

Innovation to Address Food Security

Introduction

In 2007, Ministers called upon the OECD to develop an Innovation Strategy to strengthen innovation performance and its contribution to growth. In addition to the urgent need to increase productivity through innovation, a number of unprecedented global challenges call for innovation-driven solutions. As mentioned in the OECD Innovation Strategy Interim Report, the ability to address increasingly urgent challenges, such as climate change, health, food security and poverty, depends on OECD members fostering an environment where new tools and technologies are developed, and new forms of international collaboration and governance are supported.

Meeting the challenge of global food security will require both short-term and long-term responses to raise productivity growth and strengthen the supply side of global agriculture globally. Investment in innovation is thus critical to the enhancement of agricultural productivity and the long-term challenge of sustainable development. Further, legal frameworks that create economic incentives for these innovations to occur in a collaborative and public manner should be promoted. In BIAC's view, innovation to address global food security challenges should be given a high profile in the OECD Innovation Strategy and ensuing follow-up work.

Challenges for the future

The challenges for the future are enormous. With the world population expected to reach over 9 billion by 2050, the global demand for food is projected to increase by at least 2.5 times over current levels. At the same time, food production has to take into account a number of other global challenges, such as climate change and water scarcity, as well as competing claims, including the need for animal feed, fibre for clothing and biofuels for energy. As global oil resources are finite, the world increasingly looks for ways to move from oil-based to bio-based economies. Besides the energy sector, this can include certain aspects of the chemical sector where raw materials from oil are gradually being replaced with raw materials from alternative stocks, such as renewable resources. Global warming is likely to lead to greater incidence of negative agricultural yield shocks in certain regions, calling not only for ambitious mitigation policies, but also well-planned adaptation strategies.

Overall, climate change is likely to increase land fragility and seed fragility, and will add to the complexity of the challenges at hand¹.

While the recent steep price increases for major crops were triggered by a range of different factors, they have raised the awareness of food security concerns, in particular for developing countries. In view of these challenges, investments in R&D, agricultural production and processes, technology diffusion and uptake as well as extension services, particularly in developing countries, will be essential to increase productivity and output. As low levels of investment in agriculture are a major stumbling block to achieving global food security, investment requirements must be considered urgently and broadly, not only to encompass scientific advances, but also to address the need for appropriate infrastructure, human resources and capacity building.

The urgent need for innovation

Impressive productivity growth in agriculture has been a main driver in feeding a rapidly increasing world population. To address food security needs for the future, farmers will need to continue to increase crop productivity – maximising productivity on existing farmlands is the most productive and environment-friendly option available, rather than bringing new land into cultivation. This path forward will address issues such as biodiversity, carbon sinks, deforestation and other environmental concerns, accelerating the productivity of existing agricultural land should be of priority. Consequently, innovative technologies are increasingly important to meet the growing demands of demographic and social developments as well as changing consumption patterns. There are a number of innovation opportunities—improved farming techniques, the use of crop protection products and fertilisers, new crop varieties derived through conventional hybrid as well as biotech breeding techniques, including but not limited to biotechnology and further down the road nanotechnology—that need to be given the highest attention. We therefore encourage the OECD to shed further light on the opportunities for efficiency improvements in the agriculture sector through innovation, development and application of new technologies and best practices. Further, we encourage the OECD to promote high quality intellectual property rights in creating economic incentives and fostering innovation.

Creating coherence across the innovation cycle, between supply and demand and across different markets requires a multifaceted approach. Innovation in a whole range of fields, including creating new ways of working with existing agricultural tools and inventing new technologies, will eventually lead to far-reaching and beneficial changes in food production and consumption.

The following is a non-exhaustive list of examples where innovation can make a key contribution to addressing food security concerns.

Improved seeds: Where appropriate, improved seeds, including those derived through biotechnology, have the potential to make a major contribution to increasing crop yields,

¹ See BIAC Paper: Agriculture and Climate Change (2009).

nutritional content, and productivity, and mitigating environmental impacts such as climate change. Drought-tolerant crop varieties, for example, have the ability to help protect yield potential when water is scarce, while other crop varieties can be produced with genetics that protect against yield losses due to flood conditions. Salt-tolerant crops can be developed to allow land that has become unproductive for crops to be used for food production. Breeding of plants with improved water efficiency will be important. Plants with an improved nitrogen-efficiency can grow and produce high yields with lower amounts of fertiliser or have much higher yields under the same fertiliser input. Such plants would also help to minimise the emission of nitrous greenhouse gases (GHG) and save energy on the production of nitrogen fertiliser an energy intensive process.

Integrated pest management: The objective is to produce quality crop yields with techniques that minimise environmental impacts. Pest outbreaks can thus be prevented or limited, by developing and using green mechanical, biological, chemical and other controls only as needed.

Judicious fertiliser use: The use of fertilisers helps increase cultivated soil carbon reserves by increasing the photosynthetic conversion of CO₂ to biomass that is subsequently converted to soil organic matter².

Improved water management: Agriculture depends on water availability and water quality, thus it will be increasingly important to develop innovative strategies for sustainable water management. Innovative methods for conserving water on the farm-level will be important, such as improved irrigation techniques.

Biofortification and biofertilisation: Fighting micronutrient deficiency through conventional or other forms of breeding and fertilisation could contribute to dramatically improve health and reduce childhood mortality in many countries. Initiatives include beta-carotene enriched rice, iron and zinc enriched rice, etc. Supplementing fertilisers with zinc is one of the most cost-efficient strategies which fights micronutrient deficiencies of soils, plants and people simultaneously. A joint partnership between the zinc and fertiliser industries was recently established to encourage greater adoption of biofertilisation.

Best practices to reduce GHG from livestock: There are a number of examples of how best practices can help reduce emissions. For instance, research to reduce GHG from livestock is looking at selective breeding and biological means of reducing emissions. Examples include biogas production from animal waste by using co-digestion.

Leveraging information technology (IT) for agriculture development: IT applications in agriculture are limited in the developing countries. There is significant potential for maximising gains in agriculture through various IT applications, such as drought and flood management coupled with crop advice to farmers, waste reduction, risk mitigation and market development. Therefore, it is critical to build capacity among farmers and create conditions that would allow them to access and apply these IT applications.

² Furthermore, and in partnership with policymakers, scientists, and farmers, the International Fertilizer Industry Association (IFA) has developed a global framework for fertiliser best management practices in order to help limit the unwanted impacts of intensified agriculture.

Extension: A key element in supporting agriculture's role is access to information. Extension programmes were originally conceived as a service to "extend" research-based knowledge to the rural sector in order to improve the lives of farmers. The traditional view of extension in developing countries was very much focused on increasing production, improving yields, training farmers, and transferring technology.

Minimising the pre and post harvest losses: The reduction in pre and post harvest losses would in itself contribute in a major way to food security. There is an urgent need for replacing the rudimentary pre- and post-harvest practices with innovative, scientific and low cost models.

Adjustment in farm practices: Farm mechanisation will be essential for increasing food production in developing countries. Machinery and implements have to be tailor made to the conditions in each of the agro-climate zones. In addition, the development of prediction tool models and on-site diagnostics can optimise farm practices by minimising the inputs (fertiliser, water, agrochemicals) and maximising the yield.

Carbon Sequestration: The process of transferring atmospheric CO₂ into soil and biotic pools can enhance soil quality, increase agronomic productivity, improve quality of natural waters, and lower rates of anoxia (decrease in the level of oxygen) or hypoxia (dead water) in coastal ecosystems.

Soil Conservation: Conservation agriculture techniques such as low or no-till agriculture, made possible through the use of herbicides and biotechnology-derived crops, prevents wind and water erosion and loss of ground moisture, improves soil biodiversity, increases soil fertility, and in appropriate, carefully managed cases has the potential to reduce carbon emissions. In addition, by limiting soil disturbance and promoting a permanent soil cover, conservation agriculture can contribute to limiting emissions from agriculture by increasing soil carbon content (i.e. reducing emissions) and preventing erosion.

Enzyme applications: The number of enzyme applications in food applications has been growing. Enzyme technologies can improve the quality and quantity of food products. Some examples include reducing the content of unsaturated fat in fat spreads, improving vegetable flavour, increasing cheese yield, improving phosphorous use by certain animals, enhancing fibre digestion, and slowing the staling of baked goods.

Addressing public perception issues

The issue of public acceptance of new technologies is a well-known challenge in agriculture and needs to be addressed by politicians, business and professional and scientific NGOs. It is generally agreed that innovation in agriculture will be key to addressing the challenge of global food security, taking into account environmental, social and economic considerations. However, the perceptions between stakeholders about different technologies can often vary significantly, which can ultimately lead to policy changes with respect to the use of certain technologies. If effective and sustainable government approaches for communication and education of sound fact-based information is not in place, debates can easily become misinformed and can lead to policy decisions that may in some cases have negative

implications for global food security over the longer term, such as by leading to inefficient land-use and/or higher food prices.

For example, food is often not considered to be an environmental issue when in fact the meat and dairy industries produce a considerable amount of greenhouse gases. By educating the public about food production and its impacts, we can succeed in protecting the environment while at the same time helping to solve the world's food shortage issues.

Communication of clear and objective information to the public is therefore essential for developing stronger public knowledge on important policy issues. In BIAAC's view, the OECD has impressive and long-standing experience in generating sound fact-based analysis on a wide range of policy issues. However, there is room for strengthening communication beyond the scope of closed policy circles and more towards broader society.

The importance of capacity building

Capacity building is an essential overarching requirement, and generic capacity building at all levels is crucial. However, in countries where agriculture is a predominant sector, generic capacity building has to go hand in hand with more targeted capacity building for science and technology as well as IT applications in the agriculture sector to achieve tangible outcomes. Skills shortages and too few agricultural scientists are becoming an increasingly serious problem that needs to be addressed. The process of capacity building must be complemented by improved access to essential information, such as agronomic information, price and meteorological updates to allow farmers to apply their knowledge.

The adoption and development of new technologies, both in developed and developing countries, will not be achieved without a certain level of education. A massive effort must be applied in the training of farmers, agro-dealers and extension workers as well as in primary education services. Education for current farmers, but also for children to become modern farmers, is essential to provide full skills for gainful employment in diverse sectors in both agricultural and non-agricultural areas. It will be particularly crucial to support developing countries' efforts to implement good policies for investment through targeted capacity building.

The role of the private sector

The private sector is a major contributor to innovation through agricultural research and development. However, for the private sector to be able to play its role most effectively, it requires policies that promote investment and innovation in agriculture, including science-based regulation of new technology and the protection of intellectual property rights. Establishing legal frameworks that promotes investments in research and development is essential to meet future needs. The provision of an enabling framework for the private sector that facilitates the necessary financial flows and encourages firms to address food security concerns and promote innovation is essential. BIAAC considers the following issues as particularly important:

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- Providing long-term, fact-based, risk-based, predictable and interpretable regulatory processes;
 - Fostering international and cross-discipline collaborations in the area of R&D and maximising opportunities for international cooperation in basic research;
 - Giving due attention to human resources, including relevant specialist subjects in universities and higher education (most notably in the applied agricultural sciences) and addressing skills shortages;
 - Encouraging increased cooperation between governments and the private sector;
 - Setting an overall enabling policy framework that provides adequate incentives to create and adopt new technologies in all areas, including implementation and enforcement to enable investment in new tools and technologies in line with the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS);
 - Fostering trade and investment liberalisation to facilitate the development and diffusion of technology;
 - Facilitating the development of financial and insurance solutions, which are important tools for farmers to manage markets with an increasing volatility (commodity prices) and the increasing risks they are exposed to (climate change);
 - Considering how innovation gets through to the relevant parts of the supply chain, including the role of incentives and the regulatory framework.

Furthermore, additional research will be needed in crops and techniques suited to the needs of developing countries, such as in orphan crops, technologies to address water shortages, techniques and crops suited to the needs of smallholders and which address nutritional concerns. Research in these fields will need to come from both the public and private sector and requires a policy framework that encourages public private cooperation and investment in these areas.

Concluding remarks and next steps

To address the challenge of global food security, innovation must play an important role in fostering agricultural productivity. We encourage the OECD Agriculture Committee to work closely with the Directorate for Science, Technology and Industry (DSTI) to ensure that innovation in the agriculture sector is given a high profile in the final report on the Innovation Strategy to be submitted to OECD Ministers in spring 2010. We also encourage the Agriculture Committee to consider fostering innovation in agriculture as a long-term issue to be reflected in its future programme of work and help governments portray an objective picture of the various challenges and opportunities that exist in this area.