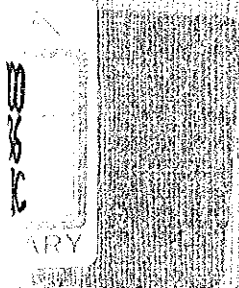


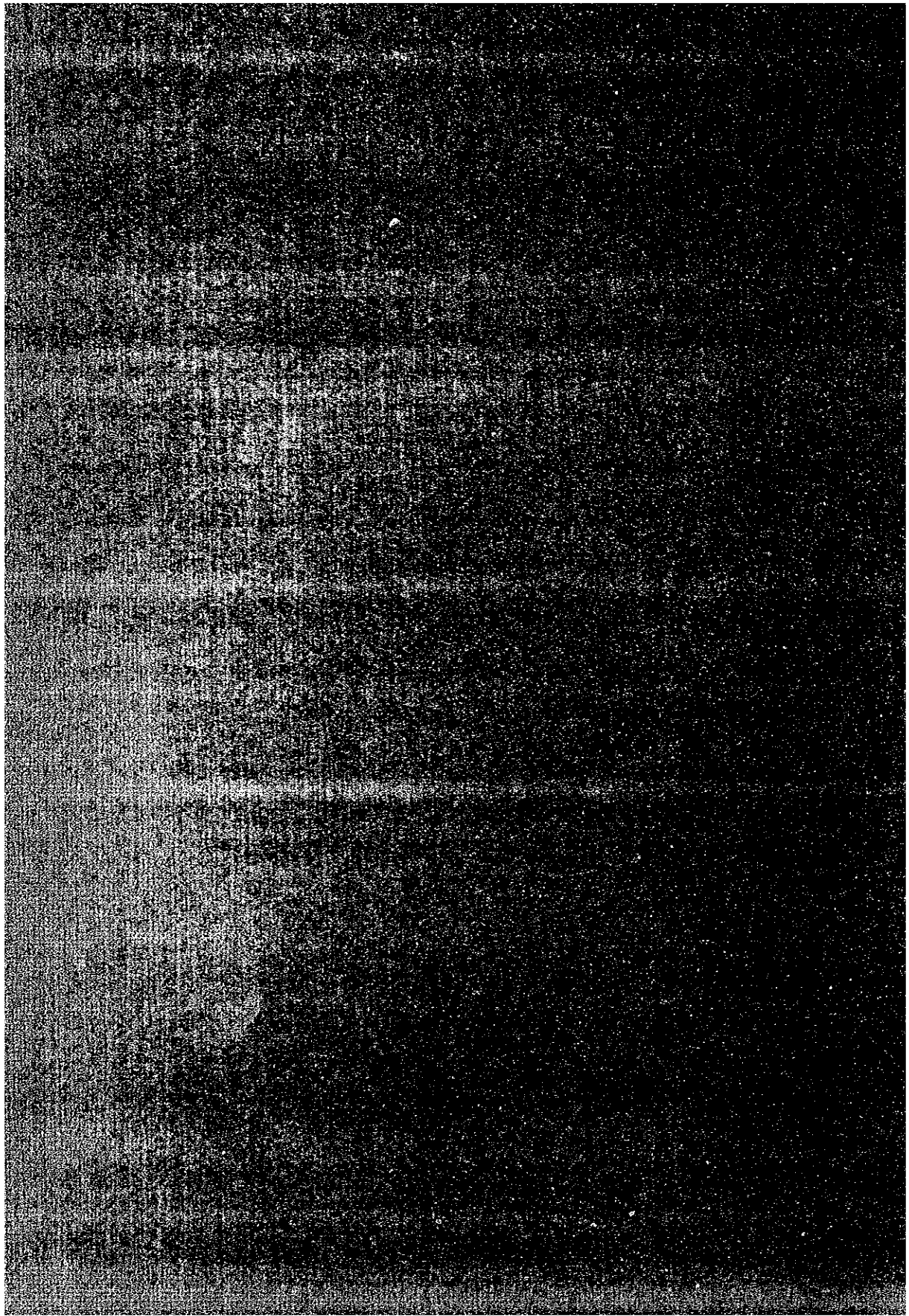
JICA/IFPRI JOINT SEMINAR  
ON  
DEVELOPMENT COOPERATION TOWARD THE 21ST CENTURY:  
AGRICULTURE, ENVIRONMENT AND TECHNOLOGY

8 September 1992, Tokyo

INSTITUTE FOR INTERNATIONAL COOPERATION (IFIC)  
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)



|       |   |   |
|-------|---|---|
| I     | I | C |
| J     | R |   |
| 92-89 |   |   |



**JICA/IFPRI JOINT SEMINAR  
ON  
DEVELOPMENT COOPERATION TOWARD THE 21ST CENTRY:  
AGRICULTURE, ENVIRONMENT AND TECHNOLOGY  
8 September 1992, Tokyo**

**JICA LIBRARY**



**1104463[3]**

**INSTITUTE FOR INTERNATIONAL COOPERATION  
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**

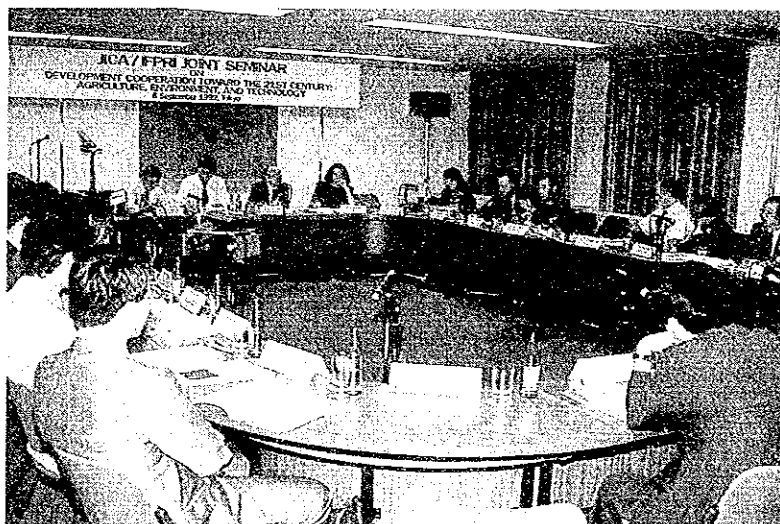
○1992 Institute for International Cooperation  
Japan International Cooperation Agency (JICA)

International Cooperation Bldg.  
10-5, Ichigaya, Honmura-cho, Shinjuku-ku, Tokyo, Japan  
TEL. 03-3269-3201 FAX.03-3269-2054

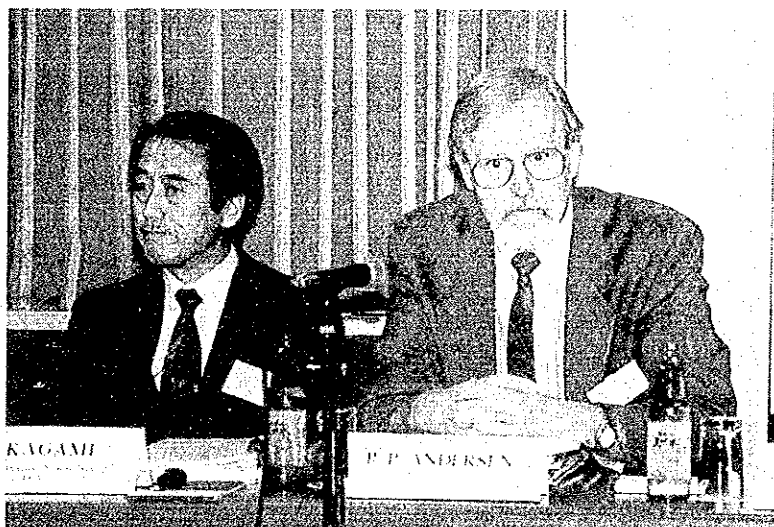
Printed in Japan, December 1992



JICA/IFPRI JOINT SEMINAR  
ON  
DEVELOPMENT COOPERATION TOWARD THE 21ST CENTURY:  
AGRICULTURE, ENVIRONMENT AND TECHNOLOGY



Seminar in progress



Mr. Kagami

Dr. Pinstруп-Andersen

## FOREWORD

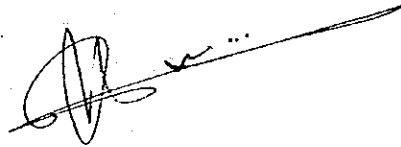
Japan International Cooperation Agency (JICA) has growing domestic and international expectation of its expanded activities, as Japan's ODA has now become one of the largest in the world. To respond positively to this expectation, it is important to share experience and knowledge with other donor agencies and to cooperate one another in assistance programs, in pursuit of more effective development assistance.

In this context, JICA organized jointly with International Food Policy Research Institute (IFPRI), the seminar titled "Development Cooperation Toward the 21st Century: Agriculture, Environment and Technology" on September 9, 1992 at the Institute for International Cooperation, JICA.

Participants frankly exchanged their views and experiences towards possible future cooperation between JICA and IFPRI, on the themes: "Food and Agricultural Development Issues in the 1990s", "Technology Policy for Agricultural Development in Asia", "Environmental Conservation and Sustainable Development" and "Women in Agricultural Development".

This is the proceedings of the seminar. I hope that it will be useful for the people concerned.

December 1992



**Akira Kasai**  
Managing Director  
Institute for International Cooperation  
Japan International Cooperation Agency

## CONTENTS

### FOREWORD

### OPENING ADDRESS

Shinichiro Omote

### SESSION I. Activities and Perspectives of JICA and IFPRI ..... 1

Takeshi Kagami

Per Pinstруп-Andersen

### SESSION II. Food and Agricultural Development Issues in the 1990s ..... 15

Nurul Islam & Keiji Oga

Toshio Sagawa

### SESSION III. Technology Policy for Agricultural Development in Asia ..... 41

Mark Rosegrant

Hideyuki Kanamori

### SESSION IV. Environmental Conservation and Sustainable Development ..... 63

Sara Scherr

Kazuo Sudo

### SESSION V. Women in Agricultural Development ..... 89

Yumiko Tanaka

Joachim von Braun and Rajol Pandya-Lorch

### CLOSING REMARKS ..... 125

Yujiro Hayami

### ANNEX

Annex (1) Program of the Seminar ..... 135

Annex (2) List of Participants ..... 137

## OPENING ADDRESS

Shinichiro Omote  
Deputy Managing Director,  
Institute for International  
Cooperation, JICA

Good morning, ladies and gentlemen,

I am Shinichiro Omote, Deputy Managing Director, Institute for International Cooperation (IFIC), JICA. I wish to welcome you on behalf of Mr. Kasai, Managing Director of IFIC. It is regrettable he is not able to be present today, as he is now out of Tokyo delivering lectures at a university. So with your indulgence, I will speak on his behalf.

It is my pleasant duty to extend to you a cordial welcome on behalf of JICA. I would like to thank all participants for their interest and reports which have helped us to make possible this seminar, the JICA and International Food Policy Research Institute (IFPRI) Joint Seminar on Development Cooperation Toward the 21st Century, especially those of you who have travelled great distances and taken valuable time from your busy schedules to attend this seminar.

We are now facing a number of big challenges as we approach the 21st century, such as poverty, population growth in developing countries and global environmental degradation. I think that agriculture will play a key role in tackling these challenges, as will the roles of women in these issues.

These challenges are so huge that we need mutual cooperation among donor agencies to find out the most effective measures leading to eventual solutions to them. In this connection, with the idea of encouraging and accelerating the exchange of information and opinions on development cooperation, this seminar has been organized. Through this seminar, all of us will have an opportunity to strengthen our understanding of development cooperation, and as a result may follow theoretical and practical applications.



# **SESSION I**

**Activities and Perspectives of JICA and IFPRI**



## Activities and Perspectives of JICA

Takeshi Kagami  
Managing Director  
Planning Department, JICA

It is my pleasure today to make a presentation to you concerning JICA's activities and their perspectives at this important joint seminar with IFPRI. Japan's ODA expenditure has rapidly expanded in recent years, and actually ranked top in fiscal 1991, surpassing the U.S. in monetary terms at roughly 11 billion dollars. Thus the responsibilities of JICA have become increasingly greater.

My presentation will cover three main areas: first, the position of JICA in the overall framework of Japan's ODA; second, I would like to outline JICA's present activities; third, I will explain the major priorities for JICA.

(1) I wish to start with the position of JICA in the overall framework of Japan's ODA. Table 1 shows Japan's ODA in 1991.

*Table 1. Japan's ODA in 1991 (Calendar Year)  
(Net Disbursement Basis)*

| Type | Amount                                      | million US\$   | share (%)     |
|------|---|----------------|---------------|
|      | Grant Assistance                            | 1,525          | 13.9          |
|      | Technical Assistance<br>(JICA's Assistance) | 1,868<br>(976) | 16.9<br>(8.8) |
|      | Grants                                      | 3,393          | 30.8          |
|      | Loans                                       | 5,477          | 49.6          |
|      | Bilateral Assistance                        | 8,869          | 80.4          |
|      | Contribution to Multilateral Assistance     | 2,163          | 19.7          |
|      | ODA Total                                   | 11,032         | 100.0         |

[Note] 1. Technical Assistance includes Administrative Costs  
2. As the figures in the table are rounded up, they do not necessarily add up to the totals.  
3. Figures include five Eastern European Countries  
4. Exchange Rate US\$1 = ¥134.50

|                            | Fiscal year 1991<br>Approx.% of<br>Japan's total ODA |
|----------------------------|--|
| - Technical cooperation    | 17%  |
| - Capital grant assistance | 14%  |
| - Yen loans                | 50%  |

As can be seen, the framework of Japan's ODA totalled roughly 11 billion dollars. The total ODA is built on two main pillars. One is bilateral assistance coming to about 8.9 billion dollars in 1991. The second is multilateral assistance, which was about 2.2 billion dollars in the year I am referring to. As regards bilateral assistance, there are two type of cooperation: grants and loans. In 1991 grants totalled about 3.4 billion dollars; and loans about 5.5 billion dollars.

The grants are composed of grant assistance in a strict sense and technical assistance. The grants in a narrow sense are capital grant assistance without any obligation to repay. In 1991 this was about 1.5 billion dollars; technical assistance was about 1.9 million dollars. JICA's main activities are connected to this technical assistance. JICA's assistance was 976 million dollars, which was about 8.8% of Japan's total ODA and about 11% of its bilateral assistance. All of these activities by JICA are financed by the Japanese government in its annual budget, and therefore comes from Japanese tax payers.

Geographical distribution of JICA's expenditure is shown by Table 2. This table is based on a fiscal year; therefore, the figures are a little different from the figures in Table 1, which was based on a calendar year.

*Table 2. Geographical Distribution of JICA's Expenditure in FY 1991*

|                            | million US\$ | share (%) |
|----------------------------|--------------|-----------|
| Asia                       | 361          | 42.0      |
| ASEAN                      | 219          | 25.4      |
| Others                     | 142          | 16.6      |
| Middle East                | 83           | 9.7       |
| Africa                     | 104          | 12.1      |
| Central and South America  | 189          | 22.0      |
| Oceania                    | 30           | 3.4       |
| Europe                     | 16           | 1.8       |
| International Organization | 10           | 1.2       |
| unallocable                | 67           | 7.8       |
| Total                      | 859          | 100.0     |

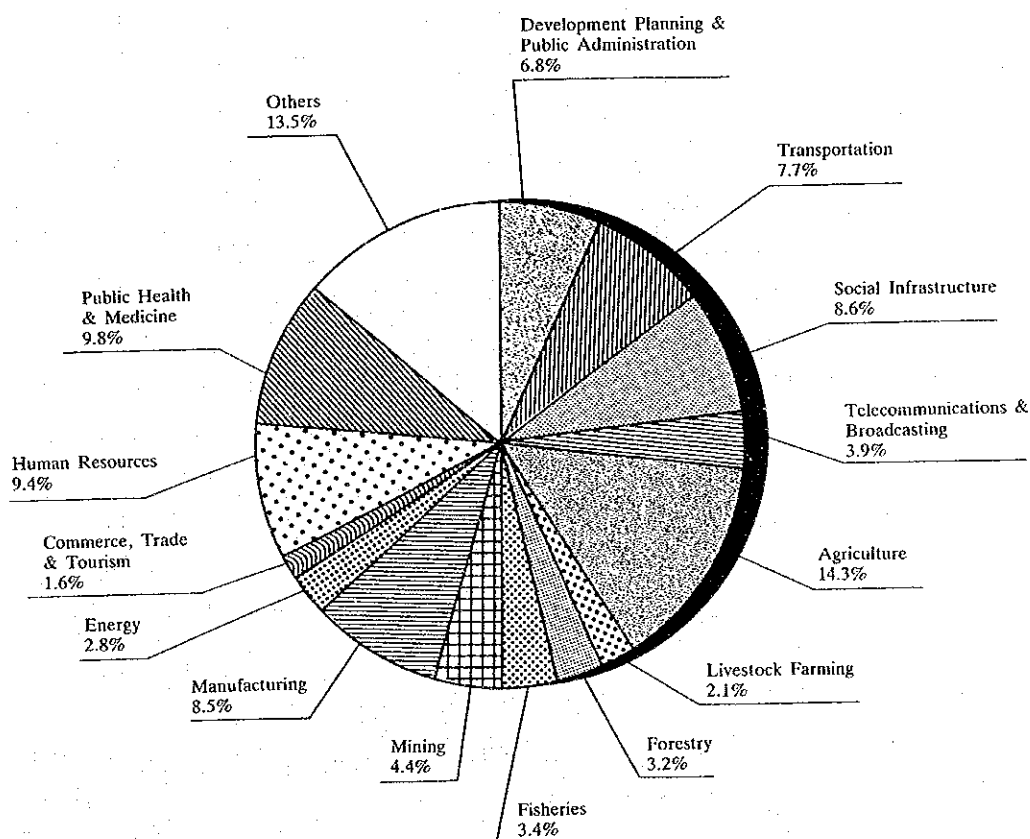
[Note] Excluding Administrative Costs

As can be seen, we put a lot of emphasis on Asia, which received about 42% of JICA's total expenditure in 1991. Asia was followed by Central and South America at 22%, and then Africa at 12.1%. As is clear, our priority is in Asia, particularly the ASEAN countries.

Figure 1 shows JICA's Expenditure by Sector in FY 1991. This is the sector wise

distribution of JICA's expenditure and you can see our priority sectors. As can be seen, I am glad to say that agriculture had the biggest share, about 14.3%. The second biggest share was public health and medicine at 9.8% with human resources at 9.4%. The above tables show JICA's position in overall Japanese ODA cooperation.

Figure 1 JICA's Expenditure by Sector in FY 1991



(2) Secondly, I would like to explain the major cooperation activities by JICA. Let me split my explanation into two parts. The first is the so-called technical cooperation. The second part is capital grant assistance.

Firstly, the technical cooperation is composed of various types of cooperation. The first type is "Inviting trainees from developing countries for technical training in Japan". In this category, over 8,000 people usually come to Japan every year as JICA trainees.

This training is on a request basis to be carried out in cooperation with various Japanese government ministries, local governments, universities, private sector organizations and corporations. When these trainees go back to their home countries, they are expected to play an important role in their country's development efforts. Since 1954, when we started receiving trainees, we have received more than 103,000 persons from developing countries for this training.

The next category of technical cooperation is the dispatch of Japanese technical experts and young volunteers to the developing countries. Since 1955, over 35,000 Japanese experts have been dispatched, with greatest number being sent to Asia. In 1991, we dispatched about 2,500 experts to developing countries. We also send young volunteers. We call them JOCV, or Japan's Overseas Cooperation Volunteers. We dispatch around 1,000 young volunteers every year at the request of governments of developing countries.

These volunteers are young Japanese with a technical background who wish to dedicate themselves to the nation building of developing countries. They are similar to the Peace Corps volunteers of the United States. They stay in developing countries normally for two years.

The third category of cooperation is "Supplying Equipment for Technical Cooperation". We supply various kinds of equipment for technical cooperation. In fiscal 1991, the total amount was approximately 90 million US dollars. This equipment is never supplied only by itself; it must always be accompanied either by experts or trainees or young volunteers of JOCV.

The fourth type of cooperation is "Project-Type Technical Cooperation". This is a form of cooperation combining the aforementioned three types of programs: "supply of equipment", "dispatching experts" and "receiving trainees".

For this cooperation, JICA formulates a particular technical cooperation project in a developing country, and achieves the project by supplying necessary equipment or

building the facilities required for such projects, together with dispatching experts to the project and giving chances for young counterparts in the project to have training in Japan.

These types of technical cooperation projects currently number around 170 in various fields. About 31% are in the field of social development; 38% in the sector of agriculture, forestry and fisheries; 22% in the field of health and population; and the remaining 9% is in industrial development.

The next type of technical cooperation is development studies. This is to provide consulting services to developing countries by dispatching study teams to help them formulate development plans and projects.

The next type, which is not directly related to technical cooperation, is Emigration Service. This is a long and traditional type of cooperation by JICA. The emigration of the Japanese people started more than 100 years ago. We restarted the cooperation after the war. We provide support to approximately 1.65 million Japanese emigrants and their descendants who now live abroad. We also help those who wish to emigrate from now. Support is done by providing information, counselling, and training courses for those emigrants.

The 7th type of cooperation is "Emergency Disaster Relief". Large-scale disasters such as earthquakes, volcanic eruptions, typhoons, floods, fires etc. take many lives in developing countries. These types of disasters can destroy in one day the efforts of development made for many years. Therefore Japan extends its cooperation in this area.

We have a lot of expertise in this area since Japan has been a disaster-stricken country for many years. Japan's Disaster Relief Team was established by law in 1987 to extend emergency relief to disaster-stricken countries or international organizations upon their request.

Let me turn to to the 2nd major category of cooperation: "Capital Grant Assistance". In addition to JICA's main technical cooperation activities, JICA facilitates the implementation of capital grant assistance of the Japanese Government. The Ministry of Foreign Affairs has most of the budget for this program. JICA is

entrusted to carry out 80% of the capital grant assistance, by, for example, conducting basic design studies and providing necessary technical service.

In fiscal 1991, the amount of capital grant assistance totalled approximately one billion U.S. dollars.

(3) I would like next to draw your attention to the major priorities for JICA. First, I wish to explain priority areas, and then I will explain the priority measures JICA employs for strengthening the efficiency and effectiveness of its activities.

First, the areas of activities which JICA now considers especially important. They are the so-called global issues, including the environment, women in development (WID), population, poverty alleviation measures, and so on. In order to work out cooperation policies for these areas, JICA organized three sectoral study groups with the participation of outside experts, one organized in fiscal 1988 for the environment, one in fiscal 1989 for poverty and one in fiscal 1990 for WID. In fiscal 1991, we organized another sector study group to research the population issue.

Let me next outline JICA's activities concerning the environment. To mitigate the effects of environmental degradation, JICA carries out many projects in the area of environment conservation. We do this, for instance, in the fields of protection of urban environments, forest conservation and reforestation, and so on.

From the initial stage of project planning, the impact on the environment is always taken into consideration. To ensure this, we try to involve environmental experts from the early stages of project planning. We also make efforts to strengthen cooperation for human resources development and institutional development to improve the environmental management capability of the partner countries.

Let me talk a little about WID. There is a very important role for women to play in the development process of developing countries. It is essential to promote women's education and training opportunities, economic independence and participation in decision making processes. JICA puts a lot of priority in these areas. We aim towards promoting women's advancement from the grassroots to the



national level.

Now I would like explain the methods employed to promote the efficiency of JICA'S activities. Some of the methods which JICA employs for this are as follows.

Firstly, we are trying to enhance our country approaches rather than depending on broad regional approaches. This is to provide well-balanced and effective assistance to individual countries, which is necessary to shed sufficient light on its overall macro economic and fiscal policy needs.

We thereby try to find the best approaches throughout the project cycle, beginning with the project identification stage until the final evaluation stage. For this reason, JICA has formulated aid guidelines for more than forty countries since 1989.

In fiscal 1991, we set up three regional divisions in JICA primarily in charge of policy making for assistance to specific developing countries. These regional divisions play a key role for the whole organization, engaged as they are in the strengthening of the execution of country programs and various coordination functions.

The next point is "Evaluation of Project Implementation". This is a very important area for appropriately evaluating implemented projects, to analyze the results and to feedback the issues raised for future cooperation.

In fiscal 1981 we organized an "Evaluation Study Committee" in JICA and set up the basic standards and methods for evaluation, and we have carried out cross-sectoral evaluation since then. Moreover, in fiscal 1990, the Evaluation and Post Project Monitoring Division was created to further enhance our evaluation capabilities.

Though we cooperate closely with other donors and agencies, the next priority is for JICA to strengthen even more its cooperation with other donor countries and multilateral agencies. This joint seminar with IFPRI is a good example of such

cooperation. We are also engaged in cooperation with USAID, CIDA, the World Bank, the UNDP and others.

I have touched very roughly and rapidly on the various activities and priorities of JICA. However, in JICA's cooperation, agricultural cooperation is clearly one of the most important areas.

As can be seen in the pie-chart I explained before, the agricultural sector accounts for the largest share of JICA's budget allocation, and it will continue to be given priority since the development of the agricultural area is essential for the stable economic growth and development of developing countries.

Since time is limited, I would like to leave the detailed discussion of this important area to subsequent speakers.

Thank you very much for your attention.

## Activities and Perspectives of IFPRI

Per Pinstруп-Andersen  
Director General, IFPRI

---

Although IFPRI'S activities and the activities of JICA differ significantly, I believe our goals are either identical or very similar. Both institutions assist the less fortunate, that is, those who suffer from poverty and food insecurity, malnutrition, and other human misery in the Third World. That, I believe, is the underlying goal of both institutions. Therefore, it seems appropriate to hold a joint seminar to explore what we are doing to inform one another and to look for ways to collaborate, so that the work we do as two separate entities may be more useful for the people we are trying to help. Let me first say a little about IFPRI in general and then talk about the priorities that IFPRI is setting for itself as it moves into its next five-year planning period.

IFPRI was founded in 1975, as the chairman mentioned, to assist developing-country governments in identifying policy options that would most effectively achieve the goals set by those governments to alleviate poverty, improve food security, and reduce malnutrition. Our specific mandate is to undertake research that will make available to governments information that would help them make decisions in the area I just mentioned. IFPRI's premise is that more and better information made available to decisionmakers will result in better decisions. We believe that policymakers in government are rational and that they will use whatever information is available to achieve the goals that they set. Whether those goals always conform to what we, as individual researchers, would like to see is less important in this context. IFPRI was not created to tell governments what to do. We were created to help governments understand the implications of their actions. So by helping to identify various policy options and the consequences of selecting one option over another, we feel that we are making a major contribution to the decisionmaking process of developing country governments. I wanted to make this distinction very clear. IFPRI is in business to provide information so that those who are responsible for making the decisions can do so in a more enlightened fashion.

In 1979, IFPRI was invited to join the Consultative Group on International

Agriculture Research (CGIAR) which consists of about 40 countries and international institutions. Japan is a key member of that group. The CGIAR provides financial support to 18 international agricultural research centers of which IFPRI is one. IFPRI is the only institute among the 18 that has, as its primary objective, research on food policy. Nearly all of the other centers have a biological research focus, and we are a very small organization. We have about 45 senior researchers on our staff and another 90 or so junior researchers and support staff. Thus, we must be very selective in what we do or we will not have an impact. That means setting priorities both in terms of what we do and how we do it.

Our mandate calls for research and also what we call "outreach" strengthening of research capacities in developing countries. I will address in a minute our research priorities. First, let me say a few words about "outreach." It is clear to us that, while the generation of information for decisionmaking by IFPRI is very important, in the longrun we will be successful only if the developing countries themselves are capable of generating such information. There is only one IFPRI, but there are many developing countries that need this kind of information. Although today's Program affords us an opportunity to discuss our own research, which, by the way, is done in collaboration with developing-country institutions and individuals, I hope you will keep in mind that IFPRI's ultimate impact is related to assisting countries to expand their own food policy research capabilities. Again, because we are so small, we cannot offer countries the kind of massive assistance that it takes to build up national institutions. We leave that to other organizations. Obviously, Japan's foreign assistance plays a very important role in building national institutions, as does support from many other organizations such as the World Bank, USAID, etc. What we can do is to try to identify some sharply focused activities where we can have an impact within this much broader effort to build national institutions.

As an international research institution we must focus on those policy problems that are of great importance to a number of countries or to a large number of poor people. That means that although most food policy is country-specific, we select for research the policy problems that are of a more general concern, because what we are thus able to make available is information that is useful to a large number of low-income people. So we try to select the policy problems that we think are of great global importance, and then we try to conduct our research in such a way that

we can generalize from it. In most cases, this means undertaking research in a small number of developing countries on the same policy problem and then synthesizing from that research generalizable lessons.

What are our priorities? We believe it is of extreme importance to accelerate the growth and transformation of the agricultural sector in the low-income countries, particularly among those developing countries that are at the low end of the income scale. In those cases, with few exceptions, agricultural development will drive economic development in general. There are exceptions but not many. A great deal more policy research is required to assist in the transformation and opening up of the rural sector. This has to do with efforts to liberalize and privatize agricultural input and output markets, which are part of the broader policy reforms and structural adjustments that have been underway in most of Africa and Latin America and in several Asian countries. Efforts to liberalize and privatize domestic markets have not been totally successful. While such efforts are necessary to accelerate growth both within and outside of agriculture, much more information is necessary to do it right, that is, to time the kinds of policy changes that have to be made to switch from markets primarily dominated by the public sector to markets primarily dominated by the private sector. This work is particularly important for Sub-Saharan Africa. But it is also important for many countries. IFPRI works with national governments and national institutions to help them better understand how this transformation can be brought about.

To help accelerate growth and transformation of agriculture, our research looks at a number of other things. Of prime importance is technological change, for if we are to feed the world's population 20, 30 or 40 years from now, we must promote an agriculture that increases production per unit of input, and that, in most cases for the time being, means per unit of land. In some cases we may be trying to maximize or optimize output per unit of labor. Whatever the resources, without continued and accelerated technological change in agriculture, there is not much hope of making food available to the populations that we expect 20 to 30 years from now, except at extremely high costs to the poor. Technological change, of course, means heavy investment in agricultural research and in irrigation facilities. It means investment in a number of things that facilitate technological change.

A second area of priority relates very closely to the first. That is the question of how to accelerate productivity in agriculture and food without depleting natural

resources. To promote sustainable production increases in agriculture, natural resources must be protected from degradation.

The third area that is very important to IFPRI is macroeconomic reform and, related to that, trade reform. Although in a narrow sense we may forget that macroeconomic policies are important for food and agriculture, they, in fact, are extremely important. The impact of macroeconomic policy changes on the food and agriculture sector is not fully understood. One of the issues has to do with the formation of regional intergrational and regional trade arrangements among developing countries. The question of rapid population increase has already been mentioned. IFPRI proposed to focus primarily on the urbanization issues that result from the present rapid demographic transformation in the developing world. Cities are going to grow, or they are currently growing at very rapid rates. It is not uncommon to find growth rates of around 8 to 10 percent per year in many African cities or towns. These towns are totally unprepared in terms of urban infrastructure to accommodate that kind of population increase. Also worrisome is the problem of how to feed these large masses of urban people. The urbanization question very much relates back to rural infrastructure, technological change, improving output markets, and so on.

While IFPRI looks to the future in all of these areas, we are very concerned about current poverty and food insecurity. As many as a billion people fall below the poverty level of one dollar per day. More than 500 million people do not currently have access to enough food to live a healthy and productive life. About one-third of all developing-country preschool children are currently malnourished. IFPRI has done a considerable amount of research to try to understand how to make transfer schemes for the poor effective, both effective in the sense of reaching the goal of poverty reduction and cost-effective in the sense of not using up too much of public resources. This research will continue at a somewhat decelerated pace.

The final area of research priority for IFPRI has to do with intrahousehold allocation of resources and decisionmaking processes. This relates very much to the gender issues. We prefer to look at this intrahousehold issue, not as a woman-in-development issue but as a gender issue, because there are some broader issues to be understood beyond the role women play in the developing process. But, obviously, that is the principle part of the gender issue.

IFPRI is also strengthening understanding of the behavior of communities and national governments, particularly the policy process and how policies are designed and implemented. This is more explanatory research that will be initiated in the next year or so.

The justification for arriving at these six areas of priority will be given by my colleague, Nurul Islam, who will address from a global perspective the future food situation.





## **SESSION II**

**Food and Agricultural Assistance in the 1990s**



## Food and Agricultural Development Issues in the 1990s

Nurul Islam  
Senior Policy Advisor  
IFPRI

---

The food and agriculture sector in the developing countries will face a number of challenges during the 1990s and beyond. The response of this sector to these challenges will determine the prospects for growth, stability, and poverty in the developing world. One of the important challenges in the future will be the growth in population in the developing world. Population in developing countries will continue to grow well into the 21st century, although the rates of population growth are already declining in Asia and Latin America. During the next decade, every year ninety million will be added to the population of the world; and ninety percent of this increase will be in developing countries.

As the world economy recovers from the present state of recession and income growth in developing countries is accelerated, the demand for food and agricultural output will expand rapidly. A 5 percent per annum growth rate in gross national product for developing countries and about 2.6 to 2.8 percent for developed countries can be expected in the next decade or so.

The combined effect of population and income growth will lead to an increase in direct and indirect demand for food grains. In the next one or two decades the rate of growth of demand for cereals in developing countries is expected to increase somewhere between 2.5 and 2.8 percent per annum whereas that for the total agricultural output between 3 and 3.1 percent per annum. The reverse will be the case for developed countries, i.e., the rate of growth of demand is expected to further slow down to between 0.9 and 0.7 percent per annum and the rate in growth of supply even if it slows down is likely to be still ahead of the rate of growth in demand, i.e., about 1.5 percent for cereals and 1.3 percent for agriculture in the absence of a drastic modification of current policies (Alexandratos, 1991).

Along with an increase in population and income growth in developing countries will be an associated increase in the rate of urbanization. The rate of increase in urban population accelerated to 6.6 percent during 1980 - 1990 compared to rate of growth of 3.7 percent during the earlier decade (World Bank, 1992e). As the

world moves further into the 21st century, urban populations will be twice the size of rural populations in the developing world as a whole. By 2000 there will be 21 cities in the world with more than 10 million inhabitants, and 17 of them will be in developing countries.

Increase in population with a changing age structure results in a high proportion of young people in the population and consequently in a rapidly expanding labor force. There is an urgent need for creating employment opportunities for an increasing labor force, especially in rural areas. Given the expected labor intensity of agricultural production and the projected rate of growth in output, agricultural employment can not absorb the excess labor force, nor is it likely for the large-scale urban industrial sector to do so.

Urbanization and income growth will lead to changes in the structure of demand, away from cereals towards non-cereal foods, i.e., horticultural and dairy and livestock products including processed foods. The comparative cost advantage in different agricultural and related activities will change in response to changes in relative prices, opportunities in export markets and cost reducing innovations resulting from research and development efforts. The marketing distribution and transportation infrastructure will require both an expansion and a redirection in order to facilitate the diversification of rural output and employment as well as to enable supplies of urban food requirements from the domestic agricultural sector.

As indicated above, an important consequence of high income growth, especially in middle and high income developing countries, is a rapid expansion in demand for livestock products and an increasing use of cereals as feed grains. By the year 2000 according to some estimates annual consumption of cereals for feed will increase at 4.6 percent per annum as compared with only 2 percent per annum for food consumption (Paulino, 1986). At the same time, given limited pasture grounds and farm residuals in many developing countries, there is expected to be a rapid increase during the next decade or so in the demand for concentrate feeds. Many countries will, nonetheless, continue to seek alternative local feed sources. The developing countries will, therefore increasingly face a choice between reliance on imports of feed stuff, on the one hand, and their domestic production on the other, including cheap alternative local feed sources.

Increase in agricultural production in the future has to be obtained increasingly from an increase in yield per hectare, given the limited scope for the expansion of

land under cultivation. Already 90 percent of the increase in cereal production in developing countries during 1961 - 1990 was obtained from increase in yield per hectare (World Bank, 1992c). The high rate of growth of output which resulted from the rapid spread of the Green Revolution during the 1960's and 1970's faced in recent years a slow down due to a deceleration not only in the rate of growth of land area under cultivation but also in the rate of growth in yield. Yield potential in subtropical wheat and the main root crops increased barely at 0.5 percent per year (Lipton and Paarlberg, 1990). In much of Asia and Latin America, few farmers in favorable areas could profitably approach much closer to the existing yield potential.

The need for increasing yield potential is greatly increased by the fact that yields in the field in many areas are being pushed down by pest buildup and by micro-nutrient depletion.

Research is needed for increasing yield potential not only for major food grains as in the past but also for hitherto neglected minor crops such as non-cereal crops. A wider dissemination of existing high yielding varieties and current technology under widely different agri-ecological circumstances through adaptive research designed to deal with droughts, pests, disease, unfavorable soil conditions such as acidity and salinity etc. is called for. In recent years there has been a stagnation in public expenditures on research carried out both in international agricultural centers as well as in national research systems; the latter has suffered in the process of readjustment or reduction in public expenditures necessitated by stabilization measures. At the same time it will be necessary to ensure that where modern technology has already spread, the efficiency of use of modern inputs and technology is greatly increased. This will include the efficient management of irrigation system as well as on-farm use of water. This emphasizes the role of education, training and extension in ensuring a more sophisticated management of agricultural resources.

The appropriate role of the public and the private sector in research and agricultural investment such as irrigation will vary greatly amongst countries, depending upon the types of research, i.e. basic versus adaptive as well as types of irrigation, i.e. big surface water irrigation system versus small scale ground water irrigation system. In the foreseeable future public sector investment in agricultural research will continue to play a very dominant role.

Along with agricultural research, policy changes and institutional reforms are

necessary. Many developing countries have already undertaken both macro and sectoral policy reforms in recent years, either unilaterally or under the auspices of international financial institutions such as the Bank and the Fund. The need for strengthening such reforms in the future will continue. In many developing countries the capacity to design, implement, monitor and evaluate policy reforms in the light of challenges and opportunities facing the agricultural sector is very inadequate and needs considerable improvement. The sequencing, the timing and the speed of policy reforms are matters of serious concern. Investment in capacity building in food and agricultural policy analysis and research is a sine qua non of appropriate policy design.

Institutional reforms at all levels from the central government onwards to the local government institutions are important for the future development of the food and agriculture sector. The role of the local government institution in the development or organization of rural infrastructure as well as extension, education and training can hardly be under emphasized. Policy reforms which reduce in many instances the role of the state in agricultural production, marketing and distribution will at the same time expand its responsibility in the provision of infrastructure, health, education and social services. Even the act of privatization, i.e., managing the transition from a system of state control and ownership to one of deregulation and private enterprise requires a great deal of administrative competence. As privatization and deregulation proceed during and in many instances beyond the transition period, public and private enterprises will coexist. This underlines the importance of sustained efforts to improve the economic performance and managerial efficiency of the public sector enterprises under a more decentralized system of rules and market signals.

The risks of environmental degradation will increase as agricultural intensification and expansion proceed in response to increasing demands placed on the food and agriculture sector. Market failures, inappropriate government policies, absence of property rights, poverty and population growth all interact to cause environmental degradation, including soil erosion, water pollution and loss of biodiversity etc. The degraded area as a percentage of the total cultivated land varies from 22 percent in Africa to 19.8 percent in Asia including West Asia, 24.8 percent in Central America and Mexico and 14 percent in South America (World Resources Institute, 1992).

A multi-disciplinary and multisectoral approach will be required to deal with the environmental challenges. In order to promote sustainable agricultural growth it is necessary to ensure a more efficient application of existing but unused knowledge about resource management and at the same time to develop new technologies. The soil conservation and management systems need to be combined with increased application of modern inputs such as fertilizers and pesticides (40 percent of nutrients in developing countries are supplied by inorganic fertilizers). Measures which reduce soil erosion, increase yield and maintain soil fertility extend from rice conservation techniques such as mulching, contour cultivation, grass contour hedges to agriforestry and integrated crop and livestock development (World Bank, 1992c).

Various estimates have been made of investment requirements for environmental measures requiring soil and water conservation as well as afforestation. Expenditures on soil conservation, afforestation, including extension and training are estimated at \$15 - \$20 billion a year whereas those on research in agriculture and forestry (including resource surveys) are estimated at \$5 billion a year, over and above what is already projected.

In the coming decades poverty will continue to be a major concern in the developing countries. In spite of increasing urban poverty, a vast number of poor will continue to live in rural areas, especially in Asia and Africa. It is projected that by the year 2000 there will be an increase in the number of the absolute poor in the developing world from 1 billion in 1985 to 1.1 billion, and 24% of the population in developing countries will be absolute poor (World Bank, 1992b).

The agro-ecologically fragile regions contain large numbers of poor people; at the same time, risks of environmental degradation in these regions are exacerbated when population moves to low potential areas because of stagnation in income and productivity in high potential areas. The scarce resources available for research and investment expenditures are to be optimally allocated between the high and low potential areas, taking into account, amongst other, the prospects of (a) technological breakthroughs in agriculture in low potential regions, (b) of non-farm income and employment opportunities and (c) potential of migration to more favorable regions.

While a strategy of labor intensive and employment oriented agricultural development with associated expansion in non-farm employment, especially in rural areas, will help alleviate poverty, there will be a need in many instances to under-

take safety net measures for the poorest. Experience with targeted measures to alleviate poverty, which have been highly recommended in recent years, is limited. How to balance the increasing cost of the targeted-poverty-alleviating measures against the benefits of concentrating limited resources on the poor is a continuing challenge. No less important is the need for mobilizing the support of the non-poor for poverty alleviating measures.

The various estimates of projections of supply and demand for food grains in developing countries for the year 2000 and beyond all indicate net deficits at levels much higher than those incurred in recent years. The reliance of developing countries on the world markets for meeting their import requirements gains credibility if they are able to increase their foreign exchange earnings, i.e., from agricultural and manufactured, especially non-traditional, labor intensive exports in which they have comparative advantage. In this context, the success of GATT negotiations in liberalizing agricultural trade is crucial in obtaining an increased access to developed country markets and a substantial reduction in subsidies on exports competing with those of developing countries.

It is estimated that even a moderate degree of trade liberalization envisaged in the Dunkel Draft will add significantly to income and export earnings of developing countries, even though countries, especially those which import meat, coarse grains, oils, sugar and dairy products and export traditional agricultural commodities like rice, coffee cocoa are likely to suffer an adverse turn in their terms of trade and a consequential loss of income (OECD, 1992). The global income would rise in the year 2002 (in 1992 prices) by \$195 billion, out of which \$104 billion will accrue to developed countries and \$91 billion to developing countries. A small number of developing countries will suffer a loss amounting to \$7 billion a year, a small amount to be compensated for, since this amount is not more than 20 percent of the Official Development Assistance going currently to the developing countries.

Already a large number of developing countries have unilaterally undertaken trade liberalization measures and in many countries discrimination against agriculture has substantially been reduced. In fact, between 1986 and 1991 more than a third of the developing countries undertook autonomous trade liberalization initiatives (United Nations, 1992).

In this context, the need for corresponding trade liberalization in the OECD countries becomes more urgent than ever. The gains from trade liberalization are



much greater if both developed and developing countries together liberalize (OECD, 1992). Contrary to expectations, it is the developing countries that have been taking the lead in this respect.

With or without the success of GATT negotiations the instability of agricultural food prices will continue to plague the world market and the developing countries. While a very substantial degree of trade liberalization will reduce the instability of prices in the world market, this does not eliminate all other reasons for instability such as climatic variations or speculative transactions. With the liberalization of trade, the instability in the domestic markets in developing countries will increase unless compensating measures are taken to cushion the impact of sudden large scale or acute food shortages on the poor.

In the past, stocks held by large developed country producers and exporters, especially the United States, served as a stabilizing force in the world food markets. With a drastic reduction of stocks held by United States and other developed country exporters in the aftermath of trade liberalization, the stabilizing influence of such stocks will no longer hold. Undoubtedly private stocks will play a bigger role but additional arrangements may be needed to persuade large producing and exporting countries to hold and release stocks according to some agreed rules of behavior to prevent a recurrence of the crisis of the 1973 - 74 type.

In the coming years the role of food aid in meeting short and long term food import needs of developing countries is likely to decline. As surplus domestic stocks and supplies decline the incentive for food aid will decrease. In view of the restrictions on export subsidies in the GATT framework and the risk that all concessional sales of food may be considered hidden export subsidies, there is a need to define clearer rules to protect legitimate food aid. Food aid provided under the auspices of the multilateral/UN agencies like the World Food Program (WFP), specifically if provided in cash to the WFP, is less likely to be branded as an export subsidy.

With or without the success of GATT negotiations, there is likely to emerge new trading blocs such as the North American Free Trade Agreement, a greatly strengthened EC (Europe 1992) and a possible trading bloc consisting of Japan, on the one hand, and the East Asian NICs, on the other. Some developing countries will be likely partners in the trading blocs, such as the participation of Latin American countries in the North American trading bloc, and that of the ACP countries with the EC even after 1992. The primary advantage the developing countries may

obtain from participating in such trading blocs will be the access to large markets in developed countries and economies of scale. Also, they may benefit from preferential access to technology and investment capital from the developed partner countries in return for trade liberalization and relaxation of restrictions on foreign investment. At the same time, the non-participating developing countries will suffer from competitive disadvantage in exporting to the trading blocs. Trade among developing countries will suffer in a region in which selected developing countries are paired off with large industrial countries.

The emergence of democratically organized and free-market oriented countries in Eastern Europe and in ex-Soviet Union will have implications for trade and aid flowing to developing countries. In the near term future, as they struggle to reorganize their economies, especially their food and agriculture sector, they will be large importers of food grains and will compete as significant recipients of food aid and external assistance. In the long run as they succeed in building up institutions of marketing, distribution and credit etc. and solve problems of land management and ownership, a few of them will emerge in the long run with agricultural surpluses, especially processed agricultural commodities competing with the exports of developing countries. As their income grows and per capita consumption of tropical commodities, such as tropical beverages or fruits and vegetables increases, their imports of non-traditional agricultural commodities from developing countries may also expand.

Looking towards the future, the food and agricultural sector in the developing countries faces important challenges; response to these challenges will involve action on various fronts. A few priority areas of action are: strengthening and implementation of policy reforms; expansion of investment in research, both national and international; investment in new irrigation projects as well as on maintenance and rehabilitation of existing projects; greater emphasis on rural infrastructure including rural roads, transportation, and electricity, marketing and distribution systems; education, extension and training. Investment in education and training acquires a special urgency in view of the requirements of more efficient management of natural resources in the future. Large investments are required in the management of natural resources, including soil and water conservation and afforestation etc.

In recent years, there has been a decline in public expenditures on agriculture owing, amongst other things, to a decline in agricultural subsidies, fall in public

sector investment in irrigation and in rural credit etc. To what extent the reduction in public investment has been offset or more than offset by private investment is not known and requires fuller analysis. Measures to stimulate private investment in agriculture, where the latter is lagging behind, are needed.

While requirements for external assistance in the face of growing population and persistent poverty grow, ODA (Official Development Assistance) to agriculture has been stagnating. ODA had fluctuated between \$9 and \$11 billion during the 1980's. Assistance from the USA declined by 50% and from the World Bank by 20% with partially compensating increases from Europe and Japan (World Bank, 1992f). Insofar as official commitment of external resources (both concessional and non-concessional) is concerned, there is a fall in the share of multilateral and an increase in that of bilateral assistance. Furthermore, the share of assistance to such subsectors as land and water development, research, extension and training and rural infrastructure in the total official commitment of external resources has recorded a decline. This is a tendency which needs to be reversed (FAO, 1991). Liberalization of world trade in agriculture, especially by large developed trading countries is essential to strengthen their efforts to pursue the objective of a diversified agricultural sector relying on a liberal access to world markets.

## Food and Agricultural Development Issues in the 1990s

Keiji Oga  
Research Fellow,  
Special Development Studies  
Division, IFPRI

---

Nurul Islam has already dealt with the projected global agricultural situation in the 21st century. I would like to focus on a very small problem—the relationship between livestock production and feedgrain in the Asian context, utilizing a projection model developed as part of my work at IFPRI.

Japan is deeply involved in development assistance to Asian countries. The latter's agriculture is somewhat different from that of other regions. In Asia, especially East Asia, the population growth rate is lowest of any of the developing regions, while the economic growth rate is the highest in the developing world. Many developing countries, including mainland China, have already taken off or are on the verge of doing so. In this context, food grain consumption is, at some stage, likely to reach a saturation point. Normally, this would occur at the per capita income level of U.S. \$500 to \$1,000 per year. As you know, when Japan took off in the 1960s, rice consumption began to decline. This resulted in overproduction of rice and the need for production adjustment in the agricultural sector. A similar situation has already arisen Taiwan. Korea is also approaching this state, Thailand will follow, and perhaps China.

Once the consumption of foodgrain reaches a saturation point, the consumption of livestock products begins to accelerate quickly. This, in turn, induces rapid growth of feedgrain consumption. Developing countries at this stage face the choice of whether to import feedgrain or to produce it themselves.

As the history of Japanese agriculture shows, shifting from paddy field rice to upland crop production is very difficult. In fact, both Japan and Taiwan did this only with great difficulty and at high cost. It is not certain whether Korea will succeed in doing so. Thailand has succeeded somewhat.

In the European countries, barley and wheat are not only used for food but also for feedgrain. The price difference between them is not great. But in Asia, the price of rice is much higher than that of grain; hence Asian farmers are reluctant to

use rice for feedgrain.

Given the price constraints to diversify out of rice at the farm level, policymakers need to identify opportunities to facilitate the growing of grain for feed in areas that are less suited to rice. This point is very important in the Asian context where historically production and distribution of rice has been heavily controlled by governments.

## Food and Agricultural Assistance in the 1990's

Toshio Sagawa  
Managing Director,  
Agriculture, Forestry and  
Fisheries Development Study  
Department, JICA

---

### 1. Goals in Agricultural Assistance

Many international organizations and advanced countries have provided agricultural assistance to developing countries through supplying funds and transferring techniques. Agricultural assistance has basically two goals for socio-economic development as follows:

- (1) Improvement of food sufficiency at a national level by increasing production.
- (2) Improvement of farmers' welfare through rural development.

Agricultural assistance has had one of the most important roles in various kinds of aid to developing countries since the 1960's. A huge amount of money has been financed and invested, and many experts have been dispatched by aid organizations as well as have numerous trainees been accepted for agricultural and rural development.

Have these various kinds of assistance been really effective and successful?

### 2. Global Demand-Supply Situation of Food

The European Community, the United States and some other advanced countries have been suffering from overproduction or oversupply in the world food market. On the other hand, food production in developing countries except for a few cases, has been stagnating. Furthermore, some countries such as the countries of Sub-Saharan Africa have been suffering from decreasing food production. This production gap between advanced and developing countries is still growing.

Last June, the Ministry of Agriculture, Forestry and Fisheries of the Japanese government published a report entitled "Forecasts of World Food Demand and Supply in the year 2000". (See Appendices 1 and 2)

According to this report, grain production in developing countries will increase slightly from 1988 to 2000. However, these countries will need to import approx-

imately double the quantity of grain in the year 2000 compared to their grain requirements in 1988. In particular, annual food consumption per capita will decrease in Africa and the Middle East. In addition several other organizations such as the FAO have also published global food estimates. Every estimate is pessimistic about the food situation in developing countries.

### **3. Food and Agricultural Policy in Developing Countries**

Almost all the developing countries regard agriculture as the most important industry and assign top priority to it in their national development plans. However, their plans have not been implemented in many cases. Up to now many aid organizations have provided their assistance to improve agricultural techniques, which is an effective way to directly increase yields or productivity. However, socio-economic policy measures as well as improved agricultural techniques are also effective for increasing production. Unfortunately, not enough of these policy measures have been taken in developing countries, because of the shortage of finance and know-how.

Same price and import policy measures are outlined in the following examples.

#### **(a) Price Policy Measures**

Taking adequate price policy measures is effective for controlling the level of production. For example, buying from farmers at a high price provides them with the incentive to increase their production. Overproduction of farm products in the European Community and the United States stems from the fact that the governments guarantee high prices to farmers through deficiency payments.

However, price policy measures are rarely taken in developing countries because of budget shortages. When price policy measures are taken, often governments buy from farmers at a low price and sell to consumers at a low price. This does not give farmers the incentive to increase production.

#### **(b) Food Import Policy Measures**

A large quantity of food imports at low price levels also decreases farmers' incentives to increase their production.

For example, many African countries import a lot of foods at low prices compared with domestic products mainly for urban residents. Therefore, farmers prefer to produce food for their own consumption. (Appendix 3 shows an example in Guinea.)

In addition, it may be risky for national food security to rely too heavily on imported food. Structural adjustment policy" (SAP for short) often requires developing countries to abandon uneconomical food production for local consumption, and to focus on the production of cash crops. The argument is whether cheap imported food can be purchased with the money earned through the sale of these cash crops. However, one of the major flaws in this argument is that prices on world food markets are extremely unstable. For example, as you may recall, during the food crisis of 1973, the price of wheat increased dramatically from a low-point of about US\$1.5 per bushel to a high-point of nearly US\$7 in a short period of time. This rapid growth in the price of wheat meant that many governments of developing countries were unable to buy sufficient quantities of wheat to feed their own populations because of shortages of foreign currency.

#### **4. Future Policy of Agricultural Assistance**

Not only technical but also socio-economic policies are necessary to achieve the two goals of agricultural assistance, namely: (i) improvement of food sufficiency at the national level by raising production; (ii) Improvement of farmers' welfare by rural development.

Both of these goals should be combined to obtain more effective results from assistance.

Socio-economic policy measures, which may assist agricultural development in developing countries, include the introduction of price and import policies; the diffusion of extension services; the provision of credit to farmers; and the creation and support of farmers' organizations such as cooperatives.



Appendix 1

Forecast of Production, Consumption and Net Trade by Region (Grain and Soybeans)

(Unit: Million Tonnes)

|                     |                   | Developed Regions |             |           | Developing Regions |             |           | World Total |             |
|---------------------|-------------------|-------------------|-------------|-----------|--------------------|-------------|-----------|-------------|-------------|
|                     |                   | Production        | Consumption | Net Trade | Production         | Consumption | Net Trade | Production  | Consumption |
| Wheat               | 1988              | 315               | 258         | 60        | 224                | 281         | -60       | 539         | 539         |
|                     | 2000 (Scenario 1) | 384               | 290         | 94        | 319                | 413         | -94       | 703         | 703         |
|                     | 2000 (Scenario 2) | 378               | 272         | 107       | 282                | 390         | -107      | 660         | 662         |
| Maize               | 1988              | 277               | 266         | 13        | 190                | 201         | -13       | 467         | 467         |
|                     | 2000 (Scenario 1) | 335               | 319         | 16        | 263                | 279         | -16       | 597         | 597         |
|                     | 2000 (Scenario 2) | 344               | 307         | 39        | 229                | 268         | -39       | 573         | 574         |
| Other Coarse Grains | 1988              | 260               | 246         | 12        | 101                | 115         | -12       | 361         | 361         |
|                     | 2000 (Scenario 1) | 344               | 294         | 50        | 113                | 163         | -50       | 457         | 457         |
|                     | 2000 (Scenario 2) | 315               | 286         | 30        | 118                | 148         | -30       | 433         | 435         |
| Rice                | 1988              | 19                | 17          | 1         | 304                | 306         | -1        | 323         | 323         |
|                     | 2000 (Scenario 1) | 22                | 18          | 4         | 428                | 432         | -4        | 450         | 450         |
|                     | 2000 (Scenario 2) | 22                | 17          | 5         | 384                | 390         | -5        | 406         | 406         |
| Grains Total        | 1988              | 870               | 787         | 85        | 819                | 902         | -85       | 1,690       | 1,690       |
|                     | 2000 (Scenario 1) | 1,084             | 921         | 164       | 1,122              | 1,286       | -164      | 2,206       | 2,207       |
|                     | 2000 (Scenario 2) | 1,060             | 882         | 181       | 1,012              | 1,196       | -181      | 2,072       | 2,078       |
| Soy-beans           | 1988              | 54                | 54          | 0         | 46                 | 46          | -0        | 100         | 100         |
|                     | 2000 (Scenario 1) | 65                | 55          | 11        | 64                 | 75          | -11       | 130         | 130         |
|                     | 2000 (Scenario 2) | 64                | 52          | 12        | 58                 | 70          | -12       | 121         | 122         |

Scenario 1: Status Quo Scenario

Scenario 2: Scenario of Slowdown in Production Growth

The Ministry of Agriculture, Forestry & Fisheries, the Japanese Government, June, 1992

Appendix 2

Forecast of Per Capita Consumption of Grain by Region

|               | Base Year (1988) |       | Target Year (2000) |       |            |       |
|---------------|------------------|-------|--------------------|-------|------------|-------|
|               | Quantity         | Index | Scenario 1         |       | Scenario 2 |       |
|               |                  |       | Quantity           | Index | Quantity   | Index |
| Developed     | kg<br>627        | 100   | kg<br>701          | 112   | kg<br>672  | 107   |
| Developing    | 233              | 100   | 260                | 112   | 242        | 104   |
| of which:     |                  |       |                    |       |            |       |
| Latin America | 264              | 100   | 277                | 105   | 260        | 99    |
| Africa        | 159              | 100   | 161                | 101   | 142        | 89    |
| Near East     | 366              | 100   | 371                | 101   | 344        | 94    |
| Asia          | 228              | 100   | 261                | 114   | 249        | 109   |
| World Total   | 329              | 100   | 353                | 107   | 332        | 101   |

The Ministry of Agriculture, Forestry & Fisheries, the Japanese Government, June, 1992

Appendix 3

*Price Comparison of Domestic and Imported Rice in Konakry, Guinea's Capital*  
(Unit: Guinea Franc/kg)

|   | Local Price<br>or<br>Import Price |             | Price in Konakry<br>Including Trans-<br>portation Cost<br>(Milled Rice) |
|---|-----------------------------------|-------------|---|
|   | Husked Rice                       | Milled Rice |   |
| Imported Rice                                   | —                                 | 80.0        | 80.0  |
| Domestic Rice                                   |                                   |             |   |
| Coastal Area near Konakry                       | 55.9                              | 111.8       | 115.3   |
| Coastal Area 200km from Konakry                 | 57.1                              | 114.2       | 128.2   |
| Kankan (Highland, Use of Cattle and Fertilizer) | 43.6                              | 87.2        | 143.2   |
| (Highland, Use of Machine and Fertilizer)       | 51.2                              | 102.4       | 158.4   |
| N'Zerekore (Lowland)                            | 42.9                              | 85.8        | 152.3   |

- Note: 1. République de Guinée, Ministère du Développement Rural "Etude de Restructuration de Services Agricoles et de Schémas Directeurs Régionaux de Développement Rural, Synthèse", 1986, p. 51  
2. Railway between Konakry and Kankan is not operated now.

## **DISCUSSION**

**(SESSION II)**



(Rosegrant) Referring to Mr. Sagawa's Table in Appendix 1 on projected import of grains: The policy implications of the projections may be very different depending on where and for what purpose the grains are imported. For example, if these imports are primarily wheat and coarse grains going to rapidly developing Asian countries to feed their rapidly growing populations or to satisfy demand for livestock feed, this poses no problem. If, instead, these imports are largely for subsistence consumption in Africa, then they may reflect very difficult problems.

(Oga) I do not have the details on this figure. The model on which it is based consists of 19 commodities and 35 regions. The chart only shows the aggregated basis. The net trade import consists about half of wheat and half of coarse grains. As for the rice, there is not much trade. So compared to the base year, the net trade in the case of wheat in developing regions increased from 60 million tons to 107 million tons. For other coarse grains, it increased from 25 million tons to about 66 million tons. So the amount is 20,000 tons; it is the same. But the increasing ratio or growth rate for coarse grains is much faster. Still, wheat imports will be large.

(Pinstrup-Andersen - Moderator) If I can just add to that, I think there is an extremely important point in Mark's question. That is, there is absolutely nothing wrong with having rapidly increasing food imports to countries that have been rapidly increasing exports of other goods and services. That is merely a sign of increased foreign trade of the country. Whereas if countries have severe food deficits, then there would be serious concerns about rapidly increasing import projections for those countries. That is at least a very important policy point. The conclusion is projections of future import demand should not be aggregated.

(Islam) Other projections show roughly one-third of this projected deficit attributable to low income countries and about one-third to middle or high income countries importing coarse grains for livestock production. The fairly large imports for Africa compared to their base is a serious problem.

(Hayami) Appendix 1 on page 12. Scenario 2 is supposed to be a scenario for a slow down in production growth. I understand that it is assuming the growth rates in yield to be reduced to 1/2 of the previous trend. Then production in Scenario 2 is necessarily smaller than production in Scenario 1. But if you look at other coarse grain for developing countries, Scenario 1 has 113 and Scenario 2 has 118. These results look very funny to me. How can such results be possible? In the case of rice

for developed countries, production is the same in spite of assumed decline in the yield. How can all things be possible?

(Oga) There may be a cross-price effect. Because of low growth rate, the price increase does not matter. So every price will change. Sometimes the cross-price effect would exceed the on-price effect. In that case, there is a little increase. But the grain total seems highly unlikely.

(Hayami) Also, there is another point which appears to me very funny. Scenario 1 assumes that the future trend is extrapolated from the past trend. This Scenario should be called a medium simple extrapolation scenario. Then, Scenario 2 assumes the case for reducing yield growth rates, which is considered a lower bound estimate. To be scientific, you must have an upper bound estimate. Why didn't you do that? If you do not do that, people tend to suspect you are creating some sort of scare story.

(Oga) I agree with you. There must also be an upper bound estimate. Otherwise the projection is distorted. This is a common tendency when making projections: to show the pessimistic scenario while not mentioning the optimistic one.

(Hayami) There must be Scenario 3.

(Oga) Yes, I think we have to have Scenario 3.

(Kagami) My two questions are addressed to Dr. Islam. The IMF and the World Bank have been promoting the structural adjustment policies in developing countries. I think there will be some skeptical views on the effectiveness of this policy. But probably the broad view is to support this policy. I would like to know how IFPRI looks at this structural adjustment policy in terms of facilitating and broadening the agricultural development in developing countries. Secondly, concerning Dr. Islam's reference to NAFTA (North American Free Trade Agreement), I wonder whether this agreement is harmful or useful for agriculture markets.

(Islam) On the question of policy reforms in developing countries, there is a consensus that past policies of intervention in the markets for agriculture commodities, directly as well as indirectly through macroeconomic policies, have been harmful for the agricultural sector in developing countries. Therefore, we broadly agree that the reforms are in the right direction. But studies are now needed on the process of implementation of the reforms—market liberalization and privatization of both output and input markets—to examine whether in the timing, sequencing, and

integration of the various policy changes, the experiences of various countries have been as expected.

As far as NAFTA is concerned, it is too early to assess the impact on agricultural markets. However we can say that if trade in agricultural commodities between Mexico and United States is liberalized, Mexico would have great opportunities for exporting fruits and vegetables, along with non-agricultural commodities, to the United States market. The United States would out compete the domestic production of foodgrains, basically wheat and corn. So in order to smooth the process of adjustment the treaty delayed the liberalization in these two sets of agricultural commodities. But even if implemented slowly, third country agricultural exports to North America, including Mexico, would be affected. Caribbean exports of fruits and vegetables to Canada and the United States will be immediately affected, because Mexican food exports will be much cheaper. Exports from East Asia, e.g., fruits and vegetables from Philippines and Thailand to the United States, will also be absolutely affected.

(Kagami) I think it affects not only the countries of the Caribbean but also countries in East Asia.

(Islam) Yes, especially fruits and horticultural products.

(Takasugi) I have a question to Dr. Islam about the important challenges faced by the developing countries in this food and agriculture sector. You listed several priority areas of action in your paper, page 7, with special emphasis on education and training. I am wondering at what level, I mean primary education or college level education or post graduate level education, do you think this urgent serious attention is necessary?

(Islam) In this particular context the emphasis should be on extension training rather than post-graduate training; possibly also the primary level.

(Takasugi) Not formal training?

(Islam) Primary education is formal training, as is extension education. The assumption is that as per hectare use of inputs such as fertilizer, pesticides, and water increases, these inputs must be much more efficiently managed. It is widely believed that, therefore, the training of farmers in the use of these inputs has to be greatly increased.

(Takasugi) At the same time you emphasize the importance of the development of new technology to increase productivity. I think to develop such new technology,

research personnel should be properly trained at university or graduate level.

(Scherr) I'd like to direct a question to Dr. Oga related to livestock feed consumption and the provision of feed and fodder resources for increased livestock production. What is the potential for diversification of meat products beyond the internationally dominant commodities such as beef? Secondly, have you looked at alternative feed sources for livestock increase? In the temperate zone, most of the increase in feeding has involved a shift from range to grain fed. That's partly because of the existence of grain surpluses. In many of the tropical countries, a lot of the important resources for feeding animals actually comes from tree fodder, shrubs, forest grazing, agro-forestry systems where in addition to grain production there are other kinds of products. Have you been able to look at alternative sources of feed, in order not to increase pressure on basic grain production?

(Sudo) My question is related to other issues. Dr. Oga mentioned that transforming paddy fields into upland crop fields seems very difficult, referring to the cases of Taiwan, Korea and Japan. He has also mentioned that animal products demand had been on the increase in those countries. I'd like to ask what is the prospect of transforming paddy fields into pastureland. Because ruminants such as cattle and sheep are largely depend on good quality roughage whereas pigs and chickens are fed on grains. What do you say about transforming the paddy field into pastureland?

(von Braun) Referring to a point made by Mr. Sagawa concerning a policy which supports exporting non-food agricultural products in order to purchase cheap food from international markets. Countries which focus heavily on self sufficiency in staple foods may run the risk of having high instability in domestic production and not much scope to balance that through trade, because it is difficult for small countries to enter the international market with staple foods. So there may be a substitution between the risk of the international instability versus the risk of the domestic food production instability. Many countries face that problem. Secondly, this instability in the international market is nowadays derived from trade restrictions and agricultural policies made in the U.S. and Europe and maybe also partly in Japan. In effect, the rich countries export instability to the world market by completely stabilizing their domestic consumption. Both points should be kept in mind. When rich countries stabilize their consumption and shield their consumers completely, that destabilizes the world market and through development assistance



policies advise lower income countries not to grow through agricultural trade because it's too risky. Part of that risk is produced by the rich countries. Thirdly, due to the very uncertain situation in Eastern Europe and the former Soviet Union, it is very difficult to predict these days how the international markets will develop. Thus, we would refrain from arguing for an all-out free trade scenario for very poor countries with infrastructure problems in Africa.

(Oga) Let me respond to Ms. Scherr's question. On the prospect for diversification of meat products, in Asian countries ruminant animals have not been so important historically, expect pig meat and poultry in non-Islamic countries. As for alternatives to feedgrain, this will require further study. In Japan, Korea and Taiwan, residual farm products were initially the main source of the feed; later, feedgrains were used. From the standpoint of effective production of animal products, whether residual farm products, imported feedgrain or some tropical alternative would be best requires further research. As for conversion of paddy fields to pasture land in Asian countries, we have had little effective experience. This is a very challenging problem.

(Islam) Let me add just one point. The years 1972 to 1974 have been much discussed and misunderstood. Rising food prices during these years were very abnormal and were unrelated to any fall in production. Rather, they were due to increased external demand by the Soviet Union which triggered tremendous speculative buying in the world market. So the price rise of 1973 to 1974 should not be generalized.

(Moderator) Obviously I am not going to try to conclude or summarize this discussion. Let me just make four brief points, I believe, have emerged from this morning's discussion. First, it is very clear that aggregate projection of increasing food demand is not necessarily a bad thing; it does not imply that things are getting worse. The structure and location of increasing imports must be made explicit before conclusions can be drawn. Second, price instability in international markets, except for the 1973 to 1974 period, has probably been exceeded by instability in food prices internally in many developing countries. Thus, price instability in the world market must be compared to price instability in countries that are trying to be self-sufficient and isolate themselves from the world market.

Third, both price and non-price factors must be considered in designing production incentives to farmers. Using price policy alone in situations where farmers

really cannot respond in terms of increasing the total supply will not be very successful. There are a number of cases in Africa where price policy has been used in lieu of removing some of the non-price constraints. The result, in most cases, has been a change in the output composition, but not much increase in total production. So price policy has some very severe limitations, in cases where infrastructure is very weak, markets are not really operating, farmers do not have access to new technology and credit, and so on. Price policy is clearly not a panacea; it is part of much bigger policy package.

Fourth, policies to increase food security need to promote both food security at the household level and food self-reliance at the national level. The latter requires that government have access to enough food whether it is produced locally or is imported.

Ladies and gentlemen, may I say how pleased I am with the beginning of this workshop. We have had some very good presentations and discussions. Thank you very much.

## **SESSION III**

**Technology Policy for Agricultural Development in Asia**



## Technology Policy for Agricultural Development in Asia

Mark W. Rosegrant  
Research Fellow  
Environment and Production  
Technology Division, IFPRI

---

### Introduction

Agricultural growth has been relatively rapid in Asia, with growth in foodgrain production of more than 2.6% per year since 1966. However, after 1982, growth has slowed significantly, to about 1.9% per year. Sharp declines in world rice and wheat prices and increasing capital costs have resulted in reduced rates of investment for irrigation infrastructure; have led to a shift of land out of rice and wheat and into other crops; and have reduced the rates of increase in input use. At the same time, increased intensity of farming, particularly in irrigated areas, has led to diminishing marginal returns to increased input use, and has caused degradation of land in some areas. Changes in government policies, such as reduction of fertilizer and other subsidies to agriculture, have also contributed to reduced growth.

With projected growth in demand for foodgrains in Asia of 2.6% per annum over the next 15 years, increased rates of growth in food production compared to the 1980s are necessary. Agricultural growth to increase food production and income, reduce poverty, and provide wage goods will therefore remain a key goal for most Asian LDCs over the next decades. What is the appropriate mix of technology policies to sustain agricultural growth in Asia? This paper discusses appropriate technology policies for Asian agricultural development in the next decade, including irrigation investment policy, agricultural research, fertilizer policy, and agricultural extension. The discussion here draws heavily on M.W. Rosegrant and M. Svendsen, "Irrigation Investment and Management in Asia: Trends, priorities, and policy Directions," January 1992; and M.W. Rosegrant and P. Pingali, "Sustaining Rice Productivity Growth in Asia: a Policy Perspective," July 1992. Supporting analysis and references can be found in these papers.

### **Irrigation Investment Policy**

Since the mid-1960s, the growth rate of irrigated area in the world has declined by about 60%; in Asia, it has declined by 72%. Recent sharp reductions in irrigation investment are likely to further slow the rate of growth in area irrigated. Aggregate lending and assistance for irrigation in Asia by the four main financial donors for irrigation development – the World Bank, Asian Development Bank, the U.S. Agency for International Development, and the Japanese Overseas Economic Cooperation Fund – reached its peak in real terms in 1977 - 79, and by 1986 - 87 it was less than 50% of the 1977 - 79 level. Total public expenditures for irrigation for individual countries in Asia also declined significantly during the 1980s. Annual irrigation expenditures in China and Sri Lanka were cut nearly in half between the late 1970s and the late 1980s. In the Philippines, annual expenditures on irrigation investment in the late 1980s were only one-third the level of the early 1980s. Declines in the late 1980s from peak expenditure level in India, Indonesia, and Thailand range from 10 percent to 30 percent.

Declining investment has been accompanied by degradation of much of the existing irrigation area, despite a relative shift in overall irrigation investment in the 1980s from new construction to rehabilitation and operations and maintenance. In many areas, particularly in China, India, and Pakistan, irrigated area suffers significant damage from waterlogging and salinization. Estimates of annual global losses of agricultural land due to waterlogging and salinization range from 160,000 - 1.5 million ha, with most of the damage occurring in irrigated croplands of high production potential. It is estimated that salinity seriously affects productivity in 20 to 46 million hectares of irrigated land, representing one-fourth to one-half of the estimated 91 million hectares of irrigated land. Much of the waterlogged and salinized area is in Asia, particularly India (6 - 10 million hectares of waterlogged and salt-affected areas), Pakistan (3 - 7 million ha), and China (7 million ha). Thus, although estimates vary significantly, degradation of irrigated area in Asia is a significant and growing problem.

What is the appropriate policy response to these trends in Asian irrigation? Rosegrant and Svendsen conclude that the substantial cutback in public investment on irrigation during the 1980s was an appropriate response to declining world rice and wheat prices and the rapidly increasing capital costs of irrigation. However, because shadow prices of rice and wheat currently being used in project evaluation

do not fully reflect the likely upward pressure on prices due to declining investment, a moderately higher shadow price for rice and wheat should be utilized in evaluation of irrigation investments. These modified shadow prices would reflect the probable long term effects on world prices of the reductions in irrigation investment over the past few years. If shadow prices were revised upward, the portfolio of cost-effective new irrigation projects would increase compared to current levels, moderately boosting expenditures on new irrigation, rehabilitation, and other irrigation improvement options.

Selective investment in irrigation rehabilitation, management reforms, and other interventions to improve the efficiency and performance of irrigation systems will continue to have an important role in future development in Asian irrigation. However, the tendency toward high cost rehabilitation to reconstruct and modernize systems from the dam to the farmers' fields should be avoided. Careful identification of systems to be rehabilitated and selection of high-payoff points of intervention within the systems will improve the cost-effectiveness of these interventions. Improved impact assessment methodologies could yield large benefits by better identifying cost-effective intervention. In order to arrest degradation of irrigated area, increased emphasis must be given to development of cost-effective projects to reduce waterlogging and salinity problems, including canal lining and drainage, field drainage, and conjunctive use of surface and groundwater.

Expansion of private investment in irrigation, particularly tubewells, is very promising. While the government role in encouraging private investment should be indirect, consisting primarily of sustenance of an appropriate legal/institutional environment and provision of adequate public goods and services, it is nevertheless critical to expansion of private investment. Targeted investments in public goods, such as energy and roads, which can facilitate the expansion of conjunctive use of tubewells and canal irrigation, should be particularly productive due to the largely unexploited positive externalities arising from conjunctive use.

### **Agricultural Research**

There was a considerable expansion of international and national support for agricultural research during the past three decades, but there was a sharp decline in growth in research expenditure in Asia in the late 1970s and 1980s. The annual growth in agricultural research personnel dropped from 6.9% in 1968 - 78 to 4.0%

during 1978 - 85. Agricultural research expenditures grew at a rate of 6.9% in 1968 - 73, but declined to about 4.6% during the 1978 - 85. This decline was inappropriate, given the very high economic rates of return to agricultural research. Analyses of rates of return to rice research in Asia consistently show rates of return ranging from 50% to 140%, indicating underinvestment in research. These high marginal rates of return have been sustained in the 1980s, despite the emphasis on yield maintenance and stability research as compared to generation of yield breakthroughs. The high rates of return to public investment in agricultural research show that research expenditures should be significantly increased, with a focus both on increasing yield potential and improving the stability of yields across a range of environments.

There is new evidence that private agricultural research also generates large public benefits in Asian countries, because private firms capture only part of the value of improved inputs through higher prices. Governments should reexamine policies which affect private investment in research, such as policies on the import of technology and intellectual property rights, and implement policies which encourage beneficial private investment in agricultural research.

Reform of the structure and organization of research systems should also contribute to increased returns to research. Greater emphasis should be placed on raising the quality of scientists and research management, and on providing adequate operating funds and technical support. The division of responsibilities and working relationships between the international and national agricultural research centers need to be reexamined in the light of seeking increased efficiency; decentralization of research regionally and to the farm level, based on agroecological characterization, may be the most effective approach, and would provide better feedback mechanisms to upstream researchers and policy makers.

### **Fertilizer Policy**

Subsidized fertilizer prices have induced increased use of fertilizers without encouraging efficiency of use, and have tended to favor the use of nitrogen fertilizers over other nutrients. As will be discussed below, the reduction and eventual removal of fertilizer price subsidies can improve the efficiency of fertilizer use. Non-price policies are also important, including location-specific research on soil fertility constraints and agronomic practices; improvement in extension services;



development of improved fertilizer supply and distribution systems; and enhancement of physical and institutional infrastructure.

There are two main instruments for increasing the efficiency of fertilizer use in Asia: improving the balance of fertilizer applications in order to deal with soil fertility constraints, and improving the placement and timing of fertilizer. However, while experimental results indicate significant gains from innovative fertilizers and placement techniques, adoption of new techniques has been slow. Farmers generally perceive that the cost of increased labor requirements for these techniques is higher than the income benefits from the resulting yield gains. Further research therefore needs to be done to generate economically viable deep placement technologies.

Governments have intervened in the setting of fertilizer prices in support of a number of broad-based policy goals. Many countries have protected the domestic fertilizer industry by restricting imports or maintaining import tariffs. In the Philippines, for example, domestic fertilizer prices were maintained well above world prices through the mid-1980s by a combination of import controls and subsidies to domestic fertilizer plants. More commonly, governments have subsidized farm-level fertilizer prices in support of several objectives, including income support for farmers and provision of incentives to increase the rate of adoption and level of fertilizer use, to increase crop production, and to balance other taxes against agriculture.

Fertilizer subsidies can become extremely costly to government treasuries. In Indonesia, subsidies have been maintained both for farmers and for the domestic fertilizer industry. The total fiscal costs for the two types of fertilizer subsidy were about Rupiah 670 billion (US\$407 million) in 1986, representing nearly one-half of total government development expenditures for agriculture and irrigation. Fertilizer subsidies in Bangladesh in 1983/84 accounted for about 14% of its budget allocation to agriculture. As a result of these high costs, both Indonesia and Bangladesh have moved to phase-out fertilizer subsidies. The economic costs can be even greater, as subsidies soak up funds that could be used for alternative investments, and can induce the overuse of fertilizers relative to socially optimal levels. To the extent that subsidies are not fully funded to provide enough fertilizer to meet demand at the subsidized price, excess demand will be created, which can contribute to non-price rationing, nonavailability of fertilizer, black markets, poor logistics, and un-

timely delivery of fertilizer.

Given the negative effects of subsidies, are there appropriate uses for fertilizer subsidies to farmers? Fertilizer subsidies to farmers may be cost-effective in stimulating farmers to adopt and appropriately utilize fertilizer together with new production technology. Temporary subsidies during the early stage of adoption of fertilizer may be effective in overcoming the fixed costs related to adoption of new technology and in inducing farmer experimentation and learning during periods of rapidly changing technological potential.

However, such temporary subsidies should be phased out as adoption and appropriate use of fertilizer become widespread as in many Asian countries. At high levels of fertilizer use, the budgetary cost of the fertilizer subsidy becomes prohibitively expensive, and the subsidy induces inefficient use of fertilizer beyond appropriate levels. Removal of fertilizer subsidies, in conjunction with appropriate extension policies, would encourage more efficient use of fertilizer.

#### **Agricultural Extension**

Available evidence indicates that the economic returns to extension are high, and the importance of extension to productivity growth in Asia is likely to increase over time. This is because of the changing demands on extension posed by the increasing importance of efficiency in input use as opposed to input and crop variety promotion. Technologies to improve the nutrient balance and the timing and placement of fertilizer applications are highly complex, knowledge-intensive, and location-specific. Proper use of integrated pest management, which requires intensive measurement and interpretation of the dynamic crop environment, may be even more difficult.

These technologies are therefore far more demanding for both the farmer and the extension agent, requiring more information and skills for successful adoption compared to the initial adoption of modern varieties and fertilizers. In addition, these improve technologies do not give as clear gains in yield and income as the initial adoption of new technology. The increase in income from these technologies in fact are highly sensitive to the farmer's skills and efficiency in utilizing them.

To provide the necessary information dissemination and training for these new technologies, extension services will have to be upgraded. The poor performance of many extension services can be attributed to inadequate training, inappropriate

organization, and lack of incentives. How can extension services be upgraded to help farmers cope with the additional complexity of efficiency-enhancing technology? The following measures should contribute to improved efficiency in extension: integrated national planning of research and extension to ensure the appropriate budgetary mix for proper operation; regular interdisciplinary evaluation of on-farm benefits of recommended technology; and establishment of a goal-oriented organizational structure which encourages a bottom-up flow from farmers to extension and research. The latter, when combined with adaptive, location-specific research, is particularly important in the transfer of complex technologies.

### Conclusions

Increased rates of growth in food production in Asia compared to the 1980s are necessary to meet projected growth in demand for foodgrains in Asia of 2.6% per annum over the next 15 years. This paper outlined the technology policies which can contribute to maintaining agricultural productivity growth in Asia. Although the specific mix of policies will vary from country to country, general principles can be derived from this assessment. In the area of technology policy, the common theme which emerges from this paper is the increasing complexity of the environment for sustaining productivity growth in Asian agriculture. This increased complexity is particularly manifested in the need to improve the management and efficiency of use of the scarce resources utilized in production, in contrast to the overriding objective of rapid dissemination of modern technology which has been dominant in the past. Thus, for example, irrigation investments must be targeted to increase the efficiency of existing systems and to reduce environmental degradation; in fertilizer policy there is a shift from a sole focus on increasing the level of use of fertilizer to improving the efficiency of nutrient balance and the timing and placement of fertilizers.

The increasing complexity of the production environment also increases demands on research and extension systems. Decentralization of research regionally and to the farm level, based on agroecological characterization, may improve efficiency, is well-suited to more complex location-specific technologies, and would provide better feedback mechanisms to researchers and policy makers. The consistently high rate of return to investment in rice research suggests that research is significantly underfunded, and that sharp increases in research funding would have

high payoffs.

To provide the necessary information dissemination and training for the more complex new technologies, extension services should be improved. Possible reforms include interdisciplinary evaluation of on-farm benefits of recommended technology and establishment of a bottom-up flow of information from farmers to extension and research to facilitate evaluation and implementation of technologies produced by the adaptive, location-specific research.

The substantial cutback in public irrigation investment during the 1980s appears to be an appropriate response to declining world rice and wheat prices and the rapidly increasing capital costs of irrigation. However, due to the long term effect of irrigation on world prices, moderately higher shadow prices for rice and wheat should be utilized in evaluation of irrigation investments, which would boost the portfolio of cost-effective new irrigation projects compared to currently planned levels. Selective investment in irrigation rehabilitation, management reforms, and other interventions to improve the efficiency and performance of irrigation systems should be sustained, but with greater selectivity and an increased emphasis on cost-effective projects designed to reduce waterlogging and salinity problems, including canal lining and drainage, field drainage, and conjunctive use of surface and groundwater. Stimulation of private investment in irrigation through establishment of an appropriate legal/institutional environment and provision of adequate public goods and services should be highly productive, and would contribute to more efficient solutions to waterlogging and salinity problems.

## Technology Policy for Development: A Case of Joining IFPRI Study and JICA Technical Assistance

Hideyuki Kanamori  
Irrigation Development  
Specialist, JICA

An intensive technical assistance program called "Project Type Technical Cooperation" is provided by JICA. Within this type of program framework, the Diversified Crops Irrigation Engineering Project (DCIEP) has been carried out for the National Irrigation Administration (NIA) in the Philippines since May 1987. DCIEP was proposed in 1984 to assist technical reinforcement of irrigation for crop diversification. The diversification means planting non-rice crops in paddy rice-based land during the dry season after harvesting rice. This strategy, crop diversification, was proposed in a study titled "Study on Food Demand and Supply Related Strategies for Developing Member Countries (hereinafter called the Food Demand and Supply Study), which was carried out by the Asian Development Bank (ADB) with the International Food Policy Research Institute (IFPRI) and the International Rice Research Institute (IRRI). It can, therefore, be said that DCIEP was proposed to support the IFPRI's proposal from the technical aspect of irrigation. JICA technical assistance and the IFPRI study were joined for crop diversification in the Philippines despite there being no face to face prior discussion. (See Figure 1)

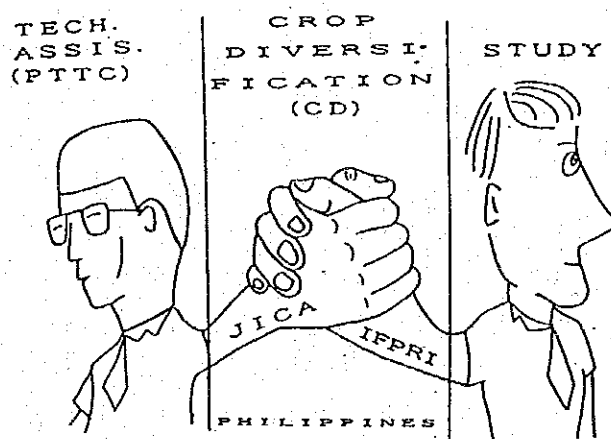


Fig. 1 Explanatory Drawing of Joining JICA and IFPRI  
for Crop Diversification in the Philippines

This paper discusses how JICA and IFPRI were joined for developing crop diversification in the Philippines, and describes JICA's Project Type Technical Cooperation, the Food Demand and Supply Study, and DCIEP.

#### **A. Project Type Technical Cooperation**

1. Project Type Technical Cooperation is a form of systematic and comprehensive assistance for efficient technology transfer. In this cooperation three forms of activities are combined and implemented over a period of several years. The three are the acceptance of trainees, dispatch of experts and provision of equipment, which are also individually carried out.

2. Under the acceptance of trainees plan, promising trainees with the potential to play leading roles in the development are accepted from the developing countries. The trainees receive technical training at various institutions in Japan.

3. The purpose of dispatching experts is to carry out technology transfer from Japanese experts to their counterparts in the assigned countries. This is one of the most fundamental forms of technical cooperation and it aims at helping human resource development. Under this program, the experts make efforts to transfer the technology that is most appropriate to the country.

4. Concerning provision of equipment, JICA supplies equipment to enhance the effectiveness of the technical cooperation of the experts and trainees. It is expected that the technical cooperation can be fruitful with effective linkage between humans and goods.

#### **B. The Food Demand and Supply Study**

1. This study was conducted from February 1983 to May 1984 with the technical assistance of the ADB, being undertaken jointly by IFPRI and IRRI. The study had operational aspects of satisfying future food consumption requirements and of developing suitable approaches and methodologies for use in analysis and determination of optimum strategies for agricultural development. The Philippines was used as a case study to develop a methodology by which to analyze other countries.

2. The study included analysis for the Philippines with the following findings:

1) The results of projections for rice consumption indicated that even with the full completion of on-going and planned irrigation investments by NIA, the Philippines would likely return to a modest deficit in the late 1980's, which would gra-

dually increase through 2000. The results for corn indicated that despite projected growth in corn yields higher than past trends, a rapidly growing supply/demand deficit was projected, primarily due to growth in demand for corn for livestock feed.

2) The analysis by sensitivity tests of the projected combined deficit for rice and corn indicated that it would be difficult to eliminate the combined deficit. However, if corn displaced the dry season irrigated rice, rapid growth in high yield variety (HYV) corn technology could reduce the corn deficit by 1.2 million metric tons but increase the rice deficit by 677,000 metric tons, the displacement of the dry season rice thus offsetting half the gain in corn production.

3) Generation of long term surpluses in rice are potentially costly. One alternative for dealing with potential sustained rice surpluses suggests a shift of the excess capacity in irrigation out of rice and into production on corn or other crops such as cotton or soybeans.

3. Based on these findings, "Diversified Irrigated Agriculture" was suggested for the shift of excess irrigation capacity.

### **C. Diversified Crops Irrigation Engineering Project (DCIEP)**

1. The recommendation of the IFPRI-IRRI-ADB study was positively considered by NIA. In addition to this food demand and supply related reason, another reason was suggested from the financial aspect. NIA expected to "shore-up" its financial viability by increasing irrigation water fee collection through raising cropping intensity in the irrigation service areas.

2. However, cultivation of non-rice crops under irrigation was a new field in the sphere of irrigation in the Philippines. In fact, never before the implementation of DCIEP had NIA taken serious attempts and steps in developing and promoting irrigation technology for non-rice crops. Furthermore, despite recent multi-agency progress in research on irrigation management for diversified cropping systems, engineering technology on this regard was still deficient and thus was not functional. Such a constraint was the primary consideration for the proposal of the technical assistance.

3. In Japan, on the other hand, the systematic study of introducing non-rice crops into irrigated paddy fields, that is crop diversification, began shortly in the post-war period. Particularly after about 1970, studies have been stepped up as a

measure against overproduction in rice. Japan, thus, had enough of a technical base to accept the NIA's proposal from the Philippines. After sending two study teams, both governments agreed through NIA and JICA to launch the DCIEP on May 28, 1987.

4. Generally, DCIEP aims to formulate a comprehensive irrigation engineering technology for diversified crops and cropping systems to fit the domestic setting. Specifically, the DCIEP aims to:

- 1) formulate guidelines on the planning and designing of diversified crops irrigation projects,
- 2) ascertain the values of the various water requirements of diversified crops,
- 3) identify appropriate irrigation systems design for diversified crops production,
- 4) determine the respective optimum amount of irrigation per application for maximum yields of diversified crops,
- 5) train the concerned technical staff of the agency concerning diversified crops irrigation engineering.



## **DISCUSSION**

### **(SESSION III)**



(Takasugi) Regarding Mr. Rosegrant's presentation, you said that research has been under-invested during the 1980's, even though there is a very high marginal rate of return. My question is why such a rapid decline in the research expenditure occurred despite such huge marginal rates of return. This is a little irrational.

(Rosegrant) That's an excellent question. There are a number of factors involved. One problem is that returns to agricultural research take a long time to occur. So governments, like many businesses, often invest for short run returns. Whereas you can invest for several years in building a national research station, it will take many years to do the cross breeding to generate one new variety. If that one variety does well, you've justified your entire investment. That's not always apparent for short-run purposes.

Secondly, the relative success of the green revolution, and therefore the decline of world prices, have made donors tired. Donors are tired of spending money on agriculture right now. There has been a pull-back away from agriculture. A sort of feeling that, "Things are all right now. We have plenty of food. So we don't need to invest anymore." So I think that's the other major factor there.

(Takasugi) I agree with your point, especially the first point. When I was in Bangladesh, I observed that some agriculture ministry officials neglected, in a sense to support the research institution activities. I thought one reason is that the ministry has some production target, say, within three years to increase the rice production by some tons. Instead of spending some money for research, buying journals or purchasing testing materials, the government just wants to buy fertilizer or others to get more harvest. If this is the case, I think your point is very correct. But I think you should try to convince the administrator of the governments of developing countries. To realize this recommendation, just simply indicating these points is not enough. I think some sort of measures to convince the administrators of the concerned ministry is necessary.

(Rosegrant) I think that's an excellent point. Perhaps Per would like to comment. In fact, we are trying to significantly increase our effort on outreach to get these kinds of policy impacts, or to get our ideas accross.

(Islam) Could it be that, if it is high, the variance on returns from investment in research is also very wide? Therefore, if you discount the variance the rate of return is not that high. I don't know; I am just hypothesizing.

(Rosegrant) The expected long-term return is still high. But you can have no

return off and on for years, and that tends to discourage people.

(Islam) If you discount the variance, returns may be low.

(Rosegrant) Right.

(Andersen) I think we have to remember that developing country governments, certainly those of Africa and Latin America, are faced with some very severe expenditure problems. They have been over-spending for a large number of years. It has now come home to roost, as the American's say, in sense that you have to do something about it. So things they are going to cut back on are the things that aren't going to have an immediate effect. So they will leave fertilizer subsidies, but cut back on agricultural research. Because if they cut back on fertilizer subsidies, they are going to be in trouble next year. If they cut back on agricultural research, they are going to be in trouble 10 to 20 years down the line. They are so cutting back on education, for example, that they're cutting back on a number of extremely important public goods. That will have implications way down the road. It's a very risky short-term approach to take. I am not quite sure how to deal with it except as Mark says, "Let's keep trying to show the evidence to the international assistance agencies, where we might have more luck."

It seems to me that Japan has a very important role to play to convince the Americans, to convince the U.N. organizations and to convince the Europeans that they must not continue to cut back on assistance to agriculture. Because Japan, as I understand it, has not done that. But many of the other major donors have. It seems to me that here is a role that Japan can play very effectively, because it is in fact practicing what it is preaching. I think the burden is just as much as with the international community as with the national governments. Because don't forget we are also telling the governments in developing countries to cut expenditures to match the revenue. And they will cut where it hurts the least and that is in the long term investments.

(Nagai) Mr. Rosegrant, about your explanations, I agree with your policies. But one thing I doubt is about private investment in irrigation systems. You mentioned we have to expand more private investment. But in case of Japan the Japanese government still employs the subsidies or sometimes employ the low interest financial support for expanding of irrigation systems. Is there any good successful example supporting your idea in developing countries?

(Rosegrant) The best example is Bangladesh. Prior to 1986, the Bangladesh gov-

ernment attempted to control the flow of private tube wells and pump sets into the country. So imported tube wells were highly regulated by the government. The government would provide some subsidies and credit and various other measures. Yet very little was happening because of the distortions introduced by these imported articles. Farmers couldn't get the pumps sometimes. They weren't available except through government dealers which may not have penetrated into the countryside. Beginning in 1986-87, the government relaxed all restrictions on the import of tube wells and pump sets. Within five years, land area privately irrigated by tube wells grew from approximately 200 thousand to 800 thousand hectares. So, without any government interference, the government getting out of the way was the key to that kind of transfer. That I think is the best example I have ever seen in the developing countries.

By happy coincidence, I was the leader of the study that Mr. Kanamori was referring to in the Philippines. I would like to ask what the plans are to try to take the technology you developed and extend and test it under farm conditions to see whether it is profitable for farmers to use the irrigation technology that you are developing there as well.

(Kanamori) One difference between us was you were the leader. But I was not. So I am not in a real position to answer your question. But I can just give my personal opinion. As I said, during five years we concentrated on the study only. But as you know, NIA of course requested extension or diffusion for the farmers. Therefore they are requesting JICA to extend the project to Phase II. I heard Phase II included this kind of cooperation, but now I think JICA is still considering. And for this one thing I have to state that, as I said, we have difficulty in the present stage of development on science and technology. We tried, and also other persons tried to create or suggest, practical ways of, for example, scheduling irrigation. But there are so many alternatives that no one alternative can persuade the farmers. That is our difficulty. I think now NIA is requesting that. I hope this kind of study will be continued in Phase II. But this is according to the judgement of JICA's head. So I am not in that position. So this is just a personal opinion.

You said that you were the leader of this study, and that you suggested crop diversification. But I cannot find in your paper any word of crop diversification. So what is the reason for this?

(Rosegrant) It's a very good question. The reason is, I think, that crop diversifica-

tion is the result of other policies, more than a policy try to pursue on its own. It comes about as a process that's led by, as you said, technology development such as the type you are doing, plus broad investments in infrastructure and roads, which creates the additional flexibility for farmers, for the rural sector to respond to change in opportunities. If you invest only in irrigation, it only can be used in rice. Farmers are very limited in how they can respond, say, if maize or other crops become profitable relative to rice. They can't diversify because there are technology constraints. Diversification requires removal of technological constraints, as you intended to do, plus providing the general economic environment that allows farmers to respond. So that's why it does not come out explicitly, but it's implicit in the set of policies which, we feel, are appropriate.

(Oga) Mr. Kanamori, just one point. You mentioned high unemployment of your research assistants. What is the reason for this?

(Kanamori) As you know, JICA's assistance always requests local funds and local government participation. In our project, employment of these research staff is the responsibility of the National Irrigation Administration. The staff was employed, but suddenly after the Gulf War, they were forced to leave their jobs. Of course JICA has some local fund assistance budget. Therefore we supported them up to the end of the research that had been undertaken. But after that, we could not continue to support them, because the support fund source was limited. That is the reason.

(Miyamoto) My question is directed to Mr. Rosegrant. You know the rice increase in Asia is very important. Many countries in Asia are investing much in the construction of new irrigation systems. I have observed many existing irrigation systems remain idle, not functioning well. As mentioned earlier, the rehabilitation of existing systems are more important than the construction of new systems. International organizations and or donor countries cut their assistance especially for infrastructure projects by 50% or more. So I think it is more economical and effective to operate and maintain the existing ones by way of rehabilitation. The operation and maintenance costs will be expensive or high for the systems which do not function well. So I would like to know whether or not your institute IFPRI conducted a study of irrigation systems in order to assess which are less costly, the construction of new systems or rehabilitation of old systems. I think farmers believe that water is free, and I think its important and necessary to establish a users'

cooperation to train farmers on how to operate and maintain the systems and to let them know that water is not free. Did you ever make any recommendation on these points? If you did, to which country in Asia?

Also as for another aspect for the increase of rice, the post-harvest technology is important; I think there are big crop losses after harvest. I think 20 to 30% of rice is lost. So I think more assistance should be promised for the improvement of post-harvest technology to reduce the losses. If a country produces 5 million tons of rice at a loss of 20% of it, the loss is 1 million tons. Imagine how big the irrigated rice paddies must additionally be in order to supplement production of 1 million tons of rice.

In conclusion, I think we have to pay attention to two aspects, that is to say, one is training of farmers for efficient operation and maintenance of irrigation systems and the other the improvement of post-harvest technology. So I'd like to ask for your opinion on these matters.

(Rosegrant) I would agree completely with one of your recommendations and differ with the other. Let me explain a bit. We have done considerable work on evaluating the cost-effectiveness of improved operations and maintenance and rehabilitation. We find in general that the key is cost control of the intervention. If you do very high tech rehabilitation, putting in new double gated turn outs and very fancy technology, you tend not to get enough benefit to justify those investments. But other types of rehabilitations such as desilting of canals and on-farm investments can have very high pay-offs. In addition, we are now initiating a number of studies on the issue of "farmers think water is free." What if we try to get them to consider the economic cost of water? How much more efficient would they be? We are just now beginning to do a series of studies on that for a number of countries in Asia. But I agree completely with your main point. It's extremely important to increase the efficiencies of the existing systems now. There is a lot to be gained there.

On post-harvest losses, actually we did have a study in Indonesia by a Japanese scholar, who in fact was at IFPRI, Mr. Tomotatsu. It tends to show quite convincingly that post-harvest losses are in fact not as large as many, such as FAO or UNDP, have claimed. They are more on the order of 10 to 12%. The reason they are fairly low is that the farmers tend to recover those losses until they are economically not feasible. To get less than 10% does not pay the farmers because very

elaborate techniques are needed. But I think the 20 to 30% estimates are incorrect, because if it was economically feasible to recover those, farmers would already be doing it; so that it's not really necessary for us to invest a lot in that area.

(Katsurai - Moderator) Thank you very much. I think it is now the end of the time. It's difficult for me to summarize this session. So I'd like to try to locate the problems to be solved in the future, maybe by the future collaboration between IFPRI and JICA. Mr. Rosegrant mentioned about the investment policy and research and fertilizer and extension. And Mr. Kanamori showed his experience in the project in the Philippines. And I am rather happy to know that there exists already collaboration between JICA and IFPRI in the past. And I think in Mr. Kanamori's project that they are trying to find and formulate appropriate technology for irrigation, and diffuse this in manuals. But on the other hand, Mr. Rosegrant mentioned in many developing countries the governments didn't understand the necessity of agricultural research. They cut the budget. Also he mentioned about the irrigation investment. At this moment all the governments are hesitating to invest. But if you consider the future, the rise grain prices, such investment for irrigation may be more feasible now than in the future. So in that point I think we will use the result of such research by IFPRI. For example, if JICA wants to do some study for an irrigation project, if it is necessary for us to persuade government people of a developing country, that not only the irrigation project but also agricultural research are necessary, we can utilize the results of IFPRI research. And also Mr. Rosegrant spoke about other innovative approaches or more effective ways. I think for that goal, JICA people are endeavoring everyday in the technical assistance projects to find such ways. Therefore especially for the agricultural research it is a rather important point for us.



# **SESSION IV**

**Environmental Conservation and Sustainable Development**



## Environmental Conservation and Sustainable Development

Sara Scherr  
Research Fellow,  
Environment and Production  
Technology Division, IFPRI

---

### Natural Resource Management and Rural Development

The human harvest of food, fibre and other organic products from the land depends upon effective management of the underlying natural resource base. Especially important for household production and consumption are soils, water, natural flora (particularly forest resources and grasses) and fauna.

The emerging policy focus on natural resources stems from widespread concern that under continuing pressures for intensification (from population increases and economic change), the resource base is being permanently degraded through non-sustainable management. The major issues can be defined within the "critical triangle" of economy, equity and ecology:

- **Economy:** Economic growth is threatened by degradation of soils in rainfed farming systems, loss and degradation of forests and other tree resources, degradation of pasture and range resources in extensive livestock systems, and degradation of soil and water resources in chemical- and irrigation-intensive cropping systems.

- **Equity:** The quality of and access to these resources, and the inputs and technology to exploit them, is a major determinant of rural welfare, income levels, and income distribution in both the short- and long-run. Scarcity and loss of access to resources has led to increasing poverty, placing further stress on remaining resources.

- **Ecology:** Finally, there is concern for the long-term effects of agroecological change, in terms of loss of biodiversity within the cropping system and natural ecoregion. At a global level, there is concern for climatic effects of large-scale tropical deforestation.

These questions demand a more comprehensive look at the interactions between different elements in the rural landscape, and the role of the policy environment in landscape change. This paper will focus on some natural resource policy challenges of particular importance for rural development, and suggest areas where

policy research and reform could have the most positive effects for productive and sustainable resource management. Brief examples are drawn principally from recent experience in agroforestry (growing of trees with crops and/or livestock on farms) and social forestry (forest or woodlot management by or for the community). More in-depth discussion of the issues may be found in Gregersen, et al. 1992, Leonard, et al., Poffenberger 1990, and Vosti, et al. 1992.

### **Policy Challenges**

The problem of resource loss is complex, and cannot simply be blamed on "poor" or "irrational" land husbandry. There are three central policy challenges: to mitigate intensification pressures, to accelerate adaptation to intensive and management, and to create a policy environment supportive of sustainable management.

The first challenge stems from very high rates of increase in population density and demand for outputs in many tropical farming regions, which have little historical precedent. To achieve sustainable rural livelihoods requires a difficult process of continuous, significant adaptation of technology and social organization.

Secondly, for many of the so-called "marginal lands"—drylands, hillsides, rainforest—there is little "modern" technology "on the shelf" appropriate to existing production systems and economic incentives. Many indigenous land management practices are sustainable for lower population densities or off-take levels, but not at higher levels. This situation holds for on-farm crop and tree production, as well as natural forest or woodland management.

A hopeful sign is the widespread local innovation in response to new pressures. This is illustrated by a historical look at the development and intensification of indigenous agroforestry systems. With declining forest access and/or increased demand from local communities and external markets, high-value trees and shrubs previously exploited from natural forests were first domesticated, then more intensively managed and integrated into farming systems. The key question is whether such innovation is extensive enough, and diffusion of superior practices rapid enough, to avoid irreversible degradation of key resources. The challenge for national and regional policymakers is how policy and the formal infrastructure of research and extension, can support and accelerate that process.

Third, the policy environment itself has frequently played a major role in resource degradation. Some effects have been direct, as in the granting of commer-

cial logging permits in ecologically fragile areas or mechanized clearing of rainforest for resettlement projects. Institutional separation of forestry and agricultural agencies has led to conflicting policies and programs for agroforestry, farm forestry and conservation farming. National systems of property rights have undermined previously stable communal management systems for forests and grazing land, or created conflict among multiple users of community resources.

A re-orientation of national policies to encourage and support sustainable resource management is overdue. Yet we are handicapped by a lack of reliable information about the actual extent and severity of degradation, and how farmers adapt to degradation. We have not systematically identified what types of technologies successfully improve productivity without resource degradation in different agroecological and socioeconomic conditions. We are only beginning to understand the interface between resource management on private farmlands, communal lands, and open access or public forests and rangelands. Without this, we cannot identify the incentives and organizational reforms needed for widespread adoption of sustainable management systems. The policy research agenda is full indeed.

Nonetheless, we can draw some practical lessons from the historical experience of intensification of tropical land use systems, along with more recent attempts to promote improve rural resource management. These suggest that critical innovations in institutional policy, technology policy, pricing policy and bioreserve planning are needed.

### **Decentralize Resource Management**

Governments have used a range of policy instruments to influence rural land use decisions. While on private farms and forests indirect instruments such as price policy are common, directive policies promoting centrally-determined management practices (e.g., extension messages or land use regulations) are also widespread. Public forests, rangelands, parks and other reserves are managed directly by specialized agencies reporting to the central government. Non-private forest and grazing lands associated with community use are sometimes under local control, but often have no effective management (open access).

In an era of intensive local pressure on resources, rapid land use change, and financially weak governments, the central management approach is often both ineffective and costly. Centralized formulation of extension messages for soil con-

ervation has proven ineffective where farming systems are ecologically and economically diverse. Most Forest Department efforts to guard forests from uncontrolled local access are unsuccessful. Meanwhile, the farms which produce an increasing share of national forest product supply are ignored.

A policy of decentralized control promises greater success in achieving sustainable and equitable resource management. This involves community or joint management of communal resources, and greater focus on supporting private farmers as resource managers in intensive farming areas. For example, forest departments in several Southeast Asian countries have begun joint planning and management of public forests with local communities. Social forestry programs in Asia and Africa are helping local communities establish mechanisms for resolving disputes and negotiating land use agreements among multiple users of woodlots and shelterbelts. Mechanisms for involving the landless in agroforestry development are being tried in Indian wastelands. Many countries are beginning to restructure their forest departments to better support farm and community forestry.

New approaches are evolving to improve local capacity for resource management and improve collaborative planning and management between communities and land use agencies. A few examples in the forest sector are micro-planning; participatory planning, monitoring and evaluation (PPME); participatory agroforestry diagnosis and design (D&D); joint land use mapping to identify areas with technical problems or use conflicts; and land use councils representing different resource users. Research is needed to understand the conditions and approaches which make group action effective.

Local management highlights the functional integration of agriculture and forestry. Institutional changes are needed to transform public agencies now organized by discipline for top-down planning into more integrated land use institutions providing technical support for community - and regionally-based management.

### **Support Technological Innovation**

Technological change to increase production while maintaining or improving the resource base, requires a dual approach of science-based research and community-based innovation and information exchange.

Science-based research has a critical role to play in genetic improvement and in answering strategic questions about long-term resource management. Scientists

should also address priority problems of plant improvement or management which have resisted solution by less formal, community-centered approaches. Greater resources and institutional reorganization for these purposes are definitely needed.

But this effort must be part of a broader strategy to catalyse and support decentralized technology development by and with land users. Responsible agencies should actively encourage testing and documentation of the practical effectiveness of innovations in farmers' fields and communal lands, and facilitate exchange of ideas and information between areas with similar resources and intensification challenges. This type of local evaluation (using simple, but consistent methods and indicators) can be useful for identifying strategic components and issues for scientific research. Coordinating agencies could identify policy constraints to local adoption and opportunities for rural investment offered by innovation.

Within this strategy, most responsibility for innovation and diffusion would be provided by communities and land user associations. The primary roles of extensionists would be as information brokers and catalysts for land user organization, technology testing, and information exchange, within a framework of integrated land management. In Kenya, for example, competitions for Conservation Farmer of the Year and Agroforester of the Year offer rewards for innovation and identify local experts who can be consulted for technical advice. In Zimbabwe, NGOs train community groups in resource assessment and simple field trial methods, and help organize farmer-to-farmer networks.

Many promising technologies for sustainable crop and resource management are being explored. The emphasis on annual crops may need to be re-considered. In many "marginal lands" perennial trees, shrubs and palms, which provide more continuous soil cover, offer greater potential for sustainable production. Tree crops can also enhance food security by providing multiple subsistence and market products (even in drought years) and providing a store of value as timber for sale to meet critical cash needs. A number of tree species could economically compete with annual crops now used for starch, oil, protein and fodder production, given strategic investments of research and marketing support by public agencies, private investors, and/or cooperatives.

#### **Consider Effects of Price and Investment Policy on Resource Management**

The resource management decisions of rural land users are affected by the

relative prices of farm inputs, farm and forest products, labor and capital. National pricing policies for commodities, farm inputs, tree products and their substitutes have often discouraged long-term land and resource husbandry. In Sumatra, for example, the economically profitable and environmentally stable damar agroforest system is on the decline in part due to input subsidies and marketing supports for rice. The economic viability of alley-cropping (growing crops between rows of leguminous trees for green manure) in Central America and West Africa has been limited by artificially low chemical fertilizer prices. Incentives to market farm-grown trees are undermined in many places by below-cost pricing of substitute wood supplies from national forests. The use of direct subsidies or taxes to promote particular agriculture and forestry practices has sometimes distorted farmers' incentives for sustainable resource management, and/or diverted scarce resources away from more economic practices and policies.

Rural incentive and investment policies are dictated by difficult national choices about where, how and who will produce commodities for urban and rural deficit areas or for export. A neglected part of the calculus has been rural resource costs. Evaluations of new pricing policies for farm inputs, outputs and substitutes should routinely assess not only their effects on production and management of the target commodities, but also their effects on land use substitution, use of critical land husbandry inputs on different types of farm fields and community lands, and on incentives for land degradation. Natural resource costs and benefits should be routinely incorporated into analyses of rural investment options.

#### **Establish Bioreserves for Ecological Preservation**

In many areas, there is scope to increase the productivity of farm, forest and range production on a more sustainable basis. Intensive land use, however, will result in ecologies and landscapes highly modified by human management. Biodiversity and landscape diversity will be valued by most land users only to the extent they contribute to sustainable and secure production and the quality of the human environment (e.g., aesthetics, wind control). Provision must still be made—and rather urgently—to establish bioreserves in land areas sufficiently large to maintain the natural ecology and landscape.

But centrally-managed reserves of natural forest, grassland, marsh, mangrove, or desert, protected by security guards, are proving difficult to establish and main-



tain. Some reserved forests in Kenya, for example, have been cleared by squatters from the inside out, leaving only a perimeter of apparent forest land. Government establishment of national parks in some countries has come at the expense of the livelihoods of politically marginal ethnic groups.

New approaches are being developed to involve neighboring communities in delineation and management of reserves. Local efforts to protect prized resources (e.g., "sacred groves") can be supported. Development of economic opportunities from bioreserves, such as ecotourism, certain types of extractive uses, or job provision, plus parallel development investment, have strengthened local support for bioreserve protection in diverse countries such as Costa Rica, Madagascar and Indonesia.

### **Conclusions**

This paper reviews some of the more promising policy directions for reversing the disturbing trends of resource degradation in the tropics. Institutional innovations include the decentralization of resource management responsibility, establishment of effective mechanisms for local resource management and local participation in public agency management, and more integrated land use institutions.

Key technology policies are strategic research on resource management, extensive field-testing of resource management practices within a development context, greater focus on perennial crops, and re-training of extensionists as information brokers and catalysts.

National policies regarding farm and forest output prices, input prices, subsidies and taxes, as well as rural investment options, need to be reviewed for their impact on farmer incentives for sustainable land management.

Finally, national and regional policy needs to clearly identify areas for bioreserves in which human activity will be sharply restricted. Participation of neighboring communities in bioreserve management or non-destructive economic activities can improve the capacity for reserve protection.

These institutional and technical innovations are being refined and adapted as experience accumulates. Comparative, empirical research assessing their effectiveness under different socioeconomic and environmental conditions—and widespread dissemination of those findings—should be a high priority for national and international cooperation and investment in resource management.