The Globalization of Science

The Place of Agricultural Research

New, expanded edition

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September 1997

isnar
International Service for National Agricultural Research

Citation

Bonte-Friedheim, C. and K. Sheridan (eds). 1997. The Globalization of Science: The Place of Agricultural Research. New, expanded edition. The Hague: International Service for National Agricultural Research.

AGROVOC Descriptors

agriculture; research; food production; food security; sustainability; international cooperation

CABI Descriptors

agricultural research; food production; food security; sustainability; international cooperation

ISBN: 92-9118-029-7

The Plight of National Agricultural Research Systems in Low-Income, Food-Deficit Countries

John H. Monyo

Few scientists think of agriculture as the chief, or the model, science. Many, indeed, do not consider it a science at all. Yet, it was the first science—the mother of all sciences. It remains the science which makes life possible. And it may well be that before the century is over, the success or failure of science as a whole will be judged by the success or failure of agriculture.

André and Jean Mayer

Introduction

As early as 1948, the Universal Declaration of Human Rights affirmed that "Everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food . . . ." Since then the right to food has been characterized as a "fundamental right" and in the words of the former UN Secretary General, Boutros Boutros-Ghali (1996), "It is the primary economic right of the human person." By implication, any nation that cannot assure the majority of its people access to an adequate and nutritious diet at a price they can afford will be doomed to shame and dishonor.

It has been reported that over 800 million people in the world today are without adequate access to food and 200 million children under the age of five are suffering from protein and calorie deficiency (FAO 1996). Most of these people are found in low-income, food-deficit countries that lack the financial resources to buy the necessary additional food on the international market. And yet it is a truism that science and its application to agriculture has advanced so much that currently there is more than enough food globally to feed everybody. The main problem has been, and will remain for many years to come, the accessibility and affordability of the available food stocks to the poor rural and urban consumers in developing countries.

Low-income, food-deficit countries have been defined by FAO as those countries with a per capita income in the range used by the World Bank for lending by the International Development Agency (IDA) and a negative trade balance in cereals, averaged over the previous five years. Currently more than 80 such countries have been designated by FAO as belonging to this group and over half of them are located in Africa. The issue at stake is whether the national agricultural research systems (NARS) in these countries are in a state to benefit from the globalization of science. Unfortunately, many of them do not have the capacity to assess and adapt to their local conditions the knowledge and technologies derived from the basic and strategic research carried out by international agricultural research centers and better-endowed national agricultural research institutions.

Capital and Technology

In any agricultural research institution, getting things done calls for capital and technology. More important, it calls for the practical and idealistic skills by which it is possible to stir, motivate, and release the creative energies of the scientists involved in research. However, due to the poor state of the economy in low-income, food-deficit countries, the required capital or appropriate technology is not available. For some countries, this state of affairs is the manifestation of corrupt government regimes and/or frequent civil strife, despite their rich natural resource base. Even in situations where the capital is available, the political and economic environment might not provide the stability required for appropriate technologies to be generated or adapted and properly assessed before being transferred to farmers. As a consequence, the capacity of research scientists in these countries is rarely fully utilized. It is not uncommon to find NARS in developing countries that could be classified as unproductive and inefficient, but the scientists and research managers running those same systems tend to excel when given an opportunity to work in another NARS or in international and regional agricultural research institutions.

Although there has been a marked improvement in the quality and orientation of public-sector spending for agricultural research and extension in some developing countries over the last three decades (Pardey, Roseboom, and Anderson 1991), the situation appears to have deteriorated in recent years. Many of the NARS have been too dependent on external donor assistance for both infrastructural and operational funds. This type of funding is no longer readily available (a situation referred to as “donor fatigue” in some circles). In some NARS, even salaries for research and administrative staff have become a major burden on the national budget; quite often the staff have to work without a regular salary! This state of affairs has had a serious demotivating and demoralizing influence on many young and potentially capable scientists. They have become an idle asset with few, if any, career prospects in agricultural research in their own countries. In many developing countries, this has led to the so-called brain-drain from emigration.

Globalization of Science

The application of science and technology will continue to play a crucial role in agricultural research and development during the 21st century. It is projected that by 2025, over 80% of the expected global population of 8.5 billion will be living in developing countries. Therefore, improving the capacity of NARS to ensure increased and sustainable production and productivity of agricultural lands to support the additional 2.8 billion people must receive the highest priority—particularly in those countries presently classified as low income and food deficit. This matter has become particularly important in the light of the Rome Declaration on World Food Security and Programme of Action approved by the World Food Summit held at FAO in November 1996. The Programme of Action has the daunting task of reducing (from the current 800 million to 400 million) the number of people who are undernourished and unable to enjoy healthy and active lives by the year 2015. While the provision of food security for 400 million poor people would in itself be a sobering goal, it must also be realized that the world population is projected to increase by about 90 million people every year.

The Challenge Ahead

The challenge facing governments and NARS is to provide food security in 2015 not only for 400 million of the 800 million people presently undernourished, but for an extra two billion! Will the present effort be enough?

Based on recent trends, the current effort might reduce the number of chronically malnourished people to 600 million in 2015. To attain the World Food Summit target of 400 million will obviously require a much greater effort, for which a multitude of mutually interrelated actions will become necessary. Many of these actions will have to be directed to the development of appropriate policies and socioeconomic frameworks. Nevertheless, effective agricultural research—at both the national and international level—will play a vital role to meet the essential food needs of the remaining 200 million chronically undernourished people.

Several studies conducted in developed and developing countries by various institutions over a number of years have demonstrated that investment in agricultural research has high rates of return (Ruttan 1982). Since then a large number of studies undertaken by the International Food Policy Research Institute (IFPRI) in Africa and Asia (Haggblade and Hazel 1989; Haggblade, Hazell, and Braun 1989; Pinstrup-Andersen, Lundberg, and Garret 1995; Delgado et al 1997) have reconfirmed the earlier findings from the perspective of public-sector investment in national as well as international agricultural research. The latter findings have shown that for every dollar of increase in agricultural incomes, the overall national economy increases its income by two and one-half dollars. In other words, for each additional dollar of income

generated in agriculture, an additional one and one-half dollars are generated from outside agriculture. The data also showed a positive correlation between investment in international agricultural research and developing-country imports. Every dollar invested in international agricultural research increases the ability of developing countries to import goods and services from developed countries by more than four dollars! This investment generates improved market opportunities for the donors as well as for the beneficiaries of international agricultural research in developing countries. Therefore well-organized and properly funded national and international agricultural research is an essential precursor for social and economic development.

Presently the public sector invests 1.5 billion dollars annually in international and national agricultural research and extension systems in developing countries. If this level of investment were withdrawn, it is reckoned that the world production of cereal grains in the year 2020 would be about six percent less than currently predicted and 10 percent less in developing countries. But, if this level of investment were increased by 50 percent, global production of cereal grains would *increase* by six percent. Such an increase would be equivalent to 95 million additional tons of grain produced in developing countries by 2020 and would be enough to provide the essential food needs of about 350 million more people, a figure which is very close to the target set by the World Food Summit for 2015.

Towards a Research Strategy for Low-Income Countries

To start with, the problems of an institutional and resource nature outlined by Nickel (1996) regarding the current situation in NARS must be overcome or greatly reduced in order to provide a conducive and an enabling policy environment for effective research. Equally important will be the need for improvements in the organization and management of national agricultural research. Enhanced training and capacity building could play an important role in improving the efficiency and productivity of NARS with respect to research planning, execution, and management. However, political stability at national and regional levels as well as the availability of adequate funds for research will be necessary if the NARS and their partners in the global agricultural research system are to make a positive contribution to economic development in the affected countries between now and the year 2015.

Given that many low-income countries do not have (and some may never be able to afford) the financial and human resources needed to ensure the sustainability of their NARS, they will not be in a position to address the most important production constraints for their major commodities and farming systems in an effective manner. The best strategy for priority setting and organization of agricultural research in these countries, including the procurement of the required investment, remains an unresolved question. Traditionally, priority setting and the organization of research in the agricultural sector at both

the national and international level begin with a discussion of the physical characteristics followed by the biological dimensions, and in some situations, a micro-social dimension—such as the major farming systems. Quite often, this approach does not include an explicit consideration of the broader (macro) economic and social dimensions such as population, income level and distribution, social and economic organization and public policy (McCalla 1991). And yet these factors play a crucial role with respect to both the final impact of the research effort and a better understanding of alternative sources of the supply of research. These macro-social dimensions are greatly influenced by national boundaries.

It seems prudent therefore, and indeed necessary, to take both ecological characterization and socioeconomic data into account when planning national research programs. The research and implementation chain has many modifiers: first, there is the agroecosystem, which determines the potential for improving the productivity of research (the productivity potential of an agroecosystem can itself be significantly modified by irrigation); second, there is the probability of the research results being adapted to local conditions and extended to farmers; third, there is the probability of wide-scale adoption of the technologies by farmers; and finally, there is the likelihood of impact on production that promotes food security through increases in supplies and reduced prices for consumers. While conventional agricultural research planning in national as well as international institutions can contribute easily to improvements in productivity and even to local adaptation of research results, an approach that combines agroecological considerations as well as the macro-socioeconomic dimension would greatly help to resolve those issues related to technology adoption and therefore increase the probability of production impact. Here probably lies the most feasible option available to low-income, food-deficit countries to achieve reasonable progress and make an effective contribution towards the achievement of sustainable food security through research. This approach has been termed "ecoregional" by the Technical Advisory Committee (TAC) to the CGIAR (TAC 1991). The notion of an *ecoregion* involves agroecologies regionally defined—in which regions are defined as being groups of countries—such as the warm subhumid tropics of Africa.

The ecoregional approach makes it possible for NARS, IARCs, and regional agricultural research institutions to take into account ecological characteristics and socioeconomic data in their priority setting, research planning, and problem analysis. Research planned and organized along ecoregional lines offers opportunities to minimize unnecessary duplication and to ensure better synergies between NARS, collaborating IARCs, and regional agricultural research institutions. This approach also makes it possible to organize and strengthen research partnerships in the manner suggested by Nickel (1996) and Javier (1996).

Although the ecoregional approach does not claim to provide a panacea for effective agricultural research in low-income, food-deficit countries, it facilitates the linking of research programs on productivity improvement and natural resource management. It also provides a mechanism to formalize and strengthen close collaboration among NARS and extension services, IARCs, international

research and development organizations, and relevant stakeholders. It allows the implementation of research and development activities in a holistic manner. Finally, it promotes the participation of farmers in technology development and ensures a more conducive environment for agricultural research and development.

The Participatory and Gender Dimensions

A considerable amount of good research has been done in developing countries. In the case of the low-income, food-deficit countries, the research was done largely through external technical assistance and financial support. However, this effort has not achieved the expected impact on agricultural and economic development in the majority of these countries, meaning that much time, effort, and scarce financial and human resources have been wasted by these countries as well as by the supporting donor agencies. The poor show this implies has also tended to give bad press to national agricultural research and has encouraged a hands-off research attitude among some influential local politicians. This "failure" can be explained partly by the lack of a participatory approach in the planning and execution of national research programs. Participation of farmers and extension agents in the analysis of socioeconomic and production constraints and in the assessment and adaptation of new technologies has been shown to increase the rate of adoption of improved technologies by farmers. Their active involvement and contribution to the development and testing of technological packages generate a demand pull.

Another major factor that is responsible for the low rate of adoption of improved technologies is the lack of a gender perspective in the planning and execution of national research activities. In most low-income, food-deficit countries, women constitute more than 60 percent of the labor force in the farm/household systems. Recent studies by a number of IARCs indicate that there is a marked increase in the feminization of agriculture in all developing regions as more and more men leave the rural areas in search of more remunerative employment opportunities in towns and cities.

The participation of women in research planning and technology assessment has many positive effects on the cost-effectiveness and productivity of the research effort. Women have a better understanding of the postharvest dimension of food security in agricultural research because they are the primary food processors and feeders of their families. Furthermore, results emanating from policy research have shown that more women than men use their additional income for the nutrition of their children. And last, women are reported to have a larger stake in improved natural resource management; therefore, their knowledge and constraints can assist in devising technologies that improve the sustainability of these resources. A panel discussion on "Meeting the Technology Needs of Poor Rural Women" organized during the 1996 CGIAR International Centers' Week in Washington, DC, concluded that addressing the technology and policy needs of poor rural women in agricultural research contributes

directly to poverty alleviation, equity, and improved sustainability of agricultural production. In conclusion, the knowledge and experience of women and particularly those living in rural areas in developing countries should be recognized as being essential in any effort geared towards the attainment of sustainable food security.

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