PRIORITIZING FOOD SECURITY POLICIES FOR HEALTH AND DEVELOPMENT IN AFRICA

Science Academy – Policymaker Interaction for Evidence-Based Decision Making

The Second Annual International Conference of the
African Science Academy Development Initiative

Science-Excellence-Progress

Prioritizing Food Security Policies for Health and Development in Africa

Science Academy – Policymaker Interaction for Evidence-Based Decision Making

Cameroon Academy of Sciences

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Dr. Susan E. Offutt of the Government Accountability Office of the US Congress; Dr. Mary Shawa of the Permanent Secretariat, Nutrition and HIV/AIDS, the Presidency, Malawi; Prof. Per Pinstrup-Andersen of the Division of Nutritional Sciences, Cornell University, New York; and Dr. Amos Namanga Ngongi, former World Food Program Deputy Executive Director.

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Preface

Food security remains one of Africa's most fundamental challenges. Yet tremendous promise for moving forward exists through changes in the policy environment. The scientific community—through a nation's science academies—has substantial potential to inform such policy changes through objective and authoritative advisory processes and thereby to contribute to national development. These opportunities were explored from November 15 to 16, 2006 in Yaoundé, Cameroon at the Second Annual International Conference of the African Science Academy Development Initiative (ASADI), *Prioritizing Food Security Policies for Health and Development in Africa*.

A long-term project supported by the US National Academies (US NAS), ASADI seeks to advance the ability of African academies to provide independent, evidence-based advice to their governments and countries on matters related to health. The initiative also aims to foster a deeper appreciation on the part of African governments for decision making based on evidence and analysis—with a view toward building the demand for science-academy-led efforts. Meetings held annually over the 10-year life of the Initiative use a scientific theme to illustrate how African scientists, through the use of rigorous academy advisory processes, can provide value to their governments and other consumers of policy advice.

This regional conference, hosted by the Cameroon Academy of Sciences, was intended to strengthen relationships among representatives of African science academies and the African policymaking community, foster the exchange of ideas on how science academies might be used to support food security policymaking, deepen participants' understanding of the process of evidence-based policymaking and its potential value, and provide relevant input and insight for their work and interests.

This year's conference theme, food security, is both representative of one of Africa's greatest needs and illustrative of the potential for evidence-based advising. Food security is also relevant to a wide array of scientific disciplines and is a central policy issue for most African countries.

Over 150 people from the continent and beyond attended the conference. Delegates included high-ranking civil servants, such as cabinet ministers and members of parliament, and representatives of the science academies of Cameroon, Ghana, Kenya, Nigeria, Senegal, Uganda, South Africa, Sudan, Zambia and Zimbabwe, and the African Academy of Sciences. Representatives of university and research institutions, the donor and foundation communities, the private sector, the media, and students also took part in the conference. Participants from beyond Africa included representatives of the US National Academies, the Royal Society of the United Kingdom, the Royal Society of Canada, the Canadian International Development Research Center, the International Council for Science, the UN Food and Agriculture Organization, the UN World Food Programme, and the Consultative Group on International Agricultural Research.

A diverse slate of speakers stimulated discussion at the conference about the key food security policy issues in Africa and the possible points of entry for science academies; the policymaking

process in Africa and the factors that constrain or promote the use of evidence in decision making; potential approaches or methodologies for evidence-based advising; and factors that may help nurture productive relationships between policymakers and science academies.

This report was prepared by the project staff and consultants, with assistance from the US National Academies, as an integrated summary of the presentations and discussions of the conference. The report summarizes what was stated in the sessions and is not intended to be a comprehensive review of the subject matter. Nor is it intended to be a consensus report. The chapters are organized according to the conference agenda, which can be found in Appendix A. Chapter 1 introduces the concept of food security, its significance in Africa, and its causes and effects. Chapter 2 introduces the concept of evidence-based advising, with several examples of methodologies for evidence-based advising offered in Chapter 3. Chapter 4 summarizes a discussion on the policymaking process in Africa and the degree to which scientific evidence can be used in decision making. Chapter 5 highlights currently controversial areas in public policy where the rigor of an academy's advisory processes could add value for decision making across a variety of areas related to food security: nutrition, agricultural productivity, resource management, markets and trade, planning for acute food emergencies, and institutional capacity development. Through discussion and examples, this report demonstrates the multidisciplinary nature of public policy controversies and underscores the reasons why science academies, through their ability to convene a nation's leading scientists from across disciplines, can yield advice that is uniquely credible to support national food security policy development.

Vincent P.K. Titanji
Organizing Committee Chair

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Executive Summary

The Second Annual Conference of the African Science Academy Development Initiative (ASADI), *Prioritizing Food Security Policies for Health and Development in Africa*, was hosted by the Cameroon Academy of Sciences in Yaoundé, Cameroon, on 15–16 November, 2006. Supported by the US National Academies, ASADI aims at building the capacity of African academies to provide independent, evidence-based advice to their governments as well as encouraging such governments to appreciate the importance of decision making based on evidence. The main objective of the conference was to explore the value and process for science academies in Africa to contribute to food security decision making. Among the participants were science academy representatives and policymakers from throughout Africa. This summary first covers conference introductory sessions on the extent, effects, and causes of food insecurity, the benefits of evidence-based advice, the value of an advisory role for science academies, and diverse examples where decision making has benefited from evidence-based advising. The summary describes a policymaker roundtable discussion session in which government officials identified opportunities and obstacles for evidence-based advice in the African context and what science academies can do to improve their role as advisors and their communication to policymakers. Finally, the summary reviews specific food security policies that might benefit from academy advising.

The Scale, Effects, and Causes of Food Insecurity in Sub-Saharan Africa

Nearly one-third of the total population in Sub-Saharan Africa (SSA) is undernourished, and undernutrition is more prevalent in SSA than in any other region of the world. While the prevalence of undernutrition has decreased over the last decade in Western, Eastern and Southern Africa, it has deteriorated in Central Africa. Undernutrition is the underlying cause of 60% of child mortality in Developing Countries including SSA. The major causes of food insecurity were identified as natural disasters, man-made disasters, conflicts, and economic and institutional failures. Major policy frameworks to address the challenges of food security include the World Food Summit, the Millennium Development Goals (MDGs), the Comprehensive Africa Agriculture Program, the Africa Regional Nutrition Strategy and the Commission for Africa.

Conference speakers noted the unique value of science academies in enabling food security policy development through communicating effective interventions, bringing multiple disciplines together, helping build institutional and human capacity, and strengthening data quality and collection.

Benefits of Evidence-Based Advice and the Value of an Advisory Role for Science Academies

Conference speakers emphasized the potential benefits of a closer engagement between scientists and policymakers. An evidence-based decision-making approach, drawing upon the strengths of science academies, can help policymakers solve critical development problems and reinforce the principles of good governance.

By mobilizing the best minds in a nation, working independently from government, and using rigorous processes, science academies can ensure that information provided to policymakers is accurate, reliable, and free from influences and special interests. In the political arena, where many interest groups often attempt to influence decision making for private gain, credible information from a neutral, authoritative source is of great value to policymakers in serving and accounting to the public, particularly when government actions may be based on evidence but unpopular. Evidence-based advising and decision making can therefore promote greater transparency of the decision-making process, public acceptance of decisions, and confidence and public participation in the decision-making process.

Several case studies were presented from the Cameroon and the United States contexts in which food security policy change was a direct result of evidence-based science advice. The first case study illustrated how research results led to a policy change—iodization of salt—that contributed to the elimination of goiter in Cameroon. A series of US National Academies studies requested by government agencies helped to inform publicly funded food security research, the methodology for measuring food insecurity, the improvement of food and nutrition data collection, interventions to prevent micronutrient deficiencies, and the design of food safety and food assistance programs for vulnerable populations. Even when a government agency has in-house scientific expertise, advice from an academy can be used to answer politically sensitive questions, to reinforce the advancement of a particular agenda, or to corroborate a request for new funding. It became evident that even in countries like the United States where several providers of advice exist, the US National Academy of Sciences still has a competitive edge because of its long-standing history, reputation for excellence, rigorous processes and government mandate to provide independent advice. Participants discussed steps involved in making a formal request for a study within a government agency and strategies for the dissemination of results to broad audiences.

Opportunities and Obstacles to Evidence-Based Advising in Africa

Policymakers from Cameroon, Ghana, Kenya, Nigeria, Senegal, South Africa, and Uganda examined the state of evidence-based advising in Africa and its potential, the decision-making process in Africa, and the factors that may constrain the use of science advice. Policymakers noted that in Africa, there is strong need, demand, and potential for the use of evidence-based advice in decision making, particularly in establishing government priorities and ensuring government accountability. They noted further that in many African countries, there is a complete absence of evidence feeding into decision making, leading to either erroneous decisions or no decisions at all. They emphasized the strong need to strengthen links with independent sources of advice, particularly science academies. Mechanisms for providing advice from within government could also be improved in African countries. Internal advisory relationships exist among ministries in most African countries, but these relationships are crisis-orientated and informal. For highly controversial issues, scientific advice from within the government may not be as credible as independently generated advice that may be provided by science academies.

Several factors influence the policy process and may constrain the ability to use scientific advice, policymakers said. A lack of institutionalized mechanisms to channel information to the political hierarchy and rapid turnover of senior ministry officials may prevent the establishment and maintenance of advisory relationships. Lack of appropriate education, low level of understanding of science and its value, and political and cultural influences on decision making may interfere with some policymakers' ability to use scientific advice. Finally, inadequate capacity to conduct and disseminate research in Africa may compromise the overall quality of the advice to which the research is an input.

What Policymakers Want from Science Academies

Policymakers indicated that science academies need to understand the policymaking process, identify points and time of entry, deliver the right message and package it effectively. They suggested strategies to science academies for strengthening their advisory role and improving their communication with policymakers.

Improving the Advisory Role of Science Academies

To improve their advisory role, science academies need to:

- Have knowledge of the policymaking process and the policy instrument to be influenced;
- Time the advice strategically, intervening during the discussion phase of the policymaking process before key decisions are made;
- Intervene at the appropriate level of government (e.g., the ministerial level, the sub-parliamentary committee level, etc.);
- Directly engage with government to determine need;
- Respond swiftly when advice is requested;
- Have databases of experts ready so that intellectual resources can be tapped quickly to address any question; and
- Identify policymakers who can champion a science academy's ideas.

Improving Science Academy Communication to Policymakers

To improve their communication with policymakers, science academies need to:

- Be clear, succinct, logical, and analytical in advisory documents;
- Use simple language and avoid scientific jargon;
- Clearly state the bottom-line advice with minimum scientific uncertainty;
- Frame recommendations to include potential unintended consequences, long- and short-term benefits, and potential social benefits;
- Provide the cost advantages of the recommended policy alternative over others;
- Include a 3–5 year implementation timeframe;
- Include a monitoring framework in the text; and
- Provide supporting evidence.

Informing Food Security Policy Challenges

Public policy challenges in areas of food security that would potentially benefit from analysis by science academies were identified in nutrition, agricultural production, natural resource management, management of acute food emergencies, and development of institutional capacity for research, education, and innovation in the system of food and agriculture. There were presentations and discussions on understanding nutritional influences on human immunity; biotechnology and its application to African agriculture; informing water-management policies to promote food security; improving nutrient management, property rights and sustainable management of natural resources; management of acute food emergencies; and strengthening capacities for research, education/training, and innovation and technology commercialization in the food and agriculture system. For each of these, suggestions were made for the role of science academies in resolving the hot or controversial issues as described in Box ES.1.

Box ES.1
Policy Issues that Could be Informed by African Science Academies

Understanding Nutritional Influences on Human Immunity

- Synthesizing knowledge on the relationship between nutrition and HIV/AIDS and TB
- Synthesizing knowledge on the effectiveness of nutritional interventions for HIV treatment
- Synthesizing knowledge on nutritional interventions at each stage of life

Application of Biotechnology in African Agriculture

- Synthesizing information on the safety of genetically modified crops for human health and the environment
- Identifying ways for African countries to gain access to existing proprietary technology and stimulate and protect biotechnology innovations
- Examining the trade-offs between the income benefits of genetically modified crop varieties and export risks
- Helping to focus research priorities and investments

Informing Water Management Policies to Promote Food Security

- Identifying ways to recover, store, and use rain water
- Identifying measures to improve water conservation
- Evaluating alternative irrigation technologies for specific soil types and crops and finding solutions to irrigation-related problems such as erosion, salinity, and sodicity
- Identifying ways to better manage floods
- Proposing feasible, cross-sectoral approaches to managing surface and groundwater, river basins, coastal and marine environments, upstream and downstream resources, transboundary water resources, and human systems

Improving Nutrient Management

- Helping governments in the formulation of optimal application rates and frequencies for fertilizers across a wide range of environments
- Advising governments on how to stimulate markets for various types of fertilizers
- Informing governments on the design of regulatory policies to minimize environmental impacts of fertilizer use
- Helping governments design approaches to minimize soil salinization and water pollution from fertilizer and livestock wastes

Property Rights and Sustainable Management of Natural Resources

- Helping governments construct more effective institutional frameworks—such as improved access to land, markets, credit, and infrastructure or promotion of collective action—to enable the adoption of sustainable natural resource management technologies

- Providing information on technological and natural resource innovations and how they may be expanded across spatial and temporal scales
- Suggesting resource management and access interventions that give special consideration for women

Policies for Managing Acute Food Emergencies

- Helping governments establish national food and nutrition surveillance systems to provide credible and timely information for decision making
- Bringing sectors together to bridge data gaps
- Developing a curriculum for training in vulnerability mapping and analysis
- Weighing alternative government safety-net options and food emergency interventions
- Designing systems to stabilize food production during periods of extreme drought
- Advising on improving access to markets and encouraging intraregional trade in order to increase marketable food surpluses within the continent

Strengthening Capacities for Research

- Facilitating communication and planning exercises among the diverse actors and sectors of the food and agriculture system
- Helping the government and the research community plan and prioritize directions and investments in food security research, development, and innovation that are most relevant to the needs of end users
- Catalyzing institutional reforms within research agencies that will enhance the impact of research investments
- Helping research institutes and universities design plans for identifying and recruiting core scientific competencies and for ensuring adequate numbers and appropriate disciplinary and age representation of scientific human resources
- Examining constraints to research publication and design interventions to improve capacity for disseminating research results and ensuring access to information by end-users
- Advising governments and research institutions on ways to improve and support research networks

Strengthening Capacity for Food Security Education/Training,

- Helping governments design more effective training and extension programs to enable improved access to technologies and credit
- Helping governments and training organizations to identify new training needs and design programs for strengthening basic and higher education capacity
- Offering assistance in developing curriculum for new training programs in the area of policy research
- Exploring opportunities for training partnerships across and beyond the continent

Strengthening Capacity for Food Security Innovation and Technology Commercialization

- Helping government develop improved programs to foster more effective working relationships and profit-sharing arrangements between the private and the research community
- Helping government develop policies for intellectual property protection (e.g., patent systems, incentives for private sector investment and innovation)
- Helping government design programs to promote market access and encourage intraregional and international trade

Conclusions

The major conclusion of the conference was that science academies have strong potential to offer guidance to decision makers in responding to challenges of food security facing Africa. Representatives of science academies recognized that providing advice will be challenging but expressed desire to take expectations of service seriously and to have impact. Workshop participants acknowledged that building the capacity of science academies will be important to

ensure that academies actually have the ability to achieve the ambitious aim of serving the variety of roles and contributions to be played by science academies. Strengthening academies of science is needed to develop working relationships with government and more dependably and capably provide advice. Workshop participants further recognized that science academies have to define their unique niche as distinct from other institutions such as universities and research institutes.

Policy makers felt that they had a clearer idea of what science academies had to offer. They perceived a major strength of academies to help governments use scientific evidence to prioritize interventions in response to the continent's food security challenges. Other values of academies were noted in bringing different sectors together, mobilizing experts from multiple disciplines, synthesizing existing scientific information, and recommending the best course of action in the face of conflicting positions.

1 Introduction

Food insecurity remains one of Africa's most fundamental challenges, and it continues to affect human welfare and to hamper economic development. Two speakers, Felicitas Atanga of the Food and Agriculture Organization (FAO) and Isatou Jallow from the World Food Program (WFP), introduced the concept of food and nutritional insecurity in Africa by defining the problem, its causes, and its effects; identifying policy frameworks already in place and those that are needed; and determining the possible contributions that could be made by African science academies to address these issues.

At the 1996 World Food Summit, food security was defined as a condition in which all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 1996). The concept of health includes complete physical, mental and social well-being and not merely the absence of disease or infirmity. Nutrition security is defined as bringing together all of these components—food security, a sanitary environment, adequate health services, and knowledgeable care—to foster good nutritional status through the life cycle and across generations (Benson, 2004). Therefore, it is not possible to address food insecurity without addressing these other conditions.

National food security exists when a sufficient, stable, and safe supply of food is available within a country to satisfy the survival needs and the market demands of its citizens. Household food security, on the other hand, exists when a household produces or obtains sufficient food to meet the nutritional needs of all of its members.

The Scale of Food Insecurity in Africa

The outcome of sustained inadequacies of food is known as chronic hunger. Malnutrition is the physical condition resulting from an inadequate diet or infections that reduce nutrient intake and can include both overnutrition and undernutrition. Micronutrient deficiencies—most commonly iron deficiency anemia, vitamin A deficiency, and iodine deficiency—are another type of malnutrition and are reported by the FAO to affect one-third of the population in Sub-Saharan Africa (SSA). Box 1.1 provides some key definitions of food-security-related terms.

In the African region, the mean daily calorie availability per capita is below the recommended level of 2,100 and in some countries it is below the minimally recommended intake level of 1,800. Over 200 million people in SSA were undernourished in the years 2001–2003, representing nearly a third of the total population (FAO, 2006a). Undernourishment is more prevalent in SSA than in any other region globally (see Figure 1.1; FAO, 2006a). Indeed, WFP reports supporting up to 48.1 million people in SSA in 2005.

Box 1.1 : Some Key Definitions of Food Security-Related Terms

Food security: A situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2001a).

Food insecurity: A situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life. Food insecurity may be caused by the unavailability of food, insufficient purchasing power, inappropriate distribution, or inadequate use of food at the household level. Food insecurity, poor conditions of health and sanitation, and inappropriate care and feeding practices are the major causes of poor nutritional status. Food insecurity may be chronic, seasonal or transitory (FAO, 2001a).

Hunger: An uncomfortable or painful sensation and feeling of weakness caused by a lack of food. Hunger is experienced by people who are food secure and food insecure (Haddad, 2006). Over time, the meaning of the word "hunger" has expanded beyond the scientific, clinical definition to encompass issues of access to food and socioeconomic deprivation related to food. Depending on the user, the concept of hunger can cover a spectrum from the short-term physical experience of discomfort to chronic food shortage to severe and life-threatening lack of food (NRC, 2006).

Malnutrition: An abnormal physiological condition caused by deficiencies, excesses or imbalances in energy, protein and/or other nutrients (FAO, 2001a). Malnutrition results from the interaction of inadequate diet and infection and is reflected in poor infant growth and an excess of morbidity in adults and children alike (Haddad, 2006).

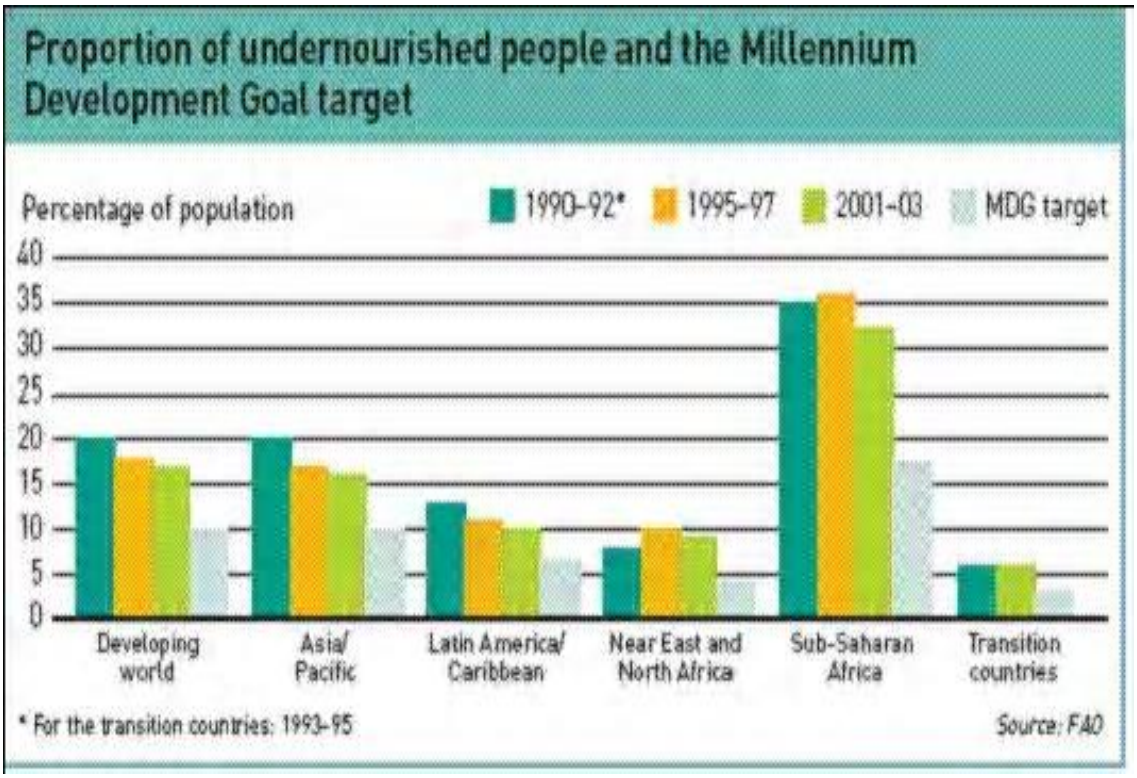
Undernourishment: Food intake that is continuously insufficient to meet dietary energy requirements (FAO, 2001a). Undernourishment is estimated from existing data about numbers of people and the amount of food available to them. Prevalence of undernourishment is measured by the share of a country's total population that is undernourished (FAO, 1999).

Undernutrition: The result of undernourishment, poor absorption, and/or poor biological use of nutrients consumed (FAO, 2001a). Undernutrition is measured using data about people's weight, height and age (FAO, 1999). Lack of specific nutrients can lead to specific deficiency diseases. A vast majority of malnourished people in developing countries experience undernutrition (Haddad, 2006).

Overnourishment: Food intake that is continuously in excess of dietary energy requirements (FAO, 2001a).

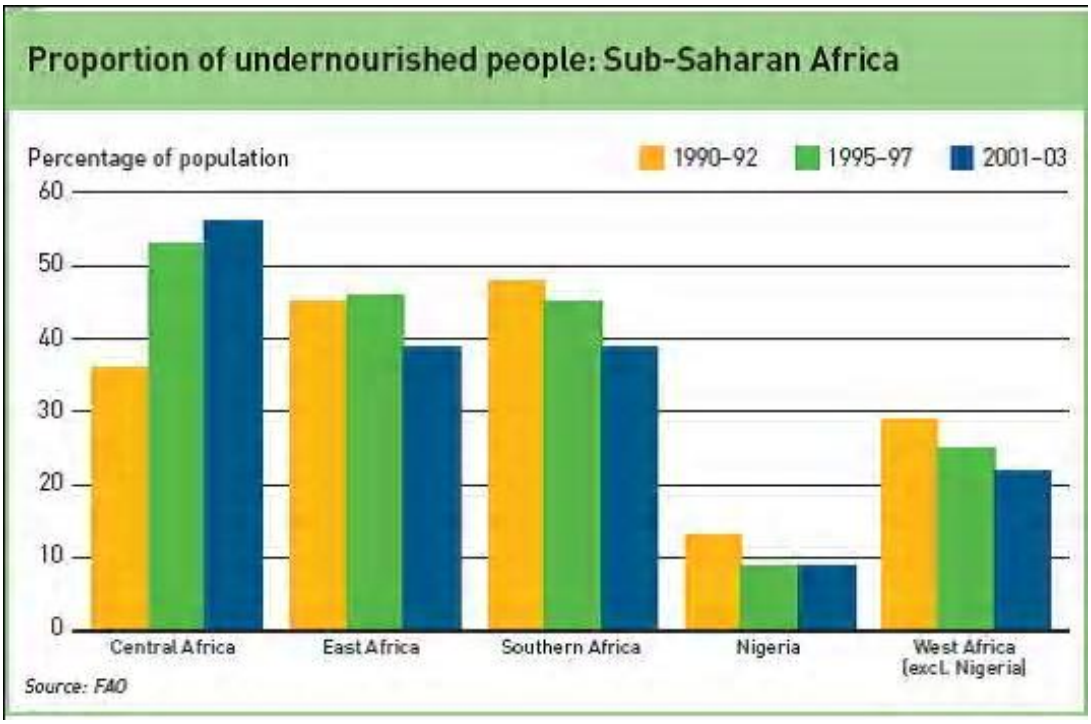
Overnutrition: Malnutrition due to an excess of certain food components such as saturated fats and added sugars in combination with low levels of physical activity (Haddad, 2006).

Figure 1.1: Proportion of Undernourished People Across Global Regions over Time Compared to Millennium Development Goal 1 Targets *(Source: FAO, 2006a)*



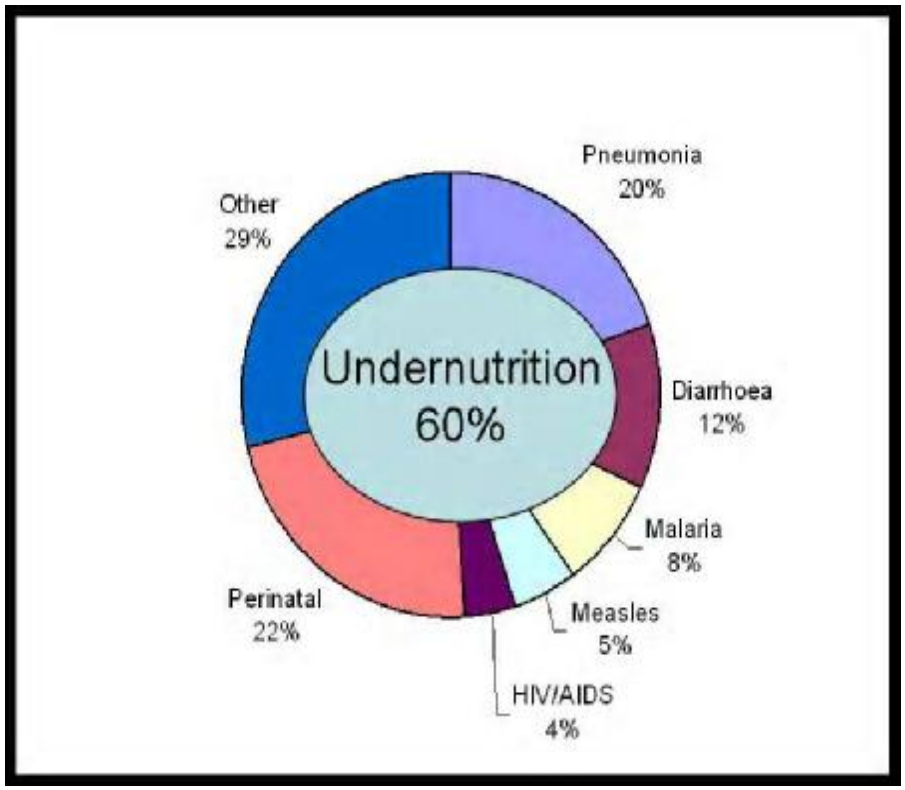
While numbers of undernourished people in SSA have increased over time along with population growth, some progress has been made across the region over the last decade, with the proportion of undernourished people decreasing from 35 to 32% (FAO, 2006a). The prevalence of undernourishment has similarly decreased over the last decade in Western, Eastern, and Southern Africa. However, in Central Africa, largely resulting from the conflict in the Democratic Republic of Congo, the situation has deteriorated, with the proportion of undernourished people increasing from 36% in 1990–1992 to 56% in 2001–2003 (Figure 1.2; FAO, 2006a). In 17 countries in West and Central Africa monitored for the prevalence of underweight children under five years of age (an indicator of undernutrition), five were on track, seven were improving slowly, and five remained unchanged or had worsened.

Figure 1.2: Proportion of Undernourished People in Sub-Saharan African Sub-regions
(Source: FAO, 2006a)



Children in SSA shoulder a large share—41%—of the global burden of child mortality, and undernutrition accounts for a large proportion of this mortality. Each year, an estimated 10.8 million children die, with 90% of the deaths occurring in 42 of the world's lowest income countries, of which 23 are in SSA. WHO estimates that undernutrition is an underlying cause of 60% of the deaths among children under 5 in Developing Countries including SSA (Figure 1.3; WHO, 2002a).

Figure 1.3: Importance of Undernutrition as an Underlying Cause of Child Mortality in Developing Countries including Sub-Saharan Africa *(Source: WHO, 2002a).*



Effects of Food and Nutritional Insecurity

Malnutrition has a substantially negative impact on the African continent through its effects on human growth and development and through its interactions with other development challenges, such as inadequate water and disease. These effects collectively contribute to the failure of food-insecure individuals to achieve their full potential, which in turn affects the continent's ability to achieve sustained economic growth.

Malnutrition is depriving Africa of one of its greatest resources—its people—through a vicious cycle of poor weight gain during pregnancy, low birth weight caused by poor fetal and infant nutrition, stunted growth characterized by poor mental development, high maternal and child mortality rates, reduced productivity, increased susceptibility to illnesses, and premature death. A typical pregnancy in SSA illustrates the devastating effects of this cycle. A pregnant woman in Africa carries a heavy work load up to a week before she delivers, has low weight gain in pregnancy because of inadequate nutrition, and gives birth to an infant with low birth-weight. A child born in such conditions has a poor start in life and continues to go through its infancy in an unsafe environment, prone to frequent infections, and lacking adequate food, health, and care. As the infant moves into childhood and adolescence, he or she will have inadequate catch-up growth, impaired development, stunting, reduced mental capacity leading to lower educational

attainment, and reduced physical labor capacity. Growing into adulthood, this child will have a lower academic attainment, restricted economic potential, and a shortened life expectancy. If this child is a girl, she will go through this same cycle again as a malnourished mother (UN/SCN, 2000).

Beyond its effects on human growth and development, malnutrition has numerous effects on human health through complex links to other development challenges, such as HIV/AIDS or malaria infection, inadequate water, and poor sanitation. Disease infection may reduce the energy resources that can be allocated to ensuring adequate nutrition. Conversely, poor nutritional status may reduce an infected person's ability to fight disease or may reduce the effectiveness of disease prevention and treatment. Inadequate water and sanitation also contribute to malnutrition through lowered agricultural productivity and through the spread of water-related illnesses.

Causes of Food Insecurity in Sub-Saharan Africa

The average number of food crises per unit time has increased globally. Since the mid 1980s, the number of food crises per year has been higher in SSA than in any other region (FAO, 2004). The causes of food insecurity in SSA are diverse and vary from sub-region to sub-region. They can be classified into the following three categories: natural disasters, man-made disasters, and economic and institutional failures. In some cases, one cause of food insecurity may reinforce or exacerbate another.

Natural Disasters

Natural disasters such as droughts, floods, climatic changes, invasion by desert locusts, and animal diseases contribute to food insecurity. In East Africa—one of the two sub-regions most affected by food insecurity both in terms of number of affected people and duration of the food crisis—natural disasters are among the main causes.

Man-made Disasters, Wars, and Internal Conflicts

FAO data show that conflict is increasing as a principal cause of food crisis globally. Between the periods 1986–1991 and 1992–2004, the percentage of food crises caused by humans—principally conflict—more than doubled, while the percentage caused by natural causes decreased. Food crises caused by a combination of factors also increased (FAO, 2004). For 11 African countries classified as chronically food insecure (i.e., those countries experiencing crisis more than 50% of the time over the period 1986–2004), current or past conflict was a principal cause of crisis in all cases. Conflicts have been a cause of food crises in Angola, Ethiopia, Eritrea, the Democratic Republic of Congo, Mozambique, Sudan, Somalia, Rwanda, Burundi, Liberia, and Sierra Leone.

Economic and Institutional Failure

Economic and institutional failure can also lead to food insecurity. Such failures include: lack of effective early warning systems; lack of infrastructure, such as roads; and low agricultural

productivity. Market inefficiencies attributable to gaps in information and lack of access to domestic and international trade may contribute to food insecurity. Additionally, many African governments are reluctant to recognize impending food emergencies, as they feel such an action would be perceived as an acceptance of failure.

Addressing Food Insecurity

A number of policy frameworks have addressed the challenges of food insecurity, including the World Food Summit, the Millennium Development Goals (MDGs), the New Partnership for Africa's Development (NEPAD) Comprehensive Africa Agriculture Development Program, the Africa Regional Nutrition Strategy, and the Commission for Africa. A 2004 conference hosted by the International Food Policy Research Institute, *Assuring Food and Nutrition Security in Africa by 2020,* also examined policy actions that will bring about food and nutrition security. Linking all of these food security-related policy frameworks is a broad array of important factors, including capacity development, gender equality, health, nutrition, market and trade issues, agricultural productivity and rural development, safety nets, and water and sanitation.

At the 1996 World Food Summit, world heads of state committed themselves to the promotion of public and private investments in agriculture in order to reduce, by half, the number of persons suffering from hunger by the year 2015. Following on this commitment in 2003, heads of state and governments in Africa convened in Maputo, Mozambique and pledged to allocate a minimum of 10% of their national budgets to agriculture and rural development for five years.

The World Food Summit commitment to improving food security has been renewed through the 2000 MDG framework, which established a new global partnership to reduce extreme poverty through a series of time-bound targets. Goal 1 aims to eradicate extreme poverty and hunger, with a target of halving the proportion of people who suffer from hunger by 2015. The other MDGs are also closely linked to food security: universal education, health improvement, environmental sustainability, and women's empowerment. The Millennium Development Hunger Taskforce, appointed by the Millennium Project to develop a more concrete plan for achieving the MDGs, has recommended action in the following areas: political commitment and action, policy reform, agricultural productivity, nutrition, safety nets, incomes and markets, and natural resource conservation.

Given the special vulnerability of children to food insecurity, the WFP and UNICEF have initiated the Ending Child Hunger and Undernutrition Initiative. This effort mobilizes political, financial, technical, and other resources required by developing countries to address the immediate causes of child hunger and undernutrition with the overall goal of dramatically reducing it within a generation.

Challenges and Opportunities

Action on the part of African governments may create new challenges and opportunities for science academies to address important issues related to food security.

Communicating Effective Interventions

Speakers noted that academies have a unique value in communicating cost-effective interventions that have a high potential for scale-up. For example, review, validation, and documentation of local agricultural practices could be undertaken by science academies so that effective and affordable practices can be incorporated into development policies and scaled up to deliver large-scale service to the poor. Similar opportunities exist in the area of nutrition interventions. Science academies may have a role in demonstrating how investments in nutrition interventions—such as breastfeeding, complementary feeding, and food processing and preservation technologies—affect nutrient availability at the household level. Academy-led investigations could also address cost-effective interventions in the areas of natural resource conservation and market chain development. Speakers noted that in addition to communicating information on effective interventions to policymakers, academies have a role in "repackaging" such information for popular consumption, for example, through the production of people-friendly or consumer-friendly information on agriculture, nutrition, and health.

Bringing Multiple Disciplines Together

Science academies have much to offer agricultural, nutrition, and health policy formulation because of their ability to convene expertise from multiple disciplines and sectors. African science academies could help to ensure that nutrition and health fields inform agricultural policies and that agricultural considerations are taken into account in health policy formulation. In addition, academies may be effective leaders in bringing together decision makers from different sectors, such as agriculture and health.

Helping Build Institutions and Human Capacity

Both speakers noted a strong potential role for academies in strengthening African institutions. Academies can assist African governments in developing strategies for increasing institutional stability and functionality, building political will, and developing an enabling environment for local and foreign investment and external partner engagement. Academies can also assist African governments and donors in designing more effective systems to develop human capacity to promote food security, with particular attention to women's education.

Strengthening Data Quality and Collection

Both speakers emphasized a potential role for science academies in helping to strengthen the quality, collection, and use of adequate, reliable food security-related data in SSA. Many countries lack sufficient trend data to monitor their own progress toward reducing hunger, so they do not know if the food security situation is improving or deteriorating. The Academy therefore has a role in helping African governments develop statistical systems for data collection and use. Academies can advise governments on the use of data to map vulnerable populations and hunger spots, predict shock spots, monitor and evaluate progress, develop early warning systems, and plan timely, sufficient, and appropriate responses.

2 Potential Benefits of Evidence-Based Decision Making

As the world comes to grips with emerging critical issues—new diseases such as HIV/AIDS, new technologies such as genetically modified organisms, and environmental issues such as climate change—the need for technical expertise in policy formulation and implementation is vividly clear. In their welcoming addresses, the US Ambassador to the Republic of Cameroon, Niels Marquardt, and Professor Michael Clegg, Foreign Secretary of the US NAS, built a case for a closer engagement between scientists and policymakers. They described how an evidence-based decision making approach, drawing upon the strengths of science academies, can help solve critical development problems and reinforce the principles of good governance.

Challenges to Policymakers in Achieving Good Governance

Decision makers in the political arena are challenged to act in an informed way that both serves the public interest and is free from self-interest. There are substantial demands on policymakers to exercise good governance, that is, to formulate and implement decisions in a responsive, impartial, effective, efficient, equitable, and transparent manner. Decision makers are also under pressure to be accountable—to accept responsibility for their judgments, acts, or failures to act—to the citizens they represent and to be able to explain the reasoning behind their actions, particularly those actions that may be unpopular. The recent example of the avian flu crisis in West and Central Africa illustrates some of these challenges. Policymakers are responsible for mobilizing an effective response and educating the public in order to prevent the spread of disease and to avoid panic. In some cases, unpopular decisions—such as culling poultry flocks, restricting travel, or enforcing quarantines—have had to be communicated and explained to the public. Decision makers must thus act visibly, predictably, and understandably.

Although formal government structures are the principal actors in decision making, many informal actors—including powerful interest groups—may make or influence decisions. Some informal decision making or influences on decision-making may result from corrupt practices or may lead to corrupt practices, in which entrusted power is misused for private gain. Interest groups attempting to influence decision making for private gain may sometimes provide policymakers with information that suppresses certain viewpoints in favor of others. Decisions made on the basis of such information are unbalanced. Eliminating corruption, assuring transparency of decision-making processes, and providing access to trustworthy sources of reliable information are therefore critical determinants of effective decision making.

Benefits of a Scientific Approach and Evidence-Based Advising

The scientific approach and the process of evidence-based advising offer strengths that can contribute both to solving public policy questions and to improving governance. Scientific investigation provides a powerful means of creating new knowledge, and the results and methodologies of scientific investigation can be independently verified to ensure that the results are accurate and reliable. Members of the scientific community uphold certain core values—honesty, integrity, sharing information, respect for evidence, and openness—in conducting their work.

Science academies, originally created in the Renaissance as a means to promote science and communication among scientists, are increasingly playing a service role to society. Science academies have a critical function in mobilizing expertise from a broad array of disciplines to review, synthesize, and analyze experimental evidence generated using scientific approaches and making that information available to policymakers. Policymakers can in turn use evidence-based scientific advice to optimize the effectiveness of decisions and to assure that finite assets are optimally used.

Evidence-based advisory processes carried out by academies may contribute to the transparency of the decision-making process in a nation, which in turn can increase the public acceptance of decisions. Working independently from government, science academies can use rigorous procedures to ensure that information provided to policymakers is free from political and ideological influence and financial and other forms of conflict of interest. Science academies can serve as a trusted source of accurate, reliable information to the media, which have an important societal role in promoting transparency and accountability. National and international communities are more likely to accept policies that are supported by the best available scientific evidence from a trusted source of respected experts. A government that seeks and uses evidence-based advice helps to build public confidence.

Evidence-based advisory processes promote public participation in the decision-making process. The evidence-based advisory process provides the public with an independent and high-quality means of participating in democratic debates over national priorities. Evidence-based advisory process can help to defuse tensions or conflict within a nation or between nations. For example, scientific analysis led by an academy may be a useful approach for resolving trans-boundary environmental disputes between feuding states.

In conclusion, as speaker Marquardt noted, truth is at the foundation of ethics. A key objective of evidence-based advising is to unearth the truth through science. It is through openness and transparency that sound evidence-based advising becomes a key component to ethical policymaking and good governance.

3 Methodologies For Advising: The Role Of Science Academies

This chapter outlines case studies from Cameroon and the United States in which food security policy change occurred directly as a result of evidence-based science advice. These examples also provide insights on the factors that might motivate governments to request independent input from science academies.

The first case study, presented by Daniel Lantum and Victor Ngu, illustrates how research findings influenced policy change contributing to the elimination of goiter in Cameroon. Next, three speakers—Susan Offutt, Susanne Stoiber, and Cathy Woteki—provided examples in which the United States government has turned to the US National Academies (US NAS) for advice on issues related to food security.

Informing Policies to Iodize Salt in Cameroon

This success story began in 1991, when professors from the University of Yaoundé School of Medicine in Cameroon conducted a baseline survey aimed at convincing policymakers that goiter—a condition in which the swelling of the thyroid glands can develop into massive protuberances around the neck—was a serious but easily preventable public health problem in the country. Before this study, goiter and cretinism—a congenital condition characterized by severely stunted physical and mental growth due to untreated deficiency of thyroid hormone—were being treated as two separate problems while in fact, they are consequences of the same condition, which is malnutrition due to a diet deficient in iodine.

The scientists sampled sites all over the country, finding a total goiter prevalence of 26% and moderate endemism. This information was provided to policymakers through workshops and pamphlets, and as a result, an assessment was conducted on strategic policy options to address these issues, including iodizing capsules, iodizing bread, iodizing water, or iodizing salt. After reviewing the options and considering the World Health Organization recommendations of 1986 (WHO, 1986), the Ministry of Health enacted a policy to iodize salt.

Implementation of this policy presented several challenges. Since salt manufacturing and fortifying with iodine are performed by industry, the Ministry of Health needed to regulate and enforce the policy. Other challenges included ensuring quality control in the salt distribution chain and selecting a stable iodine source that is resistant to atmospheric loss in a tropical climate.

The Ministry of Health responded to the challenges by engaging the scientific community, industry, and the media. In 1995, a coalition of key stakeholders—scientists and health professionals, representatives of government ministries, WHO, the United Nations Children's Fund, WFP, and the International Council for Control of Iodine Deficiency Disorder—was established by the Ministry to address these challenges and to provide information to the Ministry on iodine. This group was able to gather data demonstrating stability of the iodine through production, distribution, retail, and storage such that adequate amounts were delivered to consumers. To properly manage issues of quality control, the Ministry invested in capacity-

development programs for industry. Industry technicians were sent to Italy to acquire the necessary expertise to iodize salt. Sustained enforcement of the policy was ensured through quality-assurance inspections. The Ministry of Health also engaged the media to bring this issue to the public's attention. At a high-profile press conference, an order was issued stating that salt must be iodized. By gaining the support of the public and the media, the Ministry was able to create a communication network that eventually led to an increased consumer demand for iodized salt. Information on the importance of iodized salt was disseminated through radio, newspapers, and pamphlets, and was even included in the school curricula.

As a result of these combined efforts, iodized salt production increased and the prevalence of goiter decreased throughout Cameroon. In 2002, a national survey was conducted to demonstrate a reduction in iodine deficiency. Salt quality was monitored in factories and in households, and levels of iodine were measured in urinary excretion (Figure 3.1). The survey revealed a rise in the iodine levels in the population. Four industrial producers dramatically increased iodized salt production from 0–90% within the first 9 years after the policy was enacted. Although coverage was sustained, additional iodized salt had to be imported. The prevalence of goiter dropped to 5–8%, and no new cases of cretinism were observed in the population. People were also trained and educated in an effort to prevent a recurrence of these conditions.

Figure 3.1: A) Monitoring Quality of Iodization of Salt at a Factory in Cameroon. B) Monitoring Quality of Iodization of Salt at the Household Level through School Surveys. *(Source: Professor Daniel Lantum)*

Success of the goiter reduction initiative in Cameroon can be attributed to several factors. First, effective relationships were cultivated between policymakers, industry, and concerned scientists through effective communication, with scientists in policymaking positions serving a bridging role. Champions of the cause actively pushed for policy changes in the community. Finally, researchers also assembled a comprehensive database of evidence to support their case and to enact change.

Informing Food Security Policy in the US Government

Speakers Susan Offutt, Susanne Stoiber, and Catherine Woteki provided examples of food security-related policy studies that the National Academies have addressed at the request of the US government. Academy studies in recent years have included reports across a wide range of areas in agriculture, animal husbandry, food, and nutrition. While some of the questions are narrow and others are broad, the process of providing science advice to government is the same.

Speaker Catherine Woteki described a typical consensus-based US National Academies' advisory process, which takes between 12 and 18 months to complete. First, deep interactions take place between the government and the academy to make sure the right questions will be asked. Once the charge is finalized, a balanced committee, free from financial and other conflicts of interest and representing appropriate disciplinary expertise, is appointed. A strong leader is selected to guide the committee. Over the course of its analysis, the committee prepares a rigorous, evidence-based review and exposition of all findings and conclusions. The committee deliberates to identify points of agreement and points of disagreement. A draft report prepared by the committee is then subjected to a rigorous peer review by a group of scientists not involved

with the project. This process ensures that the report answers the set of questions that were requested. Once any concerns identified by external reviewers have been addressed, the final report is released to the public and to the requesting government agency.

Informing Publicly Funded Food Security Research

Susan Offutt, Administrator of the Economic Research Service (ERS) of the US Department for Agriculture (USDA), provided two examples of US National Academies studies that have helped to inform food security research in a US government agency. ERS is one of the dozen principal federal statistical agencies in the US government; its major function is the compilation and analysis of data and the dissemination of information for statistical purposes. ERS, as a research agency, informs policy makers but does not make policy decisions. Offutt said that even for government research agencies such as the ERS, which have in-house scientific expertise, "there are other reasons why we go to a national academy for advice. Not only do you get sound science, but you can also advance an agenda." As an organization that exists in a political environment, the ERS is required to make its research program relevant to politics and policy, yet to be objective in its findings.

Measuring Food Insecurity

Offutt's first illustration showed how the ERS used an Academy study, *Food Insecurity and Hunger in the United States: An Assessment of the Measure* (NRC, 2006), to address the controversial issue of methodologies and measurements of food insecurity, which in turn inform public policy decisions on food security in the United States. In this case, ERS sought independent advice to answer a politically sensitive question. The reputation and objectivity of the science academy and the quality of its advice were key factors in the decision to request the study.

Over the past decade, the ERS has been conducting research through national household surveys to estimate food insecurity. For instance, the December 2005 survey indicated that 12.6 million US households (11 %) were food insecure at some time during the year, meaning that they had difficulty meeting basic food needs because they lacked money and other resources for food.

Although USDA has sponsored a rigorous research program on the measurement, meaning, and reliability of the food security statistics, these efforts have raised some major questions regarding the underlying concepts, the estimation methods, and the design and clarity of the questions used to construct the food insecurity scale.

"In a country as wealthy as the US, where most people can readily afford to put enough nutritious food on the table each day**,** some thought it was a waste of resources to do the survey. Others just didn't understand the concept of hunger, and a number felt that unless there was evidence of need, school-feeding programs should be done away with."

Furthermore, because the results were computed at the national and state levels, the measure inevitably highlighted the correlation between food insecurity and state poverty, making it sensitive politically, especially because it gets a lot of media play, often hitting the front pages of

newspapers. There were also disparities between the levels of state poverty and food insecurity, raising concerns about whether USDA measurement of food insecurity does, in fact, fairly represent differences in food hardship across states.

To maintain the credibility of these surveys as a guide to federal policy, which subsequently determines the level of public effort that should go toward reducing food insecurity, it became critical for the ERS to get an independent consideration of the food security measure.

The ERS therefore approached the US NAS Committee on National Statistics (CNSTAT) to conduct a study on the measurement, meaning, and reliability of the food security statistics and how they could be used to design better policy instruments. This review marked a milestone for food security measurement in the United States. In addition to recognizing the contribution made by food security statistics in the policy and program arenas, the panel also confirmed the expected relationships between food insecurity and income, education, demographics, employment, and disability of households resident in the state.

The panel recommended that USDA continue to measure and monitor food insecurity in the United States. It also identified several potential improvements to the measurement methods and recommended that USDA explore those further. One recommendation in particular attracted much attention: that hunger—which is experienced by individuals—should be treated as a concept distinct from, but measured in the context of, food insecurity—which is in turn experienced at a household level.

As a result of these recommendations, the USDA has made changes in the language used to describe food insecurity in order to more explicitly differentiate it from hunger. Removing "hunger" from the descriptors of the survey results may well be seen as downplaying the significance of food insecurity in the United States, although that was not the intention of the CNSTAT panel of experts. To statisticians, this might look like an increase in accuracy. To the activist community, it could appear to deemphasize hunger. The value of the US NAS report is in reinforcing the decision and in confirming the reliability of the food security measure as an assessment of households' economic access to enough food. A consistent picture emerges from these studies. The food access problems reported by households in response to the questions in the food security survey can be taken at face value. Statistics on food security and food insecurity can be used with confidence to inform policy and program decisions.

Improving Food and Nutrition Data Collection

Susan Offutt's second example showed how the ERS used advice from the US NAS to justify new federal funding for the acquisition of new data to advance understanding of patterns of food consumption in the United States. ERS had been interested in expanding food consumption data collection because of the changing nature of demand for food in the United States, with consumers increasingly defining what is produced, how food production takes place, and with what effects. "These developments raise important and intriguing policy and research questions such as the cause of the increase in overweight and obese Americans: Are people eating more, eating the wrong foods, exercising less, or some combination of these? How do changes in food markets—food prices and availability—affect what people consume? How do other factors—

such as income, time, resources, and consumers' preferences and knowledge—affect food consumption decisions, and how have they changed over time? How do factors outside of homes—such as the availability of stores and restaurants, food and food preparation technology, food marketing, labeling policies, and incorporation of advances in dietary knowledge into health care delivery—affect what people are consuming and the consequences for their health and safety?" questioned Offutt.

The ERS wanted to expand the scope of measuring food consumption to more accurately interpret consumer demand shifts, help ensure supplies of safe and nutritious food, and assist farmers to prosper in new ways of doing business in diverse and ever-changing food markets. The US Department of Agriculture traditionally had monitored production of food commodities at the farm level and food consumption at the individual level. However, it had no way to trace food commodities from the farm-gate to the dinner plate—through the production, manufacturing, and distribution systems to specific foods purchased at the store or at restaurants and eaten by individuals.

ERS asked CNSTAT to convene a panel of experts to provide advice for improving the data infrastructure on food consumption and nutrition. This panel was charged with reviewing data needs to support research and decision making for food and nutrition policies and programs within USDA, assessing the adequacy of the current data infrastructure, and recommending improvements.

The primary recommendations of the panel's report, *Improving Data to Analyze Food and Nutrition Policies,* included improving inter-agency cooperation for the management of data sources, specifically the consideration of low-cost ways to enhance the usefulness of federal surveys by linking them with administrative records. The panel also urged exploration of the use of data to monitor food purchases, prices, and consumption from proprietary retail scanner systems, household scanner panels, and household consumption surveys (NRC, 2005).

To implement the committee's recommendations, the ERS requested additional funds from the US Congress to build an integrated and comprehensive data and analysis framework. ERS was able to obtain an additional US$4 million for data collection on food consumption by Americans. This idea could have been seen as an effort for the ERS to increase its own budget, but the US NAS panel reinforced and validated the importance of the task and raised the importance of monitoring data on food and consumption.

Micronutrient Deficiencies

Susanne Stoiber, Executive Officer of the National Academies' Institute of Medicine, described a US NAS study on micronutrient deficiencies requested by the US Agency for International Development in the 1980s (IOM, 1998). An expert panel appointed by the Institute of Medicine's Food and Nutrition Board was asked to review micronutrient deficiencies that affect more than 3 billion people worldwide and to make recommendations to aid agencies. After their deliberations, the committee recommended to the agency the universal iodization of salt in order to prevent iodine deficiency.

Ensuring Safe Food

Susanne Stoiber and Catherine Woteki highlighted several US NAS studies relating to food safety. Stoiber described a study conducted and completed in 1998 entitled *Ensuring Safe Food from Production to Consumption* (IOM and NRC, 1998). This report addressed the problems that occur because food regulation in the US is divided between two cabinet agencies—the Food and Drug Administration (FDA) and the US Department of Agriculture (USDA)—which use different scientific standards and regulatory capacities and deliver different standards of effectiveness. Historically, USDA is responsible for regulating the safety of meat and poultry, while the FDA is responsible for regulating the safety of fruits and vegetables. The committee recommended use of common food safety standards, and although this recommendation was not implemented, it still remains a useful guidepost. Stoiber noted that in some cases, producers' or industry's interests are so strong and so powerful in influencing government that they defeat the best recommendations that an academy might make.

Woteki described another Academy study—*Escherichia coli O157:H7 in Ground Beef: Review of a Draft Risk Assessment*—that was requested by the US government to inform a food safety regulatory decision. Woteki, a former presidential appointee and the first US Undersecretary for Food Safety of the US Department of Agriculture, had been charged with transforming the food inspection system at USDA and working with the Food and Drug Administration to use risk assessment and risk analysis approaches to formulate policies.

While the US food supply is widely considered to be among the safest in the world, foodborne diseases still cause many illnesses, hospitalizations, and deaths in the country. In the face of this public health problem, USDA was formulating risk assessments to identify important foodborne hazards; evaluate potential strategies to prevent, reduce, or eliminate those hazards; assess the effects of different mitigation strategies; and identify research needs. These risk assessments characterize the determinants of the level of microbial contamination in vulnerable foodstuffs at various points leading up to consumption.

One of the initial efforts under way at the time was a risk assessment of the public health impact of *E. coli* O157:H7 in ground beef. Woteki sought help from the National Academies in reviewing the draft risk assessment and in offering recommendations and suggestions for consideration as the agency finalized the document (IOM, 2002).

Food Assistance Programs for Vulnerable Populations

In 2005, another US National Academies study was requested by USDA to develop a new model for food assistance provided to American women, infants and children who are poor and cannot buy an adequate amount of food to support health (IOM, 2005). An expert panel appointed to look at the programs of the USDA concluded that the food assistance program did not enable mothers to make good food choices that were consistent with traditional diet and culture. The panel recommended changes in assistance to vulnerable populations to enable them to find food that fits family eating habits. The USDA implemented all of the changes suggested.

Discussion and Conclusions

One conclusion from these examples was that even in countries like the United States, in which a number of alternative providers of advice exist—such as professional societies, universities, and private companies—the US NAS still has a competitive edge because of its long-standing history, reputation for excellence, rigorous processes, and government mandate to provide independent advice.

Symposium participants discussed the steps involved in making a formal request for a study within a government agency. Substantial effort, approval, and financial resources are usually required. Sometimes government agencies are conservative and resist advice from an institution they cannot control. It is often necessary for those supporting a request for a new study to explain the value of substantive recommendations from a prestigious body. In Susan Offutt's experience, government agencies will often scrutinize the questions carefully and at times will claim that they cannot afford a study if they are resistant to substantive input.

Studies also need not initiate original research. In the US National Academies' experience, committees answer questions based on work that is already published in scientific journals. Their reports are a synthesis of existing information. Only in rare cases is it necessary to do original data gathering and analysis.

Conference participants discussed strategies for dissemination of study results to broad audiences. Some participants observed that dissemination based on publication often does not reach most beneficiaries. Susanne Stoiber shared that in the US experience, it is often a struggle to obtain resources to disseminate reports because the government agencies that pay the academy to develop studies often don't want to provide money to disseminate the results until they are sure they like the results. She noted that short summaries are a very useful dissemination tool. These can be made available to any lay person and contain the key points of a report. In addition, studies that can be accessed and downloaded on the Internet are a low-cost dissemination tool. The biggest measure of the dissemination studies, however, is the degree to which their conclusions and recommendations are implemented.

4 Evidence-Based Advising and the Policymaking Process in Africa

This chapter summarizes a conference discussion among African policymakers about the relationship between evidence-based advising and the policymaking process in Africa. Government leaders from Uganda, Kenya, Ghana, Cameroon, Senegal, Nigeria, and South Africa participated in the dialogue. The topics examined included the state of evidence-based advising in Africa and its potential, the decision-making process in Africa and the factors that may constrain use of science advice, and strategies for improved communication between science academies and policymakers.

The State of Evidence-Based Advising in Africa and its Potential

Need for Evidence-Based Advice

Policymakers recognized evidence-based advising as a positive and powerful input into the policymaking process that can have substantial benefit to society. In Africa, there is a strong need, demand, and potential for the use of evidence-based advice in decision making, particularly in the context of establishing government priorities and ensuring government accountability. Policymakers noted that in many African countries, however, there is a complete absence of evidence feeding into decision making. Without information, many decision makers either make an erroneous decision or cannot take a decision at all.

Independent Advice

Policymakers emphasized that there is a strong need to strengthen links with independent sources of advice, particularly with science academies. The visibility, prestige, respectability, leadership, and national standing of a nation's science academy make it a particularly attractive and credible potential source of advice. Science academies have a great deal to offer in terms of assembling evidence, commissioning policy research, commissioning case studies, and being an active stakeholder. Participants observed that in some countries there are other quality bodies external to government, beyond the academy, that also inform the policymaking system using evidence.

Advice from within Government

In most African countries, if scientific input is used in the policy process, it is often drawn from government in-house scientific or technical capacity. This frequently takes the form of an operational, or "action", ministry seeking assistance on a particular problem from a research ministry. The representative from Ghana described such a relationship between the Ghanaian Ministry of Food and Agriculture and the Ministry of Scientific Research, but he noted that such relationships tend to be crisis-orientated and informal. Another participant described efforts by one ministry to develop science-based informational materials, such as manuals on HIV/AIDS, on its own. In many ministries, however, there is a lack of in-house capability to assemble and interpret the existing scientific research results underpinning policy issues. Many ministries often

do not have access to the Internet or to functioning computers to gather information, or they lack adequate research skills. In addition, for the most controversial issues, scientific information that is communicated from within the government may not be as credible as independently generated scientific information.

Several participants suggested that there could be potential value in strengthening the quality of science expertise embedded within the government. Recruiting and training scientists who can serve parliamentarians and other decision makers within government would permit decision makers to follow scientific events and to operate more effectively. Another participant suggested that elected officials and other decision makers who themselves have scientific training can improve the policy process.

Factors Influencing the Policy Process and the Ability to Use Scientific Advice

Institutionalizing, Building, and Sustaining Advisory Relationships

In spite of a high level of demand for evidence by government and an awareness of the existence of science academies, policymakers emphasized that a lack of institutionalized mechanisms to channel information to the political hierarchy prevents the establishment of advisory relationships. Participants suggested that more formal relationships should guide the interaction between government and external advisory bodies, such as science academies.

A lack of formalized relationships also makes it difficult for African governments to mobilize the in-house scientific capacity that they may have for decision making. Interactions between the scientific branches of government and the operational branches of government were described as "firefighting" relationships. Participants observed that the government's structure does not facilitate relationships between science ministries and action ministries. In many countries, operational, "action"-oriented agencies lack a research function, or the research function is housed in a separate agency. Stovepiping of the ministries (e.g., between the agriculture and health ministries) makes it difficult to address issues with scientific basis in a coordinated and holistic fashion or to set a national research agenda.

Rapid turnover of senior ministry officials is a major constraint to cultivating and sustaining science-advisory relationships to government. Relationships have to be cultivated freshly each time new leadership enters government. Sustaining such relationships across administrations can be extremely difficult. In some cases, an entire political party may be dominated by individuals for whom science is not an important factor in decision making.

Level of Understanding of Science and its Value

Policymakers may not have the same level of education or understanding about the scientific approach as scientists, and this affects their ability to use scientific information in policymaking situations. Policymakers commented that they sometimes have difficulty using science-based information because of its ever-evolving nature. One participant from Cameroon remarked, "[We] are never quite sure what is right. One day, we are told that DDT is one of the best

products for preventing malaria; the next day, we are told that some of the products are banned and that DDT has harmful environmental effects." A lack of understanding of the process, value, and use of science may explain why some policymakers fear and reject new or externally developed technologies, and why scientific research is frequently not perceived as a high priority in the budgetary process.

Political and Cultural Influences in Decision Making

Political and socio-cultural factors are key determinants in decision making in Africa and are frequently considered more important than scientific merit by some decision makers. Participants noted that political interests often have a large stake in the outcome of a decision and may have strong influences on decision makers. A policy alternative based on scientific evidence may be threatening to certain interests, as there are sometimes parties that benefit from the status quo. Such interests may prevent a policy based on evidence from becoming implemented. Elected officials eager to secure another term in office can also influence decision making, either by avoiding particularly controversial decisions that may offend a political party or constituents, or by selecting priorities that may advance their political standing.

Cultural factors also play a role in decision making. One cultural value in many African countries—an individual's status—may carry substantial weight in decision making. An influential individual may thus be able to override a scientifically based argument. In addition, some scientifically based policy options are not culturally acceptable. There is a scientific consensus that female genital mutilation is a harmful practice, one participant observed, but the intensity of cultural beliefs has kept many African countries from implementing that advice. Policymakers urged science academies to include a consideration of social, cultural and ethical factors in any given analysis; many of these factors are at play at the community level.

Capacity to Conduct and Disseminate Research

A policymaker from Cameroon expressed concern that the poor quality of research in Africa—a key input to a local evidence base—may jeopardize the quality of evidence-based advice to government. He pointed out that although Africa has the competence to work and to provide advice, there is limited capability to conduct excellent research. Lack of funding is a common constraint to conducting research, publishing, and disseminating the results so that they are prominent.

Strengthening Communication Between Science Academies and Policymakers

Policymakers provided valuable suggestions to science academies on how evidence-based advising might be strengthened through a better understanding of the policymaking process and more effective communication.

Understanding the Policymaking Process, Identifying Points of Entry, and Getting the Timing Right

Policymakers challenged scientists and science academies to learn more about policymaking process, the types of policy instruments to be influenced, when it is possible to intervene, and with whom. Kweku Baah, a representative from Ghanaian Ministry of Food and Agriculture, described the steps of a typical policy decision from his experience (see Box 4.1). In Ghana, any policy proposal is first discussed with the Prime Minister and then with the full Cabinet. Negative and positive aspects of the decision are discussed, including social benefits and other outcomes. Next, funding is requested to implement the decision. Baah remarked that scientific input during the discussion phase of the process would be useful in making a better case for pursuing a particular strategy. Any critical research that promotes social benefits could be assembled and "sold" to a ministry by an academy. Sub-parliamentary committees are another point of entry in which science academies could introduce advice. He observed that once a policymaker is persuaded on an idea, he or she will advance that agenda.

Policymakers cautioned that strategic timing of science academies' interventions is critical. Science academies should deliver their message before, not after, key decisions are taken. Policymakers encouraged science academies to begin engaging directly with the government to determine the needs as a first step. Academies should also prepare to move swiftly when a request for advice is issued. For example, academies should maintain databases of experts related to particular issues. Such experts could be tapped at short notice to formulate advice.

Box 4.1
Steps in the Policy Process and Examples of Policy Instruments in the Republic of Ghana

Steps in the Policy Process

Issue identification
Assembling the evidence
Problem identification
Stakeholder consultations
Identify solution scenarios and options
Deliberate policy options – consultation loop
Finalization for Ministerial review
Cabinet consideration
Drafting of legislation
Legislative consideration
Presidential consent

Examples of Policy Instruments

Act of Parliament
Legislative instrument
Executive instrument
Government white paper
Ministerial policy paper, order, instrument

Source: Science and Technology Policy Research Institute, Republic of Ghana

Delivering the Right Message and Packaging it Effectively

Policymakers stressed that it is incumbent on science academies to communicate effectively to the government, the media, and the general public. Both the substance and the presentation of the message are important in delivering effective advice.

Policymakers expressed a desire for the advice to include a treatment of various policy alternatives and their consequences. Such treatment is important for policymakers to understand why a certain policy option stands out as the most advantageous. Recommendations should be framed in a way that lays out potential unintended consequences (e.g., unintended beneficiaries of subsidies), long-term and short-term benefits, and potential social benefit and relevance of various policy options. Capturing a positive social benefit is particularly important in cases where a given policy option might be unpopular but is nevertheless based on evidence.

Time, cost, and performance-monitoring considerations are also critical in framing any policy recommendations to government. Policymakers suggested including a 3–5 year timeframe for implementation. Advice also needs to consider the financial implications of proposed interventions. Sometimes evidence-based recommendations can't be implemented because they are too costly or fail to comply with stringent financial reforms imposed by international lending institutions. The recommended option should demonstrate a clear cost advantage over alternatives. Given that many governments need to demonstrate impact of their interventions to donors, provision of a monitoring framework to help measure the results of policy implementation would be very useful to include as part of the advice.

Policymakers want their advice to be effectively conveyed in a documented format. The text of advisory documents should be clear and logically argued, analytical rather than descriptive, and should include a summary of the problem, identification of potential solutions, and a synthesis of the supporting information. Policymakers urged academies to avoid jargon and to use simple language. As policymakers have little time to read lengthy materials, what is communicated should be succinct.

The bottom-line advice should be clearly delineated. One policymaker from Ghana cited an example of an extensive body of scientific research on the health effects of cocoa. The bottom line result of interest to policymakers is that "[t]he more cocoa you drink, the longer you live. Whatever you went through to find that finding, nobody cares". Bottom-line advice should minimize scientific uncertainty, as policymakers find it frustrating when scientists can't agree among themselves. Science academies, in conducting their analysis, should weigh any conflicting scientific opinions and should state which scientific evidence is most compelling. Such differences in scientific opinion need to be fully reconciled before the advice is ready to be conveyed to policymakers.

5 Opportunities For Evidence-Based Advising To Inform Food Security Policies

This chapter highlights public policy challenges across a range of areas related to food security that would potentially benefit from analysis by science academies. Such analysis may help to resolve questions—at times highly controversial ones—related to nutrition, agricultural production, natural resource management, management of acute food emergencies, and development of institutional capacity for research, education, innovation in the food and agriculture system.

Understanding Nutritional Influences on Human Immunity: An Academy Study

Barry Mendelow of the University of Witwatersrand described progress on a study, *Nutritional Influences on Human Immunity*, under way at the Academy of Sciences of South Africa (ASSAf). The study, to be released in 2007, comprehensively reviews the basic science of nutrition and immunity, the influence of HIV/AIDS and TB infection on nutrition, and the converse relationship of nutritional influences on HIV/AIDS and TB infection. A panel of 14 experts, chaired by Mendelow, has been appointed by the ASSAf to conduct the review. The panel includes experts from multiple disciplines, including the following: infectious disease, biochemistry, metabolism, pediatric medicine, molecular medicine, micronutrients, journalism, and reproductive health. The report's recommendations to policymakers will include practical guidance for interventions and research priorities.

The ASSAf study will be the first independent examination of the evidence base relating human immunity and nutrition in South Africa. The relationship between immunity and nutrition has been a controversial issue in South Africa because the government's HIV/AIDS policy has for many years emphasized nutritional interventions, largely in the absence of an evidentiary base, as opposed to anti-retroviral treatment.

The study considers the basic physiology of nutrition and immunology. It examines the major physiologic uses of nutrients (primarily macronutrients, micronutrients, and pre- and pro-biotics) for energy, growth, replacement, and repair. The study also explores the physiologic responses to increasing doses of specific nutrients; in some cases, both deficiencies and excesses of certain nutrients may be harmful physiologically.

The report considers the influences of nutrition, including its uses in providing energy or materials for cellular infrastructure, on the process of fighting infection. Macronutrients—including carbohydrates, fats, and proteins—are important for the growth and repair of white blood cells, of which two types, macrophages and CD4 cells, have a central role in HIV infection. Carbohydrates and fats also have a central role in providing fuel for respiratory or oxidative bursts, which are an important cellular response in fighting infections. Micronutrients, such as antioxidants, help to limit the damage to cellular structures that occurs when large quantities of energy are dissipated through an oxidative burst. Vitamins B, C, E, and trace elements such as sulfur and selenium serve this "fire extinguishing" function.

The panel is also reviewing the clinical evidence of influences of infection, specifically HIV/AIDS and TB, on nutrition. Mendelow noted that causal relationships between disease exposure and nutritional outcomes may be difficult to identify, and that randomized control trials will be among the types of evidence examined by the committee. The nutritional pathology of HIV/AIDS and TB infection is being considered at three levels: reduced food intake, decreased nutrient absorption, and increased nutrient loss and expenditure. A reduced intake of food may result from poverty, poor appetite, and inflammation of the esophagus in infected individuals. A decrease in overall nutrient absorption in infected individuals may result from impaired nutrient absorption through the gastrointestinal tract or increased nutrient absorption by gastrointestinal parasitic helminthes. Finally, some evidence indicates that HIV infection may decrease total energy expenditure while increasing the basal metabolic rate, the minimum energy expended by the body at rest to maintain normal bodily functions. Thus, in infected individuals, much less energy is available for voluntary work. The evidence reviewed so far by the committee appears to demonstrate that immunodeficiency and malnutrition are mutually self-reinforcing—with long-term immunological consequences. For example, children who were malnourished as infants may be less able to resist infections as adults.

Drawing from conclusions based on its analysis, the panel will develop evidence-based policy recommendations for nutritional and health interventions at each stage of life—infancy, childhood, adolescence and adulthood. Recommended interventions will be tailored for the general public, HIV-positive populations, and populations receiving therapeutic nutrition. For example, in light of the enormous prevalence of HIV in South Africa, recommended daily allowances of certain nutrients may need to be adjusted. An important facet of the policy recommendations will be to identify remaining research gaps.

Application of Biotechnology in African Agriculture

Wynand van der Walt, of the Food Agriculture and Natural Resources Policy Analysis Network, reviewed the main applications of modern biotechnology, its potential risks and benefits, the status of technology adoption and biosafety framework development in Africa, and opportunities for application of biotechnology in African agriculture. Samuel Nzietchueng, of the Cameroon Ministry of Scientific Research and Innovation, described international and regional forums in which biotechnology-related policy issues are currently being discussed and provided suggestions on how science academies might help to inform policy decisions.

Biotechnology and Its Application to Agriculture

Biotechnology can be defined as using the biological systems of living organisms to produce specific products efficiently or to produce new products. Modern biotechnology includes genetic modification technologies, which "overcome natural physiological, reproductive or recombination barriers and are not techniques used in traditional breeding and selection" (Convention on Biological Diversity, 2000). Uses of and products from modern biotechnologies have become part of life in all countries and cover a wide spectrum of applications, including genetic diagnostics, human and animal health products, industrial and food processing applications, and crop and livestock production.

Genetically modified (GM) crops are the application of modern biotechnology most relevant to increasing food security. GM plants used in commercial agriculture may include traits for improving crop yields or for improving product quality, such as herbicide tolerance, insect resistance, virus resistance, delayed ripening, increased shelf life, altered fatty acid composition, and altered starch composition. GM crops are cultivated on all continents and covered some 90 million hectares in 2005.

Assessment of Risks and Benefits

GM food crops in many countries have been subjected to extensive risk assessments before approval for trial and commercial release. These assessments have often been more stringent than those of new varieties and food products obtained through conventional methods. Currently cultivated biotechnology crops have not been found to have adverse effects on the environment or on human health (FAO, 2004; Sanvido et al., 2007; WHO, 2002b). Some environmental and human safety benefits of GM crops bearing insect-resistance genes have been documented. Brooks and Barfoot (2004) report less pesticide residue, less exposure by farmers to pesticides, replacement of herbicides that persist in the environment with ones that are rapidly broken down in soil, less damage to non-target insects, facilitation of crop rotation, and reduced tillage. Van der Walt advocated that forthcoming new biotechnologies should continue to be managed on a case-by-case basis to ensure environmental and human health safety.

Economic benefits have been studied extensively and reported for cotton engineered for insect resistance with a toxin-producing gene from the bacterium *Bacillus thuringiensis* (Bt) (Ismael et al., 2001; Gouse et al., 2003). Smallholder Bt cotton farmers had 18 per cent higher yields over two seasons, used 33 per cent less pesticide, and had a 20 per cent higher gross profit margin than farmers growing conventional cotton. Large-scale commercial farmers growing Bt maize had an average 11 per cent higher yield, saved 38 per cent on pesticides, and had income increases from US$47 to $149 per hectare in the different regions, compared to farmers using conventional technologies. Smallholder farmers in six test regions had on average 58 per cent less crop yield using their own seed than those using hybrid Bt maize and 24 per cent less with conventional hybrid seed than hybrid Bt maize, measured as kilos of grain harvested per kilo of seed used (Gouse et al., 2005).

Use, Regulation, and Commercialization of GM Crops in Africa

South Africa is the only African country that grows GM crops commercially, while several other African countries are engaged in field trials. The South African government adopted biosafety guidelines—regulatory systems for ensuring that biotechnology applications are safe for the environment and for human health—for the use of GM crops in 1989 and passed comprehensive legislation concerning genetically modified organisms in 1997. Starting in 1990, numerous GM crops—primarily cotton, soybean, and maize bearing genes that confer insect resistance and/or herbicide tolerance—have been approved for field trials and commercial release in South Africa. The area planted to GM crops in South Africa increased to 609,000 hectares in 2005, representing 29 per cent of the total national maize crop, 59 per cent of the total soybean crop, and 92 per cent of the total cotton crop (FoodNCropBio, 2006).

Several African countries are presently engaged in field testing of GM crops. Kenya has tested virus-resistant sweet potato and insect-resistant maize, with plans to test Bt cotton in the near future. Mauritius has developed two strains of GM sugarcane. Burkina Faso is conducting field trials with Bt cotton, and Zimbabwe has been testing Bt maize. Egypt has developed and tested Bt maize, potatoes, and cotton, and is working on a range of other crops. South Africa has been field testing herbicide-tolerant strawberries, apple, and sugarcane, and drought-tolerant soybeans and groundnuts. Plans are under way for a field trial of GM wine grapes. Several other GM crops are in greenhouse trials such as drought-tolerant and streak-resistant maize. Morocco has also reported initiation of field trials on GM crops, while Tanzania and Uganda plan to start soon.

The majority of African states have ratified and/or acceded to the Cartagena Protocol on Biosafety and are drafting or finalizing their national biosafety frameworks. Only South Africa, Mauritius, Zimbabwe and Cameroon have GM biosafety legislation in place; Zimbabwe is currently updating its framework. Over 30 other states have biosafety guidelines, regulations, or draft legislation at an advanced stage. The rest of African states either lack or have just started developing biosafety frameworks (Olembo, 2006; AfricaBio, 2006; RAEIN-AFRICA, 2006; African Seed Trade Association, 2006).

Future Opportunities and Challenges for Agricultural Biotechnology in Africa

Major opportunities exist for further biotechnology development to benefit food security in Africa, including targeting neglected African crops (e.g., groundnut, cassava, banana, sorghum, millet, and *fonio*) using locally adapted varieties for genetic insertion, targeting agricultural productivity constraints specific to Africa (e.g., drought tolerance, disease resistance, food quality, and yield), and developing animal biotechnology. Van der Walt cautioned that although GM crops offer many benefits for improving agricultural production efficiency, they are not stand-alone technologies and should be only one part of an integrated approach in farming systems and pest management. Van der Walt also observed that given the prevalence of subsistence-level and smallholder farming in Africa, where the bulk of seeds and planting materials come from farm-saved sources, systems to maintain control of GM crops and separate them from non GM products will need to be developed.

A Role for Science Academies

There is considerable uncertainty and confusion in African governments, as in most of the world's governments, concerning the social, ethical, environmental, trade, and economic issues associated with development and application of biotechnology. Nzietchueng described some of the history of policy debate over biotechnology in developing countries, beginning with a 1989 conference in Luxemburg, Plant Biotechnologies for Developing Countries. More recently, the High-Level Panel on Modern Biotechnology in Africa, established in 2005 by the African Union and of which Nzietchueng is a member, has provided a platform for discussion on the development of biotechnology and its implications on agriculture, health, and the environment. Nzietchueng and other conference participants noted that science academies may have an important role in resolving and informing sensitive policy issues surrounding biotechnology,

including human health and environmental safety, intellectual property rights, consumer acceptability and trade, and research priorities and investments (Box 5.1).

Box 5.1
Key Policy Debates in Agricultural Biotechnology that Could be Informed by Science Academies

Safety to Human Health: Safety to human health is the major area of concern in the area of biotechnology. Do applications of biotechnology result in changes to nutritional quality or in the introduction of toxins or allergens that may be harmful to human health? Are regulatory policies designed to assess and manage the risks? What is a socially acceptable standard of human health risk? Are there uncertainties about the effects of GM commodities or their derivatives on immuno-compromised populations or in populations in which starchy staples constitute the bulk of the diet?

Environmental Stewardship: Are genetically modified organisms and their derivatives safe for the environment? What is the risk of gene flow through pollination of related, potentially weedy species by GM crops? How should a government assess and manage the risk to protect the environment?

Intellectual Property Rights: Intellectual property laws simultaneously serve public and private sector interests by requiring inventors to publicly disclose their inventions following a limited period of exclusive rights to exploit the technology. In agricultural biotechnology, protection of intellectual property is usually achieved through plant variety protection or patents. Key policy issues for African countries include how to gain access to and use existing proprietary technology, how to stimulate and protect national biotechnology innovations, and how to transfer technologies to consumers.

Consumer Acceptability and Trade: One of the fundamental challenges facing adoption of GM commodities is the issue of consumer acceptability (usually on environmental, safety, or ethical grounds), which has implications for trade. The question of whether or not to label GM food and how to label it to inform consumers without raising costs is also controversial. The issue of consumer acceptability is also sensitive because some countries, such as those in the European Union, have market access limitations for GM commodities. For African countries trying to penetrate European markets, technology adoption may therefore be a trade liability (both for GM commodities, like maize and cotton, and for commodities that may be contaminated by production of GM maize and cotton, such as baby corn, sweet corn, live animals, meat, dairy products, eggs, and honey)(Paarlberg et al., 2006). African countries may also lack mechanisms to detect GM crops and enforce the non-entry of GM products. Could science academies examine the trade-offs between the income benefits of GM varieties and the export risks of reduced trade with countries with market-access limitations?

Research and Investment in Biotechnology Science: What are the highest priority areas of research, infrastructure, and investment in biotechnology? Is it more cost effective for African countries to invest in infrastructure to conduct basic research in biotechnology or to use technology developed elsewhere? What areas of human capacity development—such as training fellowships or development of scientific networks—need to be strengthened?

Informing Water Management Policies to Promote Food Security

Water, one of the most important inputs to agricultural production, has a critical role in assuring food security in Africa. Water contributes to improving food supply and nutrition as an input to irrigated agriculture, rain-fed agriculture, home gardens, livestock production, and tree crop production. UNESCO (2003) estimates that agriculture—the mainstay of most African economies—accounts for more than 70% of all water withdrawals on a global basis. Water is also essential for sustainable gathering of products from common property resources, such as

fish, tree crops, and other foods. Water can indirectly reinforce food security through its role in promoting human health and economic development. Reliable access to water can reduce illness and can redirect time, energy, and resources from water harvesting to productive economic activities.

Water Scarcity is Related to Natural and Human Factors

Twenty-seven countries in SSA are projected to experience freshwater stress or scarcity by 2025 (Hopkins, 1998), which in turn threaten food security. Contributing to water scarcity are natural factors, such as inadequate quantity and quality of water, and human factors, such as ineffective water management policies, lack of or inadequate water infrastructure, and inefficient water use practices. High temporal and spatial variability of water availability across the African continent is among the natural factors related to water scarcity. The water supply fluctuates seasonally, and there is a high variability of availability across geographic regions, with extremely arid conditions in the North, humid conditions in the central region, and arid conditions in the South. Africa is a continent with the lowest ratio of mean annual precipitation to mean annual runoff. Hence, despite the high precipitation across the continent, high water loss by evaporation results in a relatively low volume of water flowing in Africa's waterways (Gleick, 1993).

Although water-related problems in SSA are often attributed to the lack of abundance of water in the region, in most countries, water-related problems stem from ineffective management policies or end-user management practices rather than from actual shortage. Ineffective policies for the management of water resources are in turn major constraints to achieving food security in many parts of SSA. Because the countries of Africa share over 63 trans-boundary river basins, ineffective water management policies in one country can also have impact on neighboring countries (Ravenga et al., 1998).

Drawing from the Cameroon Water Development Report (Fonteh, 2003), Mathias Fonteh, of the University of Dschang in Cameroon, described a variety of water management problems that have stemmed from ineffective policies. Water management responsibilities in Cameroon are uncoordinated and highly fragmented by sector among multiple ministries. Legal and institutional frameworks for the protection and regulation of water resources are inadequate or poorly enforced, resulting in low water quantities and environmental degradation in rivers and lakes. There is an inadequate number of well trained water management professionals, and a lack of consistent and reliable data on water resources for informed decision making. Ineffective public sector water pricing policies have resulted in a high cost of water. Private water vendors in Cameroon charge 269% higher per liter of water than subscribers with a house connection from the National Water Corporation. Hence, the poorest of the urban poor who rely on private water vendors pay much more for water. Finally, water infrastructure—both for urban sanitation and rural irrigation—is designed inefficiently and is wasteful. He reported that water leakage alone has resulted in a 40% loss of water in urban water systems in Cameroon. Conference participants added in the discussion that government programs promoting the cultivation and use of tree species that consume high amounts of water, such as eucalyptus, similarly promote water waste.

A Role for Science Academies

Speakers Fonteh, Ahenkorah, and other conference participants explored opportunities for science academies to contribute to more effective water management by advising policymakers. Science academies could assist policymakers in identifying ways to recover, store, and use rainwater for food production (e.g., fish farming). Science academies could also advise their governments in identifying measures to improve water conservation, such as reduced-volume irrigation, drought or salt-tolerant crops, and crop rotations or fallow periods to reduce water loss. Academies can help governments evaluate alternative irrigation technologies and make recommendations to farmers for optimal frequency and volume of irrigation for specific soil types and crops. Academies could also help governments identify ways to better manage floods, as has been done in Senegal.

Science academies can help policymakers think about unintended consequences of policy decisions. A case study in the Sudan was described in which large-scale irrigation projects were initiated but later resulted in a malaria outbreak because of the large volumes of standing water. In this case, a science academy could have assisted the Sudanese government in carrying out the necessary environmental or human health impact assessments of interventions under consideration. Science academies can also assist governments in finding solutions to other irrigation-related problems, such as erosion, salinity, and sodicity.

Science academies could help governments organize and position themselves to manage water more effectively by recommending alternatives to a sectoral, top-down approach to water management. Academies should propose feasible approaches to managing surface and groundwater, river basins, coastal and marine environments, upstream and downstream resources, and human systems. Science academies could also help governments gather data on both the physical and socio-economic aspects of water resources for more informed decision making. New technologies using remote sensing could be employed to better assess the available water resources in Africa and manage them. Science academies working across borders might be able to help conflicted governments establish functioning organizational and planning structures to manage abundance and scarcity of trans-boundary water resources. River basin water transfer technologies could be adapted to the African context to permit the expansion of crop production into arid regions through improved water security. However, Fonteh cautioned, this should only be envisaged after the water-use efficiency in water-scarce basins has been maximized.

Improving Nutrient Management

A majority of farmers in Africa practice rain-fed agriculture and have limited options for improving nutrient management. Variations in year-to-year crop productivity responses, particularly to nitrogen, are determined largely by introduction of atmospheric nitrogen to soil through rainfall. Smallholder farmers do not usually apply fertilizers (organic or inorganic), and the return of nutrients to the soil by the recycling of crop residues is not always feasible in Africa because of competing demands for crop residues as a source of livestock fodder or straw for building material. Continuous cultivation without any nutrient input inevitably contributes to

nutrient mining of African soils and eventually leads to a reduction in soil quality and reduced crop yield. Appropriate nutrient management strategies are required in these situations.

A Role for Science Academies

Yaw Ahenkorah, of the Ghana Academy of Arts and Sciences, described how academies can assist governments in promoting more sustainable agricultural production through nutrient management improvements. Academies can help governments formulate recommendations to farmers for optimal application rates and frequencies for nitrogen, phosphorus, potassium, and micronutrient fertilizers to improve crop yields across a wide range of environments. Ahenkorah noted that in Ghana, only one type of fertilizer—15-15-15—is available; science academies could offer advice to policymakers on how to stimulate markets for other types of fertilizer better suited to other types of crops. Academies of science can synthesize what is known about improvements in fertilizer-use efficiency that can be obtained using different methods of application, variable nutrient sources, and soil-water management practices such as moisture conservation and excess surface water removal. Science academies can also help governments understand and regulate the environmental impacts of using fertilizers. They can help governments design approaches to minimize soil salinization and water pollution from fertilizer and nutrient-rich livestock wastes.

Science academies can help to inform controversial decisions surrounding nutrient management. For example, there has been considerable debate throughout SSA about the use of policy instruments to encourage fertilizer production and use. While fertilizer subsidies do increase use of fertilizer and increase agricultural productivity, some argue that subsidies do not solve underlying problems of poor infrastructure and inefficient markets, which can be addressed more effectively through market development initiatives. Ahenkorah shared the experience of Ghana, where eliminating fertilizer subsidies was among a suite of agricultural reforms introduced by the World Bank and the International Monetary Fund to open the agricultural sector to market forces, based on the belief that more competitive markets would lead to increased agricultural production. In addition to eliminating subsidies to liberalize prices of agricultural inputs such as fertilizers, these measures also included devaluating foreign exchange rates and deregulating the private sector. The removal of fertilizer subsidies in Ghana resulted in a tripling of the price of fertilizer when alternative policy instruments—privatization of input procurement—failed to respond immediately. Although subsidies were eventually phased out in Ghana, this early attempt to eliminate the subsidies was abandoned, and the decision to eliminate the subsidies was reversed (Kherallah et al., 2000). In the face of unclear impact or mixed progress of policy interventions, science academies can help decision makers to identify constraints and set priorities for making reforms more effective.

Property Rights and Sustainable Management of Natural Resources

Natural resources—farmland, rangeland, forests, and bodies of water—are a critical input for livelihoods in Africa. Property rights and collective action (defined in Box 5.2)—institutions that govern how natural resources are used—have important implications for the use of management practices and the application of production technologies, which in turn affect the outcomes of production system. Wilberforce Kisamba-Mugerwa, of the International Food Policy Research

Institute Africa Office in Addis Ababa, emphasized the importance of property rights and collective action for achieving long-term impacts in natural resource management. Science academies may have a role in helping governments construct more effective institutional frameworks, which will provide an enabling environment for the adoption of sustainable natural management technologies.

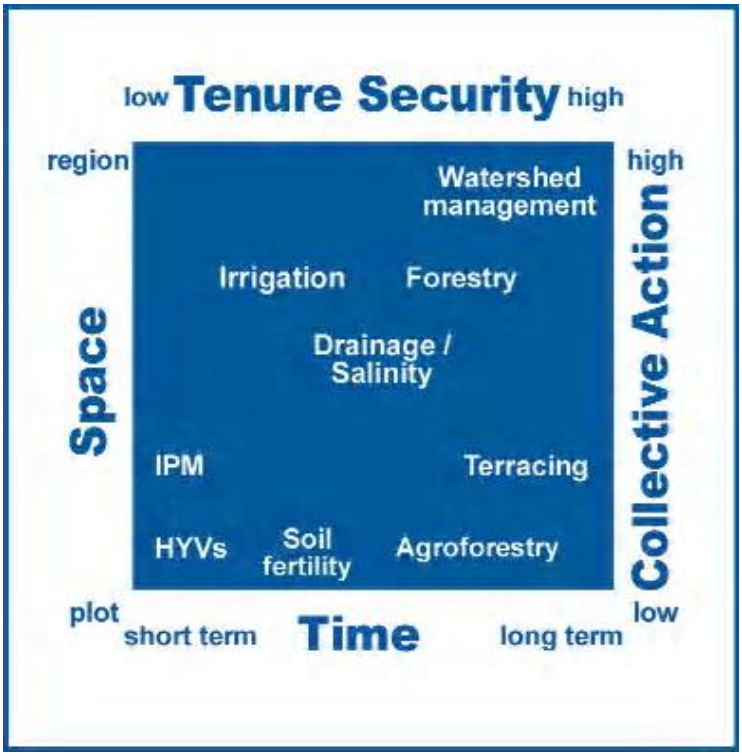
Box 5. 2
Defining Collective Action and Property Rights

Collective action can be defined "as voluntary action taken by a group to achieve common interests. Members can act directly on their own or through an organization. In the context of natural resource management, even deciding on and observing rules for use or non-use of a resource can be considered collective action, and it can be instituted through common property regimes or through coordinated activities across individual farms"(Meinzen-Dick and di Gregorio, 2004).

Property rights, often considered in terms of formal title to resources, in fact extend to the "the capacity to call upon the collective to stand behind one's claim to a benefit stream" (Bromley 1991, in Meinzen-Dick and di Gregorio, 2004). "Rights do not necessarily imply full ownership and the sole authority to use and dispose of a resource; different individuals, families, groups, or even the state often hold overlapping use and decision-making rights. To be secure, rights should be of sufficient duration to allow one to reap the rewards of investment and should be backed by an effective, socially sanctioned enforcement institution. This institution is not always the government; communities or other institutions may provide the backing." (Meinzen-Dick and di Gregorio, 2004).

Science-based innovations have strong potential to alleviate natural resource degradation and stimulate agricultural productivity; however, the types of innovations adopted and the degree to which they are adopted are dependent upon the maturity of collective action and property rights institutions. Figure 5.1 shows how the development of governance systems for collective action and property rights relates to the adoption of sustainable management practices. Some technologies, such as high-yielding crop varieties, can be adopted by a single user and can provide benefits in a single season and over a small spatial scale, such as a single plot on one farm. Such technologies can provide benefit even in the absence of secure tenure or collective action. Other technologies, such as terracing or planting trees, have benefits in the longer term and therefore can only be adopted if land tenure is secure. Similarly, technologies that must be coordinated across larger spatial scales than a single farm, such as integrated pest management or watershed management, require collective action in order to work effectively. As collective action and security of tenure institutions are strengthened, resource users have increased incentives to invest in practices that require longer time horizons and larger spatial scales.

Figure 5.1: Relative Importance of Property Rights and Collective Action in the Adoption of Natural Resource Management and Agricultural Practices *(Source: Meinzen-Dick and di Gregorio, 2004)*



In SSA, extreme degradation of natural resources and underutilization of science-based innovations are two indicators that collective action and property rights institutions need strengthening. Over 65% of the total land area in Africa is estimated to be degraded. Annual forest loss is higher in Africa than in any other region globally, at nearly 1% of total forest area lost per year (FAO, 2001b). Land degradation and soil erosion are contributing to low agricultural productivity in Africa, which in turn has led to food insecurity. Milk yields are lower in Africa than in any other region and over time have been stagnant at less than 0.5 *Mt* /cow/year (FIL-FAO-USDA, 2001). Similarly, cereal yields in Africa have stagnated, while yields have steadily increased over time in both developed countries and in developing countries in Latin America and Asia (Dyson, 2001). Low adoption of science-based innovations is another warning sign that incentives do not yet exist for African farmers to improve natural resource management. Fertilizer consumption, for example, is lower in Africa than in any other global region, and there has been low adoption in Africa of agricultural biotechnology.

A Role for Science Academies

The development of functioning collective action and property rights systems in Africa may provide opportunities for science academies to provide input. Science academies can provide information about technological and natural resource innovations and how they might be expanded across larger spatial and temporal scales. Science academies can help governments

design systems to encourage improved access to land, markets, credit, and infrastructure. Science academies can also help governments promote collective interaction among different institutions—such as the government, the public, business, universities, NGOs, civil society, and farmers' organizations—for improved natural resource management. Science academies can even suggest ways in which collective interaction can work more effectively within government, for example, between the ministries of health and agriculture. Science academies can suggest resource management and access interventions that give special consideration for women, who have an important role in natural resource management yet are among the most vulnerable and marginalized of groups lacking access to resources and not yet participating in collective action.

Policies for Managing Acute Food Emergencies

Catastrophic food emergencies have burdened the African region every decade since 1970 and continue to devastate the continent today, resulting in millions of lives lost and displaced. In addition to natural causes such as recurring droughts, human factors—including conflicts and the disruption of market forces—have provoked serious food emergencies in the region. FAO has identified over 15 countries that today face severe food shortages (FAO, 2006b). Many of these countries are either in conflict, emerging from conflict, or affected by conflicts in neighboring countries; in other countries, political and economic decisions that affected food production and marketing were a cause of food shortages. Food assistance provided to the African region by the WFP has grown from 36% of the total global food support in 2004 to 51% of the total global food support in 2005.

The major factors influencing vulnerability of population in Africa include the lack of adequate early warning systems, an over-reliance on rainfall for agriculture, chronic under nutrition, lack of preparedness, generalized poverty, limited markets and trade, and widespread conflict.

A Role for Science Academies

Together with conference participants, Namanga Ngongi, a former deputy executive director of the WFP, and Isatou Jallow, formerly Director of the National Nutrition Agency in the Gambia and currently Chief of Gender and Mother and Child Health Service of the WFP, explored opportunities for science academies to improve decision making with respect to detection, response, and prevention of food emergencies. Potential users of advice from academies might include national governments, regional and sub-regional bodies, and international organizations. Academy advice also has the potential to contribute to a number of existing international mechanisms, such as the Food Insecurity Vulnerability Information and Mapping Systems, Famine Early Warning Systems, and the International Food Policy Research Institute's Global Hunger Index.

Frequently, inadequate data or inadequate use of data is a key factor in the failure to detect or respond to food emergencies. Science academies may have an important leadership role in helping governments establish national food and nutrition surveillance systems to provide credible and timely information for decision making. Such data systems can help to facilitate early warning and response to food emergencies and to enable a better understanding of the location of vulnerable populations, for example, by mapping livelihood systems, mapping the

location of underweight children to identify hunger spots, and predicting shock spots. Academies may have an important role in bringing sectors together to bridge the data gaps, such as those between the health and agriculture sectors. Developing a curriculum for training in vulnerability mapping and analysis is another area in which academies could help.

Science academies can contribute evidence-based advice on the best ways to respond to food emergencies. Academies can be a resource for weighing alternative government safety-net options, such as school feeding programs; community nutrition programs for under-five children, pregnant women, and nursing mothers; food entitlement programs for the poorest and most vulnerable groups; food-for-work programs; and national-level food reserve programs. In addition to assessing government interventions, academies can be a resource to government in understanding and supporting interventions based on indigenous coping strategies, such as extended family networks and farm- and village-level grain reserve systems, which have traditionally contributed to reducing vulnerability of populations. Academies can help governments strike the right balance between centralized and decentralized interventions. A more decentralized approach of community-based food management can minimize the diversion of food and the use of food as a political weapon. Such an approach can also ensure a more rapid response and more equitable food distribution to the truly needy. Finally, neutral science academies can assist governments with the best science to resolve controversial policy debates, such as whether to distribute cash or food coupons rather than food-aid shipments, which can distort food markets and affect food producers in recipient countries.

In addition to helping governments detect and respond to food emergencies more effectively, science academies can also contribute to policy options to reduce vulnerability and prevent food emergencies. Science academies could help governments design systems to stabilize food production during periods of extreme drought by synthesizing existing knowledge of water management systems, drought-tolerant crops, and on-farm storage and food preservation technologies to reduce post-harvest losses. Academies could help governments design and implement long-term programs for irrigation, soil conservation, and reforestation. Academies could advise governments on how to improve physical and economic access to markets in order to increase marketable food surpluses, for example, by improving roads and promoting the availability of market information. Science academies might also have a role in helping governments design systems to improve intraregional trade (e.g., by setting quality or grade standards), which would facilitate the flow of food surpluses within the continent, especially to deficit areas, and would reduce emergency caseloads (NEPAD, 2004). Stimulating markets for agricultural inputs such as seeds, herbicides, pesticides, and fertilizers was also suggested as another type of intervention that science academies could help governments to design.

Strengthening Capacity of the Food and Agricultural System

Functioning food and agricultural systems—including national agricultural research institutes, universities, policymakers, agribusinesses, NGOs, and farmer-based organizations working effectively together—are vital for assuring food and nutrition security. Weak capacity of food and agricultural systems in Africa, however, has prevented the continent from achieving food security objectives. Among the constraints that contribute to the poor capacity of the food and agricultural system are a low level of technology generation by the research enterprise; a lack of

affordable technology; inadequate access to markets, resources, and technology, especially for women; a weak private sector and poorly functioning markets; poor linkages between research and the farm; ineffective policies; and weak institutions.

A Role for Science Academies

Speakers Willis Oluoch-Kosura, Adipala Ekwamu, and Catherine Woteki explored these constraints and identified opportunities for science academies to inform policies to strengthen research, training, and innovation and commercialization capacities of the food and agricultural system. Several speakers observed that science academies have a unique power to strengthen not only the elements of the system, but also the linkages among them. Science academies can convene and facilitate communication among the diverse actors of the food and agricultural system and perform a coordinating role across sectors—not only agriculture, but also health, education, and rural development. Science academies can effectively lead strategic planning exercises with government so that different roles and priorities for institutional actors can be identified. The US National Academies' Government-University-Industry-Research Roundtable—a neutral forum where many institutional players can come together to establish working relationships, exchange ideas, develop understanding, and identify possible approaches—was offered as a model of this convening role.

Improving Scientific Capacity

Speakers offered suggestions on how advice from science academies could help improve mechanisms for planning and implementing research, assuring competence of researchers, publishing research results, and promoting research networks.

By signaling what research and development is needed to respond to food security challenges, science academies can assist government and research institutions in enabling the generation of new ideas and technologies that can be quickly mobilized to achieve development goals. Through their ability to convene multiple stakeholders and multiple disciplines, science academies can help public research institutions and universities develop research strategies and implementation plans that are most relevant to the needs of end users. Academies can help government and the research community to plan and prioritize directions and investments in research, development, and innovation. Through their advice, science academies can catalyze institutional reforms within research agencies that will enhance the impact of research investments. A US National Academies report—*National Capacity for Forestry Research* (NRC, 2002)—was suggested as an example of a study undertaken to help a government agency set priorities in order to strengthen its capacity to conduct research.

Science academies can help public research institutions and universities design plans for the identification and recruitment of core scientific competencies. A recent report on the capacity of agricultural research in Africa (FARA, 2006) found that most National Agricultural Research Institutes in Africa lacked a critical mass of scientists to deliver needed outputs, with 89% of existing scientific capacity of these institutes approaching retirement age. In addition, many African institutions have weak representation of certain scientific disciplines, particularly in new and emerging areas. Qualified researchers who can adapt existing technologies to local

conditions are in need. Science academies could assist in developing strategies for ensuring adequate numbers and appropriate disciplinary and age representation of scientific human resources.

The capacity of many African research institutions and universities to communicate their work through peer-reviewed publications and other dissemination tools is poor. Academies of science could help research institutions examine the constraints to research publication and help to design interventions to improve capacity for disseminating research results and ensuring access to information by end-users. In addition, science academies themselves can play an important role in synthesizing and digesting existing published research.

Science academies can also advise governments and research institutions on ways to improve and support research networks to facilitate communication among researchers.

Education and Training

There is an important need to improve human resource competencies in food and agriculture for future generations. Science academies can help governments design more effective training and extension programs for farmers' groups in order to enable their improved access to technologies and credit. Science academies can play a key role in helping governments and training organizations to identify new needs for training and to design programs for strengthening basic and higher-education capacity, with a particular emphasis on improving educational access for women. Science academies can offer guidance for the improvement of postgraduate education programs in disciplines important for food security, such as applied economics, poverty, environmental issues, market access, agricultural trade, nutrition, food transformation and processing, and rural development. Academies of science can also offer assistance in developing curriculum for new training programs in the area of policy research. Academies could explore opportunities for shared learning through partnerships across and beyond the continent.

Several higher-education capacity building programs were offered as examples of the types of initiatives that could be designed, documented, shared, or scaled up through efforts led by science academies. Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), a graduate agricultural research and training research program for African universities, aims to enhance human capacity for interdisciplinary problem solving in the region, the competence and competitiveness of regional universities, the role and visibility of universities in research for development, and the linkage of universities to grassroots development issues. The Collaborative Master's Program in Agricultural and Applied Economics (CMAAE) aims to strengthen policy research and analysis capability of postgraduate agricultural economics students in 16 public universities in 12 countries of Eastern, Central, and Southern Africa. Relevance of CMAAE students' research and training to current issues in the agricultural sector is assured through a demand-driven process of ongoing consultation with prototypical employers, including government agencies, agricultural research institutes, businesses, and not-for-profit agencies.

Innovation and Technology Commercialization

Opportunities for private-sector involvement in technology commercialization exist at multiple points of the food and agricultural value chain, from agricultural inputs (e.g., production and distribution of seeds, chemicals, and fertilizers) to food processing and preservation. One of the greatest challenges in strengthening the capacity of the food and agricultural system, however, is the weak link in promoting agricultural technology transfer between research and end-users. Science academies have a potential role in enabling improved dissemination of new innovations to end users, facilitating feedback from end users to technology developers, and stimulating private-sector participation in the innovation and technology-commercialization process. For example, science academies can help the government develop improved programs to foster more-effective working relationships and profit-sharing arrangements between the private sector and the research community. Science academies can also help the government develop policies for intellectual property protection, such as patent systems, to create incentives for private sector investment and innovation. Science academies can also help governments to reduce barriers that restrict market access and can assist in the design of programs to promote intraregional and international trade.

6 The Way Forward

A major conclusion of the meeting was that science academies have strong potential to offer guidance to decision makers in the formulation of policies and programmes to respond to the challenges of food insecurity facing Africa. Conference participants posited that evidence-based decisions are better and more equitable than decisions that are not based on evidence. However, conference participants acknowledged that a potential mismatch may exist between the variety of roles and contributions potentially to be played by science academies and their actual ability to do so. Strengthening academies of science is needed to enable them to develop working relationships and more dependably and capably provide advice. Representatives of science academies at the conference recognized that providing service would be challenging but expressed a strong desire to take expectations of service seriously in their future work and to have impact.

What Can Science Academies Offer?

Policymakers felt they had a clearer idea of what academies had to offer. A major perceived strength of academies is to encourage governments to use scientific evidence to prioritize interventions in response to the continent's food security challenges. Another valued role of academies was to provide guidance to government in setting priorities for investments and directions in science (e.g., in setting policy for research, education, and innovation). Policymakers saw a particular value of academies in helping to bridge gaps by bringing sectors—such as health and agriculture—together. Although science academies do not directly conduct scientific research or gather data, as universities and research institutions do, conference participants felt they have a unique role in synthesizing existing data and information and in recommending the best course of action even when there is conflicting information. Academies can be a powerful catalytic force in instilling a "culture of data use" by encouraging the government to incorporate high-quality data in policymaking. Conference participants spoke of the value of the expertise that can by tapped by African science academies. Not only are experts convened by an academy drawn from diverse disciplines, they have "home grown" knowledge of local conditions to be able to adapt research conducted elsewhere. Finally, conference participants observed that evidence-based advising is useful not only to government but also to other stakeholders, such as the private sector and the general public.

The conference provided many illustrative examples of the practical usefulness of evidence-based advice. In the United States, advice from a science academy has been used to inform methodologies for measuring food insecurity, to improve the data infrastructure on food consumption and nutrition, to inform food safety regulatory decisions, and to improve the nutritional composition of food packages for vulnerable populations. In Cameroon, evidence-based advice has contributed to the adoption of iodized salt to eliminate goiter in the country. In Nigeria, an evidence-based statement from that nation's academy exposed an unsubstantiated local claim that HIV/AIDS could be cured. Workshop discussions highlighted many areas in which strong potential exists for science academies to play a role in informing food security policy, for example, in informing the debate about genetically modified organisms, or in

recommending what kinds of crops should be grown in different parts of the country based on soil, climate, and rainfall conditions.

Challenges to Science Academies

Policymakers challenged African science academies to be more pro-active in defining their role and raising their visibility. Indeed, some of the conference discussions indicated that confusion still exists about what science academies do differently from academia and research institutions. Therefore, science academies need to emphasize the uniqueness of what they can offer and their strengths.

Policymakers also urged science academies to ensure that their activities are "demand driven", or responsive to the needs of policymakers. Science academies can ensure that advice is actually used by governments if they develop strong working relationships with government and understand the national advisory structure. Expanded relationships beyond the academy membership, with technical and scientific associations and with the younger scientific community, will also strengthen academies' roles as national advisers. Policymakers noted that the social dimensions of food security problems are not insignificant, and that it is important for science academies, when putting together teams to investigate specific issues, to include both the natural and the social sciences. Finally, policymakers urged academies to disseminate their messages widely to not just government but also the public.

Appendixes

Appendix A Agenda

2nd International ASADI Symposium Programme
November 15-16, 2006

Conference Objectives

- *Foster exchange of ideas on how the science academies might be used to support policymaking*
- *Provide participants with opportunities to network and develop/strengthen relationships (e.g., among policymakers and representatives of science academies, among representatives of science academies from different countries).*
- *Provide relevant input/insight for participants' work and interests*
- *Deepen participants' understanding of the process of evidence-based policymaking*

Pre-symposium Programme
November 14, 2006

6:00–7:30 pm Welcome Dinner and Cocktail

Welcome
Professor Vincent Titanji, Chair, Inter Academy Advisory Panel
Professor Samuel Domngang, President, Cameroon Academy of Sciences

Ensuring Food Security in Sub-Saharan Africa through Robust Policies: The Way Forward
Mrs. Atanga Felicitas, Assistant FAO Representative/Programme Officer, Cameroon

November 15, 2006

8:30–10:00 Session I: Opening Ceremony

Session Chair: Professor Jacques Fame Ndongo, Cameroon Minister for Higher Education

Facilitator: Professor VPK Titanji, InterAcademy Advisory Panel

Protocol officer: Mr. Engelbert Mboa, Ministry of Scientific Research and Innovation

Session Objectives: To welcome conference participants and open the conference. To provide an overview of the major food security policy issues in Africa and the major policy frameworks relevant to food security, such as the Millennium Development Goals, the World Food Summit,

African Regional Nutrition Strategy, and NEPAD Comprehensive Africa Agriculture Development Programme.

Welcoming remarks:

- Professor Samuel Domngang, President, Cameroon Academy of Sciences (8 min)
- Professor Michael Clegg, Foreign Secretary, U.S. National Academy of Sciences (8 min)

Keynote Speaker (25 min):
Overview of Key Policy Issues in Food Security in Africa

- Dr. Isatou Jallow, Chief, Gender, Mother and Child Health Service, Policy Strategy and Programme Support Division, UN World Food Programme, Rome

10 minutes of questions for keynote speaker

His Excellency Ambassador Niels Marquardt, US Ambassador to the Republic of Cameroon (15 minutes)

Professor Jacques Fame Ndongo, Cameroon, Minister for Higher Education (15 minutes)

10:00–10:30 Coffee Break and Press Conference

10:30–12:45 Session II: Methodology for Providing Evidence-Based Policy Advice and Case Studies

Session Objectives: To provide concrete examples (from the US and from Cameroon) of formal, structured processes in which the best scientific evidence was used to inform a controversial food security policy. For US government representatives who have requested assistance from the US Academy to share why they requested the study and how they used the input. For committee members and academy staff who participated in the study to describe the process and outcomes of the analysis.

Session Chair (5 min):

- Professor Jacques Fame Ndongo, Cameroon, Minister for Higher Education

Facilitator:

- Professor Wieland Gevers, Academy of Science of South Africa

Speaker (20 min):
Case study from Cameroon: Informing Policies to Iodize Salt

- Professor Daniel Lantum, Former Head, Department of Public Health; and Regional Coordinator for Africa's International Council for Control of Iodine Deficiency Disorders

Policymaker (20 min):

- Professor Victor Anomah Ngu, Former Minister of Public Health, and Delegate General for Scientific and Technical Research.

25 minutes discussion

Perspectives on Selected National Academies Reports on Food Security Issues

Speaker 1 (20 min):
Food security research in the U.S. National Academies

- Ms. Susanne Stoiber, Executive Officer, Institute of Medicine of the U.S. National Academies

Speaker 2 (20 min):
Food policy research in the U. S. government

- Dr. Susan Offutt, Administrator, Economic Research Service, U.S. Department of Agriculture

25 minutes discussion

12:45–14:00 **Lunch: African Academies and Policymakers (by invitation)**

14:00–15:30 **Session III: Roundtable Discussion: A Critical Review of the Food Security Policymaking Process in Africa: What are the Patterns of Decision Making and What are the Possible Points of Entry for African Science Academies?**

Session Objectives: To facilitate discussion among science academy leaders and policymakers on the key policy questions of food security in Africa and the possible points of entry for African science academies to inform these questions. To identify mutual needs of policymakers and academies such that a more productive bridge can be built between the two communities

Session Co-Chair 1:

- Hon. Dr. Wilberforce Kisamba-Mugerwa, Director, ISNAR Division, IFPRI, Addis Ababa; Former Minister of Agriculture, Animal Industry and Fisheries, Uganda

Session Co-Chair 2:

- Professor Jo Ivey Boufford, Professor of Health Service and Public Policy, New York University, Former Principal Deputy Assistant Secretary for Health, US Department of Health and Human Services

Facilitator:

- Professor Stephen Agong, African Academy of Sciences

Ninety minutes facilitated discussion with policymakers

CAMEROON:

- Dr. Oumarou Dawa, Inspector General, Ministry of Livestock, Fisheries and Animal Industries
- Hon. Dr. Christopher Anyangwe, Member of Parliament
- Hon. Paul Ayah, Member of Parliament
- Professor Fru Angwafo III, Permanent Secretary, Ministry of Public Health

GHANA:

- Mr. Kweku Owusu Baah, Chief Director, Ministry of Food and Agriculture
- Dr. Joseph Oko Gogo, Regional Coordinator for Western Africa, African Ministerial Council on Science and Technology

KENYA:

- Dr. Jacob Olongida Ole Miaron, Permanent Secretary, Ministry of Livestock and Fisheries, Kenya

NIGERIA:

- Dr. Mrs. Mojisola Adesida, Director-General, National Stored Products Research Institute
- Mr. R.C. Ughasoro, Federal Ministry of Science and Technology

SENEGAL

- Mr. Malick Cisse, Conseileer Juridique, Ministre de la Sante

SOUTH AFRICA

- Dr. Siyabulela Ntulela, Deputy Director, Department of Science and Technology, DST Biotechnology Strategies Unit, Technology for Competitiveness Programme

UGANDA

- Hon. Gordon Sematiko, Member of Parliament
- Mr. Fidele Steven Okullo'kwany, Ministry of Agriculture, Animal Industries and Fisheries
- Mr. Paul Luyima, Assistant Commissioner, Environmental health, Ministry of Health

Discussion Questions:

- *What does your experience tell you about the feasibility of evidence-based advice in your country?*
- *What are the factors that support and the factors that constrain your ability to use evidence-based advice?*
- *How do social, electoral, ethical, cultural factors influence policy making?*

- *How should science be effectively packaged so that policymakers can use it?*

15:30–16:00 **Coffee Break**

16:00–17:30 **Session IV: Controversies and Solutions: The Role of Science Academies in Informing Food Security Policy-making in Africa**

Session IV (Part 1-5) Objectives: To highlight current controversial areas in public policy where the rigor of an academy's advisory processes should add unique value for decision making across a variety of areas related to food security, nutrition, agricultural productivity, resource management, markets, and trade. To demonstrate through discussion and examples the multidisciplinary nature of these controversies and the reasons why science academies, through their ability to convene a nation's leading scientists from across disciplines, can yield advice that is uniquely credible to support national policy development.

Part 1: Nutrition and Health: A Focus on HIV

Session Chair (5 min):

- Hon. Urbain Olanguena Awono, Cameroon, Minister for Public Health

Facilitator:

- Professor Benson Estambale, Kenya Academy

Speaker (20 min):

Nutrition and HIV

- Professor Barry Mendelow, University of Witwatersrand, South Africa; and Chair, ASSAf Study on Nutritional Influences on Human Immunity

15 minutes questions and answers

30 minutes general discussion

17:30 **Adjourn**

Thursday, November 16, 2006

8:30–9:35 **Session IV, Part 2: Agricultural Productivity: A Focus on Biotechnology and African Agriculture**

Session Chair (5 min):/ Facilitator:

- Professor Johnathan Ayertey, Ghana Academy of Arts and Sciences

Speaker (20 min):

Biotechnology and African Agriculture

- Dr. Wynand J. van der Walt, Food, Agriculture and Natural Resources Policy Analysis Network

Policymaker (20 min):
Strategic approach of biotechnology for agricultural production and development in Africa

- Dr. Samuel Nzietchueng, Ministry of Scientific Research and Innovation, Cameroon; Member, NEPAD/AU High-Level Panel on Agricultural Biotechnology

20 minutes discussion

9:35–11:10 Session IV, Part 3: Agricultural and Natural Resource Management: Keys to Sustainable Agricultural Production

Session Chair (5 min):

- Professor David Okali, Nigeria

Facilitator:

- Dr. Ousmane Kane, Academy of Sciences of Senegal

Speaker 1 (20 min):
The critical role of water management in the enhancement of food security in Sub-Saharan Africa

- Professor Mathias Fonteh, University of Dschang, Cameroon

Speaker 2 (20 min):
Agricultural and Natural Resources Management: Keys to Sustainable Agricultural Production

- Professor Yaw Ahenkorah, Ghana Academy of Arts and Sciences

Policymaker (20 min):
Property rights and collective action are critical to sustainable management of natural resources in Africa

- Hon. Dr. Wilberforce Kisamba-Mugerwa, IFPRI Africa Office, Addis Ababa and Former Minister of Agriculture, Animal Industry and Fisheries, Uganda

30 minutes discussion

11:10–11:40 Coffee Break

11:40–12:45 Session IV, Part 4: Food Emergencies and Safety Net Programs

Session Chair (5 min):

- Professor Robin Crewe, Academy of Science of South Africa

Facilitator:

- Dr Fina Opio, Director, Namulonge Agricultural Research Organisation, Uganda National Academy of Sciences Fellow and Executive Council Member

Speaker (20 min):
How science academies can advise and inform on food emergencies in Africa

- Dr. Isatou Jallow, Chief, Gender, Mother and Child Health Service, Policy Strategy and Programme Support Division, UN World Food Programme, Rome

Policymaker (20 min):
Community based safety-nets and strategies to reduce vulnerability to drought, crop losses and market crises

- Dr. A. Namanga Ngongi, Former Deputy Executive Director of the World Food Program

20 minutes discussion

12:45–13:45 Lunch break: African Academies and Policymakers

13:45–14:50 Session V: Opportunities for Academies to Inform Policies that Strengthen the Capacity of Food Security Institutions

Session Objectives: To illustrate how science academies might inform policies to strengthen the education, research, training, extension, and technology commercialization functions of food security institutions.

Facilitator:

- Dr. Jacob Olongida Ole Miaron, Ministry of Livestock and Fisheries

Speakers:
Potential Contribution of Academies of Science to Building African Capacity for Food Security Policy Research, Formulation and Implementation

- Dr. Willis Oluoch-Kosura, Director of the Collaborative Master of Science; Programme in Agricultural and Applied Economics in Eastern and Southern Africa (10 min)
- Professor Adipala Ekwamu, Coordinator for Regional Universities Forum for Capacity Building in Agriculture in Kenya, Malawi, Mozambique, Uganda and Zimbabwe (10 min)
- Dr. Catherine Woteki, Former Under Secretary of Food Safety, USDA; Former Acting Under Secretary, Research Education, and Economics, USDA; Mars, Incorporated (10 min)

20 minutes discussion

14:50–15:05 Evaluation

15:05–15:35 Coffee Break

15:35–16:40 Session VI: Roundtable Discussion with Science Academy Leaders and Policymakers

Session Objectives: To illustrate the value of academies in helping government to prioritize interventions and investments across sectors (e.g., education, health, agriculture, infrastructure, investment in export crops vs. subsistence crops, smallholder agricultural production vs. industry) to optimize food security outcomes.

Session Chair

- Hon. Patrick Amuriat Oboi, MP, Uganda Parliamentary Committee on Science & Technology

One hour facilitated discussion

Roundtable Discussants:

African Academy (ASADI) Presidents and Delegates

Professor Ibrahima El Hadj Diop, AAS
Professor Domngang Samuel, Cameroon
Professor Kwesi Yankah, Ghana
Professor Benson Estambale, Kenya
Professor David Okali, Nigeria
Professor Oussaynou Dia, Senegal
Professor Robin Crewe, South Africa
Professor Paul E. Mugambi, Uganda

Policymaker Representatives by Country

Dr. Oumarou Dawa, Cameroon
Dr. Joseph Oko Gogo, Ghana
Dr. Jacob Olongida Ole Miaron, Kenya
Dr. Mrs. Mojisola Adesida, Nigeria
Professor Lamine Ndiaye , Senegal
Dr. Siyabulela Ntutela, South Africa
Hon. Gordon Sematiko, Uganda

16:40–17:15 Session VII: Closing Session

Session Chair:

- Dr. Doube Maurice, Permanent Secretary, Ministry of Scientific Research and Innovation, Cameroon

Facilitator:

- Professor David Okali, President, Nigerian Academy of Sciences

Highlights of the Symposium in English and French (15 min)

- Professor Vincent P.K. Titanji, Chair of InterAcademy Advisory Panel
- Dr. Ousmane Kane, Academy of Sciences of Senegal

Closing Statement (5 min)

- Professor Samuel Domngang, President, Cameroon Academy of Sciences

Closing Statement (5 min)

- Dr. Enriqueta Bond, Chair, Board of African Science Academy Development Initiative of the U.S. National Academies

Announcement of Conference Theme for 2007 (5 min)

- Professor Oussaynou Dia, President, Academy of Sciences of Senegal

Closing Statement (5 min)

- Dr. Doube Maurice, Permanent Secretary, Ministry of Scientific Research and Innovation, Cameroon

17:15–18:15 Farewell Cocktail Hour

Appendix B List of Participants

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Appendix C Speaker Biographies

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FELICITAS ATANGA is an Agronomist/ Rural Economist. She studied Agronomy in the National Advanced School of Agronomy, University Centre of Dschang, Cameroon, where she graduated in 1989. From 1990 to 1996, she worked with the Ministry of Agriculture, Department of Projects. From 1996 to 1998 she studied Rural Economics at the Georg - August Universität Göttingen, in Germany where she earned a Masters degree. She then returned to Cameroon in 1998 where she continued working with the Department of Agricultural projects of the Ministry of Agriculture until 2003. In 2003 she was recruited as a consultant with the FAO Representation in Cameroon. Since 2004 she has been working with this organisation in the capacity of Assistant FAO Representative / Programme. Cameroon. Mrs. Atanga is married and a mother of four children.

MICHAEL T. CLEGG received his BS and PhD degrees in agricultural genetics and genetics respectively at the University of California, Davis. In 1972 he joined the faculty of Brown University moving from there to the University of Georgia in 1976. In 1984, he moved to the University of California, Riverside where he served as Dean of the College of Natural and Agricultural Sciences from 1994 to 2000 and he was the founding Director of the Genomics Institute at the University of California, Riverside. In 2004 he accepted a position as Donald Bren Professor of Biological Sciences at the University of California, Irvine. Clegg has received numerous awards including a Guggenheim Fellowship (1981) and the Darwin Prize of Edinburgh University (1995). Clegg was elected to membership in the US National Academy of Sciences in 1990 and he was elected a Fellow of the American Academy of Arts and Sciences in 1992. Clegg has a strong commitment to international science, and accordingly, was elected Foreign Secretary of the US National Academy of Sciences in 2002 and re-elected in 2006. He was also elected an Associate Fellow of TWAS in 2006. He has served as President of the American Genetic Association (1987), President of the International Society for Molecular Biology & Evolution (2002) and Chair of the Section on Agriculture, Food and Natural Resources of the American Association for the Advancement of Science (2003).

SAMUEL DOMNGANG, President of the Cameroon Academy of Sciences and Professor of Physics (material science) at the University of Yaoundé I, was Director of Higher Education, Vice Chancellor of the University of Yaoundé, Director General of the Ngaoundere University Centre and eventually Rector of the University, and Rector of the University of Dschang. Within these functions, he was member of management boards of several research institutes and

academic establishments. He was also member of several Cameroon delegations to several UNESCO conferences and intergovernmental negotiations. He is a former President of the Rotary Club, Ngaoundere. At the scientific level, he was member and/or President of several consultative commissions/sub-commissions within the national university system. Before entering the national university system he was a researcher at the "Centre National de la Recherche Scientifique (CNRS)", France. He has supervised several master's and doctoral theses. He is author of several scientific publications. He obtained the "Doctorat d'Etat" in physics from the Université Louis Pasteur at Strasbourg, France. He is Commander of the National Order of Valour and Knight of the Order of the "Conseil Africain et Malgache pour l'Enseignement Supérieur (CAMES)".

MAURICE DOUBE is Permanent Secretary at the Ministry of Scientific Research and Innovation, Cameroon. Before that he was "Chargé de Mission", Division of Social and Cultural Affairs of the Presidency of the Republic of Cameroon. Dr. Doube has also served as Head of the Department of Soil Science, Faculty of Agricultural Sciences, University of Dschang where he also headed the Special Control Unit. He obtained the "Doctorat d'Etat" in Agronomy (Soil Science) from the "Université d'Etat de Gand" in Belgium.

ADIPALA EKWAMU is the Regional Coordinator of RUFORUM. He is a Ugandan, and has 5 children. He graduated with a B.Sc. Agriculture degree in 1976, and M.Sc. Agriculture in 1980, both from Makerere University. He obtained a Ph.D. degree (Plant Pathology) from The Ohio State University (USA) in 1992. Adipala has worked at Makerere University since completing his B.Sc. Agriculture degree, rising to the level of full Professor in 1998. During this period he has led several University and national strategic planning committees. He has served as a Board member to 3 Ugandan Government Statutory Bodies (1981–1986), 2 Non-Governmental Organisations (2001 to date), and several national planning committees. He has served in several University leadership positions, heading 2 University - wide committees, a Competitive Grants Program, and Chair of the Makerere University Publication Committee. He has initiated and coordinated several research programmes/projects and is credited with development of 3 new cowpea and 2 soybean varieties. Adipala was elected President of African Crop Science Society in 1993, a position he held until 1997. He built the society into an internationally recognised and respected continental organisation. He founded the African Crop Science Journal and African Crop Science Society Conference Proceedings publications in 1993, and served as Editor-in-Chief for 10 years; these two publications are recognised internationally and are "windows" for exposure of African scientists. One of Adipala's key achievements has certainly been promoting networking among African scholars and dissemination of scientific information across the continent. He has over 180 peer-reviewed journal publications. Adipala has actively participated in the design and review of several development programmes in Uganda and internationally. His career has centred on human resource development, research (and from 1998 also outreach), networking and exchange and dissemination of scientific information. On 1 June 2004, he was appointed the first Coordinator of the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), A Network organisation of 12 universities in East and Southern Africa for supporting graduate training and agricultural research in African Universities.

MATHIAS FRU FONTEH has a BSc, MSc, and a PhD in Agricultural Engineering specializing in water resources management, irrigation system design and management, soil

water management for crop production, modeling variability of infiltration in surface irrigation systems. For over sixteen years Dr. Fonteh has worked as a faculty member at the University of Dschang in Cameroon, teaching, and conducting research in water resources management. Currently, he is the Head of the Agricultural Engineering Department and the Coordinator of the Master of Science Programme in Water Management in the Faculty of Agriculture., where he was responsible for developing the new programme, which took off in the 1996/97 academic year with the first batch of 30 students; the day to day running of the programme; and for ensuring that the programme content and quality in the three options offered: agriculture, community water supply and environmental water management. Mathias is also the chairperson of the Cameroon Water Partnership of the Global Water Partnership Organization which is closely working with the government of Cameroon in the elaboration of a national integrated water resources management plan.

ISATOU JALLOW is a nutritionist with eighteen years of professional experience from working in nutrition in The Gambia. She has succeeded during this period to move nutrition high on the development agenda of the country. Currently, she serves as Executive Director of the Ministry of Health to a National Nutrition Agency under the Office of the Vice President where she has coordinated the transformation of a nutrition unit. She is also responsible for adapting the global UNICEF/WHO Baby Friendly Hospital Initiative into a Gambian Baby Friendly Community Initiative. What started as a pilot project in 12 rural Gambian communities has now been scaled up to almost 300 communities (50% of all primary health care villages in The Gambia) with plans to eventually cover all rural communities in The Gambia. Jallow is currently a member of the International Baby Food Action Network (IBFAN), Africa Advisory Committee and the Sub-Saharan Africa regional Design Team for the International Assessment of Agricultural Science and Technology (IAASTD). She is a former member of the 2020 Africa Conference Advisory Committee on "Assuring Food and Nutrition Security in Africa by 2020" coordinated by the International Food Policy Research Institute (IFPRI) and hosted by the Government of Uganda. Dr. Jallow holds a MSc. in Nutrition from the University of Oslo.

WILBERFORCE KISAMBA-MUGERWA has been Director of International Food Policy Research Institute in Addis Ababa since 2004. He was Uganda's Minister of Agriculture, Animal Industries and Fisheries for 5 years; he has also served Uganda as Minister of State, Minister of State for Finance and Economic Planning, and Minister without Portfolio in the Prime Minister's Office. He has also served as Member of Parliament and as a Senior Research Associate with the Makerere Institute of Social Research, Makerere University in Kampala. Dr. Kisamba-Mugerwa holds a doctorate in agricultural economics from Makerere University.

DANIEL N. LANTUM is a retired Professor of Public Health and Community Medicine of the Faculty of Medicine and Biomedical Sciences, University of Yaoundé I. Dr. Daniel N Lantum is currently the African Regional Coordinator for the International Council for the Control of Iodine Deficiency Disorders (ICCIDD) a post he has hold since 2000 cumulatively with that of Sub Regional Coordinator for Central Africa and Madagascar which he assumed in 1987. In 2007 he won the John T Dunn Award for Distinguished Services to ICCIDD since 1986. Fellow of the Cameroon Academy of Sciences since 1992, he has been Dean of the College of

Biomedical Sciences. Dr Lantum joined the Faculty of Medicine, then known as the University Centre for Health Sciences as a founding member of the professional corps in 1970 after obtaining his Dr. P.H. degree at Tulane University School of Public Health and Tropical medicine. There he headed the Public Health Unit while lecturing History of Public Health, Medical Demography, Epidemiology, Community Medicine, Occupational Health and Tropical Medicine while organizing field postings in Community Medicine and health Care Delivery. Eventually he became the Vice-Dean from 1978 till 1986, while periodically serving as Consultant to WHO, UNICEF, World bank, UNECA, Ford and Rockefeller Foundations. As a result of publishing several papers on Epidemiology, Nutrition, Demography, Traditional Medicine, Education for Health, and Iodine Deficiency Disorders, he was awarded the memberships and later Fellowship of the Royal Society of Tropical Medicine of England and Fellowship of the Faculty of Public Health of United Kingdom. Because of his publications and professional productivity he was awarded the Bronze Medal by Albert Einstein International Academy Foundation, later the D.Sc (Honoris Causa) and the White Cross Medal by the same Academy. In 1969, he won the award of Distinguished AFGRAD Alumnus; in 1990, the Knighthood of the Knightly Association of St George – the Martyr; in 1996 the International ALGEPA PRIZE in PARIS; in 1993 the Decoration of Knight Officer of Cameroon Order of Valour; in 1995 the John Paul II Gold Medal and honour of serving as the Papal Physician; in 2006 the Pope Benedict XVI Gold Medal – Pro – Ecclesia et Pontifice. He has been honoured among “WHO is WHO in the World” since 1998 and nominated among the Top 1000 in the world for 2007–2008 by the American Biographical Institute. Dr Lantum received his M.B.B.S (London) degree at the University College Ibadan – then in special relations with University of London, obtained his Diploma in Tropical Medicine and Hygiene from the Liverpool School of Tropical Medicine in 1965, and studied the French language at the University of Montpellier in 1973. He is very active in the fields of Religion, Traditional Medicine, and African Culture.

AMBASSADOR NIELS MARQUARDT was confirmed by the United States Senate on June 25, attested by the President on July 2, and assumed his duties as Ambassador to Cameroon on August 27, 2004. He also served as non-resident Ambassador to the Republic of Equatorial Guinea, from September 2004 through November 2006. Previous to that, he served as Special Coordinator for Diplomatic Readiness 2001–2004. In this role, he was responsible for coordinating the largest increase in State Department recruiting, hiring, and training in its history. A senior Foreign Service officer, class of Minister-Counselor, he also served in 1998-2000 as Director of the Department's Entry-level Counseling and Assignments Division in the Bureau of Human Resources. Ambassador Marquardt's overseas assignments as Economic Officer have taken him to Germany (1995–98), France (1990–94), Thailand twice (1981–83, 1987–90) and Brazzaville, Congo (1983–85). He also served domestically in the Bureau of East Asian and Pacific Affairs and as a Country Risk Analyst at the Export-Import Bank of the United States. Additionally, he attended the "Senior Seminar" and the Economic-Commercial Studies Program at the Department's Foreign Service Institute. Prior to joining the Foreign Service in 1980, Ambassador Marquardt served from 1977 to 1979 as a Peace Corps Volunteer in Rwanda. He graduated from Lewis and Clark College in 1975, from the American Graduate School of International Management in 1980, and from the National War College in 1994. His foreign languages are French, German, Thai, and Spanish. He is the recipient of several Meritorious and Superior Honor Awards as well as Presidential Performance Pay on four occasions.

BARRY MENDELOW is a Staff member of the QA Division South African National Health Laboratory Service. He is Emeritus Professor Division of Molecular Medicine and Haematology School of Pathology University of the Witwatersrand Johannesburg, South Africa. He is currently Chair, Consensus Panel on "Nutritional influences on human immunity with special reference to HIV infection and Active TB in South Africa." Academy of Science of South Africa.

NAMANGA NGONGI is *World Food Programme Deputy Executive Director from 1994 to 2001*. Dr. Namanga Ngongi obtained a Bachelors Degree in Agriculture from the California State Polytechnic University in 1968. He undertook graduate studies at Cornell University, Ithaca, New York and obtained Masters and Doctorate Degrees in 1973 and 1976 respectively. Dr. Ngongi has had a diversified professional experience in areas related to food security. He served as Agricultural Extension Officer in the Cameroon Ministry of Agriculture, was Deputy Chief of Service for projects, Councellor at the Cameroon Embassy in charge of relations with FAO, IFAD and WFP and served for two decades in the World Food Programme and United Nations. He led a joint soil fertility research project between the Soil Research Institute of Ghana and Cornell University (1975–1978) and visiting Lecturer at the School of Agriculture in Yaoundé (1979–1980). Dr. Namanga Ngongi was appointed Deputy Executive Director of WFP in 1994 following more than a decade of service with the organization at different capacities including Chief of East and Southern Africa Bureau, West and Central Africa Bureau and Director of Development. His extensive travels in Africa and other parts of the world brought him in direct contact with food security problems and challenges. Dr. Ngongi was chair of the Standing Committee of the United Nations on Nutrition in 2000 to 2002. In August 2001, Dr. Ngongi was appointed as Special Representative of the UN Secretary General to the Democratic Republic of Congo (DRC). This assignment brought him in direct contact with the humanly induced food security problems caused by war and the immense suffering of the population. Dr. Ngongi retired from the United Nations in 2003. He has since led high-level missions for WFP, led a team of consultants that prepared a study that explored further options to strengthen food security in Africa for WFP at the request of NEPAD and prepared a document on Security Sector Reform in Africa for the United Nations.

ANOMAH VICTOR NGU, Director of Hope Clinic, is former Minister of Public Health and former Delegate General (Director General) for Scientific and Technical Research in Cameroon. He was also Vice Chancellor of the University of Yaoundé, Pro-Chancellor of the University of Buea, President of the Cameroon Academy of Sciences, Director of the Cancer Research Laboratory of the University Centre for Health Sciences. He is past President for Africa of the International Union Against Cancer, Past President of the Association of African Universities, the Nigerian Cancer Society, etc. He holds the Albert Lasker Medical Research Award in Clinical Cancer Chemotherapy and Dr. Samuel Lawrence Adesuyi Award and Medal by the West African Health Community. Prof. Ngu's research efforts include many scientific publications in general surgery, cancer and HIV/AIDS. Prof. Ngu's professional qualifications include MBBS,MS (Surgery) both from the University of London. He further holds the FRCS (Edinburg), FRCS (England) and FWAC (West African College of Surgeons). He is Knight Commander of the Cameroon Order of Valour.

SAMUEL NZIETCHUENG is an Agronomist, Physio-pathologist and international development specialist with thirty-two years of experience working in Europe, USA, the Caribbean and Africa. He is qualified in managing international intergovernmental organization and designing multi-sectoral and multinational programmes in the areas of agriculture production and biotechnology. Dr. Nzietchueng has extensive experience in creating effective relationships with international and national research institutions and has strong skills in institutional and human capacity building. He is qualified in teaching and supervising research works for Master & Ph.D thesis. He is also fluent in French and good in English.

SUSAN E. OFFUTT is Chief Economist of the Government Accountability Office, an arm of the U.S. Congress. From January 1996 to December 2006, she was Administrator of the U.S. Department of Agriculture's Economic Research Service. Prior to becoming Administrator of ERS, Susan was the Executive Director of the National Academy of Sciences Board on Agriculture, which conducts studies on a range of topics in agricultural science. Before taking over at the Board in January 1992, Susan was chief of the agriculture branch at the Office of Management and Budget in the Executive Office of the U.S. President. Susan served as assistant professor from 1982 to 1987 at the University of Illinois, where she taught econometrics and public policy in the agricultural economics department. She is a past president and a fellow of the American Agricultural Economics Association and edited the *Review of Agricultural Economics*. In 2002, she was named a Distinguished Executive of the United States Senior Executive Service. Susan received a B.S. degree from Allegheny College (1976) and a M.S. (1980) and a Ph.D. (1982) from Cornell University.

WILLIS OLUOCH-KOSURA is a Kenyan born on December 20, 1952. He is the Program Director, Collaborative Msc in Agricultural and Applied Economics in Eastern, Central and Southern Africa (CMAAE), since 2006. He was Associate Professor and Chairman, Department of Agricultural Economics, University of Nairobi (1999–2003) and was the Planning Coordinator for the CMAAE (2003–2005). He obtained his PhD in Agricultural Economics from Cornell University, Ithaca in 1983, MSc in Agricultural Economics from the Australian National University in 1978 and BSc in Agriculture from the University of Nairobi in 1976. His interest is in the area of Agricultural Development Policy, focusing on issues of Rural Factor and Product Markets, Poverty Dynamics, Technology Generation and Adoption, Institutions and Project Planning and Management. He has over 60 publications to his credit and has supervised many PhD and MSc theses. He has been consultant to Ministry of Agriculture, Kenya, FAO, World Bank, CTA, UNCRD and several other National and International Organizations and Networks. He is the founding President of the African Association of Agricultural Economists (AAAE) (2004–2007) and was member at large in the Executive Committee of the International Association of Agricultural Economists (IAAE) (2003–2007). Through these associations, he has built considerable social capital to facilitate further collaboration on teaching, research and outreach with professional colleagues for the benefit of the CMAAE and African Universities.

SUSANNE A. STOIBER Since 1975, Mrs. Stoiber has served in a series of senior positions in the National Academies and the U.S. Department of Health and Human Services. She was named Executive Director (Chief Operating Officer) of the Institute of Medicine in 1998. Her responsibilities include management of the IOM program operations, and support of the Institute's governance and membership functions. In this period, the Institute has doubled its'

program size, and become a major national presence in areas such as the quality of health care in America, biomedical and public health research policy, the affordability and safety of vaccines, health disparities and food safety. In the Department of Health and Human Services, Mrs. Stoiber held a number of senior positions in the Office of the Secretary and at the National Institutes of Health. She was three times appointed as a Deputy Assistant Secretary for Health – Planning and Evaluation (1979 and 1995), Health Promotion and Disease Prevention (1996), and as a Deputy Assistant Secretary for Planning and Evaluation, Program Systems (1997). In these positions, she managed analytical, research and evaluation activities. Accomplishments included coordination of Healthy People 2010 – the nation's prevention agenda, oversight of the Department's evaluation program and department-wide strategic planning. While at the National Institutes of Health in the 1980s, she served as hospital administrator of the Warren Grant Magnuson Clinical Research Center and as Senior Advisor to the Deputy Director for Science of the NIH. She received her Bachelor of Arts and Master of Public Administration degrees from the University of Colorado, and a Master of Science degree from the London School of Economics. Honors and recognition include the Secretary's Distinguished Service Award (1979, 1981, 1997); the NIH Director's Award (1985), and a Presidential Rank Award for lifetime achievement in the Senior Executive Service (1998). Mrs. Stoiber is married to Carlton R. Stoiber, an international nuclear lawyer and freelance political cartoonist.

WYNAND J. VAN DER WALT received his basic training in genetics and holds a BSc (Agric) (Genetics) and MSc (Agric) (Genetics) from the University of Pretoria, a PhD (Genetics) from University of Wisconsin, and an MBL in business management from the University of South Africa. Following a brief career in the Department of Agriculture, he joined the South African subsidiary of a multinational seed company, Asgrow, as research manager from 1967 to 1989, most of the time serving also as member of the Board of Directors. At the request of the national seed industry, he left to establish SANSOR (South African National Seed Organization), a non-profit company as secretariat for the industry where he served as general manager until 2000. SANSOR also managed all official seed certification for government and assisted with variety listing and plant breeders' rights, while acting as licensor of new seed varieties arising public plant breeding. In 1999-2000 he was one of the founding directors of AFSTA (the African Seed Trade Association) that represents seed industries in Africa, and of AfricaBio, a biotechnology stakeholders association, both being non-profit organizations. He scaled down and retired in 2002 after which he established FoodNCropBio, a private consultancy on ag-biotechnology and food safety, that also involves project studies nationally and in Africa. He is recipient of listing on the Roll of Honour for plant breeding achievements by the Southern African Plant Breeders' Association, an award for plant breeding support by the Agricultural Research Council-- Range and Forage Institute, and recognition award in the Peace Gardens social upliftment project. He was awarded honorary life membership in AFSTA and still serves as Chairman of the Board of Trustees of a tennis development foundation.

CATHERINE WOTEKI serves as Global Director of Scientific Affairs for Mars, Inc. From 2002 to 2005, Catherine E. O'Connor Woteki served as Dean of the College of Agriculture, Director of the Iowa Agriculture and Home Economics Experiment Station and Professor of Food Science and Human Nutrition at Iowa State University. Dr. Woteki was the College of Agriculture's ninth dean and the first woman to hold the position. She provided outstanding leadership for the College, enhancing the excellence of its programs, ensuring the success of

students and focusing on priorities of Iowans. Her dedication, commitment and service to agriculture and the life sciences, to Iowa State University and to the state of Iowa will not be forgotten. Prior to joining Iowa State, Dr. Woteki was a Senior Research Scientist with the College of Agriculture and Natural Sciences at the University of Maryland and Professor of Nutrition and Food Safety at the University of Nebraska. A nutritional epidemiologist and registered dietitian, she served from 1997 until 2001 as the first Under Secretary for Food Safety in the U.S. Department of Agriculture. In that position, she was responsible for development of U.S. food safety policies through the work of the President's Council on Food Safety and the Codex Alimentarius Commission, and for the safety of meat, poultry and egg products under the regulatory authority of the Food Safety and Inspection Service. Under Dr. Woteki's direction, FSIS implemented the science-based inspection system known as Hazard Analysis and Critical Control Points, which resulted in major declines in the occurrence of pathogens in meat and poultry products. She also served as USDA Deputy Under Secretary for Research, Education and Economics and as Deputy Associate Director for Science in the White House's Office of Science and Technology Policy. Dr. Woteki is a member of the National Academy of Sciences' Institute of Medicine, and served as chair of the Institute's Food and Nutrition Board from 2003 to 2005. In 2004, she was named a Fellow of the American Association for the Advancement of Science. Dr. Woteki's research interests include food safety and nutrition policy, chronic disease prevention and population health surveillance and monitoring. She earned her B.S. degree in biology and chemistry from Mary Washington College and her master's and Ph.D. in human nutrition from Virginia Polytechnic Institute and State University.

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