

# INTEGRATION AND SYNTHESIS

*Chaired by Dr. Keiji Kainuma\**

**Kainuma:**

Over the last two days we have had very extensive discussions on food security, poverty alleviation, the Millennium Development Goals, the world population, agricultural research, collaboration, and research strategies and priorities. Recognizing the futility of trying to cover everything at once, I would like to propose, as chairperson, that we focus mainly on international research collaboration. This will be useful for Japanese activities over the next decade.

In addition, seeing that this is a 10th anniversary event for JIRCAS, I hope you will give some suggestions and comments that will be useful for the activities of JIRCAS over the next decade. As you may remember, Dr. Iwamoto, our JIRCAS president, declared in his opening address that JIRCAS was seeking directions for research collaboration and international contribution through collaborative agricultural research.

## THE FUTURE ACTION AND AGENDA OF VARIOUS STAKEHOLDERS IN AGRICULTURAL RESEARCH FOR DEVELOPMENT

**Kainuma:**

When governments have budgetary constraints, they take the roles and missions of organizations very seriously. I would like someone familiar with this area to cover this point.

**Uchimiya:**

The CGIAR has a long history, and in the last few years we have been reshuffling the entire system. Based on the vision and strategy of the CGIAR, our mission is quite important because so many stakeholders are now demanding improvements in our infrastructure, policy, and the ways in which we can reimburse our efforts into poverty alleviation issues.

One of the systems we need to change is the decision-making system. The CGIAR is very complicated. We have 16 research centers worldwide and the CGIAR headquarters in Washington and Rome. This puts us in a slightly different situation in terms of negotiating our mission between the centers and also between the people responsible for directing the mission from the donor side.

One of the big changes that has been completed has been the Technical Advisory Committee in Rome. This is a more or less a "brain-type" organization that gives big dimensions to the CGIAR internal structures. The big challenge has actually been to negotiate in the creation of the Science Council: a solid base of world experts who are truly capable of understanding the situation of world hunger, policy, and scientific background. Those people will actually be rating and giving us substantial guidelines for the CGIAR research goals in the future. This is just the beginning, so Dr. Kainuma, one of the Science Council members, may have a very big burden in terms of creating the dreams for the CGIAR new research goals. In addition to this, the 16 centers have been working independently.

That creates quite a bit of difficulty in terms of the communication between them. The commodities that

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we have been working on are worldwide in scale. Maize is now shifting from Central Africa to Asian countries and even Africa. This is also true in the case of rice. Rice is not just a commodity for Asia: now there is growing interest in West Africa. We must have a kind of synergy in terms of catalyzing the functional basis of the poverty level, and we must try to efficiently alleviate poverty with both our investment and our discoveries.

To do this, we have proposed the new Challenge Programs. This is more or less a competitive ground system that encourages the centers and other organizations to make proposals. The system is very prospective, constructive, and readily available to poverty alleviation issues. We have received over 30 proposals and reviewed them extensively with many people leading in this area. A few of the projects have already been selected: projects related to genome research, biofortification, biodiversity, and so on. These Challenge Programs bring us hope the synergy and research duplication problem among the centers will be solved.

In conclusion, the CGIAR system is changing quite a bit. This will be a great benefit even for the work of JIRCAS. The changes are not just in human resource allocation but also in policy. This is quite a good start, and probably many people here can share the interest.

**Kainuma:**

Besides the CGIAR and the international agricultural research centers, there are a good many development-oriented research organizations such as CIRAD, IDRC, ACIAR (Australia), JIRCAS, and university systems. I would like Dr. Saint-Martin from CIRAD to speak about CIRAD's future activities and agendas.

**Saint-Martin:**

JIRCAS, CGIAR, and CIRAD have specific mandates on agricultural research for development to produce specific science. Most of the time we are assessed on development goals, but we are also assessed on excellence. For us in CIRAD, we see the future as being a builder of bridges between the scientific community that is not publishing or does not have the capacity to publish and the best of the science from the industrialized countries. We want to see it as a future role of CIRAD. We must be able to open up the whole scientific community that we have in the North to development issues and to the scientific community of the South.

I will just give you an example to show how we are doing it through agro-policy in Montpellier. One of the main research organizations devoted to agricultural research for development in the world is EMBRAPA of Brazil. EMBRAPA is a huge institution, bigger even than CIRAD. EMBRAPA developed a strategy to see what is happening all over the world, and it opened what it calls 'virtual laboratories' in some countries. It opened one in the US, one in Montpellier, and it had the idea of opening another here in Tsukuba. CIRAD is serving as a hosting institution for a national institution from an emerging country from the South to help it identify where the science useful for its proposals could be tackled. We see the future role of CIRAD as a producer of knowledge with the ability to make the scientists from the South participate in these international programs.

**Demment:**

One of the most important areas that we have found in our research is the development of human capacity. We have done some work on the effects of micronutrient nutrition on the cognitive and physical development of children. Children who have a diet including some animal products in fact receive sufficient micro-nutrients and significantly increase their cognitive function and many behaviors related to success. The role of agriculture is certainly one of economics and certainly has an effect on the landscape. But the most important of its roles is its effect as a conveyor of food and its connection to the development of human

capacity. Children are the fundamental unit of development. Their cognitive creative capacity in the future in an information age is going to be critical to the development process in developing countries. So we will be focusing on factors that increase dietary diversity, ensuring that micronutrient nutrition is adequate so that those children who survive are able to positively impact the development of their nations as opposed to being a drain when they are not physically or mentally capable of contributing.

**Iwamoto:**

I think a key word for JIRCAS will be “partnership.” Everybody is talking about partnership. We are also searching for ways to produce a public good. Over the more than 30 years since we found TARC, the major mechanism has been institution-to-institution-based collaboration between JIRCAS and NARS in developing countries. That is not enough to produce a public good. There are so many issues that have to be addressed in different countries. We would also like to make a stronger connection with CG centers. This is one of the ideas that we will have to take up in the future.

We would like all possible partners in your countries to collaborate with JIRCAS to cope with the very unusual and serious problems in developing countries.

**K. Takase:**

Our center is working for marine fisheries development, agriculture and rural development as well as the CGIAR. This is a huge-scale program that you people have, and I am very moved to hear all about all of your activities.

Yet in spite of these efforts, I feel that we still have problems in the agricultural sector worldwide. This is probably not related to research issue, but rather to three other points that will be important for JIRCAS in the future. Let me elaborate.

The first point regards the subsidies that developed nations pay for agricultural goods. African countries are producing many goods, but they are importing cheap agricultural goods from other countries at the time. We work on technological transfer and in many other areas to assist them, but our efforts will solve nothing if the current situation continues. How can we reduce subsidies paid by developed countries?

Second, we have talked about poverty probably several hundred times. Robert McNamara of the World Bank went to Africa in 1970 and said he would abolish all poverty, but we have not seen any sign of poverty reduction. We have seen an increased gap between the haves and the have-nots. Unless we can solve the poverty issue, the global environment will deteriorate further and the gap between the haves and have-nots will not be reduced.

Finally, South-South collaboration has become more common, especially in fisheries in Singapore and Thailand. They are helping each other and becoming more independent. Asian countries are now capable of being on their own. In the latest TICAD this year, it was concluded that Asian countries have to cooperate with African ones. That means South-South cooperation. Governments, civil societies, and NGOs and all other stakeholders also need to cooperate in Africa, Asia, and Japan. The coming 5 years will be the years of development for Africa, as called for under the TICAD consensus. Hopefully we will have built upon the TICAD consensus yesterday and today. If we continue in this direction, we can probably achieve the target.

Research institutes like JIRCAS should consider these three points.

**Iwamoto:**

Policy and political issues are involved so I think we are not in a position to answer you. But I think you raised very, very important issues. We will think about those points and I will take note. Thank you.

**I. Kobori (United Nations University, Tokyo):**

I am a former board member of ICRISAT and ICARDA. During my duties last year, I met Dr Michel de

Nuce de Lamothe, who was already talking about collaboration between Montpellier and Tsukuba. Dr. Saint-Martin just mentioned this, as well. To what extent is this collaboration established? Is it already underway, or is it set for the future?

**Saint-Martin:**

We have only four areas of collaboration, but quite active ones, and we plan in the future to further develop this. We plan to sign a Memorandum of Understanding. When I went to the science department in the French Embassy, they told me that they consider agricultural research for development a priority. That was very surprising to me. I told them that I thought that scientific collaborations between industrialized countries were more in nanotechnology, life science, and all of those things. They told me “No, we want to focus on agricultural research for development.” That was very surprising.

They are very concerned about sustainable development. Sustainable development was the main issue tabled in the discussions on science policy at the G8 Evian Summit. They think that agricultural research for development addresses this issue very accurately. As such, a good future lies ahead for the linkage between industrialized nations on agricultural research for development. I will go to the American Embassy when I’m back in Paris and try to develop this kind of collaboration with them, too.

**Demment:**

I would just like to respond to the comments about subsidies. I will describe the condition specifically in the United States, but I think our European friends are in the same boat. We have a government agency trying to improve agriculture, and at the same time we have government agencies in effect promoting policies that work against that development goal. I think it’s our responsibility not only to extend knowledge in the direction of developing countries, but also to extend knowledge into the public of our own countries. I don’t think that many Americans recognize the implications of subsidies on the rest of the world. It is important that people like those in the US universities and maybe JIRCAS participate in this public debate or this public information to indicate the double-edged sword that subsidies in fact impose upon developing countries.

**M. Toyomizu (Tohoku University, Japan):**

In order to development a partnership, I think that human resource development should be enhanced. I want to focus on the participation of younger scientists. Professor Demment, you mentioned participation of students. Could you please talk more about those students from U.C. Davis or outside universities? Who is taking care of the scholarships?

**Demment:**

In our program we have students who are getting their degrees. They are US students from U.C. Davis and other universities involved, and students from host countries. Out of the 5,000 plus students that have been trained to the Masters and Ph.D. level in the CRSP programs, about 25% are US students and about 75% are students from developing countries.

Who pays for this? In the past when we had more research money flowing from USAID, the CRSPs paid for most of that. Now we often pursue a leveraging relationship with the universities. For instance, Cornell might indicate that they are going to supply tuition-free positions to go along with their proposal to do the research. CRSP money would cover their operating expenses, travel, and in-country work, while Cornell would cover their tuition, room and board, and things like that. We try very hard to leverage that. Our budgets have decreased in real money from 100% to 60%. In that time period, however, our training actually has gone up because we have been able to leverage more funding for training.

## FOCAL REGIONS OF AGRICULTURAL RESEARCH FOR DEVELOPMENT

### **Kainuma:**

The background thinking of focal regions of agricultural research for development is very rapid development in East Asia and parts of Southeast Asia, concurrently with a large number of hungry and poverty-stricken people remaining in Africa and South Asia. Dr. Reifschneider and Dr. Uchimiya have been saying that the CGIAR will be moving its activities toward Africa from now on. But I have often heard about conflict in the targeted regions. Dr. Tanaka spoke of his observations regarding this point. I would like to discuss how these focal regions are selected.

### **Pitakpaivan:**

In Thailand we have international collaboration with so many international organizations. For the last 20 years, the products from this collaboration have been fruitful and constructive. But yesterday when I mentioned some factors affecting the project, I referred to factors on our own side as well (not exclusively factors from the partner side). From my experience with the ASEAN countries, we know that every country has its own national policy for collaboration, but in some cases the implementation is very difficult because of the lack of understanding between the government policies and researchers. Sometimes the researchers have their own projects with other partners or other governments through their institutions.

Let me give an example. Yesterday in my presentation, I talked about human resource development and human capacity. This is very important for developing countries. We had problems with specialists such as taxonomists. I would like to let you know about market access and SPS issues in the WTO and FTA. Right now, Thailand proposed having a Food Safety Year. Two months ago when I had a chance to attend the ASEAN meetings, every ASEAN country proposed the same thing, that is, food safety and food security. We have to harmonize and integrate this issue into one project. For food safety and security, we still have the problem of pesticide. The priorities for research have to be changed for collaboration, for international cooperation in each country, and for the interests of our partners in the areas such as soil science or the mutual tasks that we have for the post-harvest processing technology. We can choose a taxonomist for this kind of specialization in order to help the ASEAN countries.

Japan may be the core. I would like to propose, for this collaboration, that JIRCAS form a training program or some sort of research program that includes the ASEAN countries.

### **Bantilan:**

There is an increasing realization about the move on focusing on the bypassed areas, the areas that have been bypassed by modern technology and agriculture, that is, the Green Revolution. That is eyeing both South Asia and Africa, where the poor are now concentrated.

To share our experience in Africa and what we have learnt from our experiences in South Asia, I can say that the problem in Africa is basic. By the nature of the environment in Asia both in terms of its natural resource environment and its social structure, infrastructure, and markets, we have a lot to address in terms of its complexity. The problem in Africa can be viewed as basic. Even with advances in agronomy and information about technology, fertilizer, and varieties and availability of seeds, there is little incentive for farmers to use a technology because of the absence of input and product markets.

In our experiences through our work as ICRISAT in Western-Central Africa, Eastern Africa, and Southern Africa in the marginal environments of Niger, Mali, Senegal, and Burkina Faso, there is a lack of information about modern technology that would address the basic question of soil fertility when we go in farmers' fields. When we talked about NPK, farmers wouldn't even know what that was. It was quite a shock to me when I started to work in Africa. Agriculture in Africa has to address this basic problem.

We also have to look at both short-term and long-term solutions. Research for development has to have a

short-term impact as well as a long-term impact in terms of targets. I would suggest that, if we are to address the basic problem, the short-term track on research for development should focus on the lack of access to fertilizer and seeds. Talking about optimal seed strategies will be another thing.

But since research in agriculture is long term and has to have a sustained investment, one of the directions for research will be harnessing biotechnology for tapping the germplasm needed for the more marginal environment of Africa. If we see that draught is a very important problem, then our agenda will be to harness this germplasm to address various traits required for crops in the draught-prone environment.

Water and soil fertility are also very important. One priority can be in terms of water use efficiency and conservation of water. Soil fertility is the heart of the Africa agenda for ICRISAT, and that is the third priority area..

**Kessery:**

I think that African problem is well understood by everyone. The main problem is the lack of education. By improving the human resources, we can get better results. I will take one example about NERICA, the new varieties. We engaged real farmers in a kind of participatory research and extension service. Farmers could very quickly access the place where they were situated at the beginning and the end of the activities. If you improve that kind of process, you can improve the level of understanding. Africa has a lot of resources to feed the hungry, but there is a lack of capacity building. So I ask you to come to Africa and transplant what you have done in Asia.

**Shimada:**

Can I start by giving my naïve, sentimental, and personal impression? We talked a lot about the efficiency and accountability of research for development from the viewpoint of donors and sometimes taxpayers. But we have discussed only a bit about how we can hear from the final beneficiaries, the most poor and neglected people. I was so surprised to hear Dr. Bantilan say that African farmers don't know what NPK stands for. But I think they know well about soil fertility. We have to learn from the farmers. We have to take our hands to our heart, to think thoroughly. That is my first impression. It is very naïve, but I think it is a good opportunity because many imminent delegates from international institutions are here. Please think about this again.

The last paper by Dr. Tyler was very impressive for me. He said that, if we decide in our minds to take part in participatory programs, we should sometimes start without a predetermined agenda. What does it mean? If we talk about efficiency and accountability, nobody could pay for your research or development problem. But if we decide in our minds what we want to hear first, we sometimes need money without an agenda. This is a turning point for international institutions, even for university staff. We have to try to change the assessment system thoroughly. Some speakers—Dr. Demment from U.C. Davis, specifically — said that we have to spend more money for appraisal or assessment. This is a very important thing. We have to think about what kind of assessment framework should be used for research from the next decade.

The national universities in Japan are now facing institutional change next year. Many people are just starting to make claims about the efficiency of their studies or education. This is quite a difficult thinking. I think this same thing will be applied for this problem.

Second, we talk about a lot of crops or other technology, but I think the international agricultural research institutions should put more stress on indigenous crops that are less familiar to the people in the developed countries in the North. I know many scholars studying cassava in the CGIAR, but there are still more studying grains like wheat, maize, and rice. If we say that Africa is the most problematic, why don't we take the crops that are the most important staple foods there?

I am studying Africa and my view may be very one-sided. I just wanted to comment on that issue.

**Doppler:**

The question for target reach has very important and wide political implications and a wide political view. If you look at the history of Europe up to today, the European Commission in Brussels takes strong stances toward Africa and the Middle East as a matter of course. This is our front door. Looking at the Japanese policy in the last 30 years you can see similar developments. And the same can be said for other countries, too. When we talk about political institutions about donors' allocation of resources, we have to discuss that. But if I look from a research scientist's point of view, I would target not only geographical regions but problematic areas. From that point of view, I would realize that Laos, a Southeast Asian country, would need as much resource effort as Kenya.

If we ask where to start, we could start on Millennium Development Goals. There we could find areas where we have big problems on hunger and health issues. If you go to the Calcutta area or to India, you have big numbers compared to Africa. The picture looks quite different if you go into detail. But if you base it on those Millennium Development criteria, then you might find regions where we have lots of overuse of resources, where we have to do something in mountain regions, where we have health problems for children.

Looking from a scientific point of view, if we used those criteria defined by a world body and went down to the people, to the families, and asked, "What are your problems?" then our picture would look different. That's why I would like to replace "target geographical regions" with the words "problematic areas." It would not be targeting the problems geographically, but the problems themselves.

**Kainuma:**

You raised a very important topic. "Target region" is very political. Scientists cannot solve this alone. I agree. Does JIRCAS have something to say?

**Noguchi:**

JIRCAS has considered Asian countries and agricultural issues very important, but we are now gradually increasing our research efforts to the African countries. I think Asian countries and African countries are quite different from each other. For example, Dr. Bantilan clearly mentioned that the African regions will require a more basic approach, including fertilizer, seed, and so on. From last year, JIRCAS started a new project for Africa mainly focusing on soil fertility improvement using indigenous resources. We are studying how we can effectively produce organic matter to fortify the land, improve soil fertility, and achieve concerted effects on agriculture, livestock, and so on.

The long history between Japan and Asia makes Asia a very important region for the Japanese. Perhaps we should adopt a more careful research approach to these Asian countries. A few years ago, we had a very interesting meeting in GTZ entitled "How to Link the Farmer to the Market?" The African people there asked us, "Where is the market in African countries? We don't have any market. And, where are the products to sell to the market?" In Asian countries, because of the still increasing competition, farmers are losing motivation and incentive. How can we create new targets and incentives for the farmers? I think the Asian countries will require more sophisticated research programs. Yesterday Professor Hara told us that these countries already have complex interactions between agriculture, commerce, and industry. Picking up only one issue will never lead to an right answer to the problems. Maybe we need more conjugated groups from both socioeconomic research and natural sciences.

In addition, one of the weak points in JIRCAS is human resources. We have researchers, but sometimes we are short of program managers or program designers. And even if we hire many researchers, it is only an addition to the equation, not an multiplier in most cases. The most important point is how to hire good people with good powers, and then how to offer them well-designed figures or scenarios. And after having good discussion, how can we carry these scenarios out? If the scenarios are so good, then we are already promised some success. JIRCAS is now searching for ways to create these talented people through partnerships. This

is one of the reasons we are so interested in developing the partnership with some CGIAR research organizations.

**Oladele Idowu (JIRCAS Fellow):**

I think that the great diversity and multiplicity of focuses of research and development in Africa is of little benefit. In Africa alone you will find strategies that have been used in other parts of the world for agricultural development. There is a need for a change from this conventional pattern. Before the success of these projects or interventions is sustained, many projects have been frequently terminated or changed their foci, and Africa remains laden with its problem.

For example, NERICA has become very common to us: NERICA is succeeding. But, I feel that more partnerships ramifications in the fields of soil, agronomy, post-harvest, health, markets, and other inputs will be needed for its real success. I am afraid that some donors will divert attention to another crops.

**Mel O. Oluoch (Regional Center for Africa (RCA), AVRDC (World Vegetable Center), Arusha):**

I just want to briefly comment on some of our activities that have some relevance to the target regions. There is confusion and conflict in some regions even though Africa is basically shifting towards peace. If you go into some of the countries in Africa like the Congo, where basically 2 million people have died because of hunger and disease, or Sudan, where so many people have died because of war, or Somalia and other countries like that, the frustration and hopelessness are so tremendous that they cannot be ignored (look at the Congo, where 2 million people have lost their lives).

Quite often, obviously, it is a risky place to work, and basically we have to recognize the efforts of the World Food Program. This program has done a lot in alleviating hunger, albeit on a short-term basis. At AVRDC we have partnered with UNICEF to try to alleviate these situations specifically in Sudan, where we have been engaging in programs for the last three years, trying to improve vegetable production and consumption in those particular areas. We focus on indigenous vegetables that most of the population is used to growing and eating. They are resistant to pests, very easy to grow, and require very little inputs. They are very high in micronutrients and other important vitamins. We are really trying to change the situation in this aspect. We have also been doing the same thing in Zambia with UNICEF.

However, we know that there has been a lot of effort on cereal crops, but at the end of the day when you put your cereal crop on the table, you have eat it with something. There has to be a vegetable, a meat, or something like that. So there is a need to strengthen this particular area, to focus on these other crops that are so important (especially for the health of the body if you look at the micronutrient status). At the same time, we are trying to develop an initiative with the ICRAF and the Commonwealth Regional Health Secretariat for Eastern, Central and Southern Africa to use an integrated approach using vegetables and agro-forestry fruit trees, mainly indigenous species to improve the micronutrient status of populations affected by HIV-AIDS. We know the problem of HIV-AIDS and believe that, if there could be some focus on this particular area, there may be some improvement in the production aspects of these particular crops in these regions.

Thus, I can pose a question back to the special development agencies. Are there prospects for collaboration programs in this particular area?

**Lefroy:**

I fully agree with the comment from our colleague from Hohenheim University that it would be preferable if we could aim at problem areas. But political decisions have to be made and we sometimes do go for cruder analyses. The analysis that has recently been mentioned the most is poverty. That is a pretty strong case that would focus on Sub-Saharan Africa and South Asia.

But there is another focus that affects not Sub-Saharan Africa, but the other areas. I speak of land availability. If you look at the amount of potentially available arable land, about 70% of the arable land that



isn't under agriculture at the moment is concentrated in only 15 countries, one in South America, one in Asia, and the other 13 in Sub-Saharan Africa. When you go to parts of Asia, North Africa, and the Near East, you find that the gap between what is currently in use and what can be used is very small, if not already reached. Equally, if you multiply the area of land and the potential productivity, the potential productivity in Africa is way above the current productivity. I am not going to say that our problem can be easily solved. There are lots of issues pertaining to how that should be addressed. But in other parts of the world, particularly South Asia, North Africa, the Near East, and, to a lesser extent, in the rest of Asia, the gap between potential and current productivity is much lower. Therefore the risk of land degradation, of degrading the limited resources, is very critical. So you can argue both on a poverty basis and on a land quality, land availability, and potential productivity basis that there are some broad target areas. They include Sub-Saharan Africa and other places as well.

**Hara:**

I think that every country or every institution might have its comparative advantage in research. For example, I doubt that Japanese agricultural research can have a comparative advantage in promoting agricultural sciences in Latin America or Africa. I think we should pay due attention to this point.

## **THE THEMES OF AGRICULTURAL RESEARCH FOR DEVELOPMENT**

**Kainuma:**

I would like to point out three themes for effective discussion: contribution of biotechnology and other cutting-edge technology to development, productivity and efficiency vs. sustainability, and global issues (warming, resource depletion, economic and social globalization, population problems).

Professor Hara, would you like to take just a few minutes to comment on diversity of agricultural system?

**Hara:**

It is a big mistake to focus only on efficiency in terms of short-term market prices. As I mentioned in my keynote speech, if you can see the trend of commodity prices, there are always downward trends and high fluctuation. Therefore, economists (and former economists like me) should seriously discuss ways to establish indicators to measure the efficiency over the long term. We still lack this. That is why I emphasize the importance of diversity in agriculture. I believe that agricultural production has its own characteristics in rural societies. If someone destroys these characteristics, we may face severe tensions and conflicts. Therefore, we should seriously reconsider the importance of keeping diversity in agriculture. Of course, I understand that this is highly related to political matters.

**Noboru Osato (Tsukuba International Center, Japan International Cooperation Agency):**

I think that Dr. Froberg is promoting completely free trade in order to improve social problems not only in developing countries but also in industrialized countries. In your summary, you mentioned that trade impediments are one of the future constraints that have to be solved. I think that free trade will aggravate the lifestyles of small-scale farmers. For example, monoculture would be forced on the small farmers by trade conglomerates. Indigenous cultivation systems have conformed to the environment from ancient times. Those systems are the best and the methods are sustainable. New crops and the methods induced by free trade will destroy their productive methods as well as some traditional lifestyles and cultures.

**Frohberg:**

Indeed, I am a promoter of free trade for the very simple reason that free allows producers to produce where there is comparative advantage. If you distort free trade by governmental policies, you may not take advantage of the comparative situation of a country. Of course we can expect free trade to lead to welfare improvement (that is what I was referring to). As a matter of fact, if you look at where the increasing welfare has come in the past, you will see that, on the globe as a whole, roughly 70% of the welfare improvement is due to free trade, due to more division of labor, due to having comparative advantage realized more fully than it could be realized with, in this case, protected agriculture.

At the same time, we cannot have free trade by degrading our natural resources as a result. That is not what is intended. This is intended as free trade with proper accounting for all external effects: with proper accounting for the positive as well as the negative effects. When these external effects cannot be properly taken care of by the market, we definitely must find non-market solutions. I am aware of this problem, but if we are to just say we have to protect something for maintaining a certain lifestyle, we have to prove that the lifestyle is going to be desired by the society as a whole.

In Europe, for example, farmers' unions have found the best marketing strategy. At the end of the 1990s, they developed the idea of multifunctionality and sold it. Now the society pay for these positive externalities the farmers create. But none of us knows how positive they are or how much we have to pay to maintain them. I concede that free market in its pure sense is very likely to destroy some of these positive effects and some of the negative effects as well. But saying that we shall protect for that reason is the wrong argument.

Regarding the argument against small-scale farmers, of course I also see the problem. Scale economies in agriculture are substantial. There is a concern that, due to the scale of economies, the farmers will have no access to sufficient credit and will be unable to grow enough to take advantage of these scale economies. As we work to keep free trade, we also have to ensure that free trade helps all alike. Yes, free trade is the best strategy, but not in the pure sense that we don't take care of the disadvantages and advantages that come about as externalities and cannot be taken into the market price as well.

**Schmidhuber:**

I essentially agree with Dr. Frohberg that free trade is the best approach to begin with. There is no doubt about that. It is not only because of the efficiency gains that we have better allocation of production according to advantage. It is also simply because it is a very costly exercise in OECD countries which spend \$230 billion, or \$320 billion if you include the non-agricultural subsidies and sector-wide subsidies. This is a huge amount of consumer and taxpayer money wasted on agriculture. No doubt this money could be better spend.

If we remove these subsidies, it is of course not certain that the developing countries stand to benefit so vastly. For many of the commodities subsidized by at least some of the OECD countries, other OECD countries have a comparative advantage. What most of the models show, including ours, is that if you remove those \$320 billion, the biggest effect is actually a swap in market shares amongst OECD countries. So what is produced less by Japan, Norway, Sweden, Switzerland, or the EU is produced more by the US, Canada, New Zealand, and Australia, and of course a number of developing countries that do in fact have a comparative advantage for those highly subsidized products (examples include Indonesia for vegetable oils, Brazil for essentially everything, Argentina for wheat and beef, and so on and so forth).

So again, these subsidies should be removed, but their removal is not a silver-bullet solution for development. These two things I think are very important to distinguish, and they have to be borne in mind. If we want to harness free trade for most developing countries, we need a whole range of companion policies that actually help countries, particularly those in Sub-Saharan Africa, take advantage of freer trade.

We have essentially the same problem with free capital flows. Actually there the problem is even bigger. I'm not going to talk about the problems of short-term capital flows, but even for long-term, for foreign

direct investment (FDI) capital flows, it is of course important to look at the quality of FDI, and there again you have a situation like that in Africa, where 75% of FDI profits actually get repatriated into the countries of origin. The multiplier effects you get from that type of FDI are of course much lower than from FDI you get in Asia, where most of the profits actually remain in the countries, get reinvested, and again spark new investment in these areas.

**Kainuma:**

I don't think Mr. Osato will agree with both of your explanations, but we don't have time to go more deeply into that. The next topic is the Global Issues. Dr. Schmidhuber, could you put in a word on this?

**Schmidhuber:**

Globalization of course is also globalization of technologies. There I think we probably have the biggest challenge. It's also a big challenge for the CGIAR group. I do believe that the whole soul-searching process that I have been observing as far as the CGIAR goals has to do in part with the fact that this globalization process was not perceived in the way it actually happened. Let me explain what I mean by that. That will actually allow me to even touch on biotechnology. What we observed in the past was this phenomenal success of the Green Revolution. There was no doubt that it deserved a Nobel Prize, and if one manages to bring it to Africa, it would deserve another Nobel Prize. It worked so phenomenally well that there was probably a complacency that it could work as well as it did in the past also in the future, and as well as it did in East Asia also in Sub-Saharan Africa and South Asia (actually it did work fine in certain regions of South Asia). As it turns out, that has not been the case. This means, for the CGIAR group, that the efficiency gains that had been achieved in East Asia are gradually declining, while those that should have happened in other areas such as Sub-Saharan Africa are not forthcoming.

In part, I think this has to do with the fact that the technologies that have been so efficient in the past are simply not working in the future. That may simply also have to do with the fact that the CGIAR group was not on the forefront of developing new technologies. One of the new technologies is certainly biotechnology. There could be an interesting new way to go forward, something that has not been discussed so far, and that is cooperation with the private sector in that regard. Biotechnology at the moment is not an issue for developing countries simply because it was supplied to them. It was only produced by developed countries for developed countries, and actually not even for farmers in the developed countries, but primarily for the industry that produced it. It no doubt benefited the farmers; but it was truly a supply-driven approach. The questions, of course, are: first, how we can shift to a demand-driven approach? Second, how can we make sure that farmers are benefiting from it? And third, how can we ensure that farmers in developing countries can actually afford it (because one of the obstacles for them is still the royalties that would need to be paid for new technologies)?

One of the models that one can think of—and it has been floating around for some time—is to actually create an international tender for new technologies. We need, for instance, a draught-resistant sorghum variety for West Africa with this yield, and so on. With these specifications, we invite both the private sector and the CGIAR group and all other possible public funders for tender, and we give the bid to the most efficient one. With that, we have actually killed three birds with one stone. We, as the international community, take care of the royalties because we keep the intellectual property rights of this new product. We have a demand-driven product, and it is perfectly suitable to the environment we have been looking for.

**Kainuma:**

Our last theme for agriculture research for development is Biotechnology and Cutting-Edge Science Technology. Everybody knows that these technologies are very important for agricultural production, even in the marginal lands. Dr. Uchimiya explained that during his commentary and also answered several questions

on that. Instead of asking him to repeat himself, I will ask about the difficulties of biotechnology and cutting-edge science. Are there any comments from the floor?

**Frohberg:**

My institute has been conducting very elaborate research by looking at biotechnology applied not in research fields, but in farmer fields. The crop is BT cotton. We found in this study that it was especially the small and poor farmers who benefited from the biotechnology. The benefits are of two kinds: first, farmers save on costs because they don't need to apply that many pesticides. That is obvious. And second, quite astonishingly, the yields are even higher. Everybody thinks that if we have biotechnology and we do not get yield increases it is not worth it. In this case the yields are higher because the application of pesticides is not necessary. In a sense, the pests are attacked at the optimal time point. Farmers do not apply the pesticides at the optimal times, and in this case if you have BT cotton then the pests cannot attack the plant. So the yields increase according to these farmer level studies. The gains are tremendous for farmers, especially for small farmers because small farmers often do not have access to credit to buy pesticides. Here they do not need to buy pesticides.

**Kainuma:**

Can any farmers in Germany grow a transgenic plant on a commercial basis?

**Frohberg:**

You should not ask about anything in Germany. Germany is as backwards in this sense as you can think of. Of course the answer is no.

**Schmidhuber:**

I think that is important. What Klaus Frohberg said was referring to China. There it was a phenomenal success; there was no doubt. Actually, it brought about many more advantages. Probably the most important one was that it saves 1,000 lives a year simply because farmers do not poison themselves. It just confirms what I said before. It is a success because the farmers do not pay the royalties; the government does. They have free access to it. And it is also a success because the IPM system that was in place was not functioning at all, simply because those who were in charge of IPM were selling the pesticides. There was no doubt that IPM cannot function if you actually had the incentive to sell the stuff. Nonetheless, it was a success.

**Oh:**

It is better to ask developing countries the same question. I think developing countries have quite a different point of view in response to the explanations by Drs. Schmidhuber and Frohberg. They have quite different perspectives on what we see on biotechnology.

**Kessery:**

I think that biotechnology is very important for developing countries. Fertilizer is very costly for the farmers in my country. Now we are building a biotechnology laboratory. It is funded by USAID. It is not possible to properly respond to the demand of the farmer growing bananas in my country. We bought bananas from South Africa. We got small plants, so we had to have horticulture technology for farmers to grow and learn. If we do not help our farmers, we will have another problem in the future. Why? Young people are leaving for urban areas. If they do not find good jobs there they will have to go outside. It is very urgent to come up with new technology and to help Africa. I think that biotechnology is a good solution.

**Doppler:**

I would like to go a little bit beyond biotechnology. There is for me no doubt that it is needed, even coming from Germany. Our society does see the economic benefits but still has other arguments to not yet follow that line.

What I would like to see, in addition to this clear biotechnology strategy, is another strategy focusing on the whole chain of producing up to the end consumer, including the aspects of the life scientist at the end. If we look at the least developed countries at the moment and those industrialized countries where the end is important, the quality and the way it has produced, the countries in the middle (like some of those in Southeast Asia such as Thailand) say, "Now we also have to start look for the quality." That is why I believe this is another sector where we have to move deeper into our research fields.

Besides this specialization, I would like to come back to what has been mentioned yesterday in the introductory paper. I would also like to provoke a little bit and say that we also have to go beyond agricultural production. There is more than agricultural production. As the presentation by Dr. Hara has indicated, we have to go to the final consequence. That may be deep not into science and research but more into systems. It does not make sense to discuss the eight Millennium Development Goals and have each discipline deal with only one goal. We have to bring them together. When we are talking about agriculture, we are talking about fishery and forestry. We are trying to integrate that, and we have been doing quite well so far. We have to include all other disciplines, even human, nutritional, and health aspects. I know there is a little bit of dreaming behind this, but we have to have a vision, and I believe that, beside the specific, very deep-going fields like biotechnology, the food chain, and life sciences at the end, we need another deepening in the systems thinking, a holistic approach that goes further. Otherwise, the top-down effects of our eight goals decided by the world government will be lost. Scientists and policy decision makers have been discussing these artificial cases for three or four years, and the organizations are dealing with their management problems. That doesn't make sense. I think we need this deepening in the strategies as well as research from a holistic approach.

**Kainuma:**

We had the same situation in Japan. Today Dr. Xu mentioned genetic analysis and also the great deal of biotechnology research underway at the research laboratories and universities. Still, we have a gap between science and consumer attitudes. I think we need a policy, rules, and guidelines.

Today I had a very good discussion and also very active participation from all the participants in the hall. I genuinely appreciate that. Let me apologize for not going deeply into the policy-related issues. I wanted to discuss science and research collaboration, so our talk on political issues ended up only just touching the surface.

It is very difficult to wrap up the two-day symposium, but I will try to summarize what we have discussed over the last two days. This is my observation of synthesis.

First, we discussed a very wide range of topics regarding the future directions and goals of international collaborative research.

Second, many speakers spoke of the contributions and further expectations of Japan for food security and poverty alleviation through agricultural research. This is a very important message we received from many speakers.

Third, since this is the 10th anniversary event of JIRCAS, I think we all expect JIRCAS to play a leading role in forming a national forum among other Japan stakeholders (universities, other agencies, NGOs, NPOs, and the private sector) for more efficient and effective international agricultural research collaboration.

These are my observations of the two-day symposium, and I hope the participants agree with this summarization.

Thank you very much for your participation.

