Speaker Summary Note

Session: **Science and Technology Levers**

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Title: **Creating an Enabling Policy Environment for Science and Technology**

The urgent need to maintain the growth of agricultural productivity in order to meet the medium- and long-term growth in food demand has been voiced repeatedly by researchers and policy analysts in recent years, and has called attention to the gradual slow-down in productivity growth and the resources devoted to agricultural science and technology research and development. Given the considerable gestation period that is needed for original field research to translate into scalable and replicable technology interventions—and for those technologies to be disseminated on a sufficient scale for achieving measurable impact—it becomes clear why the pipeline of innovation, discovery and dissemination must be kept full. By some more recent estimates with US data, the 20–30 year lags between agricultural R&D investments and the measurable effect on productivity improvement might be even longer than that—on the order of 40-50 years. This suggests that the past slowdown in R&D investments might have an even more far-reaching effects, and require even greater efforts on the part of current research efforts to act against the 'inertia' within the system, and begin to make a difference on the kind of outcomes we expect in 2050 and beyond.

Science and technology, when translated into concrete gains in on-farm productivity, and reduced losses of food through the post-harvest processing and marketing chain—represents not only food that is saved, but also the savings of critical resources needed to produce it. The 'land-saving' effects of yield improvements has been clearly demonstrated by researchers looking at the longer-term need for food production growth—and the lion's share that needs to come from productivity gains. If productivity growth were to fall or remain stagnant due to under-investment in agricultural technologies—then the additional area that would need to be brought into cultivation would begin to seriously infringe upon the areas needed to maintain the health of natural ecosystems and habitat, and start to have strongly negative impacts on human health, as well. Technology improvements that reduce the per-hectare application of yield-enhancing inputs such as fertilizer or water, can also have powerful benefits for the health of the environment as well as of human beings, directly. Increasing fertilizer use efficiency in more intensive systems, reduces the run-off that would otherwise cause nutritification of surface water bodies or leaching into groundwater bodies used for sourcing drinking supplies. Water-saving technologies, likewise, provide strong environmental benefits by reducing the need for diversions of surface waters away from sensitive ecosystems that are sustained by those flows, or from direct uses for humans. There are those technologies which enhance the retention of water for beneficial uses, such as the water-harvesting techniques which capture flows that would otherwise be lost to sinks, and have very useful applications in rainfed systems. But beyond these, there are technological innovations that allow water returning from human uses (such as wastewater) to be safely processed and recycled so that it can be used for food production also represent

powerful possibilities for expanding the availability of water resources through enhancing the ability for multiple re-use.

The role of policy in facilitating the development and application of those resource-saving technologies lies in providing strong institutions that can monitor and remediate dangers to environmental quality, and provide effective enforcement where needed. Where there are multiple agents involved in drawing from a common-pool resource or who are engaged in the pollution of a commonly-shared environment—policy-makers face a particular set of challenges in monitoring or enforcing action. Oftentimes, the observability of resource use or environmental damage is very limited, and prevents the precise targeting of policy interventions. Nonetheless, there is scope for providing extension services to speed up the adoption of better management practices, and widening the availability of improved production technologies that promote both environmental and human health. The 'roll-out' of better practices and technologies, and the ways in which policy can help requires more discussion, however.

Policy has a clear role in facilitating the dissemination of critical technologies, once they are available—as well as creating direct incentives for the innovation that cutting-edge science can provide to researchers, as they develop them. Economics has long-recognized that the inability to fully appropriate the benefits of investments or efforts by private individuals or firms causes them to under-invest or to apply lower efforts than otherwise would be the case. This is an area where intellectual property rights can play an important role, in providing the assurance to innovative enterprises that they will be able to realize a long-term and sustainable return on their efforts or investments. If, however, left to their own devices—purely privately-driven interests would not be able to produce the public goods that we, as policy researcher and analysts, know to be very important to addressing key social needs and problems—such as that of hunger and poverty.

How then, can policy help to encourage the poverty-reducing and nutrition-enhancing science and technology innovations and interventions that we need to sustain future growth in the world's food system? We have seen good examples in the field of health, where some pharmaceutical companies (who undertake very costly and lengthy R&D efforts to develop new drugs) have been agreeable to allowing key anti-retroviral and other prophylactic medicines to be marketed in poorer countries in a way that doesn't detract from the sales in their more profitable markets. The role that policy had in making these licensing terms favorable enough to these firms is a compelling example of what might be done, in order to enhance the access of key agricultural technologies to those who can benefit most from it.

In summary, we argue that there are many compelling entry points for science-driven technology innovations to enhance agricultural productivity, environmental sustainability and human health and welfare. Good policies are needed, though, to facilitate this process, so that the benefits can reach the poor and that adequate incentives for innovation exist. Where private interests cannot provide needed public goods—then policy must also act to fill the gaps. Indeed, we cannot expect science and technology to close the world's 'yield gaps' if a yawning gap in policy exists and remains unaddressed.