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Increasing public spending in agricultural R&D to ensure food security in developing countries

Arguably, ensuring food and nutrition security for all people in the coming decades is the major challenge for the global community. Food demand is increasing in aggregate and per capita values, in parallel with population and income growth. In order to feed 9.6 billion people by 2050, projections indicate that food production will need to be raised by 70 per cent at global level and 100 per cent in developing countries, excluding the additional agricultural production needed for feed and biofuels. At the same time, constraints and costs are increasing on the supply side, given land and water scarcity, climate change effects, and higher energy prices. Thus, agricultural production and especially productivity have to increase sustainably, particularly in the developing world.

The key question, however, is whether productivity growth will be sufficient to ensure food security sustainably. On the one hand, yield growth for major cereals have been declining over the past decades, raising concerns about future productivity trends, food prices, and ultimately food insecurity. On the other hand, there are still significant potential agricultural productivity gains if investment in the agricultural sector, particularly in research and development, is increased and adequate reforms are implemented. This policy brief addresses these issues through the analysis of the main trends and projections on agricultural productivity, and policy measures needed to accelerate productivity gains in developing countries.

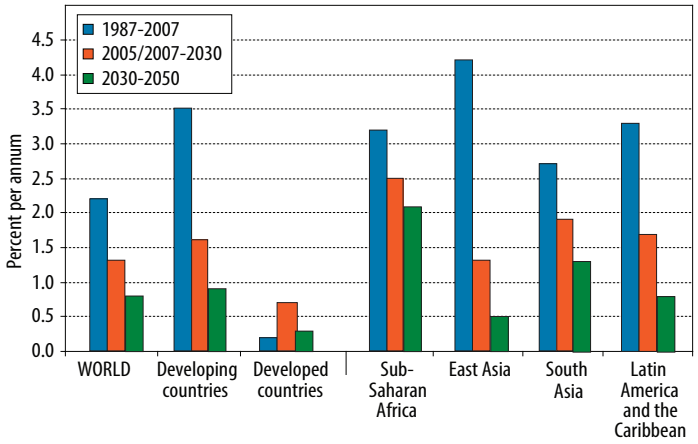
Productivity gains are slowing down in many countries

In the recent past, productivity gains have been slowing down in more food insecure countries, despite significant improvements in developing countries as a whole. The total factor productivity (TFP) – the ratio of total commodity output to total inputs used in production, including labor, land, capital, and materials – has been rising around 2.2 per cent annually between 1990 and 2009, in developing countries. TFP growth has accelerated even faster, above their regional average, in big emerging economies, such as Brazil and China. However, long-run TFP growth has remained under 1 per cent a year in South Asia and sub-Saharan Africa[1], showing that many developing countries are still facing serious challenges in achieving faster productivity growth across sectors, including agriculture.

1 Fuglie, Keith, and Alejandro Nin-Pratt (2012). A changing global harvest. In 2012 Global Food Policy Report. International Food Policy Research Institute. Washington, D.C. 2012

The overall picture is even more challenging when using partial factor productivity indicators. First, average global yield growth of most cereals - a common indicator for land productivity - has been declining for the past two decades, partly due to the increasing pressure on resources. Second, according to recent estimates in the *OECD-FAO Agricultural Outlook 2013-2022*, all countries will continue to experience a lower yield and production growth for most crops, as well as for livestock, mainly due to weather variability, higher production and supply costs, and less investment in agricultural research and development (R&D). Thereby, there are serious risks that future productivity may slow down in both developed and developing countries, affecting agricultural production growth, food prices, and food security (see figure 1).

Figure 1: **Agricultural production growth rates (percent per annum)**



Source: World Agriculture Towards 2030/2050: The 2012 Revision (Proof copy), Nikos Alexandratos and Jelle Bruinsma, Global Perspective Studies Team, ESA Working Paper No. 12-03 (June 2012), Food and Agriculture Organization of the United Nations.

Agricultural productivity gaps are still significant

As noticed above, many developing countries have been experiencing very low productivity gains over the past decades, indicating that there are still significant productivity gaps between countries. As data on yields of major cereals show, the gap between farmers' yield and potential yields, based on the latest crop varieties, varies from 11 per cent in Asia to 76 per cent in sub-Saharan Africa. According to other estimations such gaps could even reach as much as 100 per cent for rice and for maize in sub-Saharan Africa.

Against this background, it is clear that there is potential for productivity growth in many developing countries with

the existing knowledge and technology, if adequately disseminated and adapted. The example of Egypt illustrates well the possibility of closing rice yield gaps, through considerable investments in research and extension services stance. After 20 years of consistent and sustained efforts, Egypt has achieved the highest rice yield in the world. Thereby, in developing countries where yield gaps are significant, public investment in R&D should focus primarily on the adaptation of the existing extensive menu of technologies to local conditions. This will require in particular innovative approaches to reach small land holders, who often lack adequate technical support. In the long term, investment in R&D in the agricultural sector will be crucial in all countries, in order to move the technology frontier and sustain productivity growth.

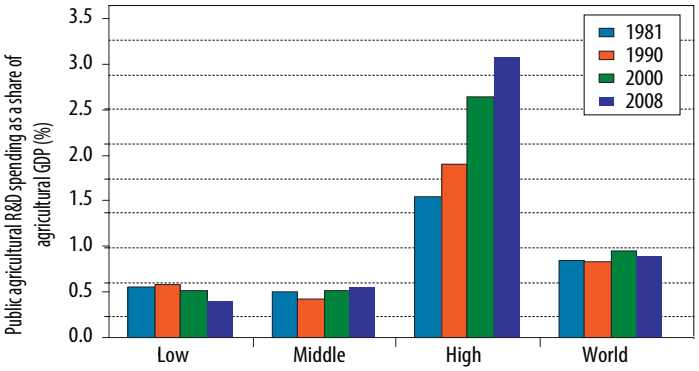
In addition to the lack of adequate technologies, the agricultural sector in many developing countries is also underperforming because of current institutional, human capital and infrastructural gaps. Institutional gaps exist in land markets, financial services, and input markets, affecting small farm holders and women in particular. According to FAO, improving women's access to land, for instance, could raise agricultural output by as much as 4 per cent. The lack of adequate access to financial services for small land holders is also preventing farm-level investments. Thus, reforming rural institutional conditions and investing in infrastructures will be a key determinant in boosting productivity in the agricultural sector, while reducing food insecurity.

Investment in R&D has to increase

The main challenge, however, is the fact that public spending in R&D has been declining in highly food insecure countries. During the last decade, global R&D increased approximately 22 per cent, from $26 billion in 2000 to $31.7 billion in 2008. According to the International Food Policy Research Institute, larger emerging economies were the major contributors to the global increase in public spending on agricultural R&D, accelerating significantly agriculture productivity. China and India alone accounted for closer to half of the global increase in agricultural R&D. But the positive pattern in R&D spending observed in larger developing countries is contrasted with negative trends in lower income economies. In sub-Saharan Africa, Asia and Latin America, many countries have registered declining public spending in agricultural R&D, affecting negatively their ability to generate and adopt new technologies. In addition, public R&D expenditures on agriculture in low and middle income countries remain relatively low, when comparing with higher income countries (see figure 2).

In developing countries, especially lower income countries, national investments in R&D need to be complemented with international support, through bilateral and multilateral organizations. The Consultative Group on International Agricultural Research (CGIAR) participation has been crucial in this field, in particular in the development of technologies adapted to small farming systems. Their support has been more expressive in regions where the agricultural sector is

Figure 2: **Public spending in agricultural R&D by income groups (1981-2008)**



Source: Beitema, Nienke, and others (2012). ASTI – Global Assessment of Agricultural R&D Spending. Developing Countries Accelerate Investment. International Food Policy Research Institute. Washington, D.C. 2012

weaker and where national public spending has been falling short, but their spending in agricultural R&D remains relatively low, as a share of total global public spending. The main challenge for developing countries, however, has been the stability of financial resources for R&D, which affects the continuity and viability of their research programs.

Concluding remarks

In the coming years, governments in developing countries, particularly food insecure countries, will need to foster long-term productivity by investing heavily in agricultural R&D, while introducing institutional reforms to create an environment that is conducive to the adoption of new technologies. In parallel, investments in rural infrastructure will be crucial to improve food production and distribution. However, given fiscal constraints in many countries, such important national efforts will not be possible without continuous and stable international support, including from the CGIAR.

Governments will also need to create the right incentives and regulations to encourage private investments. The role of the private sector should increase in the future, as economic opportunities in the food sector increase. But the insufficiency of public goods and services limits potential returns for private investments. Finally, uncertainties regarding long term productivity gains should be an incentive for policy makers to design concrete measures to reduce food waste and to change consumption patterns. Additionally, investments on the supply side need to be complemented by programmes designed to increase the incomes of the poor, as well as social protection and safety nets, as food insecurity is more often the result of limited access to food than lack of available food.

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