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RESEARCH FOR SUSTAINABLE AGRICULTURAL AND RURAL DEVELOPMENT

The current debate in relation to the French national sustainable development strategy

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Ladies and gentlemen,

The World Bank has embarked upon an International Consultative Process on the role of agricultural science and technology in reducing hunger, improving livelihoods and increasing economic growth.
At around the same time, the French government began reflecting on a national sustainable development strategy.

The French sustainable development strategy

The debate surrounding this strategy is led by around ten national working groups. You will appreciate the importance of this initiative when I tell you that one of the groups is in charge of proposing modifications to the French constitution aimed at including the sustainable development concept in public decisions. A major part of the debate is given over to the international aspect and to sustainable development-oriented research. I intend to tell you about a few aspects of the current talks on this latter field in particular. To this end, I have borrowed information from the national working group on research , and from joint talks between INRA (Institut National de la Recherche Agronomique), IRD (Institut de Recherche pour le Développement) and CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement).

The talks in question concern research (Science and Technology), but also information and training. They cover agriculture and rural development (Sustainable Agricultural and Rural Development – SARD), and more broadly, the whole range of activities relating to ecosystems and territories and their use by societies.

In this respect, promoting sustainable development means increasing production from ecosystems (agriculture, animal production, aquaculture, arboriculture, horticulture, forestry, natural spaces) in line with societies' requirements, while satisfying the following conditions: not harming the environment, improving the economic situation of rural communities by alleviating hunger and poverty and diversifying sources of income, improving social wellbeing, particularly by reducing risk and uncertainty, and lastly respecting the cultural

diversity of the different populations concerned. These conditions correspond to the “three pillars” of sustainable development (environment, economy, sociology), plus a cultural aspect.

The main questions are: what research should we be doing? How should we go about it? With whom?

In seeking to answer that question, I shall look at two aspects: 1) the content of sustainable development-oriented research and 2) the nature of that research.

As regards content, it is important to differentiate between the different research sectors: 1) technological aspects and policies of support for technical change (research on Technologies and Sectorial Policy, T&SP), 2) research on Models, Methods, Tools and Theories (MMTT), 3) Research on Sustainable Development Processes (SDP), and 4) research on Sustainable Development Governance (SDG).

As regards the nature of sustainable development-oriented research, two aspects have to be taken into account: 1) the necessarily participative aspects of research practices and the fact that research has to be geared towards user requirements, and 2) the different forms of international cooperation.

First of all, the issues for SARD-oriented research

It is meaningless to talk of sustainable agricultural and rural development on a global scale. In effect, situations vary widely from one continent to another, between regions of the same continent, between countries, and even within countries, on a local level.
For instance, from one continent to another, population levels and densities, incomes, and the volume and nature of requirements are very different. The climate, physical environment (proportion of plains, plateaux, hills and mountains) and ecological base, in particular water resource availability, vary considerably. Land availability for agriculture and the extent of the area that should be kept under forest or protected also differ widely. The ability to satisfy the population’s requirements through international trade or self-sufficiency varies. The amount of available agricultural labour per unit area (which governs the degree of mechanization) differs. All in all, the production effort that will have to made in the long term is not the same everywhere.
This production effort will inevitably result in an increase in the areas used for agriculture and in yields and labour productivity, but the proportions will vary in the main regions of the world. This should be borne in mind when analysing potential technology and research requirements.

If such an analysis is conducted on a 50-year time scale, it reveals—with some considerable simplification—1) that Asia will have to double yields, which will be difficult since the Green Revolution is already running up against its limitations, but the continent could resort to large-scale imports, 2) that Latin America has abundant land reserves and could become a major exporter of agricultural goods, primarily based on existing technologies but with significant environmental risks linked to deforestation, 3) that Western Asia and the Middle East, faced with the production limitations of Mediterranean ecologies, will have to make use of much more efficient water management technologies and import large volumes of food, 4) that Eastern Europe and Russia have considerable reserves of production potential that bode well

for an increase in exports, 5) that the USA, Western Europe and other grain-exporting countries have limited potential for increasing production. However, the main observation is that Africa will have to increase production fivefold within the next five decades[1], and probably to treble yields.

Africa is the priority

Africa will therefore have to make major changes within a very tight schedule. In effect, most of the expected population growth will be within the next three decades. It is crucial to have a clear idea of the necessary technologies and policies as of now. However, Africa is the continent least well prepared to make such changes: technical progress is slow, agriculture is still largely geared towards self-sufficiency, the market economy has not encouraged innovative practices, the State is not enough efficient and has limited means of action, and in some cases, civil unrest is common and there is an ongoing threat of conflict.

Research aimed at a new Green Revolution

In the face of these issues, research, information and training have to provide answers in the fields of 1) technology, 2) economic policy, 3) social policy and 4) culture. Green Revolution technology has only been applied in a very limited way in Africa and will inevitably continue to be so due to the very high cost to producers. In fact, as G. Conway said, "research should be aimed at higher yields per hectare, at very low cost, making maximal use of indigenous resources, physical, biological and human, and coupled with research on improving livelihoods of rural poor households through agriculture and agriculturally related income and employment generating activities". He added: "over the next three decades it must aim to repeat the successes of the Green Revolution, on a global scale, in many diverse localities, and be equitable, sustainable, and environmentally friendly"[2].

What sort of technology?

Trebling yields is therefore the main challenge. However, in addition to production, agriculture and all activities that make use of ecosystems will have to provide societies with a range of services from which they could also derive income: carbon sequestration, forest and natural habitat management, improved water quality, urban and industrial waste management with a view to recycling through the production cycle, ecosystem and landscape biodiversity management, conservation of species and of their genetic diversity, and promotion of tourism. In this sense, agriculture is multifunctional. Moreover, agriculture will have to limit the pollution it can cause and manage the natural resources (water, nutrients) it uses more efficiently so as to ensure their renewal.

These different activities are all outside the conventional sphere of production operations. This means that production has to be viewed in the context of ecosystems. To this end, research should be looking at the possibilities of making better use of the prospects offered by ecosystems and making them a source of inspiration for developing new technologies. This is the aim of the Doubly Green Revolution—a term proposed by G. Conway within the CGIAR framework—, of the Ever Green Revolution—a term suggested by M.S. Swaminathan—or of eco-agriculture—a term coined by UICN and Future Harvest. It is worth quoting a few examples: increasing the intensity of the "biological reactor" comprising the succession of

[1] Collomb P. 1999. Une voie étroite pour la sécurité alimentaire d'ici à 2050. FAO – Economica, Rome.
[2] Conway G. and Ali. 1994. Sustainable agriculture for a food secure world. CGIAR SAREC Washington DC.

biochemical reactions involved in photosynthesis, humification, mineralization and assimilation, optimizing the biological symbioses that enable plants to fix nitrogen and phosphorus, and improving knowledge of the range of host-parasite or aggressor relations so as to identify new biological methods for disease control. Functional ecology and population ecology, which are the basis for various thought processes, are thus important sources of innovation.

Biotechnologies were prompted by the same ideas. It is hoped that they will make it possible to integrate metabolic functions that already exist in nature, for instance resistance to salinity, drought, temperature and aggressors, into the genome of cultivated plants, or to create plants capable of providing good plant cover with a view to controlling erosion, storing water in the soil and preventing weed development, of capturing nutrients deep down in the soil and making them bioavailable, of perforating indurated soils or of bioremedying polluted soils..

What research should be done on policies?

Macroeconomic policies have a direct impact on agricultural performance and viability. In Africa, economic stabilization, structural adjustment and liberalization policies have failed to have the expected impacts and indeed have in fact had the opposite effect. Commercial policies have not stimulated exports as much as was expected. The liberalization of international agricultural markets has not prevented a fall in export prices or increased price fluctuations, which has put a stop to investment in production and productivity. Research therefore needs to lay the foundations for effective, appropriate policies, in terms of technical, economic and social content. This is a particularly sensitive issue, since the problems of agriculture, environment, nature conservation and water management in catchment areas need to be solved in a way that will guarantee the long-term viability of any changes made.

Likewise, it is important to conduct research aimed at defining policies capable of providing solutions to the problems posed by the foreseeable extent of human migration, rapid urban growth and the constitution of peri-urban zones of highly intensive agriculture and horticulture. Within these spheres of operation, it is essential to define long-term plans for managing settlement. In short, research needs to contribute to the establishment of long-term policy frameworks aimed at ensuring that market forces can operate freely and common policy decisions can be made while limiting the risk of taking any unsustainable directions.

What research is needed on social aspects?

Research should concentrate on defining new ways of reducing risk and uncertainty. In effect, how can farmers, most of whom are poor, be expected to treble yields in 30 years, in other words to invest heavily, when the climatic risks already affecting agriculture may be exacerbated by the greenhouse effect, the risks of price fluctuations have increased with the application of more liberal policies and they do not have access to health insurance? (In the event of illness, a major share of the production capacity of family farms is lost). Moreover, how can these family farms make the move from their current situation of self-sufficiency to an economy geared towards producing considerable surpluses for the market? How can the new practices required (adaptation to technical progress and to a market economy) be taken on board rapidly by farmers? Furthermore, how can changes be made if the younger generations (who are more open to change) cannot take over the management of family farms as the older generations do not have any other way of making a living in their old age and refuse to hand over their farms?

It is clear that it will be necessary to establish an effective education system, no doubt tailored to rural communities, so as to encourage them to make the necessary behaviour changes. This will have to be done within two generations, but in practice, it is primarily the coming generation that will have to make the most significant changes.

Rural communities will need efficient information systems on markets, prices, the climate, techniques and the experiences of others. How can new information and communication techniques be transferred to the rural world?

How can we ensure that agricultural market mechanisms do not operate at the expense of agricultural producers, as is "naturally" the case in many countries as a result of the current unequal access to information and imbalance of market forces?

For all these issues—the list is not exhaustive but there is no time to expand on it—it is essential that research analyse existing experiences, participate in testing new formulas and propose new technical and institutional solutions.

What about research aimed at respecting cultural diversity?

This issue has to be tackled, if only to highlight the problem of traditional knowledge. Many local languages are dying out, leading to the disappearance of the knowledge they described. In the case of knowledge of the medicinal properties of plants, many firms are interested and there is some motivation to recover threatened skills, but more generally, the knowledge and experience built up by societies in terms of the environment, appropriate technologies, and institutions also needs to be compiled and conserved. In effect, it could be a source of inspiration in the search for solutions to many problems.

Sustainable development-oriented research also means research on Models, Methods, Tools and Theories

The common denominator of all the research topics associated with sustainable development is their complexity. Research on molecules, cells, plants and animals, and ecosystems on various scales systematically comes up against this same difficulty. Use is therefore made of standard models, new modelling techniques that provide a simplified representation of reality (for instance artificial intelligence), increasingly sophisticated observation and processing methods and high-throughput analytical techniques, imagery, simulation and many other methods. One of the keys to technical progress is the ability to integrate data obtained through different scientific disciplines into relevant models. In all these fields, the rate of technical innovation in terms of tools is very rapid, and it will increasingly be necessary to adapt those tools and methods constantly. The increase in the volume of knowledge and the rapidity with which it is acquired will require an increased capacity for data storage and processing, exchange of information and data synthesis. For all these reasons, it is crucial to reduce the dispersal of research teams and encourage the development of international networks.

Research will also have to look into theories. The representation of complex systems follows a range of theoretical paradigms whose lifespan is linked to the general progress of ideas and science, and to technological progress. Taking as a principle the need for development to be sustainable, the ways in which dynamic systems are represented will have to change. Systems dynamics models will above all have to represent the long-term viability of these systems (ie

their ongoing renewal and resilience), rather than their optimization. They need to enable the simulation of a range of possible scenarios rather than identifying those that are desirable.

Research also needs to look at governance

Sustainable development is above all a matter of governance. As it is complex systems that need to be governed in this case, the main problem is making relevant, effective decisions. Research and consultancy firms obviously have to provide decision-makers with all the technical elements required for decisions, such as the analyses and results of simulations of the various possible options. However, research also needs to look at the decision-making process itself. In effect, in many cases, public decisions relating to sustainable development issues may be conflictual. The efficacy of decisions and that of policies therefore depend on the ability of societies to use negotiating methods and means of resolving conflicts.

Lastly, sustainable development calls for new research approaches

First of all, like research on climate change, sustainable development-oriented research is geared towards taking action and finding solutions. It therefore needs to be structured so as to pool all the necessary fields of expertise and establish links between them. This research will therefore result in increased transaction costs, and will thus have to be particularly well organized, for instance in the case of Challenge Programmes or Global Programmes with an international vocation.

Moreover, the end consumers of research are a group comprising farmers and rural inhabitants, their various organizations, and intermediaries in information and training systems. Given that in many cases, the solutions to be found have to be fine-tuned to suit local situations, due to the very wide range of environments and societies, a major share of research can only be done with the active participation of local farmers. In effect, it is those farmers who have the most relevant knowledge of the environment in which they live; they have sometimes tested solutions and therefore have useful practical experience, and lastly, they are often the most highly motivated candidates to conduct experiments and participate in research. Research therefore has to be user based and would often be more effective if it were participative.

Lastly, sustainable development-oriented research calls for specific institutional frameworks, since it has to establish close links between teams in industrialized and developing countries. The level of scientific development varies considerably from one country to another. This can result in asymmetrical cooperative relations. Moreover, in countries with limited capacity and infrastructures, it is important to combine research with training operations. Likewise, as this research is intended to have considerable applications, particularly in developing countries, it is crucial that the teams involved work in those countries, while maintaining close links with international networks. It is therefore necessary to establish sites (workshop areas, specific stations) and organizational structures (joint research units or partnership centres) that will constitute the operational bases for future international programmes.

Thank you for your attention.