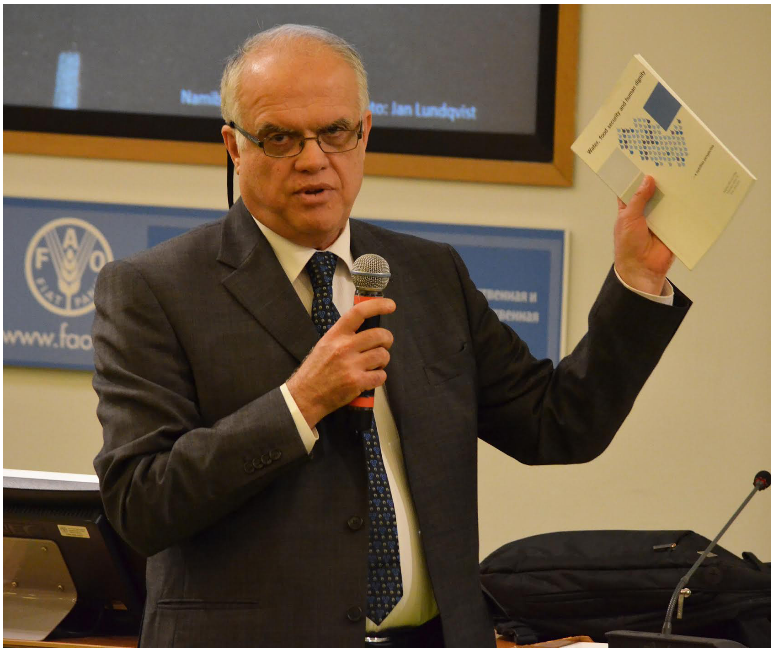
Editorial

Food security with equity through social and technological innovations



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This issue of Future of Food Journal comes at a time when the trends in the drivers of food and water, and the state of the natural resource base are giving unfavorable signals. Chronic hunger is on the rise following a steady decline of a decade; adult obesity is increasing in all regions irrespective of level of economic development; and childhood obesity is increasing in most regions. The prevalence and number of deaths due to overweight and obesity are now greater than those due to underweight and hunger. One third of land on a global scale has been lost to erosion and pollution over the past four decades; and half of the world's topsoil has been lost in the past 150 years. Major decreases in the insect biomass around the world further add to the concerns, among others, for the future of agricultural production. Against this background, we must meet the needs of a projected global population of approximately 10 billion people, who will demand 50% more food and another 50% more water than those in 2012. The gap between supply and demand could be as high as 40% by 2030. Yet, one third of all food produced globally is lost or wasted, and water-use efficiencies remain far below attainable levels.

There is widespread recognition, however, of these challenges and constraints, and we see them addressed in the major global policy discourses (e.g. 2030 Sustainable Development Agenda and Nationally Determined Contributions to the UNFCCC), National Development plans and programs, and by the private sector. The implementation aspects, including funds and funding schemes, governance arrangements, and the role of science, technology and innovation are now more prominent agenda items at all levels, with promising developments being reported frequently. One such development is the steady increase in funding for agricultural research and development, which rose by 3.1% per

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year in the first decade in the 21st Century after a slowing trend in the late 1990s. It is important to note that the R&D spending also grew in low-income countries, albeit at a slower rate.

The business as usual approach, with patchwork, detached measures, will not yield the desired outcomes. Major changes must be put into effect quickly and decisively. Achieving food security should take into account the three dimensions of sustainability (plus governance) and impacts of climate change. Public policy should ensure that food security and nutrition (FSN), poverty eradication and sound natural resources management go hand in hand. This approach should cover all aspects of the food value chain, from production to post-harvest management, storage, transport, and processing, and from marketing to consumption, with both supply and demand dimensions incorporated into policies and interventions.

Innovation for food security and nutrition for all: Prospects and examples

The broad context within which FSN should be considered is built on three pillars: economic development, including eliminating hunger and poverty, and access to basic services for all; healthy and functioning ecosystems; and resilient livelihoods. Regarding these pillars, I would like to offer examples and prospects of innovation linked to the four main dimensions of food security: availability, access, utilization, and stability (FAO, 2008).

Food Availability

Innovation opportunities related to the availability of food include those to increase agricultural productivity as well as land and water productivity through improved plant varieties (e.g. crops resistant to disease, pests, heat, or droughts; salt-tolerant crops; transgenic crops), interventions for higher crop yields (e.g. low-cost toolkits for extension workers, marker-assisted breeding, etc.), increasing soil health and organic carbon in soil, interventions to enhance water availability (e.g. rainwater harvesting, groundwater detection sensors, low cost water storage, wastewater reuse) and proper irrigation and fertigation technologies, coupled with irrigation scheduling and adaptive management. In the livestock sector, innovations in efficient animal production, animal nutrition (e.g. high-nutrient, low cost fodder), feeding practices, animal diseases and management (e.g. low-cost veterinary toolkits and pharmaceuticals), along with practices to reduce greenhouse gas emission intensity and environmental impacts are to be envisaged. In aquaculture, innovations in reproduction, disease management, holding systems and feed technologies are some of the opportunities. Urban and peri-urban farming present innovation opportunities, too, such as indoor and vertical farming, aquaponics, and low-cost greenhouses.

Food Accessibility

Improving access to food has perhaps the most significant potential among all as 1.3 billion tons of food is lost or wasted every year. Saving one quarter of that amount would be enough to feed the 815 million people suffering from chronic hunger. Much potential exists in improving access of smallholder farmers to markets, and appropriate post-harvest technologies, including adequate and proper storage of the products and handling, refrigeration and transport. Some of the possibilities are fruit preservation, milk chilling, seed and grain drying, rice parboiling and drying, low cost refrigeration and vacuum/hermetic sealing.

Food Utilization

Nutrition innovations to tackle malnutrition, both underweight and obesity, can help address inadequate intake of nutrients, which is often coupled with an intake of excessive calories. Biofortification (i.e. incorporation of critical nutrients and vitamins, especially into staple crops) can be listed under this category. The HarvestPlus Program, hosted by the International Food Policy Research Institute, has pioneered biofortification as a global plant-breeding strategy for a variety of crops such as vitamin A-enriched cassava, maize and orange-fleshed sweet potatoes, and iron and zinc-fortified rice, beans, wheat and pearl millet in over 40 countries (https://www.ifpri.org/program/harvestplus).

Food Stability

The increased uncertainties as a result of climate change make a wide spectrum of food systems vulnerable to the otherwise manageable drivers. The broad response to this is climate-smart agriculture,

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which incorporates climate science in transforming and reorienting agriculture in support of food and nutrition security through sustainable increases in production and productivity; adapting and building resilience to climate change; and reducing greenhouse gas emissions to the extent possible. Much potential lies in this area for innovative solutions. Use of big data and internet of things (IoT) offer some of the current and promising innovations that can enhance food stability. FAO's updated Climate Smart Agriculture Sourcebook (http://www.fao.org/climate-smart-agriculture-sourcebook/en/), released in Bonn, Germany during COP23 of the UNFCCC, lists a broad and diverse number of examples and possibilities for crops, livestock, aquaculture/fisheries, and forestry.

Three areas to watch for innovation

Much potential exists in agricultural biotechnology to enhance production, productivity and sustainability in agriculture. The possibilities range from low-cost, low-technology solutions to high-end technology, including advanced DNA-based methods, genetically modified organisms (GMOs) and nuclear techniques in food and agriculture. The polarizing debate GMOs have stirred since the 1990s casts an unfortunate shadow on the use of other biotechnologies, and their potential for products, such as new crop varieties, which could benefit smallholders and those sectors where the private sector has little or no commercial interest.

A second area to watch is the use of information and communications technologies (ICT), which enable agricultural innovation by providing a wide range of information, from weather to market conditions, and allowing connectivity to buyers and customers as well as between producers, for example. More recently, ICT has created the possibility for those who have difficulty accessing formal financial services and infrastructure to make financial transactions. ICT can also help strengthen the links from science to extension and technology transfer, as well as broaden the use of the non-proprietary genetic material.

The third area to watch is the innovations to deal with water scarcity, including not only the physical scarcity of water but the scarcity emanating from lack of infrastructure, investments or capacities, all with consequences for or links to FSN. This results in alternative pathways to food and nutrition related targets, depending on the policies (or lack of them) chosen to cope with water scarcity (Lundqvist & Unver, 2017). A recent multi-stakeholder initiative, Global Framework on Water Scarcity in Agriculture in a Changing Climate (WASAG), established by FAO and its partners (http://www.fao.org/land-water/overview/wasag/en/) brings together actors from governments and the public sector, United Nations agencies, research organizations, and membership organizations in an innovative, loose framework offering multi-disciplinary, integrated solutions in agriculture sectors and food systems. WASAG has working groups dealing with water and migration; drought; innovative financing schemes and mechanisms; water and nutrition; and agricultural transformations.

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