a national scale. They partnered with the World Bank so that the country would receive an insurance payout if a seasonal rainfall were ten percent or more below the national annual average. This amount, payable before harvest, has given Malawi the ability to take emergency agricultural policy action before a food crisis hits, namely by being able to put a price cap on imports, allowing enough food in national markets, without preventing smallholders from being able to sell their crops at market.<sup>49</sup> The success of policy schemes such as these have prompted efforts by international institutions to attempt to deliver food security through even larger insurance networks as a national safety net. In 2009, the World Bank established MultiCat, a catastrophe bond program to provide natural disaster insurance. One year later, the IMF established its Rapid Credit Facility, offering low-interest rate loans to quickly combat food disasters. Furthermore, the African Union Commission and the World Food Programme established their own pooled capital fund, from which individual

nations can withdraw loans in efforts at disaster recovery to assure a steady stream of funds quickly enough to prevent more significant food insecurity.<sup>50</sup> Beyond insurance schemes, the proliferation of microfinance over the past couple decades has proven to be yet another promising option in providing a safety net to those who need it to achieve food security. Policy supporting the access to credit on a small scale should prove fruitful, because those smallholders able to secure microcredit are able to invest further in their productive and resilience capabilities, giving greater assurance for long term food security. Microsavings schemes are another viable option supported by international organizations that organize the pooling of small-scale savings for when it is needed most by community members, providing a limited degree of financial security.

**SMART INPUT SUBSIDIES**

A simple, traditional protectionist way of promoting domestic agricultural production levels has always been subsidization by the government. While this causes major problems for international trade when carried through the early stages of development into a wealthier, more articulated economy, it is widely considered a viable option for influencing developmental agricultural behaviors because there is often no other policy that can as effectively or directly disseminate more productive agricultural assets. However, there are problems with the classical model of agricultural subsidies even for development. Large programs, which distribute waivers and inputs broadly with disregard for need, have the potential to waste the limited capital resources that Sub-Saharan African nations have where they are not needed, and potentially increase income disparities amongst those in the agricultural sector. Larger-than-necessary subsidies can also prompt dependence rather than innovate investments in production, leading to continued reliance on substantial subsidies beyond the period of their primary need, as has become a problem in India today. Poorly managed subsidy programs can disregard negative externalities, resulting in poor crop choices and environmental degradation, negatively impacting actual nutritional intake amongst those who would seemingly have enough caloric intake. The solution to these problems with subsidies are not readily available, but over recent years, the concept of smart input subsidies has emerged and evolved as one of the most promising avenues of reducing the traditional negative externalities of subsidies. Smart subsidies are subsidies that only apply in very limited amounts to smallholders—

those who need the inputs most because they have often never had access to fertilizer or improved seed with their own meager incomes. These programs generally serve to deliver improved seed and fertilizer or nutrient-fixing agroforestry to rural farmers with minute plots of land in order to dramatically intensify their production. The most notable and expansive program, the Farm Input Subsidy Programme (FISP), has been in Malawi since 2005.<sup>51</sup> It has shown promising results, as well as revealing a number of challenges to smart subsidies, and has plenty of data to offer to the development of further subsidy policy measures in Malawi and other countries dealing with subsidies. Malawi instituted its subsidy program in the wake of a maize famine that required food aid for 4.7 million people, and while they found initial support from the Millennium Project, the international donor community remained unconvinced by the idea of reinstating input subsidy efforts that had been stripped during structural reform, due to the threat of long-term costs and misunderstandings of the benefits. Malawi's efforts shifted the opinion of the World Bank when the program trumped expectations of its economic viability and the country shed the \$44 per person in aid they had been receiving in 2005. Early on, in 2006 and 2007, agricultural output and exports were up with a benefit to cost ratio of at least 2.3, operating on a budget of less than one dollar per person per year.<sup>52</sup> Malawi's primary staple crop is maize, which is especially notorious for depleting nitrogen from the soil, and as such, provided a primary impetus for the need of fertilizer. Most of the improved seed, which was subsidized in sets with fertilizer, ended up being maize. This, along with corresponding price changes, prevented greater diversity and more nutritious foods from taking hold even with the potential to free more land to grow them. As a result, even with greater production, several nutritional indicators appeared to have fallen and effects on poverty have been fairly inconclusive (rising inequality during the very same period also held back the rural poor),<sup>53</sup> Without enough reliable data for accurate economic analysis, confidence intervals overlap substantially in many of the results, leading to less than convincing results. The findings of Malawi's bold attempts at agricultural input substitution suggest that while it has productive benefits, more pains must be taken in the future to account for externalities, and these types of programs may benefit from additional cross-sectoral support.

Mozambique has undertaken its own attempt at an improved subsidy program since 2001 on a smaller scale. Instead of providing specific inputs, as Malawi did,

Mozambique delivers vouchers to smallholders effected by disaster, or who are simply too poor to jumpstart their capacity on their own, which they can then take to special input markets set up by the government and choose their own inputs for diverse agricultural development. These markets are intended to provide an impetus for market development, but their scope has been limited, with only brief setups in specific areas, such that they have had little lasting impact on the areas they focus in, though they have been successful in their stated purpose of delivering productive assets to smallholders and helping them start off on moving out of poverty.<sup>54</sup>

### INFRASTRUCTURE

Being a landlocked farmer in Sub-Saharan Africa is a dramatic disincentive for further agricultural development because nothing can be done with surplus crops to obtain income, and it is unlikely that storage would be available such that one could provide themselves and their family with food security over the course of the year. Access to transportation is vital to incentivize productivity, income growth, and food security opportunities, and could be remedied with governmental policy and outside investment. Access to all-weather roads coincides with a seven percent decrease in poverty levels because of improved access to markets and healthcare.<sup>55</sup> Post-harvest losses are a further, specific setback to food security amongst smallholders who theoretically produce enough to achieve nourishment and greater economic involvement. This problem could be addressed with investment in community granaries and storage facilities, in which farmers could even contribute to use since they offer income enhancing opportunities. Post-harvest losses could be further reduced by improved roads, which would allow farmers not only to get their surpluses to market, but also processing facilities—a higher income industry which would be able to expand under such circumstances. Transportation networks and post-harvest infrastructure development are likely the most effective ways in which policy tangentially support the agricultural sector in Sub-Saharan Africa.

### CROSS-SECTORAL COMPREHENSIVE POLICY

There are large benefit-to-cost gains from policy intervention in agricultural sectors, but even larger gains could be made from efforts that can more directly prop up nutrition. The various factors that tie into food security are complex and interconnected, making coordinated policy approaches that target multiple variables challenging. However, where it has been attempted and managed,

several such coordinated policies have shown evidence of success. Perhaps the most notable case of cross-sectoral planning by an African government is that of Senegal. Senegal launched its first round of significant policy intervention from 2002 to 2007, during which nutrition spending increased sevenfold, followed by additional strategies in 2007-2011 and 2012-2017. They established the Unit for the Fight Against Malnutrition, comprised of the Ministry of Health, Agriculture, and Family and Education, as well as provincial governors, local authorities, and international organizations. Efforts have included salt iodization and the fortification of food with iron and vitamin A, with promising results from the early years of its comprehensive policy measures. Between 1990 and 2005, the proportion of children under five who were underweight dropped from 22 percent to 15 percent and the incidence of stunting decreased from 34 percent to 20 percent.<sup>56</sup>

Likely the most comprehensive and far reaching policy intervention program thus far, though most controversial at the same time due to massive up-front expenses and potentially concerning reporting methods, has been the non-governmental Millennium Villages Project. This project, a joint initiative of the Earth Institute at Columbia University and Millennium Promise, has focused on 14 villages in 11 agro-ecological zones in ten countries around Sub-Saharan Africa, affecting 52,000 households, in an attempt to embody the Millennium Development Goals in a way that centers on agriculture. The program started off by using a smart subsidy model to provide fertilizer and improved seed and provided training. With this hands-on approach to increasing output, maize yields increased by at least 220 percent across all sites, teff yield increased 100 percent in Ethiopia (where it is an important staple crop), and all yields achieved were above the control yields, with the least notable changes in millet and groundnut production in semi-arid regions of West Africa. These effects made for a benefit-to-cost ratio of two on average sold at harvest, but was much higher when stored and sold at peak market value, which was made possible by further interventions. The establishment of access to microfinance opportunities enabled the procurement of water management and irrigation systems. Access to nitrogen fixing plants meant sustained fertilization beyond inorganic fertilizers. Agriculture extension officers offered valuable agricultural information. Access to crop insurance provided a safety net for smallholders. Grain storage and access to high value crops provided expanded income opportunities. Childhood nutrition and lifelong decision-making was improved through arranged

donations to school meal programs and nutritional education in classrooms. Business advising was available such that entrepreneurial ventures were able to take off.<sup>57</sup> Such overarching policy interventions are more expensive than one-track investments, and require a greater deal of institutional organization. The final results of such a concentrated program remain to be seen, but it seems as if modifications of strategies such as this may lead to successful developmental efforts in the future.

## CONCLUSIONS AND RECOMMENDATIONS

A number of trends have begun to present themselves over the past several years which will continue to shape efforts to assure access to nutrition through agriculture to the broader benefit of Sub-Saharan African economies. As the population of Africa, south of the Sahara, has risen dramatically over the past several decades, demand for food and nutrition has risen as well, making it difficult to increase, or even maintain per capita food security in some cases due to lags in increases in production. While proportionally food security has managed to become a smaller issue, the absolute number of people lacking access to food and nutrition is at its highest ever, and that number will only continue to rise until population peaks, unless more dramatic efforts are taken to support smallholders. Over the past couple decades, in particular, incomes have risen throughout Sub-Saharan Africa as signs of broad development have taken shape. As food security rises and economies grow, incomes in Africa will continue to grow and demand for food, especially meat will continue to grow in accordance. There have already been slight decreases in cereal production and rises in livestock production in some regions. This will continue to put new strains the supply of nutritious food in the region, especially creating a challenge on smallholders to produce more meat while maintaining and expanding access to nutritious crops. Livestock is a less efficient use of land, and causes additional land degradation in many cases posing further challenges to balancing the environment, staple food supply, and meat supply as a cash crop.

Climate change in recent years has coincided with more extreme weather events and changing climate. If global climate change escalates in the coming years, it will impose severe challenges to agricultural production, and thus access to nutrition. Drought, heat, and disease resistant crops tailored to their specific sub-region will need to proliferate in the coming years, coupled with sustainable intensification methods that provide resilience in the face of climate change. In some cases the interest

of sustained high yields may come in conflict with nutrient biofortification, so more concentrated efforts in the research and development of improved and genetically modified crop varieties may become a necessity to provide food security regardless of any questions concerning the current cost-benefit analysis.

Food security has come a long way over the past forty years, from a fledgling concept, to a broadly accepted necessity for development in Sub-Saharan Africa. As scientific, economic, and policy interaction knowledge has accrued more significantly in recent years, an African “green revolution” appears within reach. There is a need for donors, international organizations, and African governments to increase their actions on these understandings, especially in light of post-2015 global sustainable development negotiations, by directing funds and resources to where they are known to make a difference in improving welfare. Some policy options, based upon those already well understood, seem less explored in practice, and could serve to best promote development going forward. There has been an underwhelming presence of pushes to promote women’s rights in Sub-Saharan Africa, despite the documented evidence of the benefits of gender equality in the promotion of nutrition and economic growth. More policy actions specifically targeting the empowerment of women must be taken. There have been many, single sided approaches to developing food security (and more government spending on agriculture is still needed), but more countries must follow in the footsteps of Senegal and the Millennium Villages Project in putting together multi-pronged approaches to propping up agriculture and achieving human development. As part of this effort, the potential role of safety nets and smart input subsidies must be explored more broadly. Much of the literature on food security seems to downplay the role of food diversity, yet no matter how improved the seeds and inputs get, maize will never be the most efficient crop to grow, nor the most nutritious to consume. In the name of sustainable yields and greater nutritional diversity, education must be provided on sub-regional options for diverse crops, which must then be made available to smallholders, especially biofortified, higher yielding, and more resilient varieties. And, the science of genetically engineered crops should be seriously considered and supported in order find solutions in cases where advanced breeding faces limits. Producing nutrient-rich food in a region plagued by micronutrient malnutrition and food insecurity will be essential, especially as the impact of climate change continues to create greater challenges to populations liv-

ing in vulnerable, low-resource regions of Sub-Saharan Africa. More countries must follow Ghana in promoting measures for better established, and more equitably spread roads as not only an agricultural investment, but as an investment in the long-term development of other industries and to provide an opening to foreign organizations and firms to take a role in rural development. Access to markets is ultimately limiting if African farmers cannot sell their crops in the global marketplace. This will likely pose a significant challenge for decades to come, as has already been a fairly stagnant effort for several decades, but the WTO must work to combat special interest groups and bring OECD members in line with international trade law with reductions of barriers to trade. Perhaps equally as challenging, but on a national scale, must be the continued effort to combat the cronyism and weak institutional abilities of governments that have plagued development efforts in Sub-Saharan Africa for decades. The help of the rest of the world and good policy intent have proven not to be enough, and never will be enough to overcome decentralized authority and large capital leakages—which must be overcome with pragmatically organized institutional frameworks that efficiently and effectively carry out policy decisions. These measures to direct resources towards policy that increases spending strategically in areas that feed into agriculture and nutrition must take a central role in any post-2015 development agenda that hopes to bring positive change to Sub-Saharan Africa. They are the region’s best bet to capitalize on the cumulative developments of the past four decades, and to utilize agricultural and nutritional policy to significantly boost and sustain increases in the standard of living for the region’s growing population.

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