Science and Sustainable Food and Nutrition Security: Challenge and Response

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My talk today is on "The Role of Scientists and Science Organisations". I shall talk about the Asia-Pacific food security and nutrition challenge with focus on the area of ICLARM's work, namely, fisheries and aquaculture. I would like to illustrate the different roles that science plays in tackling the challenges. We all agree that science itself is not enough, but there is absolutely no doubt that without science the problems cannot be overcome. The World Food Summit acknowledged the importance of science and research in particular, by saying that research in agriculture, forestry, and fisheries will be essential to achieving sustainable food productivity increases upon which food security will depend. Objective 3.4 more specifically called on the plan of action, and all the countries that it cited, to strengthen and broaden research and scientific co-operation in agroforestry and fisheries, in support of the need to eradicate poverty. So research and science, particularly science, are definitely embedded in the plan of action and have a recognised role to play.

All foods are critical, but fish is particularly critical. At ICLARM we have estimated that about one billion people in the world rely on fish as quite a significant form of animal protein. In the Asia-Pacific region, more than half the animal protein, on an average, comes from fish. In some countries it is very high, up to 80 to 90 per cent in parts of the Pacific, between 50 to 70 per cent in places like Bangladesh. Fish, of course, is a very good source, not just of calories, but high quality animal protein, of calcium, depending on which parts are eaten. Some species have very high levels of certain micronutrients, while others of the three major fatty acids. There are thousands of species of fish and related aquatic organisms eaten as part of the diet in Asia and not much is known about the composition of most of them. We do know from a small amount of work in Bangladesh, for example, that some species of very small fish called maoa is extremely high in vitamin A. A lot more knowledge is needed to look at the actual contribution of different types of fish to micronutrients and to nutrition.

Fish create of the order of 150 million livelihoods, most of them in Asia-Pacific. In the '90s we have seen the phenomenon of vast increases in fisheries exports—shrimps and other species of fish. Thailand is now by far the biggest exporter of seafood in the world. Particularly during the economic crisis, the exports of seafood tended to cover and even outweigh the food import bills of several Asian countries. The Asia-Pacific nations— China and India, in the main—account for 91 per cent of the aquaculture

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production in the world and more than 50 per cent of the captive fisheries. Pacific island nations rely almost totally on the sea in many cases, and their stocks are very important to food security. However, fish production is declining from natural sources in most areas. Aquaculture productivity is still fairly low and most aquatic ecosystems are being heavily and quite rapidly degraded by upstream effects from terrestrial uses including agriculture and also industry, urban uses, forestry and so on.

There are social and economic challenges. Small-scale fishing people are among the poorest in any country. They lack resource rights, they are very marginalised. Women and children, who often make a very large contribution both to the fishing itself and also to the post-harvest and ancillary services in the household, are discounted and are only now starting to be recognised in this region. A few years ago, through the Asian Fisheries Society, we ran a conference on Women in Asian Fisheries and will be having a follow-up global workshop on that topic later this year. The access rights to fisheries resources are extremely challenged. When people are so marginalised—when everybody else wants to use these resources or take over control of an area (mangroves, coastal areas, etc.)—poor people don't get much of a say, leading to great conflicts. Now this threat to fish supply is generally leading as well to an increase in the price of fish. The price of fish is greatly influenced, if not set, in every case by global prices, because fish is one of the most heavily traded commodities. About 40 per cent of world's fish production is traded internationally.

There are very great difficulties in managing fisheries, especially in getting compliance with any rules and regulations that are established. Even those that are established by the communities themselves are sometimes not complied with. Aquaculture in most countries requires quite a lot of attention to make it environmentally and socially responsible. Its technological development tends to have gone ahead of the regulations and policies it is surrounded by. Lastly, effects from other sectors in the economy as well as macroeconomic policies tend to even conflict with, and certainly influence, the development of fisheries. Many countries, for example, have subsidised their boat building industries and caused many more boats to be built than their stock can actually support and sustain.

Now, I believe that there are some ways in which science organisations can help resolve such issues. The first step is to establish 'visions' for the role of a science organisation to address the food security challenge. This is true at the national, international, and even regional levels. The CG centres, centres such as my own, and the ICAR centres all have established visions which give them direction in tackling these challenges. This is a necessary step.

Another strategy is to enhance leadership capacity at all levels. Organisations need to become experts at networking. The number and the breadth of different types of partners is increasing over time. My own organisation, in its year 2001 operational plan, has 220 partner institutes which makes it more than 220 individual partners and many other informal ones as well. And lastly, science organisations have to promote public and political awareness of the work that we do and what good it can do and I think this expert consultation has certainly shown us the way today. Rising political awareness will also raise public awareness through the press.

Leaders within our science organisations have complex and difficult tasks. They must look very broadly and not narrowly at the food security challenge. For example, although productivity is very important, we must not look at only productivity but at the whole complex system it is a part of. Leaders must think of long-time visionary spans, say 25 years at least. We must also have a time horizon that goes back, that looks at what has been done, what lessons have been learnt, where we have come from, what is the continuity, what we have tried and did not work then but might work now, what we should not try again because it was an utter disaster. So we need leaders who not only look ahead, but also understand history. Leaders need very solid technical skills, it is not enough if they are only good at science. So leaders must combine technical skills as well as scientific knowledge.

The tasks they have are manifold. First of all, they must understand the context within which the organisation is working and within which they need to deliver. This includes local, national, regional and international context, what can be best done with regional collaboration, what can be borrowed from or given to the international scene. Planning systems are critical. We need a coherent, linked system of plans, we need to manage the performance, we need to involve many partners, partners from the grassroots to partners in peer organisations. The leaders need to nurture the organizational assets, and that is not just the staff, the infrastructure, and the finances, but the management of all the knowledge. Institutes are more than the sum of their parts. Lastly,, the most difficult part of all and very important, is the need to make very hard choices; resources to do all these are very scarce and very hard choices have to be made.

Now, science, as Jill Lenne said, is a very blunt instrument, not a magic bullet. We can sharpen that blunt instrument by understanding that science can play several different roles and probably many more than can be envisaged. I have been able to identify four different roles. The first is to generate knowledge and make it available. The second is to identify the issues, their causes and consequences. The third is to help resolve conflicts (often by finding the facts). And the fourth is to create options and solutions to the problems. Now, this last is the one that is most familiar within agriculture—new varieties, new technologies, and so on. This is where we mostly focus our attention. But the other three—particularly where natural resources management and broader issues come into play—are becoming increasingly important. These roles are rather dynamic and, as situations and contexts change, the role going to be used by a science organisation or by a research project has to be thought through and chosen carefully.

I am going to cite four examples from fish and fisheries to illustrate my thesis. The first one is the role of generating knowledge and making it accessible. ICLARM and FAO and a whole range of partners around the world created a encyclopaedia of the world's fishes. It describes approximately 2500 fish species, with a lot of information on them, although a lot more information can be put in. This data has been compiled from 10,000 scientific papers, most of which are very obscure, very rare copies from libraries and museums and so on—inaccessible to a wide range of people. We are trying to cover details of all the fish, the source of fish, tiny fish, food-security important fish (particularly in Cambodia) which are made into fish paste or fish sauce, and charismatic little creatures like the sea-horse that are also important to the food security of some coastal people who collect them for the traditional medicine market. The accessibility of this through CD-ROMs and the Internet is increasing all the time, including and especially in the developing countries. The web site gets about 15 million hits per month, but that has been going up as more and more information is being used in training courses and in feeding into research where decisions about fisheries are made.

The next role is in identifying issues and their causes, and I consider the Food Security Atlas of India an excellent example of this. I want to speak briefly about work that we have done in Bangladesh, on one particular site which we studied in 1990–1991 and in the later '90s, where a lot of aquaculture development was going on. We were able to show that the aquaculture interventions and the various development projects that were underway over that period led to an increase in production per hectare of ½ a tonne to 2 tonnes, which is not a bad increase. This is fairly low-tech polyculture. We discovered over the period that women were becoming more and more important in the actual production activities. We found, looking in the markets, that the price of aquaculture species stayed steady or declined slightly due to the increase in production. However, the price of wild fish caught from natural water bodies increased dramatically. We don't have full information on their abundance but we are pretty sure that the dramatic increase in their price is to do with the declining availability. Even the poor and landless people in this district are now able to afford quite a bit of aquaculture fish. So, the good news is that aquaculture is having a big impact in that area and, in fact, across the whole country. The bad news from this study is that it is not good enough. The decline in captive fisheries production on balance led to an overall decline in total fish consumption among the people in that region. So, there is a huge challenge still ahead, despite the partial good news.

The third role of science is one of rendering help by resolving conflicts. The various issues in farming draw more and more on scientific facts. Of course, we all know that science in the end helps but it does not create the final resolution, because often the differences come down to differences in values and opinions between people and not differences in fact. But, science can at least untangle what is just opinion and what is fact. In fisheries, particularly with declining fisheries resources and much more competition over fish stock, many fisheries' scientists spend much of their lives in this role of science, resolving conflicts over fish stocks. I myself spent most of my time working in this area. In ICLARM, we have been looking at the involvement of research in community-based co-management activities and we have been able to show that, with the mediating role of science in getting to some of the facts, the co-management with the government has led to better equity incomes in most cases and to greater efficiency of management of the resources. In some cases, but by no means all, it managed to improve the resource situation and that is something that still needs to be worked on. It has also led to somewhat better compliance with regulations, but again there is no magic bullet in that one.

The fourth role, my last example, is when science creates solutions and solves problems. We have been working in ICLARM for more than 10 years now on genetically improving tilapia. Fish, unlike crops, have very early stages of selective breeding. Very traditional selective breeding technology is gaining ground. For the species that is being worked on, gains are between 10 and 20 per cent per generation still, because we are in such early stages. This is true of the Nile tilapia (we worked on over six selective generations) and of the *rohu*, a very popular form of carp here in India. In tilapia, we have had 85 per cent better growth, accumulated over those generations against the Philippines local strain. The experiment demonstrated the importance of a diverse genetic base, thus underlining the use of biodiversity. The original genetic base consisted of 8 strains of Nile tilapia, all in one species, four of them brought directly from Africa and four brought secondarily from other parts of Asia. We also looked at the socio-economic impact of the fish—an assessment showed that this fish should be able to lower the price, which is starting to happen in countries where the fish is now grown, to the benefit of low-income consumers. However the price needs to go down even much further, for the very poorest to be able to afford to eat adequate amounts of fish. It enhances the profitability for fish farmers and it has also led to a lot of excitement among other scientists networking for exchange of ideas, germplasm, and so on. It has led to the need for new ways for disseminating and maintaining these breeds of fish.

So, with these few examples, I hope I have given you a small taste that science does not have only one type of role to play in alleviating poverty, in trying to ensure food security, and in improving nutrition.

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