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Biotechnology and its impact on development

(Issues note)

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A. Introduction

1. At its third session, in May 1997, the Commission on Science and Technology for Development decided to hold a panel meeting on biotechnology and its impact on development, with particular attention to food production. The meeting would identify critical issues relevant to development that are not sufficiently covered by existing fora and recommend how further work on those issues might be undertaken.

2. Global food demand is expected to double between now and the year 2050. It is now widely acknowledged that conventional food production technology alone cannot meet this demand. In designing their strategies for food production, countries will need to examine the role of new technologies, especially biotechnology. Modern biotechnology - chiefly plant tissue culture and cell culture and the transfer of genetic material between plants or animals - has expanded the tools available for crop and animal improvement. It offers possibilities of short-circuiting the traditional trait selection processes and of overcoming conventional barriers of genetic incompatibility. It can thus contribute to increasing potential yields by improving the genetic potential of varieties and animal species, optimizing the attainment of potential yields by eliminating cultivation stresses and improving quality, including nutritional content and post-harvest and shelf life. It has also been argued that biotechnology is scale-neutral and could therefore protect small-scale agriculture and solve specific problems such as nutrient availability and pest control at the farm level. In summary, biotechnology could enable food-deficient countries to meet the objectives of food sufficiency, sustainable agricultural production and improved environmental management. The actual as compared with the potential generation and diffusion of biotechnology and its applications depends on the complex interaction of an array of not only technical but also economic and institutional factors. There are many areas in these complex interactions which are not sufficiently covered by existing fora. The purpose of this panel is to identify those which are of relevance for food production, with emphasis on developing countries.

3. The present note has been prepared by the secretariat to assist the panel in its discussions. It is not an exhaustive review of the major issues in the area of biotechnology and its impact on development but tries to provide a broad framework within which to discuss the various critical issues. Thus, it is proposed to present the various issues under three thematic areas: (i) issues related to plant and animal species and their traits, as well as to the different biotechnology techniques and their applications for crop and animal improvement; (ii) capacity-building for the development and transfer of biotechnology, including mechanisms for integrating biotechnology into the mainstream of agricultural research; and (iii) other factors related to biotechnology which may have an impact on food production.

B. *Species and traits: techniques, applications and relevance to developing countries*

4. The focus of research to date has been predominantly on temperate zone crops and conditions prevailing in advanced industrial countries. It is not clear to what extent existing knowledge on biotechnology is directly relevant and beneficial to developing country conditions. What is clear, however, is that biotechnology-related knowledge regarding certain crops which are staple to the traditional diet of developing countries is still limited. Little progress has also been made in understanding the traits that would need to be introduced to crops essential to developing countries in order to improve the attainment of potential yields by reducing cultivation stresses and thus

allow the reclamation and cultivation of areas which would otherwise be considered non-arable. Such traits include salinity and alkalinity tolerance for island and coastal countries; adaptability to drought-prone areas, such as sub-Saharan Africa and areas ruined by overgrazing; and enhanced biological nitrogen-fixing capacity of leguminous plants. From a developing country's perspective, further work in this field would also include *inter alia* the application of biotechnology for improving the nutritional value of food and prolonging shelf life. Research results are also limited as regards trees or the animal world.

C. Policies and institutional capacity-building

5. Building a national capacity for biotechnology research and application requires *inter alia* policies that stimulate investment in biotechnology research and its application, institutional support structures and the development of local research capacity in biotechnology and its integration into the mainstream research and development capability in agriculture.

6. In designing an effective R&D capacity for biotechnology which ensures the successful transition from research to commercialization and which considers the demand structure of users, it is important that research is situated in the context of the national system of innovation. Yet the scope of the role that biotechnology policies could or should play in the context of a national system of innovation has not yet been fully studied, nor has there been adequate assessment of the policies, networks, institutions and other supporting infrastructures required to promote the development, diffusion and assimilation of new techniques in biotechnology. Further work is needed to ascertain the capabilities required to promote the transfer, diffusion and assimilation of biotechnology in developing countries and to ensure that the techniques applied respond to local needs and conditions. An appropriate mechanism must be found for integrating biotechnology into existing agricultural research systems and for enhancing the ability of such systems to generate pro-poor/small farmer technologies in partnership with different actors at the national level, such as private firms, extension service providers and NGOs, and also partners at the international level. In addition, national policies and institutional support and linkages in relation to biotechnology need to be complementary to and part and parcel of the overall national agricultural strategy. These are areas in which there is need for a better understanding, particularly on how to translate objectives into policy measures.

D. Other critical issues in biotechnology

7. As noted above, advances in biotechnology have opened up a whole new area of food production possibilities. However, the implications of advancement in this new technology, especially in the area of biodiversity, bio-safety, proprietary rights, production patterns and other critical factors, are not yet sufficiently understood. Some of the critical areas that require further attention include:

(a) *Biosafety*: The *biosafety issue* has been at the forefront of discussions among the OECD countries and has led to the formulation of safety guidelines intended primarily to avoid the spread into the environment of harmful micro-organisms created in laboratories. A more global code of conduct for the release of organisms into the environment has been developed within the United Nations Industrial Development Organization (UNIDO). Nevertheless, there has been continued concern over violations of the safety measures recommended, and greater awareness may need to be built up. Countries are sometimes uninformed of the potential benefits and risks of this new technology and often do not have sufficient capacity to enforce existing policies, regulations or guidelines governing the use of these crops. What are the options available to developing countries in ensuring biosafety?

(b) *Biodiversity*: Like preceding technologies, biotechnology has influenced and will further influence agro-biodiversity. In the past, higher food production based on high-external-input varieties caused the loss of traditional varieties and their genetic diversity. Modern biotechnology has the potential to compound this effect. In some developing countries, a combination of weak or non-existent policies on the one hand and efforts of private firms on the other have already stimulated a shift from food production for subsistence or for the local community to large-scale production of few crops and varieties for the national or global market, resulting in a loss of diversity. Could biotechnology techniques based on genetic diversity be developed, as for instance in the use of genetic markers or genetic modification in integrated pest management? What are the impacts of new biotechnologically designed crop varieties on biodiversity? These are critical questions which are not sufficiently addressed by existing fora.

(c) The *patent issue* has also been raised with regard to biotechnology, and views thereon tend to differ depending on the economic and social interest involved. Many new biotechnologies are proprietary, which makes them relatively less accessible to certain users, in particular those from developing countries where local technological capability is generally less developed, skills inadequate, the intellectual property regime weak and purchasing power limited. This has raised concerns among developing countries especially because the biodiversity within many developing countries often provides large stocks of untapped genetic resources to be utilized in areas such as agricultural and pharmaceutical development. Further discussions in the context of the Trade-related Aspects of Intellectual Property Rights (TRIPS) Agreement need to give special consideration to the biodiversity in developing countries and the implications for proprietary rights. Developing countries need to be better informed of these critical issues. Furthermore, at present, the Agreement on TRIPS and the Convention on Biological Diversity seem contradictory in their objectives and practices with regard to access to and remuneration for plant genetic resources, and in the international arena they are largely perceived as incompatible. It is important to understand clearly how these different agreements could be made compatible by linking intellectual property right (IPR) laws with non-IPR access and remuneration systems for plant genetic resources and how farmers' rights could be strengthened in this context.

(d) Related to the discussion on biodiversity is the emergence of new *seed sterility variants* ("*terminator gene*"). The terminator or "traitor" technologies have built-in gene sequences that render seeds sterile and incapable of re-use. Patent holders hailed the technology as "technology protection systems" which help ensure that individuals and companies developing new traits and technologies for commercial varieties earn a fair return on their investment. NGOs concerned with agricultural development in the developing world, however, have dubbed it "terminator technology" in that it will terminate farmers' independence and threaten the food security of over a billion resource-poor farmers in developing countries where farm-saved seed accounts for an estimated 80 per cent of total seed requirements. Seed-saving is considered necessary for farmers to be able to adapt seeds to their own needs and local conditions, thereby generating and nurturing biodiversity. However, apart from the concerns raised by some NGOs about the potential negative effects of this technology on agricultural production in poorer regions, little is still known about the wider implications of the new technique for ecological balance and the welfare of small-scale farmers.

E. Identification of critical issues for further work

8. The primary objective of the Panel is to review the key issues in biotechnology, with particular focus on food production, identify the critical areas in which less knowledge exists at present and recommend the specific issues which require further work. The Panel's recommendations, which will be submitted for consideration by the Commission, could include suggestions

on how further work can be carried out by Governments, agencies within the UN system, the CSTD and other bodies. Furthermore, the Panel may wish to suggest guidelines regarding research and the application of biotechnology in food production that the Commission might consider for adoption.