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Sustainability Issues in Agricultural Development

Proceedings of the Seventh Agriculture Sector Symposium

Ted J. Davis and Isabelle A. Schirmer, editors



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PREFACE

SUSTAINABILITY ISSUES IN AGRICULTURAL DEVELOPMENT

Proceedings of the Seventh Agricultural Symposium

January 8 - 9, 1987

These proceedings are the seventh in a series of records of Agriculture Symposia presented at the World Bank beginning in 1980.

The theme chosen, "Sustainability issues in Agricultural Development", reiterates the essential commitment of the World Bank to long-term development. At a time of growing concern with environmental issues in developing countries, it also reemphasizes the fundamental contribution to economic development of the basic asset base -- natural resources and human capital.

The symposium was opened by Barber B. Conable, president of the World Bank, who emphasized the key role played in sustainability by the agricultural sector. Sustainability issues in agriculture were then introduced in a broad framework by David Hopper, Vice President, South Asia, and Francis Idachaba, University of Ibadan, Nigeria. The symposium examined in separate sessions sustainability issues in agriculture from three perspectives: institutional development, natural resources management, and diversification. Each session began with an introductory speech to all participants, which was followed by simultaneous smaller discussion groups. V. Ruttan, University of Minnesota, R. Repetto, World Resources Institute, and D. Winkelmann, CIMMYT Mexico, were the introductory speakers with presentations on: "Institutional Requirements for Sustained Agricultural Development", "Managing Natural Resources for Sustainability", and "Diversification Issues in Sustainable Production Systems" respectively.

G. Edward Schuh, Director of the Agricultural and Rural Development Department, concluded the symposium by sharing "Some Thoughts on Economic Development, Sustainability and the Environment".

The planning and organization of the symposium was the responsibility of a Working Group 1/ composed of all departments of the Bank dealing with agriculture. This working group met numerous times during the planning process, and was responsible for not only the theme of the Symposium, but also the development of the main subjects within the theme and the choice of speakers to develop the papers and presentations at the Symposium.

The symposium was jointly sponsored by the Agricultural and Rural Development Department and the Personnel Management Department, Staff Training Division. This volume is the work of these departments and the Publications Department. It contains the papers presented by the Speakers for both the full sessions and the small sessions, together with the Rapporteurs' comments. It is designed to be a permanent record to further enhance the knowledge of the Bank staff working in agriculture and rural development and as a mean of exchanging knowledge with other leaders working in agricultural development.

<i>1/ Messrs. G. E. Schuh, Chairman,</i>	<i>Agriculture and Rural Development Department</i>
<i>R. Armour, C. Plaza,</i>	<i>Latin America and the Caribbean Projects Department</i>
<i>M. Pease, C. Collins,</i>	<i>Europe, Middle East and North Africa Projects Department</i>
<i>D. Pickering,</i>	<i>Western Africa Projects Department</i>
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<i>J. Olivares, V. Vyas,</i>	<i>Agriculture and Rural Development Department</i>
<i>B. Masters, I. Denning,</i>	<i>Personnel Management Department</i>

OPENING REMARKS

Barber B. Conable*

It is a pleasure for me to open the World Bank's Seventh Agriculture Sector Symposium. I understand this is the largest single intellectual revitalization effort in the Bank each year. This is fitting, given the importance we attach to agriculture in our lending program, and given the rapid changes taking place in agricultural technology and knowledge.

As I don't need to tell this audience, strengthening agriculture is the key to economic development in low income nations. Most of the resources in these countries are in agriculture; and raising the productivity of these resources provides a broad base for economic growth. Most of the poverty in these countries is also concentrated in agriculture. Raising the productivity of agricultural resources is thus the key to alleviating poverty as well as to stimulating economic growth. Of equal significance, if these productivity-enhancing effects should cause food prices to decline, the benefits of economic progress are distributed more than proportionally in favor of the poor since low-income families spend a larger share of their budget on food than do medium and upper income families.

The Bank's lending for agriculture last year was an all-time high \$4.8 billion. That was equal to 29 percent of our lending program. Approximately half of this lending was designed for direct alleviation of poverty. As we look to the future, agriculture will continue to occupy this key role in the Bank's activities. It can't be anything other than that if we are to sustain our commitment of economic growth in the low income countries and to poverty alleviation.

I am pleased to see the Symposium addressing the topic of Sustainability Issues in Agricultural Development, especially with the emphasis it is giving to the management of natural resources and environmental issues. As you are aware, the Bank has come under increasing criticism for what is perceived to be its failure to address these issues on a systematic basis. Whether that charge is correct or not, perceptions are important and we are responsible for the perceptions we create. We must in the future not only give these issues more attention, we must be perceived to be giving them more attention. A symposium such as this, with such outstanding speakers on the program, both from inside the Bank as well as from outside, should go a long way not only in helping each of you to upgrade your knowledge and skills to deal with these important problems, but to persuade those outside the Bank that we are serious in doing a more effective job in the future.

Agriculture in low-income developing countries is based in large part on a country's natural resource base. As modernization and economic development proceeds, output is increasingly based on science and technology and on inputs produced in the nonfarm sector. But sustaining the natural resource base is critical at early stages of agricultural

* President of the World Bank

development, and that's the stage at which most of our borrowing countries find themselves. Moreover, preserving the resource base provides an even stronger base for science and technology to increase productivity when that later stage comes along.

I am aware that a major share of the environmental problems the Bank has to deal with in its lending programs are associated with our agricultural projects. I am struck by the wide range of these problems the organizers of this conference were able to work into the program: soil conservation, watershed development, land management, forestry, diversification, management of salinity problems, and irrigation. I didn't see it on the program, but I suspect that environmental problems associated with the dams that provide the water for the irrigation projects will enter the discussion at some point.

Finally, let me commend the organizers of the conference for the extent to which they blended together the various elements of economic policy, institutional development, and knowledge from the technical disciplines. Clearly, these complicated problems cannot be solved without multi-disciplinary approaches that bring together the skills and talents of social scientists as well as those of the biological and physical sciences. Moreover, creating and developing proper institutional arrangements has to be the key to sustainable development. The fact that the Bank has such a wide range of professional skills persuades me that we are in a unique position to provide the leadership needed to address these important problems.

This seminar will challenge each and every one of you to help us provide that leadership. Unfortunately, the tendency is to view the Bank as a source of loan funds alone. You and I know that the technical skills and knowledge embodied in each of you, plus your creativity and drive, are by far our most important input into the development process.

To conclude, let me say again what a pleasure it has been to be on your program. You should have two challenging and rewarding days ahead of you. I wish you all the best.

OPENING REMARKS

RAPPORTEUR'S COMMENTS

E. E. Senner*

In response to a question on how the Bank should be handling the increased attention (and criticism) from environmental groups, Mr. Conable said the Bank needs to organize its environmental work clearly and visibly. He noted that some of the complaints heard may indeed be historical and anecdotal in nature, and may fail to acknowledge corrective action that had already been taken. Nonetheless, it was important that the increasingly international environmental movement be shown how the Bank has developed increased sensitivity and capacity in dealing with the issues; how borrowing countries are also taking initiatives in the area; and how we have developed mutually acceptable conditionalities in operations to get appropriate action. Mr. Conable cautioned that the environmental issue is serious, and substantial, and not just a public relations problem. The Bank needs to possess a "catalogue" of information on resources, to be aware of issues, to enlist effectively local commitment to resolving the issues, and to establish better and more collaboration with interested non-governmental organizations in dealing with environmental problems.

A speaker, noting that Mr. Conable's attendance at the multi-lateral trade negotiations in Uruguay had seemed an unprecedented and important step for a new Bank President, asked if Mr. Conable planned any other major Bank initiatives in the trade area. Mr. Conable spoke briefly on the key role of increased trade in the development process and in the resolution of debt management problems. He noted that both the developed and developing countries have an important stake in seeing trade expand. Mr. Conable also mentioned the special issues which exist in agriculture and the distortions which emerge in the economic environment as a result of some countries' efforts to dispose of agricultural surplusses. While this issue had even led some local political leaders in developed countries to question support of agriculture in the developing world, Mr. Conable was convinced that agriculture was a key to growth efforts in most poor countries and that such development, coupled with freer trade, would bring broad benefits to both developed and developing countries.

Mr. Conable was asked about his views on the complementarity, and/or tradeoffs, between project efforts to alleviate poverty and to promote efficiency and growth. Nothing that tradeoffs may exist, Mr. Conable pointed out that the opportunity which growth provided for efforts to redistribute income was much greater than that provided in an environment of stagnation. Referring to current debt management issues, he believed that broad debt forgiveness (as proposed by some) could substantially harm, in the longer term, the capital flows which developing countries will need. He said the Bank was not an institution primarily concerned with debt management, but a development institution. As such, the Bank must seek growth and the alleviation of poverty. One of its most effective tools for doing this was in agricultural lending.

* Assistant Director, South Asia Projects Department, (ASPDR), World Bank.

A final question posed to Mr. Conable was on his views regarding the role of technical staff in the Bank, and whether the relative absence of technical staff on the various task forces recently set up for the reorganization exercise reflected a generally declining role for such staff. Mr. Conable, noting a similar protest made earlier to him, said that the technical/non-technical balance had simply not been at the forefront of considerations in setting up the task forces; quite a number of other factors (experience in the Bank, nationality, etc.) also had come into play. Mr. Conable said he hoped his very presence at the symposium would help to convey his strong belief that the need for technical excellence in the Bank was not declining. While the need for macro economic skills had grown, most future work of the Bank would continue to be in projects, the historical strength of the institution. While he had no specific goals on possible cuts of one type of staff or another, he would be disappointed if the reorganization effort would not find areas for savings or increased efficiency. The effort to find such areas was critical to restoring the confidence of major shareholders.

SUSTAINABILITY, POLICIES, NATURAL RESOURCES
AND INSTITUTIONS

W. David Hopper*

The title "Sustainability, Policies, Natural Resources and Institutions" leaves me lots of room for saying just about anything, and it would seem to be ungracious of me to ignore the open-ended mandate the organizers of this symposium have so generously extended to me by doing anything so mundane as to focus my remarks on a particular set of issues. But I will do so in that I will focus on sustainability and try to forge a tie between it and a core definition of social and cultural institutions. Thus warned, I will now wander about the open Plain suggested by the topic and examine an array of only partially connected ideas in the hopes that you will find the few nuggets and fill in the gaps.

The temptation is to begin with a definition of 'sustainability'. To ask: What is it? Frankly, I don't think I can define it without unduly constraining the free flow of my thoughts. In other words, I don't know what it is. As it is something that is 'sustained', it obviously has a time dimension. But I am unclear as to what this dimension is -- is it five years? ten years? or what?. There is obviously something called 'history' in the sense that whatever has been 'sustained' has left a mark of 'something' changed, a material and obvious shift in the actions of people or in the manifestations of their actions. The puzzle is whether the shift we observe is specific to an action we have initiated or induced, or is the result of the underlying heritage of the social or economic movement that is to be found in all societies and cultures. And if we cannot directly find our role in the observed change, can we identify it as an indirect force from which present events are derived?

The World Bank Operations Evaluation Department (OED) quest to find 'traces' of a project some time after its completion reminds me of a very successful project I participated in during the early seventies. It was to upgrade the breeding stock of the Awassi sheep (the fat-tailed sheep of West Asia and North Africa) in the Lebanon. The UNDP global program and the International Development Research Centre of Canada invested quite heavily in acquiring and maintaining a pure breed flock of sheep to be housed in the Bekka Valley and used as a source of semen for artificial insemination, research, and breeding by local farmers and participating national Middle East animal research agencies. Following Syrian troop movements in the Bekka Valley in the mid-seventies, all that could be found of the sheep project were the satisfied smiles of a company of soldiers who claimed that the flock made the best mutton chops they had ever eaten. Traces left at the project site: none. But I know that the sheep semen had left a legacy throughout the Middle East; I grant that it

Vice President, South East Asia Region, World Bank.

may be difficult to find, but I would argue that only the location of the project was wrong. The more germane question in the Awassi story, however, is whether the project was sustained. Obviously not, but is that fact condemnatory of the project, its conception and purpose? or is it merely an incidental fact of Lebanese history?

Let me push the issue further. In Mr. Conable's introduction he mentioned the issues of poverty redress. What is sustainability in this context? Does it mean that if we target a group of poor people, the project has been a failure? Do we try to measure before and after incomes and what might have been without the project? Since so many of our projects have multiple objectives, what do we measure when we talk of sustained activity? As the outcome of a project is dependent on the total milieu in which it is placed, has it been sustained if critical elements in that milieu are altered to its detriment and, perhaps, its disappearance? The question can continue, and the answers can remain uncertain.

Indeed, I cannot avoid the view that it's easier to agree on what hasn't been sustained than on what has been. That when one returns to a project site after a favorable completion report and, say, finds the canal silted and without water; or detects no observable changes in farming practices; or discovers an extension service or a research base or an institutional framework reverted to its previous patterns; then something was not sustained. The economists have given us definitions of economic and internal rates of return based on relatively short spans of time and we are delighted when a project completion report and an OED audit finds that the project has attained a return close to or above that predicted in the appraisal report. But in the years after the completion, it seems to me that the 'gut' feel of whether anything was in fact sustained is our most reliable indicator. The Awassi sheep will always haunt me when I examine the issue of what is or was sustained.

Thus, I'm not going to spend time on a definition. I'm assuming that we can all recognize something which if we didn't recognize it we would not be development practitioners; something that we sense rather than define -- 'gut' reaction that reasonable people can reasonably agree on -- a sense that we will know with little dispute what has been sustained and what has not. Instead of seeking to elucidate the boundaries of sustainability I will, instead, focus on agricultural projects in the context of the core issues of developmental change.

A cross-sectional graph of Asian nation rice yields produces the familiar 'S' shaped curve stretching from below one ton per hectare in average yield for the nations of South Asia to over six tons per hectare in Japan and Korea. The curve seems to break into four segments: 1) low yield rice grown under traditional practices; 2) a yield acceleration driven by the early phases of a technological change in farm production methods from

traditional means to those based on scientific research; 3) an even more rapid growth phase to an inflection point as the yield increase from further applications of science based technology gives way to a yield growth derived from the impetus of organizational improvements and better efficiencies in farm supply and marketing systems and in the infrastructure supporting the agricultural sector; and 4) slowly rising yield found in those countries that have an elaborate and complex rural economy that enfolds farm and farmer firmly into the national economy and polity.

It is critical, I think, to recognize that even in traditional farm economies there is strong evidence of a slow upward drift of yields. From old South Asian land records it would appear that the rate of advance in per hectare rice yield has been roughly one-half to one percent per year over the past couple of centuries. About the same yield growth found from the records of old estates in Europe stretching back to the 15th century. The upward drift of yields should be hardly surprising. Farmers can and do observe the results of their husbandry and modify their practices to incorporate successful inventions and innovations. It is now evident that a sustained break in this evolutionary course of change in traditional methods can only come about by farmers using science derived technologies; technologies developed by a research activity that is outside the traditional boundaries of the agricultural economy and introduced to farmers through an external system of demonstration (the role of the extension service) and supported by new or altered factor and product markets.

Functioning markets, however inefficient or imperfect, play a crucial role in the transformation from traditional to scientific farming. They supply new inputs and provide the cultivator with an outlet for his additional product; they transmit the signals and incentives critical to maintaining the pace of innovative change. They undergird and complement the research and extension systems, which ensure the technical feasibility of innovation, to provide the organizational feasibility for sustaining change.

The improvement of the underlying organization and efficient functioning of farm markets seems to be a critical component in the assurance of a continued upward advance in agricultural output. A vigorous market structure offering an elaboration of services and goods to area farmers provides a foundation for change.

The South Asia story of the growth of output of wheat and rice is an interesting example of sustained change. An alteration by plant breeders in the architecture of biological materials of these two grain types produced varieties of a high yield potential that was realized when they were properly fertilized and adequately watered. The new 'high yielding varieties' performed as advertised because they could thrive under

crowded conditions that gave a high output per unit area. Farmers' markets provided the seed, the fertilizer, the pesticides, and, frequently, the irrigation equipment necessary to attain the yield promise of the new plant types. The result has been a growth of output that has continued over almost two decades at a level of two to three percent above the growth rates of a traditional agriculture. By the test of the 'senses' -- the 'gut' reaction -- the evidence suggests that the effort to induce change has been sustained.

But this is a relatively simple view of sustainability. It is a one dimensional phenomenon in that it has only one focus: the productivity of land for producing a single crop. Most of the Bank's work in agriculture is neither simple nor easily assessed. Drawing again from South Asia, the complex water control projects in Bangladesh, the rural development projects in Nepal, and the milk projects in India have a multiplicity of goals and as many measures of success and continuity. How is sustainability to be conceived in this context?

The Indian sub-continent has a long history of effort in rural uplift and change. Many of these are well documented and appeared to attain success for substantial periods of time. Yet a visit to these project sites now reveals little of a legacy of change. In most cases the history was made by a charismatic leader who, through the force of personality, succeeded in mobilizing people and instilling in them a collective action, an alteration in traditional behavior. I can cite only a few cases where the projects seem to have functioned successfully after the disappearance of the original leader.

The early 1950s community development experience in India, the Etawah project, is a case in point. It was built on the vision of a truly extraordinary community planner, Albert Myer of New York. It was supported by the most powerful members of the nation's elite. It was implemented by a stellar staff of talented social and rural development scientists. And the project was a success by almost any measure you can devise. It worked, and worked well enough to become the model for 'all-India' community development program. The project was a unique example of a successful application of participatory methods of village transformation, the introduction of everything from bore-hole latrines to better water supplies, from improved agriculture to village libraries, from youth recreation to smokeless; name it and the project had it or was about to have it or was thinking about having it. It did not succeed on a national scale although the structure of rural administration that was introduced to bring it about remains to this day in the Block Development Officer and the Village Level Worker. Perhaps it was too much to expect that it would be successful in a nation so vast. It would likely be unreasonable to expect that the staff dedication of the original Etawah project could be duplicated on a nationwide basis. But the sobering reality cannot but assail one on a return visit to Etawah today. There is little evidence of

any project remains. The buildings are there, of course, some of them a bit run-down, but most are part of the District's beneficial infrastructure, and there are memories of a period of bygone excitement when the world's visitors and India's mighty paid court to this little evidence of a continued dynamic in a rural district that was to be taught how to mobilize its human and material resources for its own betterment.

I do not sense a sustained result, but there can be no doubt that the Etahwah experience altered the perceptions and attitudes of India's decision makers about the importance of rural development. The concern for the well-being of the mass of India's villagers was given practical expression at Etahwah; and the initial success of the project firmly embedded in the national consciousness a belief that rural development was not only important but could be done -- a belief that underlies much of what the Bank does in agriculture and rural improvement.

My example was from India. I could have drawn it from many other geographic regions where one can find instructive studies that would sharpen understanding of the outcome called sustainability. On the positive side, there is the Gazera Scheme for growing cotton in the Sudan. By any standards it was a sustained success, at least until politics and policy combined to ensure that its management would be ineffective. The large, irrigated cotton growing area southeast of Khartoum was for decades among the world's most admired and profitable farming experiments. It was built around small cultivators who collaborated in managing the irrigation system and integrating their production decisions for the collective benefit. The scheme had a central management able to ensure a continued flow of externally generated technology, the inputs to support its adoption by cultivators, the training of all levels of scheme employees and the operation of factor and product markets that triggered the incentive structure to signal cultivator responses that would lead to its continued viability and profitability.

Certainly management is a crucially important factor in any discussion of sustained projects. Those of us working with project implementation cannot quarrel with the recent Project Implementation Report conclusion that found quality project management a central need to insuring sustained results. But what are the lessons we have drawn from this? I find them not too satisfactory.

I am reminded of our work in Nepal where we compete among many donors for the Government's assignment to our projects of a manager to be drawn from a severely limited pool of competent, experienced projects. We make the assignment of a person from this pool a condition of project effectiveness, a prudent and wise precaution. After some delay, the assignment is made, and the project becomes effective. All too often, within a few months if we're unlucky, several months if we're lucky, our new manager is transferred to the German project or the French project or

the Canadian project or ... as a condition of making it (or them) effective. While we complain of being robbed of a good manager and express our ire to the Government, perhaps we should recognize that a bluster about the spirit of conditionality is of little avail look to ourselves for a solution. What have we done to augment Nepal's managerial capacities? What have we done to provide trained support for a sustained system of developing project managers? What have we accomplished in nearly 15 years of project assistance to Nepal to help that nation to overcome this critical constraint to its long term development progress? In fact we have done little to nothing. We have helped build both domestic institutions and manpower skills to ease the shortage of technically trained engineers and para-professionals. But we seemed to have blithely assumed that managers will be found, and when they are not, we complain, we score the '590'* low on management and write nasty Back to Office Reports and aide memoirs. In our latest moves we talk of including improved implementation and management as a condition of the next structural adjustment operation, a matter to be addressed not by us but by the Government.

The obligation is clear. If project management is a vital factor in insuring sustainability, then we must ask tough questions about our assumption that each of our client nations has this capacity and, if they fail the quiz, we must ask even harder questions about how we can build such capacity as a pre-condition for lending. I suggest that we are not doing this adequately. That in our desire to lend we make the easy assumption of a managerial capability. That we often build complex projects that would tax the most capable of the world's managers and then express our disappointment when our borrowers fail to meet the challenge implicit in the project designs. And, least you think I'm preaching too loud, let me confess that I am more culpable than most in this neglect -- I pass the projects forward with my own misgivings suppressed and unspoken. It is not a proud admission.

If management is one of the elemental supports in longer term project success, an embrasive vision of the future must be another of its beams. It is perhaps not too surprising that many of us in planning projects do not really extend our imagination to cover what will occur if the project succeeds. In fact, for too many of us the preoccupation is a fear of failure and how to avoid it; not the prospect of success and how to accommodate it. We all know the danger of succumbing to the mesmerizing quality of a highly innovative project that seems to hold within it an unbelievable promise of abundance. And thus hypnotized we 'shoot the works' and become single issue advocates, true entrepreneurs of development who label the cautions of inner-self and colleagues the counsel of the 'weak and faint-hearted'. In becoming advocates, we focus inordinate amounts of time on effort to get the project launched, and we put little effort in trying to anticipate what will happen if our vision of 'what might be' actual comes to be 'what is'. Sometimes we're right about the project and the future unfolds untended. It did in India for the green

* Summary Form for World Bank Project Supervision Report.

revolution when the skeptics seemed to be unlimited and true believers became underground evangelists for their faith in technology, profit responsive farmers, fertilizer and irrigation. Sometimes the project works, and the future is choked on its success. Cassava and Guyana is a case in point.

In the early seventies cassava was discovered to be a Cinderella crop well suited to the infertile, sandy soils of the coastal plains of Guyana. The project analysis focused on its technical promise, the nutritional need for augmenting national supplies of carbohydrate, and the obvious profitability of the crop. The implementation of the project resulted in a virtual cassava revolution. The technology was simple. Anyone who could find a tuber could become a producer. Virtually every farmer grew cassava and obtained high yields. In two years the market was flooded and the price collapsed. The unwanted abundance rotted in the fields. No one had planned a revolution, no one had foreseen the need for processing facilities, no one had anticipated a glut of food in a food scarce country. The cassava project was an outstanding success; it died from a lack of vision of a future with abundance.

The cassava story can be replicated with many other examples. The production of maize in western Kenya in the late sixties, the over-grazing of the fragile range in Mali and Niger that accompanied the installation of stock watering facilities in the sixties and seventies, the expansion of onion production in Ceylon, to name but a few of many examples of projects that were well conceived, well implemented, and initially triumphant only to prove unsustainable because they were unsupported by the milieu, the surroundings, in which the project was placed.

These examples arise from a view of project design inherent in the work of the technician-economist who sees a likely return from a complex of actions undertaken to attain relatively simple purpose. An irrigation facility, an expansion of livestock production, a growth in rural employment, a delivery system for better health, a decline in fertility, even a mix of purposes that group logically to reenforce each other. There is an objective; there is a tactical plan; there is an implementation thrust; there is a measure of accomplishment: a rate of return, the miles of canals dug, the prevalence of practice, an output estimate of before and after. All very neat and tidy ways of assessing achievement.

There is another approach to project development, however, that arises from the desire to build into the project design a permanent change in the way peoples conduct their affairs. The project should finish with an alternation in the set of values, beliefs and practices that guide and govern how people work and believe. Indeed if we are not seeking this form of change, what are we talking about when we meet to consider sustainability? There are, of course, philosophers and historians, poets and social scholars, writers and theologians who have given the process

and permanence of change in human affairs a great deal of thought. Perhaps it is not surprising that they are in little evidence among the Bank staff, but it is to their work that I would like now to turn.

The social sciences, or, as I prefer to use Prof. Max Black's term, the social studies have long recognized the maverick nature of economics with its mathematical models of individual and mass behavior, and its central quest to elucidating the conditions of optimal resource allocation whether normative or positive. To the non-economist scholar of social phenomena, the behavior of human beings is conditioned by an interactive web of a multitude of purposes and objectives. In contrast to the technician-economist, those who hold a holistic view of human affairs are deeply suspicious of a conception of economic development that is focused on simple objectives (however complex the technician-economist may claim the objectives to be) and even more disbelieving of the validity of simplistic measurements of its attainment.

In the domain of Bank concerns, that is with the evolution and change in non-western cultures, it is mainly the anthropologists who claim our attention. Underlying their work is a conceptual frame that permeates all the disciplines of social study. It is the concept of institutions. Not institutions as we normally define them: the United Nations, the World Bank, the local school or government, these are really organizations, often with a formal structure and a formal hierarchy of authority and direction, but they are not what social scholars mean when they use of the term social (or cultural) 'institution'. Institutions are the long persisting elements of a people, society or civilization: its legal traditions or methods of adjudicating disputes, its shared religious beliefs and the organization of its religious practices, its patterns of the exercise of political power and authority, its means of building and maintaining family relations, its frame for child rearing and education, its methods of structuring human interaction both among its own kind and with outsiders, in short it is the system of rules required for social behavior--the rules that give predictability and sanction to what people do.

The structure of social institutions is underpinned by the beliefs and shared values of the society and the feed-back between values and institutions is at the root of change regardless of whether we wish to label it as 'economic' or 'social' or 'political' or anything else. It is the interaction of values and institutions that persists from one generation to the next, and distinguishes one people from another. Its micro-variations establish sub-cultural boundaries and often give rise to internal social differences in both the structures and dynamics of human behavior and in the social and individual responses to stimuli for change. Its macro-variations differentiate civilizations.

To the holistic philosopher, the anthropologist with a broad view of cultural change, or to the social scholar who finds change in an

alteration of social values and institutions, Bank project activities focused within the narrow bands of flux inherent in economic and technical concerns provides little basis for meeting the test of permanent change, i.e., the test of sustainability.

In practical terms what am I talking about?

The technician usually takes an uncomplicated, perhaps a rather obvious view of the world. The resources are there; the technology is easily acquired and applied; everything is set to move forward with a properly designed project. In contrast, the anthropologist wants to make sure there is a perceived need among the project's potential beneficiaries for its intended results; that there is a capability, or at least the absence of hostility, within the society to absorb the altered patterns of behavior demanded by the project activities. The anthropologists can rightly ask the technician-economist who claims an obvious gain for his intervention, obvious to whom? and if the project yields the benefits foreseen, how will it alter the underlying cultural framework of values and institutions so that its behavioral demands become a persisting part of society's underlying institutional frame? In turn, the technician can question and doubt the cumbersomeness of the holistic outlook and doubt that the deep complexities of cultural change apply to the simple conceptions embraced in his project design.

Regardless of the philosophy each of us brings to project design, the issue of project sustainability in a long term is a matter of changing the underlying institutions of the society.

To illustrate this, I can think of no better example than the issue of cost recovery for rural drinking water facilities on the North Indian Gangetic Plain. Traditionally, water, a vital necessity of life on this often parched, hot, dusty Plain, has been free to villager and traveller. The tens of thousands of dug wells that dot the river basin were dug by villagers for drinking and irrigation water as acts of social responsibility. There is no tradition of charging for water used. The use of the well for drawing irrigation water is free to all subject only to the order of a queue with the right to pre-empt a place being held by the person who provided the well. Drinking water at a well is free to all although occasionally subject to restrictions relating to the caste of each thirsty user.

The social institution of free water is violated when government systems of piped village water supplies carried accompanying service fees. While fees for irrigation water supplied from privately or publicly owned pumps is readily accepted because of the large savings in labor and animal power usually needed to draw water from a dug well, such savings are less obvious in the case of drinking water. And besides, since water is traditionally provided as an act of personal or family social contribution,

what more socially responsible agency than a democratic government can be found to bring improved facilities to the community? And this perception is given added validity when so many of the village water supply schemes are inaugurated and opened by the local members of parliament. When water charges follow, an ancient social compact is broken, a cultural institution embodying society's responsibility to insure each person's access to drinking water is violated. The obvious cultural response is to forego payment of the water charges, or, if need be, to let the new, foreign system decay.

In many respects this is a simple but meaty example. It has never been clear to me why village water supplies are considered important in the Bank. Obviously it has something to do with clean, healthy water sources. But in a culture that has little belief in the western cultural theories of water-borne diseases. In a culture where water is a source of purification, not of pollution. Whose felt needs, whose perceived benefits give rise to a village water project? And if these benefits are not felt necessary by the villagers, and if the project content is mismatched with the cultural institutions of the community, who should bear the costs of ensuring sustainability?

The example leads to another of the oft mentioned but little used approach to projects that strives through some form of group dynamics and 'participation' to evolve action programs founded on 'felt needs,' often newly generated. The basic assumption being that if these perceived 'needs' are not yet present in the target society, they can be engendered by involving the intended beneficiaries, and particularly their leadership, in discussion-education-discussion meetings designed to build both understanding and enthusiasm for the project's aims. Both the project's methods and its implementation course would be subject to participatory review with as much responsibility as possible for the project activities being vested in the local people. It is an attractive proposal. It has been tried with many very successful outcomes and not a few notable failures when leadership has been repudiated, or the promise of the technicians has not materialized. Whether successful or not, however, the method has proven to be time consuming and staff intensive, and despite the best efforts of seemingly brilliant persuaders, traditional behavior patterns often prove to be stubbornly persistent. The record of participatory means of inducing cultural change needs much more study and experimentation. It is too logical to dismiss. It is too costly to recommend without a better understanding of its requirements and a detailed appreciation of its benefits as well as limitations.

South Asia's green revolution was underpinned by the rational economic decision processes of millions of India's farmers. The essential debate was whether the farmers would plant the new varieties and adopt the practices necessary to reap their promise. Was such a decision process a part of the cultural heritage of the society? The answer in this case was an overwhelming 'Yes'. But it is not at all clear that what we in the Bank

would consider 'rational behavior' in health or sanitation practices is so regarded by our client peoples. And even in our own society it is hard to bring about change in even such simple behavior as cigarette smoking, much less in activities that involve deep-seated manifestations of cultural values such as attitudes toward women or race. The Etawah community development project tried to change too much that was embedded in transmitted culture. And one cannot be a spectator to the past four decades of Chinese history without a profound sense that for radical changes to take place across a cultural horizon and be sustained is indeed a most difficult process. Further more it is not adequate to refer to the age of cultural institutions. They can persist for centuries or they can be changed rapidly. I doubt that any of us has met a thousand year old farmer. The people we work with today have not been 'doing things that way for thousands of years,' they can and do change. But cultural values and institutions have their own internal consistencies and rationales, these intertwine to buffer the incentives and pressures for alteration. They are often transmitted imperfectly from generation to generation, but the value package transmitted contains the sanctions and educational structures to insure that the transmission process produces an effective if imperfect socialization of the next generation.

The 'package program' in India (officially known as the Intensive Agricultural Districts Program or IADP) which the Ford Foundation and the Government of India began in 1960/61 was designed to focus integrated community efforts on agricultural production. The program was to double the national rate of growth of agricultural output in 15 districts selected for their production potential. The program was generously funded, the supporting bureaucracy was highly motivated and committed to its implementation, and it was aided by large technical assistance staff of very senior and experienced Americans. Yet the whole effort proved to be inappropriate for both its goals and for the task of altering village farming practices. An analysis of the program revealed that its technological foundations were insufficient. It was an extension program with little to extend, an insufficiency corrected a few years later with the advent of high yielding varieties. But more importantly, the program did not mesh to the social and cultural traditions of the Indian village. In essence the program relied heavily on building village cooperatives as the source of productive inputs, new technologies, farm credit and product markets. It did not work because Indian village culture is structured around hierarchically ordered castes and competitive family lineages. Cooperation as it is known in Western rural communities is not a traditional aspect of Indian rural life except for religious ceremonies and the maintenance of a few elements of the village economic infrastructure.

The IADP was designed by a group of top-class U.S. experts who modelled it on the cultural patterns familiar to them of an American rural community. Because they drew heavily on western cultural conceptions of rural equality and the individualism of rural cooperation, the program had

little meaning to the Indian villager. As it wasn't a success I suppose the issue of its sustainability does not arise, but it is instructive that when the high yielding variety seed became available, the IADP districts were not at the forefront of their adoption. Indeed, the first farmers to adopt the complex of new practices seemed to do so with virtually no extension advice and even less dependence on the many components of the Governmentally assisted rural uplift programs. As the use of the new crop production methods required only an individual decision, there was no significant break with village cultural traditions.

This was not the case with the Community Development Movement that failed to make much headway in the early fifties. The movement, which owned much of its philosophy and methodology to the dreaming of anthropologists, was premature at best. It demanded too much in the way of cultural change as it sought to alter both cultural values and institutions. In doing so it reflected more the needs of those who designed the program, mainly the elite of India, than it did the needs of the villagers who were to benefit. In the beginning the movement seemed successful, in the end it could not be sustained because it did not become part of the cultural heritage of Indian rural communities.

Let me close on the question of sustainability by returning to South Asia's green revolution story and, through it, bring together several of the leads I have sketched.

In laying the groundwork for this massive change in agricultural practices there was a firm assumption that farmers would adopt new techniques if they were profitable and if the required behavior was in conformity with the cultural traditions of village society. For the diffusion of the high yielding crop varieties, these assumptions proved valid. More difficult was the organization of farmer cooperation. The competitive structure of village kinship groupings has made and will continue to make farmer cooperation a difficult social innovation. Health practices, changes in social organization, legal system reforms, etc., will be much more difficult to engineer without significant and continuous pressure on the structure of traditional social and cultural values and institutions. Obviously if project execution is faulty due to poor management even those activities that do mesh with the basic cultural framework of the society will have little impact and even less duration. And if the economic, social or administrative infrastructure of support for the project and its several components is not in place, the likelihood of later finding much of a residual of the project vision will be very small indeed. Education, training and an understanding of how cultures evolve, how practices within a culture, within a society interact and evolve and alter are keys to the sustainability of the endeavors we seek to initiate and nourish to completion.

SUSTAINABILITY, POLICIES, NATURAL RESOURCES AND INSTITUTIONS

RAPPORTEUR'S COMMENTS

E. E. Senner*

Referring to Mr. Hopper's cautionary comments regarding possible unexpected consequences in moving from communal to private individual land rights, a speaker asked whether Mr. Hopper could offer any guidance as to how to arrive at a reasonable compromise. Mr. Hopper, noting that no clear solution or simple answer exists, stressed the basic need to understand first the existing land tenure system and the culture as fully as possible. Often, one would do best by trying to start the process of improvement by working within the traditional system. He went on to discuss the importance of finding means to fund the small scale or pilot efforts often needed to assess the social or cultural acceptability of various development options. The Bank, already pressed by budgetary concerns to do fewer and larger operations in many countries, hadn't always been particularly successful in finding the appropriate vehicles to support small pilot efforts, but needed to continue to explore new means for doing so. Private foundations were also finding it increasingly difficult to provide the needed budget support for such pilot projects.

A speaker noted, with pleasure, the importance given by Mr. Hopper in his presentation to the cultural dimension of development. The speaker asked if Mr. Hopper felt the Bank had adequately "institutionalized" its capacity to deal with this dimension. Mr. Hopper noted that a good many staff now possess considerable sensitivity in dealing with the social and cultural dimensions of the development process. He felt the need was not so much one of having many more pure social scientists (though he felt some additional sociologist and anthropologist staffing was still necessary), but that other technical staff also needed to possess a more adequately broad perspective. The development issue was one of understanding the range of economic and technical options in light of the cultural environment, and then helping match the selection of options to what was culturally appropriate.

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SUSTAINABILITY ISSUES IN AGRICULTURE DEVELOPMENT

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The failure of agriculture in SubSaharan Africa to attain sustained growth performance in the last two decades is now well documented (World Bank, 1981, 1984, 1986). The virtual collapse of export crop production has not been accompanied by a corresponding increase in food production. Per capita food production declined in 26 countries out of 39 African countries during 1977-79, with 1967-71 = 100; it declined in 23 countries out of 31 during 1982, with 1974-76 as base period. Growth rates of agricultural GDP declined in 15 out of 20 SubSaharan countries during 1973-84, compared with 1965-63 (World Bank, 1986). SubSaharan Africa's share of world commodity trade has also declined: cocoa from 79.9 percent in 1961-63 to 69.3 percent in 1980-82; rice from 0.9 percent in 1961/63 to 0.1 percent in 1980/82, groundnut from 85.5 percent in 1961/63 to 3.0 percent in 1980/82.

This paper focuses on sustainability policy issues in agriculture, with particular focus on African agriculture. The focus on Africa and Nigeria in particular stems from the enormity of the food and agriculture problem of the region and from this author's relatively greater familiarity with it. It is hoped that some of the issues raised would be sufficiently country-and region-neutral to have relevance for other countries and regions. First, we will discuss, the problem of sustainability under three sets of factors, as well as the interactions between these factors, then we will examine, the policy issues for sustainability, and at the end, we will draw some conclusions.

The Problem of Sustainability

According to the Oxford Advanced Learners' English Dictionary, sustainability refers to "keeping an effort going continuously, the ability to last out and keep from falling." Sustainability in agricultural development therefore refers to the ability of agricultural systems to keep production and distribution going continuously without falling. It refers to how agricultural growth and development can be sustained into the future.

National agricultural systems lose sustainability from several sources. Four classes of sources of discontinuity are identified: the national macroeconomic and political environment; the world economy (the external sector); the agricultural sector; and the interaction between the particularly agricultural sector, the macroeconomy and the world economy. The treatment in this paper implies a certain order of priorities of sources of nonsustainability in developing agriculture, especially in SubSaharan Africa.

Discontinuities in growth performance impose severe costs at several levels. At the household level, especially in production regimes dominated by high levels of subsistence, discontinuities in production threaten the nutritional status of the rural majority as well as the food-dependent urban population. Discontinuities have differential effects on different household and income groups and tend to exacerbate social inequities in the distribution of wealth and income. At the community level, discontinuities in growth performance have differential distributional effects on local communities within the context of agroecological zones. At the national level, discontinuities in growth performance adversely affect the nutritional status of the citizenry, disrupt foreign exchange earnings from agriculture and frustrate national efforts to exploit comparative advantage. In addition, discontinuities, regardless of the source, create great uncertainty which in turn results in levels of agricultural investment that are lower than they would otherwise have been.

The allocative (investment) consequences of discontinuities are relatively easier to track than the distributional consequences: who are the gainers and the losers? Are there mechanisms for the gainers to compensate the losers? Suppose there is a bumper harvest of prices from good weather or from efficient distribution of farm inputs in a given season. And suppose that because of the primitive state of rural feeder road and other transportation facilities and on-farm storage facilities, huge stock-piles of grains are sold off at give-away prices to rural market operatives. Assume that the collapse of the rural grains market leads farmers to drastically cut down on grain production in the following season. The lack of credit facilities forces farmers badly in need of cash to part with their grains even during scarcity. Or the scarcity might have been caused by bad weather - the income effects on a credit - constrained rural populace are the same. Such discontinuity imposes losses on farmers and confers benefits in varying degrees on grain merchants, processors, money lenders and consumers. In political regimes with a high degree of mass illiteracy and social disarticulation, there are no effective mechanisms via the budgetary process for gainers to compensate the losers.

It is tempting to approach the problem of sustainability from the supply side alone - focusing on the technological and institutional sources of nonsustainability. Such treatment will emphasize the national macroeconomic causes such as exchange rates, domestic inflation, wages, tariffs and nontariff barriers, monetary and fiscal policy, and interest infrastructural and input supply back-up, the external sector and institutional arrangements. But sustainability should not be just a supply-side phenomenon, with the lack of it being explained away by an appeal to supply side factors alone. What are the sources of demand for sustained growth performance? African countries have so far been able to get away with nonsustainable growth performance by resorting to food and fibre imports, external loans, grants and emergency relief during periods of domestic supply shortfall. Urban political coalitions have been able to influence the allocation of foreign exchange and aid to protect the nutritional status of urban dwellers during periods of domestic food availability decline. Food imports and emergency food aid have diluted the price and income effects of production shortfalls at the farmgate. The rural majority - the main losers from nonsustainability of African

agriculture - are unable to articulate their demand for sustainable growth performance from the political class. This inability to articulate the demand for sustainability rests on two pillars: illiteracy and the wide spatial dispersion of smallscale farmers which makes social mobilization for a common cause very difficult. Distinct pressure groups built around small coalitions (poultry associations, especially when it has a strong membership of retired army generals, civil servants, etc., owners of plantations of perennial crops, etc) tend to exert more effective leverage over the policy process to demand sustained agricultural growth performance, at least the sustained prosperity of their industry (Olson, 1965). The search for sustainability must therefore address both the supply and demand sides.

Policy Issues For Sustainability

Discussions of sustainability issues must indicate some sense of order so as to aid the process of setting priorities in the allocation of resources to attain sustainable growth and development performance. Four classes of issues are treated in decreasing order as source of nonsustainability: institutional arrangements and the policy environment, macroeconomic policies, agriculture and the rural sector and the external sector. Interactions between these classes are also important for sustainability.

Institutional Arrangements and the Policy Environment

There are several critical issues.

(i) Changing Perceptions of the Role of Government in Agriculture

Changing perceptions of the role of government in agriculture are a major cause of unsustainable growth performance of developing agriculture. The period following the First World War and the Second World War witnesses the development of export crop economies with their reliance on private farmers, small or big. Government intervention centered around the development of transportation facilities (road and rail) linking the hinterland with the seaports, together with the development of panterritorial and national research institutions. In West Africa, the focus was on the smallscale farmer for both annual and perennial crops; in East Africa with a settler element, plantations were developed.

The decade of independence with its euphoric launching of national development plans emphasized a strong role for government in national economic affairs, including agriculture. Public revenue for an activist government role in national economic life often came from taxes on agriculture. Given reasonably price elastic supply curves, output of activist government role in national economic life often came from taxes on agriculture. Given reasonably price elastic supply curves, output of

traditional export crops in many countries fell in response to the sustained heavy crop taxation in many countries. In Nigeria, the growth performance could not be sustained: cocoa production fell from an annual average of 225,297 tonnes during 1965-67 to 107,331 tonnes during 1979-81; groundnut production fell from an annual average of 834,290 tonnes during 1964-66 to 17,940 tonnes during 1979-81; cotton production fell from 135,558 tonnes during 1963-65 to 91354 tonnes during 197-81 and palm oil exports from an annual average of 188,400 tonnes during 1953-57 to zero tonnes during 1979-81. The degree of taxation had also varied over time. Marketing board taxes on cocoa as a proportion of potential producer price per tonne of cocoa ranged from 19.67 percent during 1956-58 to 48.30 percent in 1946-48; percentage taxation in cotton ranged from 10.37 percent during 1965-67 to 36.53 percent during 1952-54; in groundnuts from 7.10 percent during 1958-60 to 27.0 percent during 1953-55; in palm, oil, producer price as share of world price ranged from 44.4 percent during 1963-67 to 62.0 percent during 1953-57 and in palm kernels, the corresponding figures ranged from 50.2 percent during 1963-67 to 62.0 percent during 1953-57 and in palm kernels, the corresponding figures ranged from 50.2 percent during 1963-67 to 60.9 percent during 1948-52.

Direct government intervention in Tanzania resulting in the nationalization of prosperous private sisal estates has resulted in these estates being overrun by weeds and a dramatic fall in production. ^{1/} Only recently has the process of denationalizing these estates begun, after years of policy - induced stagnation and decline. ^{2/} The 1960s and 1970s witnesses a spate of establishment of (publicly owned) state farms in which national governments, ostensibly in a hurry to solve the food and agriculture problem in Africa, proceeded to establish large-scale mechanized farms to product staple foods and fibre. This had four major consequences. First scarce public resources (financial and managerial) were tied down in roles that the state was least prepared for, leaving little or nothing for public investments in the rural infrastructures and the strengthening of national agricultural research system. Second, the erroneous belief gained ground, against mounting evidence, that the public, rather than the private sector, held out hope for agricultural transformation. Third, public programming for the private farmer received

^{1/} Sisal production declined from 81,000 tonnes in 1970/71 to 80,000 tonnes in 1981/82; cashewnut production grew from 126,000 tonnes in 1971/72 to 143,000 tonnes in 1973/74 only to decline to 40,000 tonnes by 1981/82 and cotton production declined from a peak of 76,000 in 1972/73 to 44,000 tonnes in 1981/82 (World Bank, 1983).

^{2/} In Nigeria, the National Livestock Production Company was established in the 1970s to engage, as a federal parastatal, in direct livestock production. In 1985, the Company was scrapped, but not until it had guzzled N21 million without showing profit in any single year.

only lip service support, with public attention focused on the promised deliveries from the state farms. As a result, earlier government investments in rural infrastructures were not sustained, both in terms of new capital investments but also in terms of needed public maintenance of constructed infrastructures. Fourth, nationalization of private estates provided a great investment disincentive which discouraged new investments in agriculture especially by the organized private sector. In Nigeria, UAC and Lever Brothers lost their oil palm estates to rather a typical government nationalization, making these companies dependent entirely on purchases supplies of needed raw materials, including embarrassingly large quantities of imported vegetable oils that could have been produced from domestic resources.

(ii) Parastatal Syndrome and the Plurality of Public Institution in Agriculture

Generations of public parastatals have been created in most African countries as vehicles for translating an activist state role in agriculture into action (Table 1). The plurality of public institutions in agriculture has resulted in overlapping functions and duplicated roles and uneven flow of public support services for African agriculture (World Bank, 1983). Public parastatals are often under pressure to produce physical results regardless of economic profitability and have therefore gone through cycles of false starts and dashed hopes. High staff turnover, partly the result of frequent changes in political regimes (more on this shortly), has meant little or no sustained and consistent programming from these parastatals.

(iii) Political Instability and Sustainability

High political instability has made sustained agricultural growth and development performance almost impossible in most African countries. Political instability results in four types of changes in the policy environment of direct relevance for sustainability. First are the changes in programme priorities introduced by new regimes, civilian or military. Changes in priorities produce changes in public resource allocations which affect policy sustainability and growth performance. Second are policy or programme changes of a largely cosmetic nature, meant to give a semblance of change when in fact nothing has changed. Third are changes produced by changes in the public bureaucracy, the traditional source of policy advice. Fourth is the loss in sustainability caused by the "learning lag," the time required by new political and bureaucratic leadership to study the files and get informed on policies and programmes of the previous "discredited regime."

Tables 2 and 3 present evidence on frequent changes in the political and administrative leadership of the Ministries of Agriculture at both the federal and state levels. From Table 2, while Nigeria had 6 Heads of State during the period, there were 9 political heads and 7 administrative heads of the federal Ministry of Agriculture. From Table 3, Oyo State had 13 political heads and 20 administrative heads of the State Ministry of Agriculture and Natural Resources, after adjusting for repeat posting to the Ministry. With such high staff turnover at the political and bureaucratic levels, programme sustainability becomes difficult.

Table 1: Agricultural Parastatals in Tanzania, 1983

<u>Parastatal</u>	<u>Function</u>
A. <u>Agricultural Marketing</u>	
1. National Milling Corporation	Sole rights to buy domestically produced grains and import when necessary
2. Sugar Development Corporation	Sole rights to market, export and import sugar
3. Tanzania Cotton Authority	Sole rights to purchase and export cotton
4. Coffee Authority of Tanzania	Sole rights to purchase and export coffee
5. Tanzania Pyrethrum Board	Sole rights to purchase and export pyrethrum
6. Tobacco Authority of Tanzania	Sole rights to purchase and export tobacco
7. Tanzania Tea Authority	Sole rights to purchase and export tea
8. Tanzania Sisal Authority	Sole rights to purchase and export sisal
9. Cashewnut Authority of Tanzania	Sole rights to purchase and export cashew
10. General Agricultural Products	Monopoly rights to purchase and export a range of minor crops
C. <u>Agricultural Credit</u>	
B. <u>Agricultural Production</u>	
11. National Agricultural and Food Production	Principally wheat and rice production
12. Rilombero Sugar Corporation	Sugar production
13. Tanganyika Planting Company	Sugar production
14. Mtwimba Sugar Estates	Sugar
15. Dairy Farming Corporation	Livestock and milk production
16. National Ranching Corporation	-
17. Tanzania Rural Development Bank	-
D. <u>Agricultural Inputs</u>	
18. Agricultural and Industrial Supplies Company	Importation of agricultural inputs and equipment.
19. State Motor Corporation	Sole rights to import vehicles and spare parts.
20. Tanzania Fertilizer Company	Production and marketing of fertilizer production and marketing of seed
21. Tanzania Seed Company	Production and marketing of seed
E. <u>Agricultural Research, Extension and Education</u>	
22. Tanzania Agricultural Research Organization	Generation of new technology
23. Tanzania Livestock Research Organization	
24. Uyole Agricultural Centre	
25. University of Dar-es-Salaam	
F. <u>Transport and Retailing</u>	
26. Regional Trading Corporation	Food crop retailing
27. Regional Transport Companies	Provision of transport services

Source: World Bank.

Table 2. Frequent Changes in the Political and Administration Leadership of Federal Ministry of Agriculture, Nigeria 1969-86

Political Leadership			Administrative Leadership		
Title	Office Holder	Period	Title	Office Holder	Period
Commissioner	A Y Gusau	1969-72	Under Secretary (Agric.)	n.a.	1968/69
Commissioner	J O Okezie	1972/75	Permanent Secretary	Ige	1969-72
Commissioner	A Adetoro	1975-76	Permanent Secretary	B Shaib	1972-74
Commissioner	B O Mafeni	1976-79	Permanent Secretary	B S Oloruntoba	1974-77
Minister	I Gusau	1982-83	Permanent Secretary	M Liman	1977-83
Minister	A Ciroma	1984-Aug85	Permanent Secretary	N O Popoola	1983-March 1986
Minister	A Akinrinade	Sep.85-Sep.86	Permanent Secretary	J Edozien	March 86 to date
Minister		Sep.86 to date			
Minister	G Nasko				

Source: Federal Ministry of Agriculture, Water Resources and Rural Development, Ibadan.

Note: By comparison, the political leadership of Nigeria has changed as follows in recent times.

Title	Office Holder	Period	Remarks
Head of State	Y Gowon	July 29, 1966 - July 29, 1975	(Military)
Head of State	M Mohammed	July 29, 1975 - Feb. 13, 1976	(Military)
Head of State	O Obasanjo	Feb. 13, 1976 - Sept.30, 1979	(Military)
President	S Shagari	Oct. 1, 1979 - Dec. 31, 1983	(Civilian)
Head of State	M Buhari	Jan. 1, 1984 - Aug. 28, 1985	(Military)
President	I B Babangida	Aug. 28, 1985 to date	(Military)

Table 3. Frequent Changes in the Political and Administrative Leadership of
Ministry of Agriculture and Natural Resources, Oyo State of Nigeria 1954-86

Political Leadership			Administrative Leadership		
Title	Office Holder	Period	Title	Office Holder	Period
Minister	G Akin-Deko	1956-59	Director of Agriculture	H H Croucher	1954-56
Minister	Adeyi	1959-60	Permanent Secretary		
Minister	n.a.	1960-62	Permanent Secretary	P H Palmer	1957-59
Minister (Jnr)	S O Onabamiro	1962-63	Permanent Secretary	I D Cameron	1960
Minister	Z A Opaleye	1965-66	Permanent Secretary	C C Taiwo	1961-62
Commissioner	Bola Ige	1967-69	Permanent Secretary	T S B Aribisala	1963-65
Commissioner	G A Asiru		Permanent Secretary	T O Ejiwumi	1966
Commissioner	O Ogunsola	1974-76	Permanent Secretary	T S B Aribisala	1967-68
Commissioner	M O Ogunlana	1976-78	Permanent Secretary	M A Akintomide	1968-73
Commissioner	A Babalola	1978-79	Permanent Secretary	M S Adigun	1973-74
Commissioner	Ayo Ojewumi	1979-83	Permanent Secretary	T A Akinyele	1974-75
Commissioner	V O Ojutalayo	01-1984-08-28-85	Permanent Secretary	V O Oduntan	09-1975-10-75
Commissioner	Mrs. Abimbola	09-1985-09-1986	Permanent Secretary	J O Akinwolemiwa	11-1975-03-76
Commissioner	Asafa	09-1986 to date	Permanent Secretary	S Babalola	04-1976-03-77
			Permanent Secretary	S Alabi Ogun	11-1978-79
			Permanent Secretary	D A Folorunsho	1979-80
			Permanent Secretary	N O Ogunjide	1980-81
			Permanent Secretary	T Farotimi	1982-83 (Agric)
			Permanent Secretary	D A Abinusawa	1982-83 (Natural Resources)
			Permanent Secretary	D O Elliot	10-1983-01-84
			Permanent Secretary	P O Ishola	1984-85
			Permanent Secretary	K Adeleke	1985 to date

Source: Ministry of Agriculture and Natural Resources, Ibadan.

agricultural sector), what are second best solutions for attaining sustainability in agriculture? First, within a given regime, public bureaucratic and policy makers must ensure good policy formulation and effective implementation so that poor agricultural performance does not in itself constitute a source of political instability (urban food riots). Second, policy formulators must strive for a minimum core package on which there is general consensus that is regime neutral. Such minimum package must be widely disseminated - quite often, policies are embarked upon without explanation for the benefit of all potential food and agricultural policy participants, including army majors and generals. Otherwise good policies get discarded out of extremely limited understanding of the merits.

Macroeconomic Policy Issues

(i) Exchange Rate

Overvalued exchange rates have made sustained growth of developing agriculture, especially in Africa, difficult. At the output level, artificially cheap food imports have had negative effects on sustainable growth. First, cheap food imports have progressively created investment disincentives for domestic substitutes. Second, cheap food imports had led to a failure to identify the structural and policy constraints of the domestic food system as a prelude to the formulation and effective implementation of policy prescriptions and projects. Third, food imports have encouraged half-hearted execution and, quite often, the abandonment of on-going food production projects by providing a false sense of security. Fourth, there has been undue concentration of policy attention on the food consumption needs of the urban populace with little attention to the sustained production performance of the rural majority. Fifth, the production gains of African export crop economies have not been sustained because of the heavy tax on export crops implied by the overvalued foreign exchange rates. The political leadership of newly independent African countries have been more concerned with their continued stay in office by subsidizing urban food consumption through overvalued exchange rates than with the sustained performance of export crop economies. The international donor community has always been available to bail out those in need. 3/

As countries implement different versions of structural adjustment programmes utilizing a variety of exchange rate paradigms, what will be the results from the realignment of relative prices of tradables and non-tradables? Five issues are pertinent for sustainability within the context of structural adjustment programmes and exchange rate adjustments. First is the set of policy instruments needed to raise the supply price elasticity of export crops, with emphasis on the physical infrastructural

3/ See Schuh, 1986

imperatives of the export economies. Second, the supply price elasticities of domestic substitutes for food imports must be raised. Third, special stress must be placed on drastic reforms of rural capital markets to make credit readily available to farmers (especially smallscale) if farmers are to benefit from the new producer prices. Otherwise, the gains from devaluation will accrue to middlemen, merchants, transporters money lenders and other market operatives who provide farmers with cash when they need it most. Fourth, monetary, fiscal and incomes policies must not result in inflationary spirals that will result in a depreciation rather an appreciation of the real exchange rate. Otherwise inflation will negate the gains from devaluation: while devaluation in Kenya during September 1981 - September 1982 raised the shilling price of the dollar by 16.8 percent, the increase in the consumer price index over the same period was 22.3 percent, wiping out the gains from devaluation.^{4/} Fifth, sustainability of the gains from devaluation would require complementary trade liberalization and a rationalization of the entire tariff structure, preferably with minimum time lag, again to moderate the inflationary consequences of devaluation and streamline the degree of protection across sectors.

On farm inputs, imported fertilizers, pesticides and farm machinery and implements become more expensive after devaluation, a move that realigns relative factor prices with relative factor scarcities. The real issue is how to contain the political opposition to the new farm input prices without resorting to multiple exchange rates, with special rates for agriculture and other preferred sectors. Should the erstwhile implicit input subsidies conferred by overvalued exchange rates be maintained at their old rates after devaluation? And how about the fiscal (deficit financing) consequences which tend to be inflationary? And would the initial gains in new technology adoption not be lost? The farm input subsidy question will be treated shortly.

The distributional consequences of structural adjustment programmes threaten sustained enhancement of the nutritional status of the poor. The removal of farm input subsidies has consumption as well as production consequences in production regimes with high levels of subsistence. Nutrition gains by poor segments of the farming population during the subsidy era cannot be sustained under structural adjustment.

^{4/} The data below shows trends in nominal and real effective exchange rate changes, in selected african countries, 1972-82.

Country	Nominal Effective Exchange Rate				Real Effective Exchange Rate			
	1977	1980	1981	1982	1977	1980	1981	1982
Kenya	100	98	91	84	100	108	100	100
Mauritius	100	76	73	70	100	100	97	95
Madagascar	100	104	97	78	100	113	22	95
Somalia	100	90	75	58	100	142	153	124

Source: World Bank (1983), Table 5, p. 25.
(IDS, Bulletin, July 1985)

Sustainability of the gains of structural adjustment programmes and exchange rate adjustment is not a unidirectional supply-side phenomenon. What are the sources of demand within the political and socio-economic system for the sustainability of gains from macroeconomic reforms? The losers from exchange rate adjustments (devaluation) include the urban elite consumer groups (wage earners, public bureaucrats, the intelligensia, the army, the labour unions, the media, etc) who must now pay more for imported food and nonfood items. Given the disproportionately heavy share of food in the urban consumer food basket, there is serious erosion of urban real incomes that urban interest and pressure groups will fiercely struggle to protect in the name of "political and economic nationalism," a last ditch "battle with imperialists and their agents," etc, conveniently forgetting the interests of the rural majority in structural adjustment programmes. Owners of large scale mechanized farms initially attracted into farming by overvalued domestic currencies will articulate their opposition to devaluation as they suddenly find farming operations unprofitable. Erstwhile beneficiaries of corrupt import licencing schemes and other quantitative controls will mount fierce opposition and try to sabotage the new arrangements. The farmers, especially the smallscale farmers with little input import dependency, the main intended beneficiaries of structural adjustment reforms, are unable to articulate their needs for sustainable performance under new macroeconomic reforms. The donor community has an interest in sustained performance with structural adjustments and their funding leverage often turns out to be the effective demand for reforms and sustainability. To continue to blame policy reform failures on perennial policy mistakes is no longer adequate as it fails to explain the persistence of such failures and mistakes, from country to country and, within the same country, from year to year.

(ii) Tariffs and Nontariff Barriers

Frequent changes in tariffs and nontariff barriers pose serious problems for sustainability in African agriculture. First, they send confusing price signals to farmers as to what to produce in crops, livestock and fisheries. The distributed lag effects on investment in perennial crops and the uncertainty factor as expectations get built up each time all reduce farm investments below what they would otherwise have been. Responses to investment incentives get blurred because of basic uncertainty as to the permanence or durability of the new policy, with or without a change in government.

Part of the problem lies in the traditional exclusion of the Ministry of Agriculture from the process of setting tariffs in the annual budget exercise, an exercise usually reserved as the prerogative of the Ministry of Finance. Tariff and nontariff changes are therefore often effected not in accordance with the priority needs of agriculture but in response to powerful pressure groups.

On the demand side, the generality of farmers are not organized to lobby Ministry of Finance for changes in tariffs and nontariff barriers that are in their sectoral interest. It is within the context of structural adjustment programmes that the international demand for stable and rational system of tariffs and nontariff barriers hopes to become effective by being a loan conditionality.

Second, frequent changes in tariffs and nontariff barriers introduce instability in the demand for new technologies, farm investments and therefore in the supplies of farm produce. Policy-induced shifts in the supply curves of farm produce threaten sustainability in growth performance of agriculture. When production gains are not cumulative, agricultural systems are unable to meet the challenges posed by growth in population and income.

(iii) Wage Rates

Wage earners in all African countries have benefited from periodic increases in institutionalized urban minimum wages in the public and organized private sector since 1960. The linkages between urban and rural labour markets have guaranteed a secular increase in rural wages, the bulk of farm production costs in smallholder agriculture. Whenever the rate of increase in wages has exceeded the rate of increase in nominal farmgate (crop) producer prices, real producer prices have fallen and threatened sustained growth and development performance. Part of the problem arises from the spatial asymmetry of prices: for while farmgate prices of crops remain low as a proportion of retail food prices, rural wages as a proportion of urban minimum wages for unskilled workers appear relatively high, at least in Nigeria. Rural wages have also been upwardly induced by the boom in public administration and services as well as in construction. Farming has simply not been profitable. Countries without an effective producer price support scheme or a rural infrastructures development programme have their agriculture caught in a double squeeze: depressed farmgate producer prices and inflated farm labour wages and production costs. The problem has been exacerbated by the fact that the new technologies have been demanding in additional labour requirements for peak farming operations. Technologies that initially appear profitable from farm models soon become unprofitable with the continuous upward drift in rural wages.

(iv) Rural Infrastructures, Rural-Urban Differentials and Sustainability

That urban-rural wage differentials have induced massive rural-urban migration is well documented. What has not been well documented is the gross rural-urban disparities in the provision of basic social amenities like hospitals, maternity centres and dispensaries, potable water, electricity, etc. The recent comprehensive survey of rural infrastructures in Nigeria (Idachaba, 1985) reveals (i) gross inadequacies in per capita supplies of rural infrastructures (ii) great rural-urban disparities in available infrastructures and (iii) considerable variation in the distribution of amenities within each state of the federation. Observed massive drift from rural to urban areas is not just a response to a rural-urban wage differentials but a response to a rural-urban quality of life differential (See End Tables A1-A4).

Agricultural Sector Policy Issues of Sustainability

(1) Rural Roads and Water Supplies

Export crop economies in Africa tended to be restricted to limited geographical enclaves that could be accessed by a limited network of roads linked to seaports. Such transportation networks were able to bear the export crop traffic without major breakdown. Production for the food crop and agro-allied economy, however, is spatially much more widely dispersed and the requirements of rural roads and rural markets therefore much more extensive, involving linkages of surplus producing areas with the main food deficit (largely urban) areas of these countries. Three issues are pertinent for sustainability. First is the design of rural transportation networks that will link up surplus production areas with primary, secondary and terminal markets. Second is the evolution of criteria for assigning fiscal responsibility for rural road construction and maintenance among different tiers of government (federal, state and local). Third is the maintenance of rural roads. In Nigeria, rural roads have traditionally been the responsibility of the lowest and the poorest tier of government (local). The design of World Bank-assisted Agricultural Development Projects (ADPs) with their emphasis on extension and improved input distribution to accelerate food production required extensive networks of feeder roads if production gains were to be sustainable. Table 4 presents data on feeder road construction in selected ADPs. Completion of the projects has revealed the following critical issues of sustainability of these roads and other rural infrastructures, among others:

Table 4. Rural Feeder Road Construction by World Bank-assisted Agricultural Development Projects (ADPs), Nigeria

ADP	Length of Feeder Road Constructed (km)	Rural Road Density (m/km ²)	Remarks
Ayangba	1,561	118.71	Enclave
Bauchi	1,057	16.02	Statewide
Bida	620	36.47	Enclave
Ekiti-Akoko	78	15.6	Enclave
Ilorin	72.2	6.13	Statewide
Kano	745.1	17.33	Enclave
Lafia	469	23.51	Enclave
Oyo North	221	17.95	Enclave

Source: Federal Agricultural Coordinating Unit (FACU).

- criteria for locating rural feeder roads must give heavy weight to actual and potential agricultural production, rather than focus on linking human settlements, the locations of which may have more to do with source of drinking water than with agriculture;
- the local government as the lowest administrative unit must be involved in the original design and construction of the roads to build up capabilities for repair and maintenance of the roads after project completion; this requires the development of a culture of commitment, backed up by political will at the local level, to the network of rural infrastructures left at the end of the project in the form of technical personnel resources and the funding of recurrent costs;
- local communities must not only be involved in the selection of roads and other infrastructures but must be involved in their repair and maintenance; and
- networks of project feeder roads, hand pumps for potable water supplies and other rural infrastructures have tended to collapse after project life because of the failure of the local governments to take over their maintenance and repair.

It is tempting to conclude from these experiences that rural infrastructures development basically lacks sustainability. The real problem is faulty project design that at best only makes passing reference to cooperation with local governments but is woefully deficient in concrete proposals for collaboration between local governments and project management units. The collapse of project roads and water pumps after project completion has resulted in (a) collapse of food and fibre production from the collapse of the network of rural markets for produce evacuation, (b) collapse of the flow of marketable quantities to the urban areas, (c) high road user charges, especially vehicle operating costs, (d) distorted rural market structures, conduct and performance, with a narrowing down from competitive structures to oligopolistic and oligopsonistic structures and (e) a loss in potable water supplies, with adverse consequences for health and time allocation in the rural areas.

Lack of sustainability in rural infrastructures rooted in faulty project design is only part of the top-down planning process so prevalent in African countries. Such planning approaches are fatally flawed by their failure to obtain sustained commitment of the local beneficiaries to the maintenance and repair of project infrastructures.

The larger problem is the failure to recognize that integrated rural development forms the foundation for sustainable agriculture. This calls for a shift from the materialistic functional view of rural residents as sources of marketable quantities of food and fibre to a humanistic view of the rural resident as a producer as well as a consumer, equally entitled to basic social amenities, possessing productivity value as well as a consumer, equally entitled to basic social amenities, possessing productivity value as well as yielding utility. Isolated sectoral approaches to agricultural development quickly run out of steam from the omission of the interactions and linkages between agriculture, health,

education, electricity, water supplies and rural institutions. But why has development programming neglected the rural sector? Viewed through urban eyes, rural development has focused largely on surplus resource extraction to feed the urban political economy. Surplus extraction approaches are not sustainable once the inherent contradictions (such as gross urban-rural disparities in supply of amenities) become apparent. Rural development viewed through rural eyes remains an unrealized dream, largely because of the inability of the rural people to organize and articulate rural needs and partly because urban interest groups stand to lose from enhanced political consciousness of rural people and so do not allocate resources for rural social mobilization (de Janvry, 1981; Idachaba, 1986; Tandler, 1982).

(ii) Drought, Irrigation and Pest and Disease Outbreaks

Drought, pest and disease outbreaks cause discontinuities in production, reduce net food availability and result in food entitlement exchange failures and nutrition collapse. The challenge is for African agricultural systems to reduce their vulnerability to natural and manmade threats to sustained growth performance. The development of irrigated agriculture has been hampered by overdesigned and overbuilt large scale dams to neglect of smallscale and medium scale irrigation facilities. First generation irrigation facilities in Nigeria are known more for their grandeur and engineering spectacle than for the total hectareage irrigated and the number of farm families covered, relative to capital costs. The overwhelming dominance of engineers and rent-seeking bureaucrats and politicians in the irrigation policy process explains some of this "big is beautiful" syndrome. The political leadership admires large dams to parade as "success stories" but these large scale schemes and their attendant problems of human resettlements often sow the seeds for social unrests. In February 1980, there was large scale riot by farmers at one of Nigeria's largest dams during which many people lost their lives - they were protesting against the nonpayment of compensation.

The large dams have not contributed their quota towards food security and sustainability because:

- they irrigate only a small percentage of total arable land and do not reduce the near total dependence on rainfed agriculture;
- they are heavily dependent on foreign technical personnel for construction, operation and maintenance and therefore subject to abrupt personnel changes in response to changes in service conditions for expatriates;
- they are overdesigned, overbuilt, too management-intensive and prone to large cost overruns; they also do not provide insurance against prolonged droughts;
- they are externally imposed structures not involving the local communities and the lower tiers of government; and

- the construction, maintenance and repair to larger scale dams is foreign exchange-intensive resulting in a large collection of half-completed and abandoned projects during periods of foreign exchange squeeze.

But why have large scale dams continued to be built inspite of mounting evidence against their effectiveness in different parts of Africa and the developing world? the "large dam lobby" has been at work, consisting of engineers, foreign consultants, the political and bureaucratic leadership of African countries and their suppliers, to mention a few. Countries have borrowed and continue to borrow scarce foreign exchange to build large dams that promise benefits to only a few farm families and cover only a tiny fraction of total arable land.

Smallholder production is widely dispersed across different ecological zones. Irrigation facilities, if they are to have enduring benefits, must be equally widely dispersed, a requirement that cannot be met by the large dam approach. Through such dispersal of facilities, countries can ensure sustained production and national food security within the framework of "compensating weather failures," whereby weather failures in one ecological zone could be compensated by good weather in another.

In the absence of large domestic stocks of grains or food imports or food aid, large percentage deviations of domestic food production from trend values in some years would lead to serious food entitlement failures and possible famine. Sustained access to food at all times would require dramatic increases in the share of the irrigation budget and in the share of smallscale and medianscale irrigation in countries' total irrigation programmes.

For sustainable agricultural performance, is the irrigation constraint both a supply and a demand problem? The demand for irrigation water has always existed but the articulation of cost effective national irrigation policies has been lacking. Potential beneficiaries are farmers in dry marginal areas who are not part of the policy process. Guidelines and cost recovery measures need to be worked out for assigning fiscal responsibility for the construction, maintenance and repair of irrigation infrastructures among different tiers of government as well as local communities.

Efforts to combat pest and disease outbreaks have been too little, too late and ineffective. Recent outbreaks of rinder pest in West Africa have exacted a heavy toll on livestock while the perennial locust and quelea bird invasion has caused heavy losses for the grains economy of Northern Nigeria and other Savannah regions in West Africa. Minimizing the discontinuities to domestic agricultural production requires not only efficient, fast and flexible domestic responses but also international coordination within a regional context.

(iii) Agricultural Pricing Policies

Many African countries have operated marketing board crop taxes as if the supply price elasticities of these crops were zero and as if the

elasticity of tax revenue with respect to the tax rate would be always be positive. The drastic fall in output of export crops and the loss of Africa's share in World markets suggests the contrary. Heavy crop tax regimes have rendered export crop production unprofitable, relative to onfarm and off-farm opportunity costs and relative to escalating farm production costs. On the demand side, the urban political class has needed crop tax revenues to finance expenditures primarily of benefit to urban dwellers. This has been dressed up as variants of the "vent for surplus" model in which agriculture was seen in official planning documents as the source of the surpluses to finance dubious import substitution nindustrialization programmes (Nigeria, Second National Plan, 1970-74).

Nigeria sold oil palm seedlings developed at the Nigerian Institute for Oil Palm Research to Malaysia in the 1960s. By 1985, Nigeria had fallen from its position as a leading exporter of cocoa in the 1960s to the fourth position by the 1980s. Nigeria has moved from a position of major exporter of cotton in the 1960s to become a major importer of cotton in the 1980s. Ghana has moved from an annual average production of 400,000 tonnes of cocoa in the early 1970s to 158,000 tonnes during 1983/84.

The long term growth consequences of heavy crop taxation must be balanced against the revenue needs of resource-poor countries that rely on crop tax revenues as the primary source of revenue (Mali, Senegal). Five issues arise. First is the appropriate level of tax for given supply price elasticities of crops. Second is the production consequence of taxation. Third is whether a significant part of crop tax revenue is used to finance appropriate supportive infrastructural development in the main crop producing areas or whether the tax revenue ends up erecting five-star hotels, township stadia and breweries in the state capital or even in running electioneering campaigns. Some taxation could be justified provided the egg that lays the golden egg is not killed in the process. Fourth is revenue diversification to reduce the pressure on agriculture to finance general development. Finally, crop tax regimes must not be regressive in order not to impose relatively heavier tax burden on the poorer segments of the rural population.

(iv) Producer Price Support Schemes

Producer price support schemes have been advocated for five main reasons. First, given reasonably price elastic supplies for farm commodities, producer price incentives will stimulate production, "the production or output effect". Second, producer price incentives will encourage new farm investments and accelerate long term growth, the "capacity effect". Third, producer price incentives and guarantees reduce market uncertainty and risk and assist in building up the market confidence so essential when market infrastructures are in a primitive state - this is the "market confidence effect." Fourth, producer price incentives are used to encourage production of priority commodities within the context of a national food policy, the "allocative effect." Finally, producer price incentives could be used to compensate farmers for other explicit or implicit taxes, to transfer incomes to the rural sector as is the case with countries benefiting from resource windfalls (such as petroleum) - this is the "income compensating or distribution effect."

The powerful role of producer prices in the accumulation of food surpluses has been illustrated with several country experiences. The sustenance or production gains depends significantly on price guarantees. In Nigeria, World Bank-assisted ADPs introduced fertilizer-responsive maize varieties to the Savannah zones in 1974/75 where maize was not a traditional crop in the average farmer's production or consumption portfolio. Thus, the elasticity of marketed surplus with respect to production could be presumed to be very high. The supply price and marketed surplus price elasticities could therefore be presumed to be very close. There were bumper harvests in 1978/79, 1982/83 and 1985/86. For a crop that is not a staple, income effects of bumper harvests on own-household consumption among producers is minimal, meaning that bumper harvests literally translate into marketed quantities. The three bumper years witnessed a virtual collapse of the maize market in the main producing areas. Prices plummeted. As at November 1986, maize sold for N350.00 per tonne in Funtua market (Kaduna State), compared with N1000.00 in average years. The gains from years of encouragement and support are threatened by bumper harvest and price collapse. Government producer price support schemes have been of little assistance in these years because (a) government storage capacity ten years after the launching of a storage programme has only achieved 36 percent of the target to achieve within the first five years, (b) agents of the Nigerian Grains Board cannot be found at the farmgate and when found, they are unable to pay farmers for one or two years, with the result that farmers auction off their maize harvests middlemen, money lenders and other agents who pay for the grains cash down and, (c) the Nigerian Grains Board does not have the expertise in procurement logistics with respect to timing of market entry, stocks, inventories and deliveries, etc. ^{5/}

But why has the private sector not responded? Merchants require substantial capital sums to erect networks of warehouse and fleets of trucks that will ply networks of feeder roads that are mainly seasonal, leading to prohibitive vehicle operating costs. But why do the commercial banks not give credit for grain trading? Investigations by the author (June 1986) show that banks insist on merchants having an assured market (as is the case with merchants acting as buying agents of the Nigerian Grains Board) so as to minimize the risk of loan default if there should be a quick succession of bumper harvests.

^{5/} In Tanzania, a Government commission has noted that: "issues which prevailed at all times and in all regions were (a) Authorities/Corporations failing to buy crops on time, (b) Authorities/Corporations not paying peasants their dues after collection of produce, and (c) Authorities/Corporations not transporting crops early enough from the villages, "with the result that "this has caused peasants to reduce or abandon completely the farming of crops being purchased by the Crop Authorities/Corporations" in URT. Report of the Prime Minister's Commission of Inquiry into the Possibility of Reestablishing Cooperative Unions in (World Bank 1983).

To complicate matters further, maize for livestock is consumed mainly in Southern Nigeria where, with the large urban populations, the poultry industry is not fully developed. Feed mills located in the South do not have the storage capacity for carry over stocks from year to year.

In addition, new private merchants are cautious about entering grain trading and commodity speculation in order not to hurt the political sensibilities of populist regimes. In 1984, a prominent private grain trader in Kaduna State, the leading producer of marketed maize surpluses, was reportedly arrested and detained by the State Governor or his agents. His crime: hoarding and speculation. Potential grain merchants still recall this incident with grave concern about the social stigma attached to such labels.

When incentive prices exceed market price, governments may find it necessary to sell accumulated stocks to urban consumers and industrial users at subsidized prices. Resulting budget deficits especially when financed with credit from the banking system tend to be inflationary. In Tanzania, the National Milling Corporation had operating losses of Tsh 470 million in 1980/81, 31 percent of its turnover of Tsh 1,525 million. Huge budget deficits resulting in high inflation rates are clearly not sustainable from the view point of domestic economic stability. ^{6/} Once a government gets locked in a quandary of producer price incentives and consumer price subsidies, strong political will is required to phase out urban food subsidies and unrealistic producer price incentives in a strong contest of competing interest groups. In SubSaharan Africa, there are no large pockets of the landless poor in most countries. The variance in personal incomes and in food entitlements which can be explained by the variance in land holdings can, on the average, be presumed to be small. Abstracting from famine episodes, massive urban food entitlement failures are unlikely if governments did not operate extensive urban consumer food price subsidies. Care must be taken not to transfer Asian solutions to the African environment when circumstances are markedly different. While food rations and massive urban consumer food price subsidies might be eminently sensible and indeed necessary in India, Bangladesh and other Asian countries, the structural factors which recommend them do not exist in most of Africa. When one takes cognizance of the corruption of centralized public bureaucracies in much of Africa, consumer food price subsidy schemes are clearly not sustainable.

The persistence of corruption in public food distribution systems suggests, like in most public programmes, the need to distinguish between "normal" and "real" intended beneficiaries. While the nominal intended beneficiaries may be the urban poor, the real intended beneficiaries may be merchants acting as procurement agents, transporters and landlords who rent storage space to the distribution agency, to mention a few. Vocal demand for consumer food price subsidies must be critically examined to ascertain the real intended beneficiaries.

^{6/} To meet parastatal overdrafts has required an expansion of Tsh 5 billion in the money supply over and above the Governments' official budget, or 12 percent of GDP... (this) has added substantial inflationary pressure in the economy" (World Bank, 1983).

(v) Farm Input Subsidies

Farm input subsidies within the context of political economy need to be seen in their allocative and income distribution roles. Policy issues for sustainability relate to (i) the capacity of the economy to sustain the allocative inefficiencies of subsidy schemes during periods of severe resource scarcity (ii) the capacity of the economy to sustain the fiscal burden of subsidies (iii) the relationship between public expenditures on farm input subsidies and total government revenue each year, with emphasis on the degree of co-movements during the upswing and the downswing (in revenue) (iv) the administrative sustainability of farm input subsidy schemes and (v) rigidities in administrative procedures for the execution of the scheme.

Pesticides and Fertilizer Subsidies in Nigeria:

Two Case Studies. Two recent Nigerian examples are used to illustrate the policy issues of sustainability: cocoa pesticide subsidies and fertilizer subsidies.

Cocoa pesticide subsidies have the longest history of consistent farm input subsidies in Nigeria. Launched by the Western Nigeria Government in April 1959, the scheme aimed at reducing the financial cost of pesticides, promoting their use and stimulating cocoa production through the effective control of pests and diseases of cocoa. Average annual expenditures on cocoa pesticide subsidies rose from N0. 486 million during 1959/60 - 1961-62 to N3,657 million during 1978/79 - 1980/81 and N5.567 million during 1984/85 - 1986/87. For insecticides, consumption of Gammalin 20 rose from an annual average of 182,000 litres during 1957/58 - 1958/59 (presubsidy period) to 1.773 million during 1969/70 to 1971/72. For fungicides, consumption of copper sulphate rose from an annual average of 171 tonnes during 1958/59 (pre subsidy) to 2572 tonnes during 1968/69 - 1970/71 and that of caocobre sandoz from 119 tonnes during 1961/62-1963/64 to 411 tonnes during 1969/70-1971/72. ^{7/}

The pesticide subsidy scheme was not sustainable in the long run in its original form for several reasons. First, marginal and inefficient cocoa farms could not be sustained indefinitely by being shielded from the pricing realities of the day, thereby preventing needed dynamic farm adjustments. Second, the subsidy fiscal burden meant that only a fraction of total requirements could enjoy subsidies - the system moved from one in which all cocoa farmers were intended to benefit to one in which only some farmers were able to benefit. Third, the system moved from being funded by state government partly through funds from taxes on cocoa to one in which the federal government alone assumed full responsibility for pesticide subsidies after the abolition of the taxation powers of marketing boards in 1974. Fourth is the problem of sustainability and enduring viability in the face of plurality of institutional arrangements for input subsidies in a federation where agriculture was mostly the constitutional responsibility of the states. Lack of harmonization of subsidy policies of different states resulted in pesticides flowing from high subsidy to low subsidy states. Fifth is the problem of sustainability when a scheme gets bogged down in bureaucratic snarls. Under the pre 1974/75 arrangement in Western Nigeria, three administrative steps were involved. One, the

^{7/} For data and detailed analysis, see Idachaba, 1981, 1977.

Ministry of Agriculture (Western Nigeria) issued a call circular to firms/suppliers inviting them to send quotations on prices of pesticides to enjoy subsidy in the coming subsidy (fiscal) year beginning April 1. During 1965/66 - 1974/75, the modal month in which the circular went out was January. Two, an interministerial meeting was convened after the receipt of quotations, to review the subsidy scheme in all ramifications. The modal month in which this meeting actually held during 1965/66 - 1974/75 was March, the last month before the statutory beginning of the subsidy year. ^{8/} The final administrative step was Executive Council approval. The modal month in which this approval was given during 1965/66 - 1974/75 was June, about three months after the subsidy year was supposed to have started. In fact, in 11 years during 1965/66 - 1975/76, in only one year (1971) was Executive Council approval given before April 1. In three of the last four years of this period, approval was given in July, almost four months after the subsidy year was supposed to have started. The excessive administrative delays caused hoarding of pesticides as suppliers and other operators held on to stocks in anticipation of public announcement of subsidies.

Year Date When Subsidies Were Announced (Nigerian Cocoa Board Era)

1977/78 9/9/77, 5 months after commencement of subsidy year.
1978/79 6/10/78, 6 months after commencement of subsidy year.
1979/80 24/6/79, almost 3 months after commencement of subsidy year.
1980/81 24/4/80, almost 1 month after the commencement of the subsidy year.

Source: Nigerian Cocoa Board, 1980.

Fertilizer Subsidies. Prior to 1976, state governments directly imported and subsidized fertilizers. In 1976, the federal government centralized all importation of fertilizer in the Federal Ministry of Agriculture to coordinate purchases and reap the benefits of quantity discounts, ease the financial burden of the states and ensure that fertilizers reach farmers.

8/ Month in which Interministerial Meeting on Subsidy Scheme was held, selected years:

Year

1968 Late April (about 1 month after commencement of subsidy year).
1969 May (about 2 months after commencement of subsidy year).
1970 June (about 3 months after commencement of subsidy year).
1972 May (about 2 months after commencement of subsidy year).
1974 May (about 2 months after commencement of subsidy year).
1975 June (about 3 months after commencement of subsidy year)

Source: Idachaba (1981)

The federal government subsidized fertilizer importation, port clearance and transportation to state warehouses to the tune of 75 percent, with farmers paying the remaining 25 percent during 1976/77-1978/79. States bore the costs of internal transportation within states. The federal subsidy was reduced to 50 percent in 1979/80 while states were to bear 25 percent of the subsidy plus the costs of internal distribution, when it became evident that the initial division of fiscal responsibility for fertilizer subsidies was clearly not sustainable. The subsidy programme has turned out to be nonsustainable because:

- the heavy fiscal burden of the subsidy scheme, combined with centralized procurement, has limited the quantity of fertilizer imports, thereby limiting the growth of fertilizer consumption, especially in the grain-legume states where farmers are willing to pay more than the subsidized prices if only they can get the fertilizers they need at the right time and in the right quantities;
- foreign exchange has dried up and Nigeria has had to obtain a fertilizer loan from the World Bank;
- the system of subsidies combined with government direct involvement in fertilizer distribution has produced major distribution inefficiencies and losses with the perennial late arrival of fertilizer well after the first rains, ^{9/} and
- panterritorial pricing did not encourage private sector participation in fertilizer distribution as government had no programme for reimbursing transportation and other marketing costs e.g., in the World Bank-assisted ADPs, projects incurred ADPs to the farm service centers. ^{10/}

^{9/} These delays have resulted in fertilizer applications well below recommended dosages, huge storage and warehousing bottlenecks and in losses from foregone yields of fertilizer-responsive varieties and in pilfering along the long distribution chains.

^{10/} Selling prices of fertilizer were set by Federal decree in 1976 in which the selling price of fertilizer was set to be N1.50 per 50 kg bag (compound N2.00). As a result the Projects (ADPs) suffered a considerable loss leading to depletion of the revolving credit fund. The Federal Ministry of Agriculture and Rural Development agreed to reimburse the projects up to 75 percent of the landed costs. The total amount involved and the amounts received so far are:

<u>ADP</u>	<u>Subsidy Refund Claimed</u>	<u>Subsidy Received</u>	<u>Loss to ADP</u>
Funtua	3,693,341	1,893,000	1,800,341
Gombe	1,163,266	1,107,000	56,266
Gusau	1,299,940	968,404	331,537

If the system of fixed selling prices continues and with subsidization only at 75 percent of landed costs, the projects will continue to suffer a shortfall ... under present prices and subsidy levels, as a further subsidy is required from state and federal sources to prevent the depletion of the revolving credit fund" (APMEPUM 1978)

The ADPs have clearly demonstrated superiority over mainstream ministries of agriculture in the efficient distribution of fertilizers. In the old Gusau Project comprising only about 3 percent of the land area of Sokoto State, the project accounted for up to 59 percent of total fertilizer consumption in the state in the late 1970s (See Table 5).

Efforts to privatize fertilizer distribution have been stalled for years because of vested interests in existing arrangements, even after repeated demonstration of the nonsustainability of government direct involvement in fertilizer distribution. Under pressure from the World Bank as one of the conditions for the fertilizer loan, financial subsidies have had to be reduced from an effective rate of over 85 percent in some years to under 30 percent currently. It must be stressed that economic subsidies after adjusting for overvalued exchange rates have been much higher than the financial subsidies.

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Input subsidies in Nigeria have tended to be intimately associated with an activist role for government input distribution. ^{11/} So who are the advocates of farm input subsidies? The cocoa pesticide subsidy scheme stands out as a unique outcome of a competitive political process in which the Action Group and the NCNC were competing for rural votes in Western Nigeria in 1957/58. The federal schemes were part of the mass mobilization or more accurately mass awareness campaigns of the mid 1970s to get agriculture moving - part of the oil boom - induced federal initiatives in agricultural policy making. ^{12/}

11/ The cocoa pesticide subsidy scheme was an exception.

12/ For the theoretical case for subsidies, see Shalit and Binswanger, 1985.

Table 5. Farm Service Centers and Relative Effectiveness of World Bank -assisted Agricultural Development Projects (ADPs) in Fertilizer Distribution, Nigeria, 1977/78 - 1979/80

<u>Year</u>	<u>FUNTUA ADP</u> <u>Fertilizer Sales (tonnes)</u>			<u>GUSAU ADP</u> <u>Fertilizer Sales in Tonnes</u>		
	Project	Rest of Kaduna State	Relative Share of Project in Kaduna State (%)	Project	Rest of Kaduna State	Relative Share of Project in Sokoto State (%)
1977/78	16,178	26,016	38.3	4,881	7,816	38.4
1978/79	16,285	20,438	44.3	14,274	9,986	58.8
1979/80	27,210	28,486	48.9	10,109	17,680	36.4
1977/79/80	59,673	74,940	44.3	29,264	35,482	45.2
Land Area (Km 2)	7,500	60,285	12.44	3,800	97,257	3.76
Service Centers/ Agro Service Centers	70	54	56.5	43	15	74.1

Source: Funtua and Gusau Projects; State Ministries of Agriculture in Okorie and Idachaba (1983).

(vi) Agricultural Research and the Generation of New Technology

Two questions need answers: one, why, after almost a century of organized agricultural research are there still no technological breakthroughs and two, why has the limited success with technology in export crops not been sustained in SubSaharan Africa?

Failures on the two counts can be traced to several factors. First, political support for national agricultural research systems has fluctuated wildly, from active support for exports in the 1950s and 1960s to the low level support of the 1970s and 1980s, within countries and from country to country. Second, the demand for improved research performance has not been consistently effective. Demand for effective performance of the agricultural research establishment in the colonial system was rooted in the needs of the export economies, the interests of imperial transnationals and the marketing board revenue needs of colonial administrations requiring export crop production. The linkages between colonial administrations and research interests of colonial transnationals guaranteed effective demand for improved agricultural research performance. The demand for improved food research is widely dispersed among millions of unorganized and politically important smallscale farmers unable to articulate their research needs - therefore ineffective. Third, research gains have not been sustainable not only because of inadequate funding but because the funding has been highly unstable, resulting in half-completed and abandoned research projects (Idachaba, 1980). Fourth, many national research systems lack the "critical mass" of experienced researchers that will initiate and successfully execute research projects. Fifth, many national agricultural research systems experience very high turnover or instability in research staff who migrate to the universities and the private sector because of the poor service conditions of that curious hybrid called the civil servant-scientist.^{13/} Sustainability of research performance becomes virtually impossible under those circumstances. Sixth, sustainability has been gravely affected by discontinuities in research management, particularly frequent unpredictable changes in the institutional arrangements for managing national agricultural systems (see Table 6). Such frequent changes have disrupted the agricultural research planning process. Seventh, the research resource allocation system has not been rationalized in many countries for national systems to have sustained productivity effects. National agricultural systems have been unable to achieve sustained growth performance. Eighth, discontinuities in technology generation have been compounded by dicontinuites in dissemination of technology through agricultural extension systems: in staff, in funding, in management and in relations with research, producing a convolution of instabilities and discontiuities.

^{13/} For more on the identify crisis of the civil servant-scientist, see Davis, D. 1975 and Idachaba, 1981, 1986.

Table 6. Frequent Changes in Institutional Arrangements for Managing Agricultural Research in Nigeria, 1964-85

Law/Decree	Year	Provision	Remarks
1. Nigerian Research Institute Act.	1964	Established Cocoa Research Institute of Nigeria, Nigerian Institute for Oil Palm Research, Rubber Institute of Nigeria and Nigerian Institute for Trypanosomiasis Research.	Following Dissolution of West African Research Organization in 1962.
2. Nigerian Council for Science and Tech.	1970	Umbrella Organization to coordinate research grouped into physical sciences, agriculture, medicine.	-
3. Agricultural Research Council of Nigeria (ARCN Decree)	1971	Established ARCN to coordinate all agricultural research.	-
4. Agricultural Institute Decree	1973	Vested Power to establish institutes to conduct research and training in any field of agricultural, veterinary sciences, fisheries, forestry, agro-meteorology and water resources in Federal Commissioner for Agriculture; also power to take over any existing state research station.	Watershed in State, Federal funding of agricultural research. Destroyed all initiative for states to fund agricultural research.
5. Research Institutes (Establishment) Order	1975	Established 14 research institutes: NCRI, NRCRI, NIHORT, CRIN, PRIN, FRIN, NVRI, NAPRI, NIIR, NIFOR, LRIN, LCRI, KLRI, NIOMR.	Clear Commodity mandate for each institute.
6. National Science and Technology Development Agency Decree	1977	Set up an executive agency to coordinate all research in Nigeria, agricultural and nonagricultural. All research institutes established by the 1975 decree were brought under the aegis of the NSTIDA.	Repealed the 1973 decree but still vested powers to take control of any existing federal or state research establishment in NSTIDA Commissioner.
7. Constitution of the Federal Republic of Nigeria	1979		
8. Federal Ministry of Science & Technology Act.	1979	Scrapped the NSTIDA. Created the Federal Ministry of Science and Technology.	Placed "industrial and agricultural research" on the concurrent list.
9. Federal Ministry of Education, Science and Technology Decree	1984	Scrapped the Federal Ministry of Science and Technology and merged it with Federal Ministry of Education.	Military suspended. Constitution.
10. Federal Ministry of Science and Technology Decree.	1985	Created separate Federal Ministry of Science and Technology.	

Africa's fragile tropical soils pose special problems for sustainability with respect to carrying capacity, sensitivity to mechanization, degradation and stability of structures under continuous cultivation. While tested packages exist for agronomic practices involving seed - fertilizers combinations, very few viable packages exist on appropriate combinations and rotational systems involving soils, mechanization, labour, fertilizers and pesticides in different crops, with stress on changing physical and chemical soil properties under varying farm practices. With favorable land/man ratios, SubSaharan countries need to evolve optimal land tenure and land access arrangements and mechanical land preparation that will lead to sustained gains in productivity per manday. For land of given physical and chemical endowments, technologies must be developed to prevent farming systems from rapidly running into diminishing returns and thereby facilitate sustained growth performance. The International Centres for Agricultural Research, in collaboration with African national agricultural research systems, need to assist with the development and testing of viable packages of soil management using new inputs that exploit Africa's favorable land/man ratios.

International Environment

Instability in world market prices for export crops has acted as investment discentives not only from the confusing signals but from the market uncertainty. For given stable demands, at least in the short run, fluctuations in world market prices can be traced primarily to fluctuations in supplies. A country has no influence on the production circumstances of competitors as sustainability of its growth performance is affected by shifts in the supply curves of competitors.

Countries have formed cartels and entered into commodity agreements to control prices and quantities over a given period. The market confidence effects of such agreements - where they are effective - help to sustain production performance. Commodity price and market sharing agreements are subject to the same structural weaknesses of all cartelization efforts; chiseling, cheating and a tendency for arrangements to break down.

Barriers to entry into international markets of semiprocessed products requires that African countries develop technical negotiating capabilities to extract maximum concessions during GATT and other similar negotiations to ensure sustainability of production gains.

Oil shocks have produced serious consequences for developing agriculture: sharp increases in production costs in relatively foreign exchange - intensive systems (farm machinery, chemicals), decline in world demand for primary commodities as a result of the accompanying world recession; domestic terms of trade effects especially in the face of primitive rural infrastructures, etc. Growth performance of developing agriculture has not been sustained in the face of such exogenous shocks.

Countries are going to have to brace up to the production and export challenges of new entrants into world markets, especially China. The China factor in cotton and other commodities poses a new challenge to developing agriculture with respect to the maintenance of traditional market shares. When export subsidies and dumping are added, then the external factor in sustainability becomes even more complex.

External aid is basically of two types: as emergency relief and as a development tool. The pertinent questions for sustainability regarding external aid are: what are the medium and long term consequences on domestic agricultural production in recipient countries? Is advice a major source of instability in domestic growth performance of recipient countries? Are the new institutions created to administer technical aid and external loans (for example, the World Bank type) viable in the long run? The false sense of security offered by external aid and the absorption of scarce public management resources in technical aid management constitute disincentives for domestic agricultural production. Serious domestic programming gets substituted by externally initiated and funded solutions to pressing food and fibre problems of recipient countries. The culture of patient indigenous programming fails to develop in preference to heavily subsidized imports of expatriates from abroad who end up displacing local skills that would have developed under the pressure of necessity. The real problem for sustainability is why local expertise fails to develop in the public sector under an apprenticeship system, comparable to the private sector. Learning by doing seems to have very limited scope in the public sector, assuming that the technical assistance had the right skills to impart.

Inconsistent advice from the donor community seriously threatens sustained growth performance in recipient countries. Two types of inconsistencies are identified: inconsistent advice from the same donor at different points in time and conflicting advice from multiple donors. The World Bank-assisted agricultural projects in Nigeria, successful as they are perceived to be, would serve to illustrate the first. The first three enclave ADPs were launched in Nigeria in 1974/75 at Funtua, Gusau and Gombe. Following on the perceived success of these, the Federal Government borrowed more money on behalf of the states to launch new ADPs in Lfia, Ayangba, Ilorin, Bida and Ekiti-Akoko as additional enclave projects. New statewide, much bigger ADPs were launched in Bauchi, Kano, Sokoto and Kaduna States during 1981-84. In 1985 multistate ADPs were launched in 7 more states: Anambra, Benue, Plateau, Cross River, Imo, Oyo and Ogun. The rest of the country will be covered with ADPs by 1987. Up until the multi-state ADPs, rural roads were a major component of these projects. The World Bank now frowns on rural road construction as a project component - what is now favoured is "road rehabilitation and spot improvement." The ostensible reason given was failure to maintain the first generation of project roads. It is possible that the Bank takes certain project positions based on a world view, on comparative experiences from other countries. A World view posture, while potentially beneficial to countries and programmes at the margin, might fail to adequately consider country-specific needs; indeed, special care needs to be taken in imposing positions on a given country which are derived from a world view and are believed to be invariant to the peculiarities of individual countries.

Sustained growth performance must be based on the optimal sequencing of public investments in agriculture: for example, rural roads and rural markets must precede attempts at improving input distribution, implementing producer price supports and farm input subsidies, etc. Sustainability requires the exploitation of dynamic complementarities between public investments within the context of proper sequencing. All Nigerian governments have indicated that rural roads remain at the top of the rural development agenda: a Directorate of Food, Roads, and Rural Infrastructures has been established in the Office of the President to build a network of feeder roads, regardless of what the World Bank thinks or wishes about rural roads!

Separate institutions were created outside mainstream Ministries of Agriculture to handle the execution of ADPs. ADP Project Management Committees were charged with overall responsibility for project execution in an attempt to circumvent the bureaucratic sludge in mainstream civil service. Slightly better conditions of service were offered to project staff to motivate them for higher performance levels. Monitoring and evaluation units were established. The Agricultural Projects Monitoring, Evaluation and Planning Unit (APMEPU) is now charged with evaluation studies while the Federal Agricultural Coordinating Unit (FACU) handles planning and technical backup support for projects, monitoring and coordination of the ADPs. Questions have arisen on the long term relationship between these extra ministerial institutions and mainstream Ministry. There is now new rethinking by a powerful "back to the Ministry" lobby that now advocates a reabsorption of these World Bank-assisted "exotic" institutions within parent Ministries. The issue of optimal institutional arrangements to handle external technical aid and grants is an empirical, nor theoretical question. It revolves around the relative operational efficiencies or structures, processes and procedures of alternative institutional arrangements. The Nigerian experience with these institutions shows great potential for developing and, much more importantly, utilizing technical capabilities. One other area where the ambivalence of the donor community has been very costly for sustained growth has been the encouragement and support for a multiplicity of public parastatals that have served as conduit pipes for draining public resources in the last two decades.

Interactions between Domestic and External Factors

The effects of factors reviewed above on sustainability can be regarded as first order effects. Over and above these on sustainability are those from the interactions of the separate factors. Failures of national research systems to develop short duration varieties in the face of exogenous shocks from a quick succession of droughts produce compound effects for sustainability. Similarly, the interaction of political instability, bureaucratic instability and a weak policy process characterized by poor policy formulation and bad execution produces compound consequences for sustainability. Also, when high unstable supply conditions or main export competitors, sustainability becomes more difficult, over and above their separate individual effects.

Conclusions

Sustainability has been viewed in terms of three main sets of factors: national macroeconomic and political environment, the agricultural sector, the external sector as well as interactions between them.

The traditional approach to a discussion of sustainability issues in agricultural development focuses on supply-side considerations. This view emphasizes the constraints that define the limits of technology, the policy process and institutional arrangements in attaining sustainable agricultural growth and development performance. Such an approach however fails to explain the persistence of nonsustainable agricultural performance in SubSaharan Africa, twenty-five years after independence. This paper therefore examines the demand side - identifying the sources of demand for programmes, projects and institutional arrangements to ensure sustainable agricultural sector performance. The supply-demand approach to sustainability provides greater insight into the perennial problem of lack of sustainability in agricultural development.

The discussion implies that the core of the sustainability problem is to be found in the inadequacies in domestic policies, programmes and projects as well as the structural elements in national economies and societies which hamper the articulation of the effective demand of the rural majority for sustained sector performance. Though external factors also play an important role in sustainability, they are considered secondary to the domestic factors.

Political instability has adversely affected consistent public programming for agricultural and rural development. The challenge is to attain a minimally acceptable level of sustainable agricultural sector growth and development performance in the face of largely exogenous political instability.

Table A-1

Nonsustainability in Production Performance of Tanzania's Major Export
Crops in Tanzania's Major Export Crops in the Three Plan Periods
(annual percentage growth in production)

Crop	First Plan 1964-1969	Second Plan 1969/70 - 1973/74	Third Plan 1976/77 - 1980/81
Coffee	7.0	-3.1	2.5
Sisal	-0.2	-6.0	-0.7
Cotton	8.4	-2.0	-0.1
Cashews	10.4	7.0	-6.9
Tobacco	19.6	10.1	-0.1
Tea	8.4	5.8	4.0
Pyrethrum	3.9	1.6	4.4

Source: World Bank.

Table A-2

Revealed Preferences for Rural Infrastructures: The Distribution of Self-Help Projects 1978/79-1980
(percent)

State	Self-Help Community Roads	Health & Medical	Self-Help Project Markets	Education	Water Resources Development	Others
Anambra	378(44.07)	52(6.84)	55(6.84)	95(12.07)	46(5.72)	174(21.41)
Bauchi	136(26.45)	24(4.67)	41(7.78)	11(2.14)	238(44.75)	93(14.20)
Bendel	136(26.46)	39(5.45)	39(5.41)	292(40.83)	44(6.15)	155(21.67)
Benue	199(47.5)	114(27.2)	n.a.	16(3.8)	21(5.0)	24(5.7)
Borno	69(30.0)	20(9.0)	16(7.0)	41(18.0)	66(29.0)	15(7.00)
Cross River	125(12.61)	104(10.49)	100(10.09)	323(32.59)	26(2.11)	115(11.60)
Gongola	104(56.0)	6(3.0)	4(4.0)	n.a.	8(4.0)	26(13.0)
Imo	420(39.18)	85(6.62)	90(8.40)	194(18.10)	66(6.25)	34(3.17)
Kaduna	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Kano	94(29.2)	21(6.5)	2(2.6)	20(6.2)	65(31.7)	117(37.2)
Kwara	522(41.17)	46(3.63)	52(4.10)	322(25.39)	63(4.97)	146(15.54)
Lagos	154(45.0)	6(2.0)	9(3.0)	n.a.	27(8.0)	14(4.0)
Niger	155(44.57)	44(12.5)	22(6.29)	36(10.29)	8(2.29)	84(24.00)
Ogun	261(49.52)	25(4.74)	24(4.55)	88(16.7)	47(8.92)	18(3.42)
Ondo	440(66.3)	31(4.7)	26(3.9)	n.a.	11(1.7)	25(3.8)
Oyo	1,443(77.46)	128(168.30)	59(2.92)	13(0.64)	108(5.34)	94(5.34)
Plateau	194(23.5)	84(10.2)	14(1.7)	293(34.3)	99(12.0)	35(4.2)
Rivers	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sokoto	485(35.00)	25(2.00)	31(2.00)	112(8.00)	438(32.00)	285(21.00)

Source: Idachaba (1985).

Table A-3

Secondary School Facilities in Sokoto State Nigeria, 1979/80

LGA	No. of Schools	Student Enrollment	Student Enrollment Per Trained Teacher	Trained Teachers as a % of All Teachers	Land Area Served by a Secondary School (sq. km)	Walking Radius of a Secondary School (km)
Anka	2	696	46	83.33	4,817.50	39.16
Argungu	5	1,754	58	76.92	1,610.40	22.64
Bagudo	4	1,672	56	75.00	1,727.50	23.45
Birnin-Kebbi	4	1,530	41	84.09	508.25	12.72
Bodinga	1	223	74	33.33	2,432.00	27.82
Bunza	2	432	108	33.33	1,545.00	22.17
Gummi	3	1,169	56	60.00	3,118.30	31.50
Gusau	4	1,621	36	83.33	1,791.00	23.88
Gwadabawa	3	1,396	41	89.47	1,129.30	18.96
Isa	3	1,115	43	74.29	1,751.70	23.61
Jega	2	552	50	57.89	1,233.00	19.81
Kaura Namoda	3	969	48	76.92	1,646.30	22.89
Silame	2	609	61	90.01	3,380.00	32.80
Sokoto	8	2,736	21	94.16	205.88	8.09
Talata Mafara	3	999	45	81.84	2,167.00	26.26
Wurno	2	552	50	100.00	1,994.50	25.19
Yabo	2	769	43	78.00	2,012.50	25.31
Yauri	3	1,034	41	80.65	1,861.30	24.34
Zuru	3	1,075	41	68.42	2,610.70	28.83
<u>All Sokoto</u>	50	20,903	40	81.30	1,712.80	23.35
Median Values	3	999	45	76.92	1,751.70	23.61
Sample Range	7	2,513	87	66.67	4,611.62	31.07

Source: Idachaba (1985).

Table A-4

Public Water Supplies in Borno State Nigeria (1979)

<u>LGA</u>	<u>Pumping Capacity (Litres/Day)</u>	<u>Per Capita Supplies of (Litres/Day)</u>	<u>Cost of Construction (N)</u>	<u>Trained No. of Public Wells</u>	<u>Population per Well</u>	<u>Land Area (sq. km)</u>	<u>Walking Radius of a Well (km)</u>
Askira/Uba	43,000	0.35	165,000	55	2,246	44.8	3.77
Bade	2,480,000	17.80	118,050	120	1,161	41.7	3.77
Bama	3,218,000	15.25	145,500	15	14,068	411.7	11.44
Biu	1,274,400	3.38	270,500	9	41,952	960.1	17.46
Damaturu	907,200	3.13	310,250	n.a.	n.a.	n.a.	n.a.
Dambo	-	-	-	18	9,335	472.2	12.25
Fika	2,838,300	8.64	129,855	n.a.	n.a.	n.a.	n.a.
Fune	734,000	3.16	75,000	12	19,381	439.2	11.81
Geidam	24,000	0.08	161,500	n.a.	n.a.	n.a.	n.a.
Gujba	1,157,760	9.18	170,000	26	4,853	238.0	8.69
Gwoza	157,500	1.67	180,000	232	407	11.6	1.92
Kaga	604,800	2.36	60,000	42	6,112	211.7	8.20
Konduga	1,615,680	5.60	72,000	58	4,973	138.7	6.66
Kukawa	1,978,560	4.19	179,000	48	9,833	294.0	9.66
Maiduguri	22,500,000	108.29	2,132,305	38	5,468	14.3	2.13
Monguno	2,185,920	7.80	28,000	14	20,021	280.4	9.44
Ngala	6,002,080	27.02	330,000	16	13,928	337.0	10.35
Nguru	3,240,000	10.21	159,150	80	3,967	91.9	5.40
All Borno	50,981,900	11.45	4,586,110	783	5,700	148.9	6.88

Source: Idachaba (1985).

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POLICY ISSUES FOR SUSTAINABILITY

RAPPORTEUR'S COMMENTS

Peter Hopcraft*

Having expressed appreciation for the presentation, the first questioner raised the issue of the environment that was not covered by the paper but was very much on the agenda of the symposium. The question was how deeply environmental concern and awareness had penetrated the thinking of African governments with respect to planning, policy-making and project formulation -- was this primarily a concern in Washington and New York or was it more widespread among the countries that were supposed to be the beneficiaries of these projects.

Mr. Idachaba replied that there is probably an income elasticity of demand aspect to environmental concerns, in that richer people and countries tend to give them more attention and higher priority. Most African governments are concerned with getting agriculture moving, getting production up, and perhaps improving income distribution. From their perspective, longer run environmental issues, which may be very important, are often seen as second generation problems that tend to give way to more immediate concerns.

The second question concerned the introduction of foreign goods such as wheat, which may not be locally produced, into the consumption package. Mr. Idachaba replied that bread has become a convenience food, often replacing traditional staples in the urban areas as the costs of time have increased. Such imports can become a problem when foreign exchange is scarce, though there is always the option of shifting back into local foods. In Nigeria, import bans for such commodities as wheat and rice may have affected prices and the rents involved, but have generally not inhibited the flow of imports through informal channels, so that most of these items are available in the market, regardless of government policy.

The third question sought clarification as to the tendency toward large dams and irrigation schemes. In terms of rent-seeking, the amount going to politicians, bureaucrats and suppliers is presumably no more in percentage terms than for small dams. The speaker's response was that people tend to be interested in absolute amounts rather than percentages. More seriously he discussed the appeal of large projects to politicians, officials and even to donors, all of whom may be in a hurry for a dramatic demonstration of success and accomplishment. Given the amortization costs and the management and technical difficulties of the large schemes, Mr. Idachaba questioned the ethos of "big is beautiful" in such projects.

The chairman expressed his appreciation for what he called a very provocative paper by Mr. Idachaba.

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SESSION I: INSTITUTIONAL DEVELOPMENT

INSTITUTIONAL REQUIREMENTS FOR SUSTAINED AGRICULTURAL DEVELOPMENT

Vernon W. Ruttan*

We are during the closing decades of the twentieth century, approaching the end of one of the most remarkable transitions in the history of agriculture. Before the beginning of this century almost all increases in agricultural production occurred as a result of increases in the area cultivated. By the end of this century there will be few significant areas where agricultural production can be expanded by simply adding more land to production. Agricultural output will have to be expanded almost entirely from more intensive cultivation in areas already being used for agricultural production from the existing resource base be completed.

Over the last several decades economists have made major contributions to our understanding of the impact of advances in natural science knowledge on technical change and of the impact of technical change on economic growth. We have also significantly advanced our understanding of the sources of demand for and supply of technical change. Our knowledge of the contribution of institutional change to economic growth has advanced much less rapidly. And our knowledge of the factors that affect the rate and direction of institutional change and the factors that contribute to successful institutional design is even more limited.

In work published in the early 1970's Yujiro Hayami and I extended the theory of induced technical change and tested it against the history of agricultural development in the United States and Japan. (Hayami and Ruttan, 1971 and 1985; also Binswanger and Ruttan, 1978). It is now generally accepted that the theory of induced technical change provides very substantial insight into the process of agricultural development for a wide range of developed and developing countries. And economic historians are increasingly drawing on the theory of induced technical change in attempting to interpret differential patterns of productivity growth among countries and over time (Thirtle and Ruttan, 1986, pp. 60-66).

The demonstration that technical change can be treated as largely endogenous to the development process does not imply that the progress of either agricultural or industrial technology can be left to an "invisible hand" that drives technology along an "efficient" path determined by relative resource endowments. The capacity to advance knowledge in science and technology is itself a product of institutional innovation. Whitehead has insisted that "the great invention of the nineteenth century was the invention of the method of invention". (Whitehead, 1926, p.96).

In the case of agriculture Japan followed a mechanical technology path in response to an environment in which land was expensive and labor was expensive. (Figure 1) The biological technology path permitted Japan to substitute biological and chemical technology for land. The United States followed a mechanical technology path in response to an environment in which labor was expensive and land was cheap. The mechanical technology path permitted each agricultural worker to cultivate more land. In both

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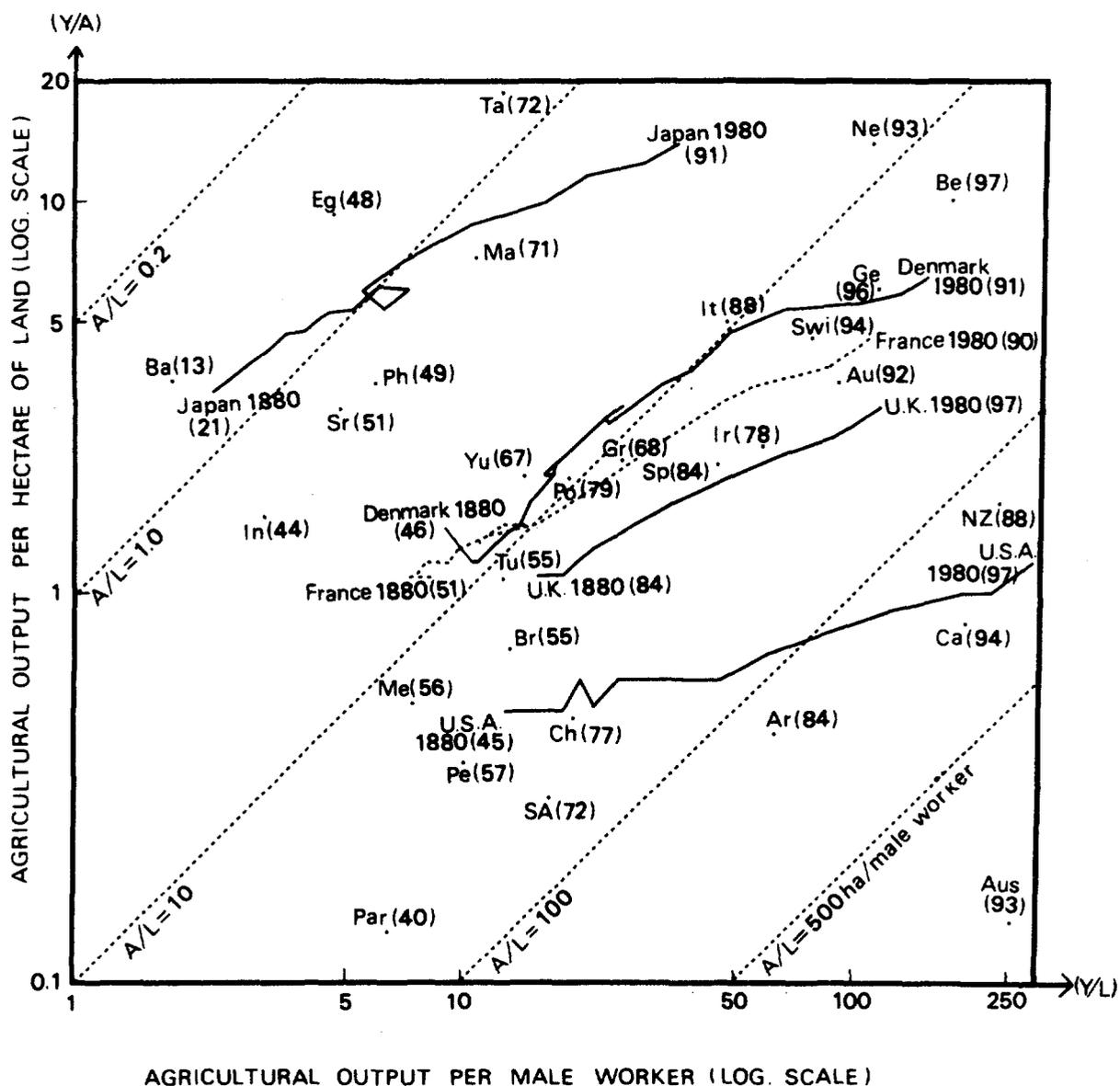


Figure 1. Historical Growth Paths of Agricultural Productivity of Denmark, France, Japan, the United Kingdom, and the United States for 1880-1980, Compared with Inter-country Cross-section Observations of Selected Countries in 1980

Note: Values in parentheses are percent of male workers employed in nonagriculture.

Source: Data from Hayami and Ruttan, Agricultural Development, rev. ed., 1985, appendixes A and B.

Symbol key for Figure 1

Argentina	Ar	Norway	No
Australia	Aus	Pakistan	Pak
Austria	Au	Paraguay	Par
Bangladesh	Ba	Peru	Pe
Belgium (& Luxemburg)	Be	Philippines	Ph
Brazil	Br	Portugal	Po
Canada	Ca	South Africa	SA
Chile	Ch	Spain	Sp
Colombia	Co	Sri Lanka	Sr
Denmark	De	Surinam	Su
Egypt	Eg	Sweden	Swe
Finland	Fi	Switzerland	Swi
France	Fr	Syria	Sy
Germany, F. R.	Ge	Taiwan	Ta
Greece	Gr	Turkey	Tu
India	In	U.K.	UK
Ireland	Ir	U.S.A.	USA
Israel	Is	Venezuela	Ve
Italy	It	Yugoslavia	Yu
Japan	Ja		
Libya	Li		
Mauritius	Ma		
Mexico	Me		
Netherlands	Ne		
New Zealand	NZ		

countries the more abundant, and lower cost, factor was substituted for the scarce and more expensive factor. This substitution required the invention of new technology that was appropriate to the resource endowments and economic environment in each country. In both Japan and the United States much of the technical change that has led to growth of output per hectare has been produced by public sector institutions. These institutions--state (or prefectural) and federal (or national) agricultural experiment stations--obtained their resources in the political market place and allocated their resources through bureaucratic mechanisms. The success of the theory of induced technical change gives rise, therefore, to the need for a more careful consideration of the sources of institutional innovation and design.

In this paper I elaborate a theory of institutional innovation in which shifts in the demand for institutional change are induced by changes in relative resource endowments and by technical change. I then discuss the seemingly contradictory export promotion and import substitution policies followed with respect to industry and agriculture in East Asia to illustrate the effect of changing resource endowments and changes in the economic environment. I then turn to a review of the efforts by the World Bank and other members of the donor community to build institutions to sustain agricultural development in Pakistan. In a final section I attempt to see if we can draw any lessons from the theory and the experience. Finally, I suggest a more inclusive framework within which to attempt to understand the process of institutional innovation.

Sources of Demand and Supply of Institutional Innovation 1/

Institutions are the rules of a society or of organizations that facilitate coordination among people by helping them form expectations which each person can reasonably hold in dealing with others (Runge, 1981). They reflect the conventions that have evolved in different societies regarding the behavior of individuals and groups relative to their own behavior and the behavior of others. In the area of economic relations institutions have a crucial role in establishing expectations about the rights to use resources in economic activities and about the partitioning of the income streams resulting from economic activity--"institutions provide assurance respecting the actions of others, and give order and stability to expectations in the complex and uncertain world of economic relations" (Runge, 1981a, p. xii. Also Commons, 1950, p.24; Knight, 1952, p.51, Runge, 1981 b). In order to perform the essential role of forming reasonable expectations in dealings among people, institutions must be stable for an extended time period. But institutions, like technology, must also change if development is to occur.

Shifts in the demand for institutional innovation or improvements in institutional performance may arise from a wide variety of sources. Douglass North and Robert Thomas (1970; 1973) attempted to explain the economic growth of Western Europe between 900 and 1700 primarily in terms of innovation in the institutional rules that governed property rights. A major source of institutional innovation was, in their view, the rising pressure of population against increasingly scarce resource endowments.

1/ This section draws on material that is discussed in considerably more detail in Ruttan and Hayami (1984); Hayami and Ruttan (1985, pp. 94-114); Binswanger and Ruttan (1978, pp. 327-357).

Theodore W. Schultz, focusing on more recent economic history, identified the rising economic value of labor during the process of economic development as a primary source of institutional innovation. North and Thomas would apparently have agreed with Schultz that "it is hard to imagine any secular economic movement that would have more profound influence in altering institutions than would the movement of wages relative to that of rents" (Schultz, 1968, p. 1120). It seems more apparent today than a decade ago that in non-market environments, or in environments where prices are severely distorted, the shadow prices that reflect the real terms of trade among factors and products (or the gap between shadow and market prices) convey information to economic and political entrepreneurs that leads to shifts in the demand for institutional innovation and performance.

The Marxian tradition has emphasized the importance of technical change as a source of demand for institutional change. Marx insisted that: "At a certain stage of their development, the material forces of production in society come in conflict with the existing relations of production, or--what is but a legal expression for the same thing--with the property relations within which they had been at work before. From forms of development of the forces of production these relations turn into their fetters. Then comes the period of social revolution. With the change of the economic foundation the entire immense super-structure is more or less rapidly transformed". (Marx, 1913, pp. 11-12).

There is a supply as well as a demand dimension in institutional change. Collective action leading to changes in the supply of institutional innovations may be generated by tension among interest groups. The supply of institutional innovations is strongly influenced by the distribution of political resources and by the cost of achieving social consensus (or of suppressing opposition). And it also depends critically on culture endowments, including ideology and religion. Advances in knowledge in the social science (and in related professions such as law, administration, planning, and social service) can reduce the cost of institutional change in a somewhat similar manner as advances in the natural sciences reduce the cost of technical change.

The induced innovation perspective suggests that technical and institutional change are highly interdependent and must be analyzed within a context of dialectal interaction.

The Sources of Demand for Technical and Institutional Change Are Similar

A rise in the price of land (or natural resources) in relation to the price of labor induces technical change designed to release the constraints on production that result from an inelastic supply of land and, at the same time, induces institutional changes that lead to greater precision in the definition and allocation of property rights in land. A rise in the price of labor in relation to the price of land (or natural resources) induces technical changes designed to permit the substitution of capital for labor and, at the same time, induces institutional changes designed to enhance the productive capacity of the human agent and to increase the workers control over the conditions of employment. The new income streams generated by technical change and by gains in institutional efficiency induce change in the relative demand for commodities and

services, and open up new and more profitable opportunities for product innovations. And the new income streams generated by either technical or institutional change induce further institutional changes designed to modify the way new income streams area partitioned among factor owners and to alter the distribution of income among individuals and classes.

Shifts in the Supply of Technical and Institutional Change Are Also Generated by Similar Forces

Advances in knowledge in science and technology reduce the cost of the new income streams that are generated by technical change. Advances in knowledge in the social sciences and related professions reduce the cost of the new income streams that are generated by institutional change--by improved institutional performance, by new institutions, and by conflict resolutions.

There are, of course, multiple sources of both technical and institutional change. And there are autonomous as well as induced sources of both technical and institutional change. But there have been two very pervasive sources of institutional change that have been of particular relevance for agricultural development during the last century that are particularly relevant to the cases discussed in this paper.

One has been the closing of the land frontier. Prior to the beginning of this century almost all increases in agricultural production came from expansion in land area. By the first decade of the next century, almost all increases in agricultural production will have to come from more intensive land use--from higher yields per unit of land area. This is the most dramatic change in agriculture since neolithic women invented agriculture. And it is occurring in the remarkably short period of a single century.

The second major source of institutional innovation is the rising economic value of the human agent. Within a single century, the value of the human agent per unit of time has, in Western societies, risen by a multiple of four or five. This change occurred first in the countries of new settlement and Western Europe. Since mid-century it has occurred in Japan in several small countries in East Asia. It is well under way in Latin America. The sources of these changes are still not well understood but the implications for institutional change can hardly be underestimated.

Export Promotion and Import Substitution: Examples From East Asia 2/

Let me now turn to a case of institutional innovation that illustrates the effects of some of the changes in resource endowments and changes in the economic environment discussed in the previous sections. The case that I will discuss is the rather dramatic change that has taken

2/ This section draws very heavily on a series of studies on the political economy of agricultural protectionism in East Asia by Kym Anderson, Yujiro Hayami and several other colleagues (Anderson, Hayami and others, 1986). For a very useful analysis of the sources of industrial import substitution policies in the initial stages of industrial development in the US see Pincus (1975, 1977).

place in sectoral patterns of import substitutions and export promotion in East Asia since the beginning of industrial development. Many observers have credited the export oriented industrial policies pursued first by Japan, and later by Taiwan and Korea, with creating an economic environment that has been exceptionally favorable to economic growth. It has also been noted with a good deal of puzzlement, that these same countries are pursuing import substitution agricultural policies. It is clear that these policies have imposed rather large welfare losses on all three economies. Does economic rationality vanish at the edge of the rice fields?

A series of studies by Kym Anderson, Yujiro Hayami and several colleagues has helped to clarify the economic and political forces that have given rise to the transition from earlier agricultural export and import-substitution industrial oriented regimes to the present industrial export promotion and agricultural import-substitution regimes.

The transition from an export oriented agricultural policy in Japan began shortly after the turn of the century. In the 1890's, Japan shifted from being a small net exporter of rice to becoming a new importer of rice. A tariff was first imposed on rice imports in 1904. After World War I, the protection afforded to Japanese rice producers was reduced by allowing duty-free imports from Korea and Taiwan under a policy of Imperial self-sufficiency. During this period, land taxation was reduced and expenditures on agricultural research and rural infrastructure was expanded. During the first decade after World War II, Japanese farmers received prices that were slightly above world market prices. Since the mid 1950's, however, nominal rates of agricultural protection (producers price/border price) have escalated rapidly.

The transition to agricultural import substitution in Korea and Taiwan came much later. In the 1950's, both countries were pursuing industrial import-substitution policies. Nominal rates of protection for most agricultural commodities were negative. During the early 1960's, both Korea and Taiwan shifted from industrial import-substitution to export-oriented policies. Nominal rates of protection for agriculture turned slightly positive in the 1960's and escalated rapidly in the 1970's in both Korea and Taiwan. This transition from taxing to protecting agriculture is not unlike the changes that occurred in Western Europe during the process of industrialization. What is remarkable about the East Asian experience, particularly that of Korea and Taiwan, was the extraordinary speed of the transition.

Anderson, Hayami and their colleagues have attempted to explore both the sources of demand and supply for the rapid emergence of protectionist agricultural policies. In the case of Japan, the demand for protection was based on the economic cost to rural families and communities and resulting political stress that would have accompanied rapid structural adjustment. Japanese agriculture lost comparative advantage--measured in terms of labor productivity, relative to both Japanese industry and United States agriculture--very rapidly after the early 1950's. The loss of comparative advantages in Korea and Taiwan in the late 1960's and 1970's was even more rapid (Anderson and Hayami, p.40). The impact of structural adjustment costs would have been born largely by a single generation of rural people.

There were also a number of factors that shifted the supply curve for protectionism to the right. Economic growth rapidly reduced both the share of the consumer budget accounted for by food purchased in the market and the tax burden of producer subsidies. It was advantageous to Japanese commercial and industrial interests to accede to policies that would maintain farmers' commitment to the conservationist Liberal Democratic Party (LDP). Large numbers of Japanese industrial workers and part time farmers have strong emotional links to rural households and to the political imagery of food self-sufficiency.

The situation in Taiwan and Korea was not unlike that in Japan. In addition the potential political threat from The Peoples Republic of China and North Korea provided additional impetus for the government, the industrial and the commercial interests to assure rural commitment to political stability.

The conclusions that Anderson and Hayami draw from their East Asian analysis has been tested using cross section data from a large number of developed and developing countries. The cross-sectional evidence suggests that as economies grow they tend to change from taxing to assisting or protecting agriculture. They also conclude that this change occurs at an earlier stage of economic growth, the weaker the countries' comparative advantage in agriculture. Their analysis also suggests that these changes occur more rapidly the faster the rate of economic growth and the faster the decline in agricultural comparative advantage.

This conclusion is reinforced by the results of the analysis by Robert H. Bates and William P. Rogerson, (1980), that as the share of agricultural population declines its desirability as a coalition partner rises. Furthermore, the policies pursued by Korea and Taiwan are not inconsistent with the model suggested by Irma Adelman which implies the desirability of shifting to an agricultural demand-led industrialization policy once the process of development is well underway. (Adelman, 1984).

The implications for other developing countries seem quite clear. As other densely populated developing countries enter into a period of rapid industrial growth they are also likely to adopt increasingly protectionist policies with respect to agriculture. This switch is likely to occur at relatively low levels of per capita income, as in Korea and Taiwan, in situations where comparative advantage in agriculture is weak or rapidly eroding. It is difficult to believe that the growth of agricultural protectionism in the world economy will be significantly reversed in the next several decades.

The question remains, why, in view of the very large deadweight losses associated with the protectionist policies pursued in both East Asia and Western Europe, alternative policies that would delink income support from commodity prices have not been developed? This is a particularly difficult challenge to economics and other social science research. In the United States the efforts to bring about a delinkage between commodity price supports and income support for farm families began in the mid-1940's. It received very little political support until the mid-1960's. (Ruttan, 1984). The rise in the comparative advantage of U.S. agriculture in the post World War II period seems to have been an important factor in pushing the U.S. toward a gradual delinking of income

and price support. Only by completing the delinkage will the U.S. be able to remain an effective participant in international commodity markets.

Institutions to Sustain Agricultural and Rural Development in Pakistan

In this section I draw on studies that I have been involved in over the last several years as part of a World Bank team, led by John P. Lewis, to review the role of the World Bank, and other donors, in Pakistan. (World Bank, January 1986).

The Bank has devoted major resources to the development of Pakistan's physical infrastructure to support agricultural production, particularly for the supply of irrigation water, the control of salinity, and the production of fertilizer. It has also contributed to the development of institutional infrastructure, particularly rural credit, agricultural research and extension, and the reform of the agricultural price structure. But it has tended to avoid the support of land tenure reform, the schooling and health of rural people, and other more broadly based rural development activities.

The performance of the Bank, in areas where it has devoted major resources, presents a mixed record of success and failure. In some cases, the lack of success in areas of emphasis appears to reflect the lack of progress in areas which the Bank has avoided.

Irrigation, Water Logging and Salinity

Participation by the Bank in the Indus Basin Development Project, and in subsequent support for water resource development--including irrigation, drainage and salinity control--has been fundamental to the relatively good performance of Pakistan agriculture.

Investment in water storage and delivery largely focused on the development of the Mangla and Tarbela Dams. The completion of Tarbela is generally regarded as a magnificent engineering achievement; and by the standards generally employed to measure performance of water projects, it must be judged an economic success. The economic rate of return to investment in the Tarbela project has been calculated by the Bank at about 12.5 percent.

But neither the engineering success nor the economic performance of Tarbela represent a strong vote of confidence in the water resource planning process. The project was plagued by unanticipated engineering problems and large cost overruns. The acceptable rate of return achieved by the project in spite of these deficiencies, appears to be more a reflection of the unanticipated increases in energy prices during the 1970's than a testimony to the skill or precision of the planning process. In retrospect, it is clear that the political commitments made in connection with settlement of the Indus Basin disputes between India and Pakistan have tended to dominate engineering and economic considerations.

The Indus Basin is one of the world's great centers of irrigated agriculture. The realization of its production potential has, however, been inhibited by the difficulty of arriving at a technical and institutionally viable system for controlling waterlogging and salinity.

Much effort has been spent over the past several decades by the government, the U.S. assistance agency, and the World Bank to find acceptable methods for dealing with these problems. After two decades of controversy and delay, and many studies, there now appears to be substantial agreement between the Government and the Bank on a strategy covering areas that are not saline: public tubewells would be gradually phased out and replaced by privately managed tubewells, plus there would be a program of improved canal design and more efficient on-farm water management. It appears, however, that no long-run program has yet been agreed on for areas with saline water. Nor is it clear that effective arrangements have been developed to replace the public management of the large tubewells by private management. As a general conclusion, very large investment will be required over the next two decades to maintain or enhance agricultural productivity in the Indus Basin. Unfortunately, the development of the institutional capacity to conduct research and training in Pakistan on water resource engineering and management has not been an important area of Bank concern. As a result, it is not at all clear that the viable institutional innovations necessary to organize and manage "the greater Indus Valley water machine" have yet been designed, let alone implemented.

Agricultural Credit

Agricultural credit projects absorbed 15 percent of the Bank's agricultural sector lending in Pakistan over 1965-84. Substantial staff and consultancy effort has been committed. The primary channel has been the Agricultural Development Bank of Pakistan (ADBP).

During the 1960s, several Bank loans supported agricultural mechanization. Based on its own internal reports, which criticized the economic and distributional effects of the mechanization program as well as the management of the ADBP, the Bank discontinued its support for almost a decade. In the late 1970s and early 1980s, managerial and policy changes encouraged the Bank to resume its support for the ADBP. The willingness of the Bank to discontinue its support for the ADBP, when confronted with unsatisfactory performance, can be interpreted as an important and positive contribution to subsequent reforms. It seems quite clear that, partly as a result of Bank support, the ADBP has developed an effective capacity to deliver subsidized credit to farmers in a manner that is relatively efficient. There are two major criticisms that remain, however.

The first is that the new lending is in support of agricultural mechanization. The Bank has not faced up to its own criticism of the credit program's emphasis on mechanization. We have not been able to find any evidence that the interest-rate subsidies to tractor mechanization have contributed to the growth of agricultural production in Pakistan. And we have not been able to obtain a satisfactory answer to the question of why so little ADBP credit has been devoted to the support of investments, such as private tubewells, which have demonstrated capacity to enhance agricultural production.

The second is that the Bank's support for agricultural credit institutions has not been guided by a comprehensive perspective of the function that a credit system should be expected to perform in a developing country. The rural system remains dependent on a continuous hemorrhage of donor and Government resources. Even after thirty years of donor support,

Pakistan is left with a number of useful credit institutions but with a system that is not yet able to effectively mobilize credit resources in rural areas for either private or public development purposes.

Policy

The Bank's impact on the development and reform of the pricing system has only been moderately effective. The Agricultural Prices Commission, established after 25 years of policy dialogue, is expected to concentrate on how to establish--how to set--input and product price in relationship to each other and to border prices in a manner that will contribute to more efficient choices by producers. Attention has been focused on the strain that the huge subsidies place on the development budget, but the advantages of using market signals appear to have been slighted. It would be unrealistic to expect that the Prices Commission will contribute to a significant liberalization of credit, input, or product markets. We found few Pakistani economists or planners who thought that the generation of "efficient" prices would emerge out of market processes. Nevertheless, the establishment of the Prices Commission must be regarded as a significant institutional advance.

Agricultural Research and Extension

The Bank and other donors have contributed substantial resources to develop institutional capacities to generate new technology and to diffuse that technology to farmers. Large increases in agricultural productivity and output occurred in the late 1960s and early 1970s as a result of Green Revolution transfers. However, Pakistan's research and extension system has not demonstrated a capacity to maintain that momentum. There is a lack of effective articulation between national and provincial research. The provincial system is excessively fragmented. There are too many small stations with limited scientific and technical capacity.

At present, the strongest scientific capacity in agriculture is located at universities. Performance is poor because of poor access to research resources to complement graduate training.

The fragmentation problem is being addressed through technical and financial support for the Pakistan Agricultural Research Council (PARC). The continuing support of PARC by the Bank and other donor agencies has placed the institution on its way to becoming the strong national research institution that has been lacking. Unfortunately, the Bank's support for research was reactivated relatively recently after a long lapse of time. The effect of years of neglect of the provincial research institutions will not be quickly remedied and cannot be overcome without a serious commitment from the federal and provincial governments to removing the administrative obstacles to better coordination of the overall research effort.

The Bank's effort to reform agricultural extension has focused on the Training and Visit System (T&V). The T&V system involves a much more intensive and tightly programmed approach to technology transfer than the traditional system. Effective implementation seems to have been hindered

by bureaucratic rigidities, staffing difficulties, and inadequate program management. But it is hard to escape a conclusion that many of the program's difficulties stem from an attempt to transfer an institutional innovation, one that the Bank regards as successful in a number of other countries, without adequate attention to how the program design should be adapted to the Pakistan agricultural and bureaucratic setting.

The Bank's technical expertise has been demonstrated with regard to individual institutions--witnessed by its initial success in the Faisalabad University and PARC projects. But the Bank's confined successes also illustrate the limits that it faces in dealing with complex political, bureaucratic and institutional issues. It is unlikely that agricultural growth in Pakistan will return to the level of the Green Revolution period until a more effective agricultural research and extension system is in place. Broadly speaking, Pakistan's educational system as a whole is at fault. Its failure to produce either a numerate and literate peasantry, a cadre of highly skilled agricultural technicians, or the substantial number of the scientists needed to staff applied research activities continues to retard the country's capacity to develop effective agricultural research and extension.

Rural Development, Land Tenure Reform, and Human Capital

During the 1970s Bank policy--as policy--increasingly emphasized the role of broadly based rural development, the reform of rural institutions, and the importance of human capital in the process of agricultural development. These policy concerns were not, however, reflected in the Bank's program for Pakistan.

The Bank has played only a marginal role in support of rural development programs and land tenure reform. It avoided direct support of the rural development program in the 1960s. It stood aloof from the land tenure reform efforts of 1959, 1972 and 1977. It is not clear whether the Bank's action was determined primarily by prudence, in an unstable political environment, or by a lack of commitment to rural development and land reform objectives. What is clear is that weaknesses of the social and institutional infrastructure at the village level, and the failure to adopt a system of land tenure and rural support institutions that provides greater incentives for small-scale producers, place a burden on both the growth of agricultural production and on the well-being of Pakistan's rural people.

The largest lacuna in the Bank's program has been its lack of attention to the problem of rural education. The research has not yet been done in Pakistan that would demonstrate the gains that might be obtained from investment in rural education and rural health. This is in itself surprising, given the substantial literature that has emerged on this issue over the last several decades in other Asian countries. Pakistan's under investment in human capital and rural institutional infrastructure is a serious hindrance to the growth of agricultural production and rural income. The Bank's failure to invest in rural reform and human capital projects has dampened the return from other projects where the Bank has invested substantial resources. I regard the Bank's reluctance to take an active interest in strengthening Pakistan's resolve and capacity to develop human capital as indicating a failure to think in terms of development strategy rather than development projects.

Strategy and Policy

It is particularly surprising, given the contribution of the World Bank to the development and diffusion of economic planning methodologies, to find that long range strategic considerations have tended to dominate short run economic considerations in the major Indus Basin water resource decisions. The early drive to put more water in the land was largely driven by other than economic criteria. These investments were dominated by strategic considerations involved in the settlement of the decade old Indus Basin water dispute and a vision of the rate that the Indus basin water had to play in the future development of Pakistan. There were major errors in the handling of issues such as the water logging and salinity problem and in the development of water distribution and research institutions. But these errors are gradually being rectified within the framework of the larger term strategic vision.

In the other areas reviewed here one does not find a clear articulation of long range development strategy. Bank sponsored activities in areas such as rural financial markets, agricultural research and extension, and rural education reflect neither a clear sense of development strategy nor a sense of commitment. Lack of strategic vision is most clearly reflected in the Bank's failure to invest in rural education or to place rural education high on its agenda for policy dialogue. The low level of rural literacy and numeracy in Pakistan acts to depress the rate of return realized on every other investment that the donor community and the Government of Pakistan has made in the field of agricultural and rural development.

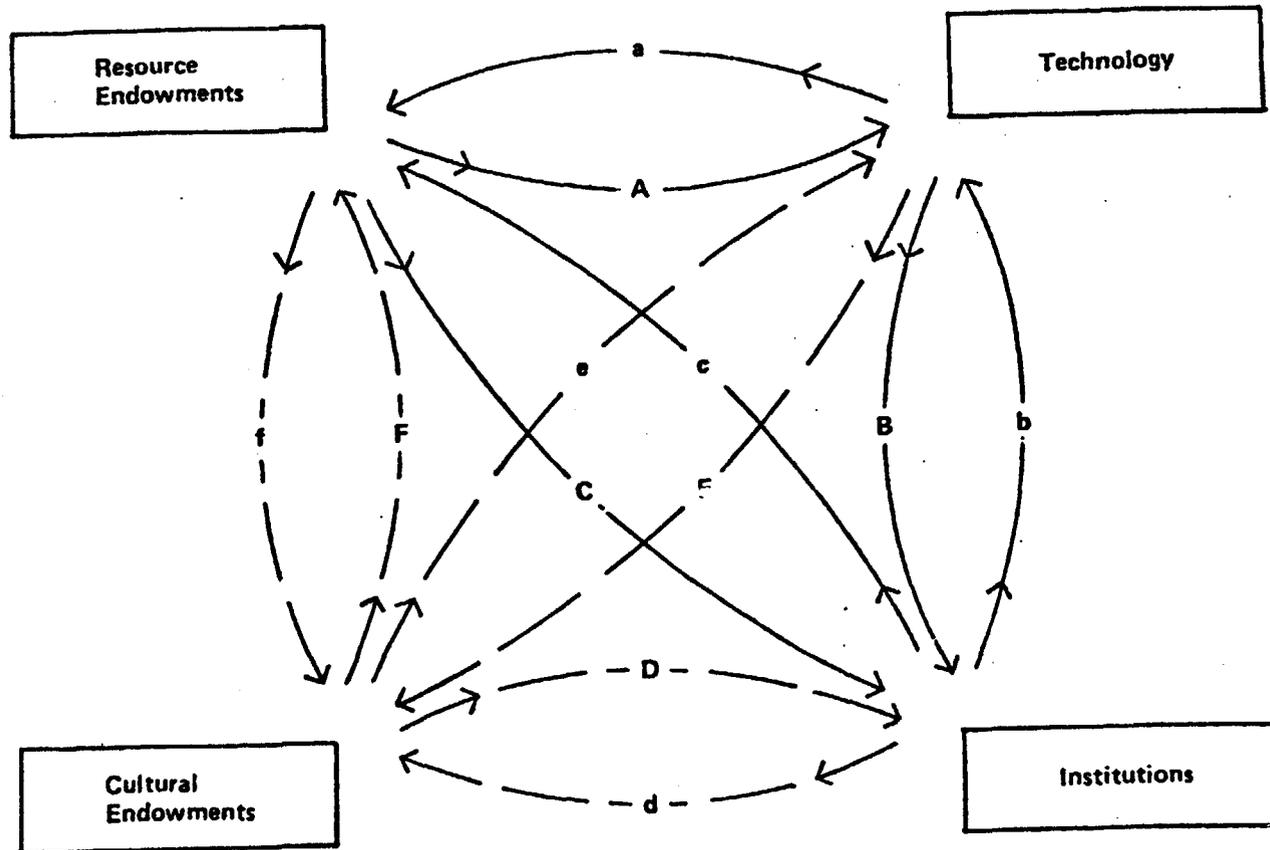
It is not adequate, however, to simply call for greater strategic vision. One may call but the response may be no more than an echo. There are a number of structural considerations in the Bank organization that, in my judgement limit the capacity of the Bank staff for strategic thinking. The highly centralized Washington centered decision structure in the Bank would be one of my candidates for critical evaluation. There is clearly a need to advance our understanding of the relationships among resource endowments, technical change, institutional change and cultural endowments. In the next section I suggest a framework for thinking about these interrelationships.

Toward a More Complete Model of Institutional Change

In closing I would like to reflect on the directions that future work might take in efforts to develop a more analytical approach to understanding the process of institutional change. The elements of a more complete model that maps the general equilibrium relationships among resource endowments, cultural endowments, technology and institutions are illustrated in Figure 2. ^{3/} The model suggests the importance of going beyond the conventional general equilibrium model in which resource

^{3/} In the Hayami and Ruttan work the term cultural endowments is used to capture those dimensions of cultures that have been transmitted from the past. Contemporary changes in resource endowments, technology and institutions can be expected to result in changes in the cultural endowments available to future generations.

Figure 2. The Induced Innovation Model of the Relations between Changes in Resource Endowments, Cultural Endowments, Technology, and Institutions



endowments, technologies, institutions and culture are treated as given. In the study of long-term social economic change the relationships among the several variables must be treated as recursive. The formal microeconomic models used in the Hayami-Ruttan work and in the work of others to analyze the supply and demand for technical and institutional change can be thought of as "nested" within the general equilibrium framework of Figure 2.

One advantage of the "pattern model" outlined in Figure 2 is that it helps identify areas of ignorance ^{4/}. Our capacity to model and test the relationships between resource endowments and technical change is relatively strong. Our capacity to model and test the relationships between cultural endowments and either technical or institutional change is relatively weak. A second advantage of the model is that it is useful in identifying the components that enter into other attempts to account for secular economic and social change. Failure to analyze historical change in a general equilibrium context tends to result in a unidimensional perspective on the relationships bearing on technical and institutional change.

For example, historians working within the Marxist tradition often tend to view technical change as dominating both institutional and cultural change. In his book Oriental Despotism, Karl Wittfogel views the irrigation technology used in wet rice cultivation in East Asia as determining political organization (Wittfogel, 1957). As it applies to Figure 2 his primary emphasis was on the impact of resources and technology on institutions (B) and (C).

A serious misunderstanding can be observed in contemporary neo-Marxian critiques of the green revolution. These criticisms have focused attention almost entirely on the impact of technical change on labor and land tenure relations. Both the radical and populist critics have emphasized relation (B). But they have tended to ignore relationships (A) and (C). This bias has led to repeated failure to identify effectively the separate effects of population growth and distribution of income.

The analytical power of the more complete induced innovation model has been illustrated in the Laguna Village study by Yujiro Hayami and Masao Kikuchi, (1982). In the Laguna (Philippines) they studies showed that increase in population pressure (C) and the higher incomes generated by technical change in rice production (B) resulted in substantial change in both land tenure and labor market relationships between the mid 1950's and the mid 1970's.

^{4/} Fusfeld (1980, 33) uses the term 'pattern' or 'Gestalt' model to describe a form of analysis that links the elements of a general pattern together by logical connections. The recursive multi-causal relationships of the pattern model imply that the model is always 'open' - "it can never include all of the relevant variables and relationships necessary for a full understanding of the phenomenon under investigations."

Armen Alchian and Harold Demsetz, identify a primary function of property rights as guiding incentives to achieve greater internalization of externalities. (Alchian and Demsetz, 1973) They consider that the clear specifications of property rights reduces transaction costs in the face of growing competition for the use of scarce resources as a result of population growth and/or growth in product demand. Douglass North and Robert P. Thomas, building on the Alchian-Demsetz paradigm, attempted to explain the economic growth of western Europe between 900 and 1700 primarily in terms of changes in property institutions (North and Thomas, 1970; 1973; Field, 1981). During the eleventh and thirteenth centuries the pressure of population against increasingly scarce land resources induced innovations in property rights that in turn created profitable opportunities for the generation and adoption of labor-intensive technical changes in agriculture. The population decline in the fourteenth and fifteenth centuries was viewed as a primary factor leading to the demise of feudalism and the rise of the national state (line C). These institutional changes in turn opened up new possibilities for economies of scale in nonagricultural production and in trade (line B).

In a more recent work Mancur Olson has emphasized the proliferation of institutions as a source of economic decline. (Olson, 1982; North, 1983). He also regards broad-based encompassing organizations as having incentives to generate growth and redistribute incomes to their members with little excess burden. For example, a broadly based coalition that encompasses the majority of agricultural producers is more likely to exert political pressure for growth-oriented policies that will enable its members to obtain a larger share of a larger national product than a smaller organization that represents the interests of the producers of a single commodity. Small organizations representing narrow interest groups are more likely to pursue the interests of their members at the expense of the welfare of other producers and the general public. In contrast, an even more broadly based farmer-labor coalition would be more concerned with promoting economic growth than would an organization representing a single sector. But large groups, in Olson's view, are inherently unstable because rational individuals will not incur the costs of contributing to the realization of the large group program — they have strong incentives to act as free riders. As a result, organizational "space" in a stable society will be increasingly occupied by special interest "distributional coalitions." These distributional coalitions make political life divisive. They slow down the adoption of new technologies (line B) and limit the capacity to reallocate resources (line C). The effect is to slow down economic growth or in some cases initiate a period of economic decline.

While substantial progress has been made, in economics at least within a partial equilibrium framework to analyze the sources and impact of technical and institutional change almost no attention has been devoted by economists to the role of cultural endowments. To the extent that cultural endowments are considered at all by economists they tend to be subsumed under the concept of tastes. And tastes, even more so than technology and institutions, are regarded as not subject to economic analysis. (Stigler and Becker, 1977).

At the intuitive level we have little difficulty in accepting the view that cultural endowments, including religion and ideology, exert at least some influence on the supply of institutional innovation. Cultural endowments make some forms of institutional change less costly to establish and impose severe costs to others.

It has been argued, for example, that the traditional moral obligation in the Japanese village community to cooperate in communal infrastructure maintenance has made it less costly to implement rural development programs than in societies lacking such traditions. (Ishkawa, 1981, pp. 325-47). The traditional patterns of cooperation have represented an important cultural resource on which to erect modern forms of cooperations marketing and joint farming activities. In China, communist ideology, reinforced by the lessons learned during the guerrilla period in Yenan, inspired the mobilization of communal resources to build irrigation systems and other forms of overhead capital (Schran, 1975). Similar control endowments are not available in South Asia villages where, for example, the cost structure inhibits cooperation and encourages specialization.

In the cases cited above cultural endowments acted to shift the supply of institutional innovation to the right--to reduce the cost of institutional change. Cultural endowments are in the development literature, more frequently viewed as obstacles to technical or institutional change. Kusum Nair insists that the differential response to the green revolution seed-fertilizer technology among regions in India can be explained, at least in part, on cultural grounds (Nair, 1979). It has been argued that a primary explanation for British economic decline over the last century has been a set of cultural changes associated with the "gentrification" of bourgeois culture - "the rooting of pseudoaristocratic attitudes and values on upper-middle-class educated opinion, shaped an unfavorable context for economic endeavor" (Wiener, 1981).

The first post-war generation of development economists gave a prominent role, at least at the rhetorical level, to the role of cultural endowments in constraining or facilitating economic growth. ^{5/} They accepted the body of scholarship in history, philosophy, anthropology, and sociology and political science that insisted that cultural endowments exerted major impact on behavior and hence on the response in traditional societies to the opportunities associated with the modernization of community life and the possibilities of national economic development (Hagen, 1962). Professional opinion has, however, not dealt kindly with the reputations of those development economists who have made serious attempts to incorporate cultural variables into development theory or into the analysis of the development process. But in spite of the failure of

^{5/} I have reviewed this lecture in "Cultural Endowments and Economic Development: What Can We Learn From Anthropology". Paper presented at a conference on East Asian Development, Graduate Program in Economic Development, Vanderbilt University, Nashville, Tennessee, October 16-19, 1986.

research on the economic implications of cultural endowments to find a secure place in economic development literature or thought the conviction that "cultural matters" remains pervasive in the underworld of development thought and practice. The fact that the scholars and practitioners of development are forced to deal with cultural endowments at an intuitive level rather than in analytical terms should be regarded as a deficiency in professional capacity rather than as evidence that culture doesn't matter. In my judgement it is time for a new generation of development economists to again take stock of the advances in the related social sciences and attempt to assess what they can contribute to our understanding of the development process and to institutional design.

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INSTITUTIONAL REQUIREMENTS FOR SUSTAINED AGRICULTURAL DEVELOPMENT

RAPPORTEUR'S COMMENTS

Turid Sato*

Summary of Speech

Professor Ruttan in his speech entitled "Institutional Requirements for Sustained Agricultural Development" talked about the remarkable transition that has taken place in agriculture in this century. Before the beginning of this century almost all increases in agricultural production occurred as a result of increases in the area cultivated. By the end of this century there will be few areas where agricultural production can be expanded by simply adding more land to production. Future increases will have to come from more intensive cultivation in areas already under production. During this century economic forces have contributed to two distinct technological changes. Japan exemplified the biological technology path by substituting biological and chemical technology for high-cost land while the U.S. followed the mechanical technology path in response to an environment in which labor was expensive and land cheap. Changes in relative resource endowment and technology also created demands for institutional change whether in terms of creating new institutions or for cost reductions in services offered. The specific example of the Pakistan agricultural development was cited to illustrate some general points of institutional development in agriculture. The World Bank's role in it was also discussed.

Professor Ruttan, on the basis of an extensive evaluation of the Bank's experience in agricultural development in Pakistan, concluded that while the Bank has contributed in great part to its success, particularly in the infrastructure areas such as water resource development where a long-term strategy had been developed which was pursued by the Bank and the Government, there were other areas in which progress was less impressive, for example in the management of water resources, rural education, rural finance, agricultural research, etc. The underlying theme of the shortcomings in these areas was the lack of institutional capability and capacity. An overall strategy to govern rural development in Pakistan was lacking.

Dr. Ruttan's theme presented a model for institutional development that spelled out the direct and indirect relationships among four factors: Resource Endowment, Technology, Cultural Endowments and Institutions. He indicated that much more work was needed in relating these factors before a complete theory can be formulated to guide institutional development. He stressed the importance of renewing interest in such work, as institutions do contribute a great deal to the growth and wellbeing of a society.

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Comments and Questions

Several staff members had comments and raised questions. Onestaff member commented that in the past the agriculturalists, the economists, and the engineers often took credit for the improvements or the benefits but tended to blame the institution, the people or the culture when things went wrong. A more balanced approach facing both the positive and negative effects of change would be desirable. With specific reference to Pakistan, the staff member took particular exception to the notion that donors did not have a strategy, as Pakistan was perhaps a unique case in which the donors collaborated closely on a strategy. Instead, the problem may have been that institutions in Pakistan existed at the elite level but had not filtered down to the grass roots.

Professor Ruttan basically agreed with the staff member's comments, but noted that in the case of water resource development a common vision had guided the donors and the Government alike upon which a strategy had been formulated. This common vision or objectives has guided the decision makers when things went wrong and corrections were needed. A corresponding vision shared by the donors and the country did not guide the other areas of development, such as human resource development, agricultural research, etc. In this Professor Ruttan faulted the donors for not involving themselves or the Government in formulating a common vision and a strategy in support of the agreed upon objectives.

Another staff member commented that in Pakistan there were other institutional constraints such as lack of coordination between the agricultural department and the engineering department, frequent changes in management, etc., making it difficult to carry out a cohesive development program. One staff member commented that while one could do better in terms of increased productivity, technical factors such as the limitation of water represented a basic constraint. Another staff member felt that the progress made in creating some 10,000 water resource associations at the grass roots level was an important positive innovation that should not go unnoticed.

One staff member asked whether on the basis of the knowledge available now, it was possible to have criteria to determine whether there is a fit between the institutions and the environment or the other endowments referred to. Dr. Ruttan advocated a cautious approach to assessing the fit between institutions and other factors as we were just beginning to conceptualize the role of institutions as part of the resource endowment and its impact on economic growth. But as we start to understand cause and effect and the functions of institutions in a particular environment, we should do better. In response to another question he mentioned that the methodology is developing and starting to get recognition as indicated by the Nobel Prize Award given to the originators of the Public Choice theory. With respect to political economy, we have less to offer and in terms of cultural endowment, we are even further off. But, he said, at least there is a change in the recognition of the role of institutions and its impact as contrasted to the post-war period when economists considered institutions to be a barrier to development. At least now institutions are seen potentially to be an important source of growth - an important first step.

Responding to a question about whether the Green Revolution was a one-time event, Mr. Ruttan felt that historians would judge the Green Revolution an evolution rather than a revolution as the trends had been going on already in several countries even in the pre-war period; it started with Japan and Taiwan but was interrupted by the second world war.

In response to a question of overall cultural endowment being a constraint in agriculture in Pakistan, Professor Ruttan replied that we needed a "thicker" set of institutions in the countries in which more plans and decisions could be made at the local level over the resource base that exist, to avoid waiting for things to happen at the center.

HUMAN DEVELOPMENT AND SUSTAINABILITY

Bernard M. Woods*

A wealth of data and experience of development confirms what common sense suggests: that sustainable development requires the necessary human skills, attitudes, motivation, understanding, leadership, organizations, policies, plans, and administrative and financial systems for whatever activities are involved - as well as the necessary infrastructure, funds, and physical inputs. Yet 'official', government-led development worldwide has had great difficulty with these human and institutional aspects of development, or 'human capital formation' to use economists' language. World Bank supervision, completion, and evaluation reports, almost without exception, record difficulties with one aspect or another of this 'human dimension' of the development process. Despite all the resources and dedication that have been applied to development, shortcomings in 'institution building' and 'human resource development' remain, and a great many well-intended projects and programs have failed to be sustainable as a result.

Why?

The problem is well known, but its solution continues to elude even some of the best development efforts. Why should this be? A better understanding of the reasons for this persistent difficulty in development would be half way to its solution. This paper addresses this issue and draws together the separate conclusions of authorities in a variety of relevant fields. They show the reason to be simple, but the solution to affect some of the underlying assumptions and philosophies on which development assistance has been based.

The paper first considers findings in the agricultural sector; it touches on economic theory; examines the learning process on which human development depends, and how this has been approached in 'development'; and it then describes an underlying cause of a pervasive problem.

The Three Dimensions of Agricultural Development^{1/}

Three distinct, but interacting, dimensions of agricultural development can be distinguished: the technical, physical dimension; the financial, economic dimension; and the human, institutional dimension. Each has its distinct language and distinct range of activities that follow from that language.

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^{1/} Enlarging upon a concept described by Professor Niels Roling, Professor of Agricultural Extension at the University of Wageningen, the Netherlands, in a presentation at the AERDC Conference at the University of Reading, England, September, 1985.

The language of the technical, physical dimension uses the terms: land use, agricultural technology, research, dissemination of technology, agricultural inputs, credit, markets, access, maximizing production, and the like.

The language of economists and financial people is in terms of costs, incentives, pricing policies, subsidies, budgets, maximising returns, financial channels and procedures, and so on.

These describe the activities and mechanisms which society expects agriculturalists, economists, and financial specialists to handle in their achievement of increased agricultural production. These, one might say, describe the tools of their trades.

The language of the human, institutional dimension uses different terms such as: relevant knowledge and skills, training and staff development, leadership, two-way communication, management, integrated development, organization and administration, participation, local government, the involvement of women, institutional capacity, and so on.

These are not the usual fields of expertise of agriculturalists, engineers, economists, or financial specialists.

An example of the effect of the distinction in the focus of attention in these three dimensions is that between 1976 and 1980 the Bank invested US\$ 920 million in agricultural projects without funds in any one of them being allocated to the staff training needed for the new activities on which those projects depended. They were designed by technical, financial, and economic specialists who concentrated on technology, farm inputs, prices, road, market, and irrigation infrastructure according to their specialities, but not on the skills and systems to maintain the programs subsequently. Typically, they defined the objectives of their projects in technical, physical, and economic language and referred to elements of the human dimension as 'problems' in achieving those objectives.

An analysis by the Operational Training Unit in OPS in June 1986 showed clearly that agricultural missions which included training, communication, and/or institutional specialists produced projects with a different profile: one in which aspects of the human dimension were treated more as equal objectives of the projects and less as 'problems'. Where technical, economic, and financial staff had received training in human and institutional aspects of project design, the projects they subsequently designed also showed a better balance between all three dimensions showing that they were inherently able to be effective in these fields, but that something in their background, or in their working environment, had previously restricted them from being effective in the human, institutional dimension.

Emphasis on human and institutional aspects of project design has increased in more recent lending, but the inherent problem remains. For example: a recently proposed project supports a national program in a predominantly livestock-producing country "to improve the use, management,

and production of land and natural resources." Project designers recognized that this would require collective initiative and responsibility at village level to improve grazing control and traditional attitudes toward livestock, and that "there will need to be a strong element of participation (of villagers) in the project." Thus, in conceiving the project, the project planners recognized the need for addressing the human dimension of the project. The detailed project objectives, however, were described as: "soil and water conservation; use of organic matter; tree planting; fodder production; integration of livestock into the farming system; valley bottom development, and infrastructure improvement." Mobile teams were provided but their object was described only as being: "to help villagers in the development of land use plans and contracts." Despite the intention to address key elements of the human dimension, the project is described in the language of the technical, physical dimension, and excludes the language and activities needed for successful implementation - such as sensitizing the whole rural population to the dangers and alternatives of traditional livestock practices; developing community leadership and systems to administer grazing control; training and information systems for all the new activities indicated above, and so on.

Why should this be?

The Staff Profile of the Agricultural Sector

The profile of the Bank staff positions with responsibility for agricultural (and rural development) lending is roughly:

Agriculturalists and Engineers	180
Economists and Financial Specialists	280
Others (Marketing, Statisticians etc.)	10
Sociologist	1
Communication Specialist (not yet filled)	1
Agricultural Training Specialist	<u>22/</u>

The staff profile of several other major development agencies has a similar technical, economic orientation, and that of agricultural ministries of governments is almost exclusively biased towards the technical, physical dimension of agricultural development (but with less of an economic, financial bias than the Bank, for obvious reasons).

This technical, economic orientation of the major development agencies and governments towards the language and activities of those dimensions has preempted attention to the human dimension. It has caused an imbalance in development approaches in the agricultural sector away from the human dimension, and thus away from areas of activity that are vital for sustainability and poverty alleviation.

Why has this happened?

2/ Reduced from four in FY86, but none in agricultural divisions with direct responsibility for agricultural lending.

This bias towards the technical and economic dimensions is not the cause but a characteristic of the present problem. It has other characteristics which we should consider before seeking the underlying cause. These include economic theory, and current approaches to the learning needed for development.

Neo-Classical Economic Theory

Much macro- and micro-economic planning has been founded on the interactions between production, demand, and prices which neo-classical economic theory predicts in 'perfect market conditions'. Much attention has been given to the physical and financial aspects of those market conditions; far less to the perfect skills and perfect information required to make perfect markets operate as predicted ^{3/}

In commerce and industry, problems of quality and shortfalls in production quickly show where essential skills and information are missing. Much is spent on staff training and market research, and on advertising to inform intended consumers and to generate demand. In these conditions, the necessary information is generally present and supply and demand perform, to a greater or lesser degree, as predicted. A totally different situation pertains among rural people in developing countries and among the poor in urban areas. Little has been invested in most projects to determine what the intended beneficiaries actually know, and existing information systems are selective in their contact and limited in the information that they can convey. In this situation, supply and demand fluctuations have been erratic, and because it has been difficult to assign an economic value to knowledge, skills and information, consideration of the extent to which information actually reaches intended beneficiaries, and disadvantaged groups in particular, has, in some cases, been completely omitted in project design.

We all know that skills and topical information are key elements in all production processes. How is it that their contribution to 'perfect market conditions' has received such inadequate attention in economic thinking?

The Learning Needed for Development

Improvement in any of the elements of the human dimension of development listed in the first sentence of this paper requires a learning process on the part of every individual involved. To be concerned with development, therefore, means to be concerned with learning, and the information transfer on which that learning depends. If development is to achieve sustainability, it must make possible the continuing learning needed by everyone involved for every activity required for sustainability.

We can examine this whole universe of learning for development by considering the universe of learners, the information, knowledge, and skills needed by each subset of that universe, and the location of the

^{3/} "The Economics of Information and Theory of Development". Professor Joseph Stiglitz, University of Princeton, lecture at the World Bank, April 1986.

initiative and responsibility for facilitating the learning needed for each category of skills required. These are outlined in simple form below.

The Universe of Learners can be represented by the rectangle in Figure 1. All learners can be divided on an age basis as shown. Half (or more) of the population in developing countries is now aged 0-18, and almost a quarter aged 0-6. All are involved in pre-employment learning. Adults are involved in a continuing learning process for all on-going adult activities (including employment). For analyzing the location of responsibility for providing the skills and knowledge they need, adults can be divided according to those who are employed - both by governments and by the private sector - and those who are at, or are close to, subsistence level. The knowledge, skills and information they require can be disaggregated according to those related to employment and occupations; those related to day-to-day living, and the special knowledge and skills required by women. As employment is strongly male-oriented in most developing countries, a majority of the self-employed are women.

Figure 1. The Universe of Learners in Developing Countries

		Employed in the Private Sector
Age 0 - 6	Age 7 - 18	Self employed and at subsistence level.
		Employed by Governments
0 - 6	7 - 18	Adults

Responsibility for Learning: Educational authorities in countries at all stages of development have responsibility for formal school and university education, pre-entry training for specific trades, and some pre-school learning. Increasingly, they are being successful in reaching people out of school through functional literacy and numeracy programs and distance learning techniques. The numbers in school systems are still less than 30% in some countries and, whatever their coverage, the scope of what is learned through education systems is still small in relation to the total universe of knowledge and skills needed for development.

In developed countries, most adults are employed and employers have responsibility of on-going, job-specific training. ^{4/} The private sector also provides for a great deal of the continuing learning needed

^{4/} The scale of this activity needed in development is indicated by the fact that commerce and industry in the United States are estimated to have spent about US\$ 60 billion on their own staff training and development in 1985 (four times the investment in education by the World Bank in all developing countries in the past 20 years.

for everyday activities both by children and by adults. This they provide through radio, TV, newspapers, journals, books, advertising generally, workshops, exhibitions, and so on. Central governments in developed economies (other than centrally-planned economies) make only a small contribution of the total information dissemination process for adults. This is shown in Figure 2A.

The situation is quite different in less developed countries, as is shown in Figure 2B. Here, relatively few are employed and so employers have made only a small contribution to organizing and funding the learning needed by adults, and, being undeveloped at early stages of development, the private sector is poorly equipped to provide for day-to-day learning among children and adults. Central governments have had to take much of the initiative for information dissemination and the learning needed for development; typically, they have addressed this through traditional school and university systems and through extension and information services of technical ministries.

Figures 1 and 2B show that the largest single subset of the universe of learners in developing countries is adults who, in all but the more industrialized of developing countries, are self-employed or at subsistence level.^{5/} Because employment is strongly male-oriented in developing countries, more than half of this subset is women. If we add to this subset the children in the 0-6 age group, (who depend upon their parents for their early learning), plus those not attending schools, those groups of learners constitute, in most developing countries, about two-thirds of all people. Typically, responsibility for the learning they need has been fragmented among governmental agencies according to their sectors. Each sector has responsibility for providing the practical knowledge, skills, and information related to the physical products of its technical discipline—crops, livestock, water, health, fish, trees, energy, and the like. All are necessary ingredients of development, but provision of the non-technical knowledge and skills required by adults has not been the role or expertise of the technical sectors: skills and understanding, for example, in the fields of non-agricultural employment, village level technology, and credit and savings systems for the poor; and of practical leadership, management, administration, financial control, planning, evaluation, communication, and the special learning needs of women. An examination of any but a few villages in developing countries will show that the mechanisms to provide these skills are not generally in place. A serious gap exists as shown in Diagram 2B. Where they do exist, these and other essential 'skills for living' have mostly been provided by NGOs. Starting from all sorts of motivations and sectoral biases, NGOs have tried to fill this vacuum in official development approaches. A recent analysis of over 600 successful, village-level programs in 55 countries shows that, in one way or another, every one of those programs made learning in these fields possible.

Why should there have been this vacuum?

^{5/} Their number is approximately 1200 million - and this will double within the next 18 years.

Diagram 2: Location of Initiative and Responsibility for Information Dissemination and Learning for Development.

Diagram 2A: Developed Countries

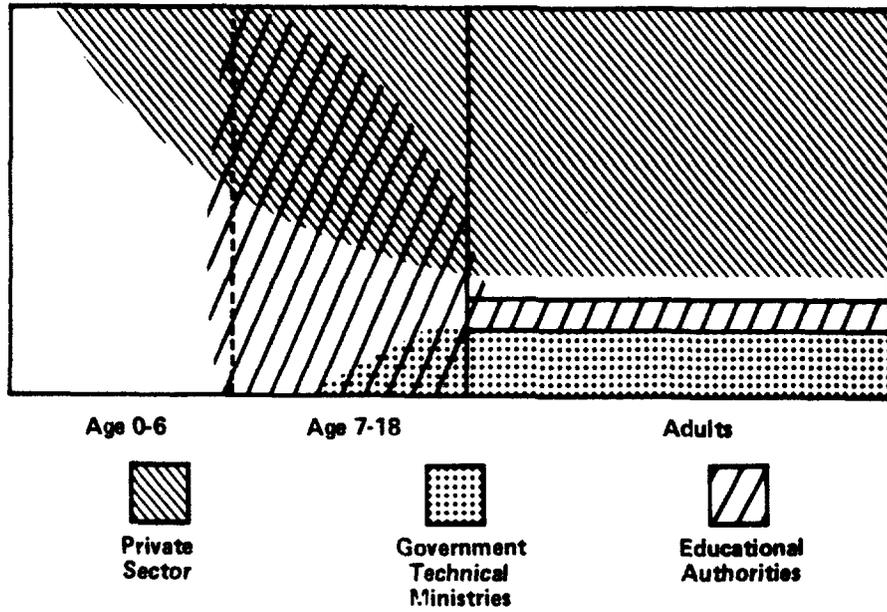
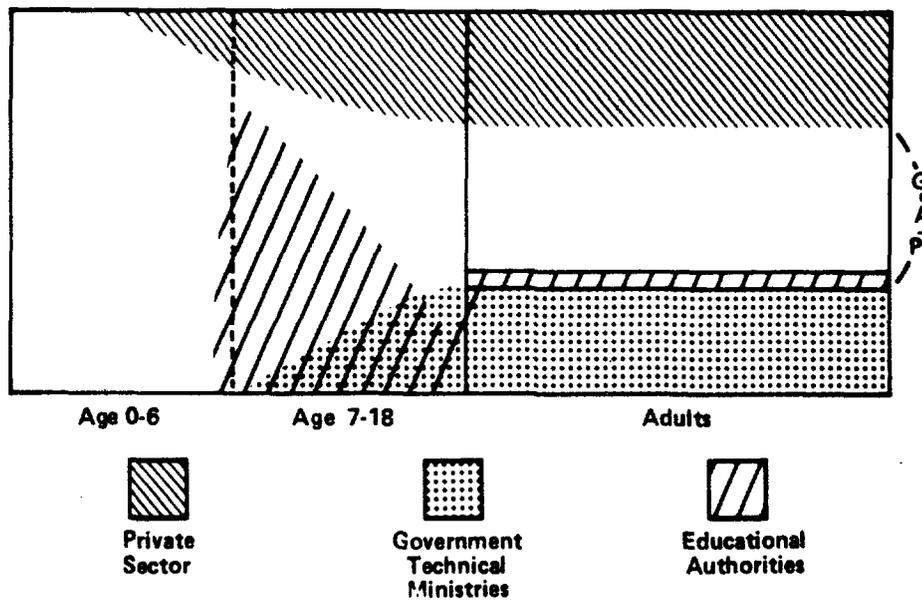


Diagram 2B: Less Developed Countries.



Figures 1 and 2 show that school-age children and adolescents constitute only a subset of the universe of learners and are involved in only a portion of the universe of learning. Despite this, 'education' has been treated as a sector in development whereas, in fact, it is only a subsector within the larger human resource development sector (HRD). Educators and educational authorities do not have the role, background, or opportunity to deal with the continuing, job-and occupation-specific learning among adults needed for development. The treatment of education as a sector has preempted equivalent attention being given to the other subsets of the total universe of learning.

Like the prevailing bias towards the technical, physical dimension of agricultural development, and the inattention to the value of information in economic thinking, this neglect of adult learning in development approaches is also a characteristic of the present problem. The cause lies deeper.

An Underlying Cause

The persistent neglect of the human dimension of development has its origin in the way we have thought about, and so approached, development. It is more pronounced in the agricultural sector, partly because of the breadth of the sciences, disciplines, and subsectors which 'agriculture' encompasses, but it can be shown in other sectors too.

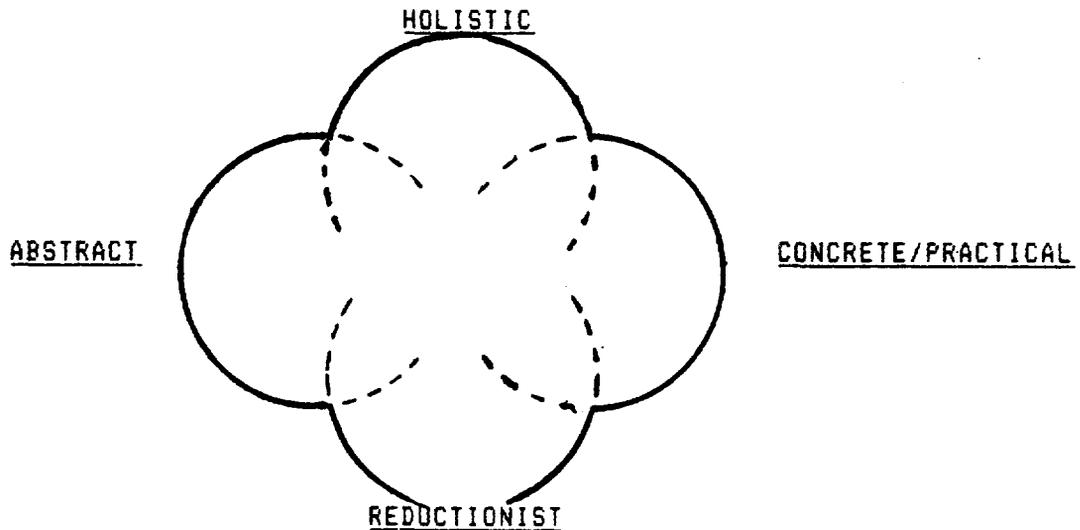
For the past seven years, driven by a concern over the declining agricultural industry in Australia and worldwide experience of agricultural extension workers having limited impact on farmers, a team of 42 academics at the Hawkesbury College in Australia has sought the causes of these phenomena. Their research has taken them far from agricultural science into the fields of psychology and learning theory, drawing from relevant work wherever they could find it. Their conclusions have led to a total reassessment of the roles of communication and learning in development and a review of how agriculture should be taught, and of the role of agricultural extension workers. 6/

A growing body of evidence suggests that, as a result of our individual genetic make-up, our particular past experiences (specially educational ones), the conventional wisdom within which we work and live, and even the relative development of different parts of our brains, we each develop a personally-biased learning and thinking style which we prefer to use over others. As we mature, the preferred style influences the way we think about and approach problems and it often becomes so strongly held that it can dictate the types of problem situations we prefer to tackle, even to the extent of influencing career paths. Once set, these styles can be remarkably resistant to change.

6/ What follows in the next two pages is drawn from a presentation in April 1986 at the World Bank by Dr. Richard Bawden, then Visiting Professor of Systems Agriculture at the University of New Jersey, Rutgers; now Director of the Hawkesbury Research Foundation, N.S.W., Australia.

The four styles are represented in Figure 3. They show two sets of opposing but interacting characteristics of learning and thinking: reductionist versus holistic, and concrete versus abstract. Every individual's particular thinking bias can be represented as a point on the diagram - determined by his personal background and genetic pre-disposition. Individual thinking styles reflect and cause markedly different ways of construing the same real events. Because we are all most comfortable within our own thinking styles, we tend to pursue activities, or preferentially accept information, which reinforce our own positions, and tend to discredit information which would give cause for doubting them - let alone challenging them.

Figure 3



In simplistic form, the four styles are as follows:

Reductionist thinking is typical of scientists and educators. In both cases the spectrum of knowledge with which they have to deal is so great that it has to be disaggregated to be manageable. The disaggregated parts then tend to take on a life of their own and tend not to be re-aggregated. With increasing 'depth' of investigation, or the 'higher' the learning, for example, more and more becomes known about less and less, often with a shift towards abstract thinking.

Concrete/practical thinking is typical of successful farmers and businessmen. Their world is one of constant interactions between physical, social, and financial considerations and realities. They must continually coordinate knowledge that is mostly available to them in fragmented subject-based form. The more experience they gain, the more they tend toward holistic thinking styles.

Economists and lawyers typically think in abstractions. They work in a world bounded by laws of their own invention against which they must constantly test reality. Many lack scientific or practical backgrounds and so must take on trust the views of technicians and practitioners (who are, of course, influenced by their own particular biases).

Holistic, global thinking grows with the range of one's experience of different situations, activities, cultures, places and so on, but 'systems' thinking is also an innate ability involving a stronger right-brained, conceptual process than the linear, rationalistic thinking of stronger left-brained people. It is possible to teach people to think more holistically, however, and so correct the imbalance of strongly reductionist educational backgrounds.

Major implications of these findings for agriculture and development as a whole include the following:

1. The reductionist approaches of traditional education have led to sharp, often artificial distinctions between 'subjects', 'disciplines', and 'faculties', and between the physical and social sciences. An agricultural qualification in many countries has traditionally been either largely or totally science-oriented-leading to the almost exclusively technological orientation of most agricultural research, fragmentation between inter-related aspects of farm systems (crops, livestock, horticulture, trees and so on), and to the technical orientation of the staff profiles of agricultural organizations.

2. Extension agents almost everywhere are taught to think as scientists, and extension services are organized on a discipline basis accordingly. Farmers, on the other hand, have to think quite differently. Almost every decision they take is based on a interaction between a set of technical considerations, practical realities, and the farmer's individual social and financial priorities. Most extension agents the world over do not have sufficient practical farming background to enable them to think as farmers do; their education has 'programmed' them to think in a different style. Not surprisingly, there are relatively few really successful extension agents - particularly young ones - whose experience is insufficient to overcome their educational inadequacies. 7/

3. Reductionist thinking styles have permitted economists and others to give sufficient value to elements of development which they cannot measure, and to consider as 'good' projects with an acceptable economic rate of return - irrespective of the fact that the human and institutional capacity to implement and, particularly, sustain those projects subsequently, may not exist.

7/ The systems approach to the teaching of agriculture introduced at Hawkesbury College as a result of their research is being adopted widely in Australia - in whole or in part - and is being tested in the Philippines, Indonesia, and in the USA. It has many features that are shared by the Rural University in Columbia which also grew from a questioning of the adequacy for development of traditional educational approaches.

4. At a higher level, the reductionist style of thinking that derives from traditional education systems has a larger effect. It has led to the disciplines, professions, and 'sectors' which we tend to accept unquestioningly. This in turn has led to the preoccupation of development with the physical products of the sectors and subsectors which we have created, and with their technology, physical inputs, and products, and the costs and economic value of those products. All these elements are necessary, but we need now to compliment them with the human ingredients of sustainable development and so correct the imbalance that has evolved. This will require new skills among technical staff of agricultural organizations and development agencies, and a change in their staff profiles to equip them to handle all three dimensions of agricultural development.

Improving the balance between the three dimensions would help in achieving agricultural goals, but would not, in itself, achieve sustainable development because all the ingredients for sustainable development do not reside within the role, responsibility, or expectation of what we call 'agriculture'. Neither do they reside within what is currently possible in the sum of the other technical sectors and the education 'sector'. At any one time, we are only able to achieve, on a wide scale, what is possible within the perceived functions and expertise of the organizational structures that exist. The sectors now in place in the Bank and in most developing countries are unable to deal with the whole spectrum of adult learning needed for development - particularly the learning needed at community level in the fields outlined above. Something can be done by new emphasis on these fields through our present sectors, but had these things been within the scope of our present sectors, they would have been achieved already. Rather than attempt to stretch or bend existing sectors to deal in fields which are not their logical function, we need to create the organizational structures within which it will be possible to deal with all ingredients of sustainable development.

Mass communication media illustrates the problem well. Modern forms of mass media were not available when the present organizational structures of existing governments were established. As each sector has become aware of the potential contribution of mass media to its programs, each has independently set up small, duplicative media production units. Most of these have been too small to offer career advancement opportunities to their specialist staff, or to include adequate maintenance skills for their equipment. Relics of these units can be found in many ministries in most countries. Meanwhile, as new communication technology becomes available, the critical mass of effective media production, testing, research, and equipment maintenance capability increases, and experience is showing that units able to provide these services can be drawn multisectorally. Thus, various sectors have each attempted to stretch their structures to handle media individually, rather than governments create the organizational structures within which the full potential of media can be realized.

Conclusion

To sum up: we can view the human development required for sustainability first in the context of what is needed within the agricultural sector, and then in the context of what is needed for the total universe of learning on which development depends. We can conclude that:

1. Within the agricultural sector:
 - a. the staff profile, skills, language, and perceived role of the sector have led to great emphasis on the technical/physical, and economic/financial dimensions of agricultural development, but excluded equal attention to the human dimension;
 - b. we all know that development has to be effective in the human dimension to achieve sustainability, but prevailing conventional wisdom and the mental programming of most development planners and practitioners which derive from traditional education systems currently prevent wide success in that dimension;
 - c. we can correct the imbalance between the three dimensions through 'reprogramming' of those involved in the sector; and
 - d. we need to focus on the root cause of the problem which lies in the reductionism of traditional educational systems, and in agricultural education especially.

Beyond the agricultural sector there are other essential, but missing, ingredients of sustainable development on which the sustainability of agricultural development depends. These include particularly the extent to which development approaches deriving from the technical sectors now in place are unable to deal with the whole spectrum of adult learning needed for development. The addition of the organizational structures, expertise and resources needed to achieve this whole spectrum of adult learning offers new opportunities for investment and for success in development. But it calls for a move toward holistic, systems approaches and away from the reductionist thinking styles which have dominated development assistance to date.

HUMAN DEVELOPMENT AND SUSTAINABILITY

RAPPORTEUR'S COMMENTS

Susan A. Stout *

Constraints to the development of a more holistic approach to human resource development and sustainability

Several participants commented on factors constraining the recognition of the role of learning and human resource development in achieving sustainable projects. Factors cited included the lack of staff with appropriate training in sociological, anthropological, and 'reductionist' and technical/financial traditions. The training and background of the majority of Bank staff, leads to a tendency to assume that 'money can fix anything'. Although in recent years there has been growing recognition of the need to pay attention to sociological aspects of, and the learning needed for development, there is still little understanding of how to do so. Moreover, there is a risk that the results of sociological/anthropological analyses in support of projects won't easily 'fit' within the present conceptual framework implicit in the sectoral organization of the Bank's work. Analyses of political constraints to the introduction of agricultural innovations, for instance, may not be readily incorporated into a typical agricultural project design exercise. A speaker suggested that while the Bank should likely make more use of sociological and anthropological skills, in his experience the perspectives of such experts may be overly passive in orientation. He further suggested that the Bank might be wise to invest in generating, through training, a core of expertise with a more activist orientation to the applications of sociological, cultural and communication expertise to development.

Implications for training and extension

A speaker noted that Mr. Woods' paper had several implications for the design of training and extension efforts, and suggested in particular that the question of how to incorporate institutional and sociological issues into extension agent training should be considered. Another possibility would be to consider the use of teams of technically and sociologically trained extension agents to assure that more relevant and useable information was transmitted to farmers. Mr. Woods pointed out that consideration of the dimensions of the need for adult learning and skills development in developing countries pointed to the need for an extensive re-training effort for existing extension personnel and reform of standard approaches to agricultural education. Under current arrangements, responsibility for developing cost effective responses to the need for adult learning seems to 'fall between the cracks' and does not fit into either traditionally defined education or agricultural agencies' span of control. The potentially massive costs and inefficiency of conventional training and extension efforts also points to the need to consider the role

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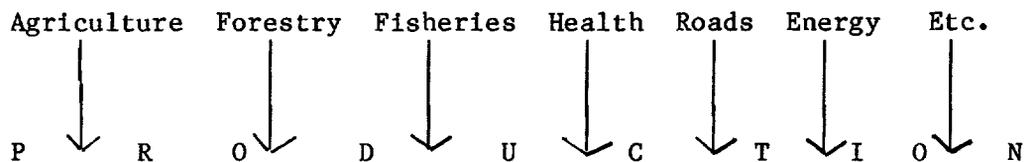
of new technology, for instance the use of video and microcomputers in promoting improved adult learning, and for the Bank to be suitably equipped to do so.

What should be the World Bank's role?

Several participants noted that the paper raised several questions concerning the role of the Bank in promoting greater interest in an effort to improve, understanding of the role of human resource development in achieving sustainability. A speaker noted that recognition of the need to incorporate better understanding of the role of communications in development into the Bank's work might lead to the trap of simply hiring additional experts to fill gaps rather than achieving more fundamental improvement in the current laissez-passez approach to such issues within normal Bank work. Mr. Woods commented that although currently weak in the area of learning and communication, the Bank needed to provide leadership in this field in the developing world and could act as a catalyst in articulating the issues and developing sound approaches.

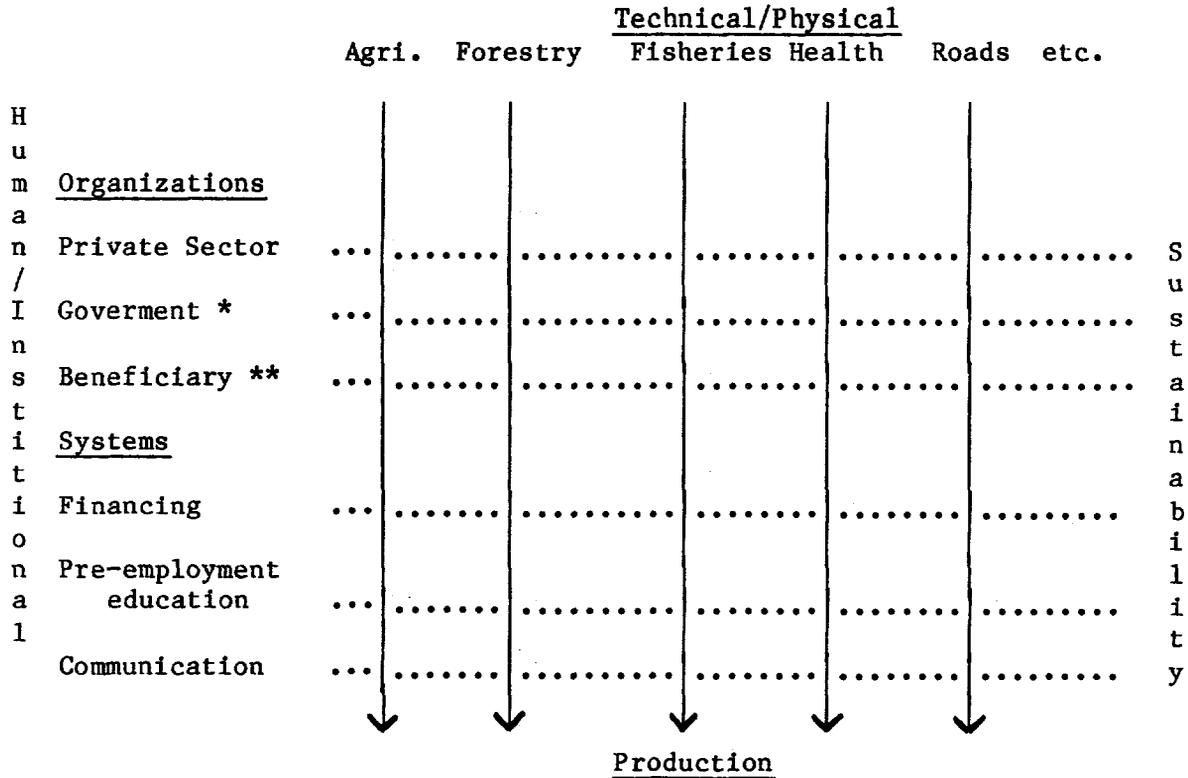
What are the implications of the paper's findings for Bank reorganization?

A participant asked Mr. Woods to comment on the implications of his paper for Bank operations and particularly the re-organization of the Bank currently under discussion. Mr. Woods pointed out that preoccupation with the technical/economic dimension of development has led to an emphasis on production, and an equation of production with development. We have build and staffed the sectors we have today to achieve the logical products of these sectors:



We speak of management, institution building, administration, participation, and the like as 'problems' in achieving that production, and we are limited in the things we do to want is possible in those sectors - whose sum does not add up to the totality of development in either the rural or urban areas.

If we are concerned with sustainability, (which does equate with development) we need to be concerned with creating the human and institutional capability to achieve and sustain both production per se and the institutional environment in which that can be achieved. The institutions needed for development sub-divide (for Bank organizational purposes) into three categories of human organization and three essential supporting systems:



- * including legal systems
- ** communities, cooperatives, groups, etc.

The Bank needs to be organized and staffed so that it can finance programs to develop any of the six subsets of the human/institutional dimension as well as programs in the technical dimension (and combinations of them). As well as increasing the success of our investment, this would open up new opportunities for Bank lending. The Public Sector Management divisions are a start in this direction. We now need to recognize the totality of the human resource development sector. In response to a question concerning the degree to which those involved in the Bank reorganization exercise are aware of current thinking about the role of communication and adult learning in human resource and institutional issues, Mr. Woods felt that partial awareness of the issues existed and undertook to follow up the suggestion that the groups discussion be formally passed to those involved in steering the reorganization exercise.

LOCAL GOVERNMENT AND LOCAL INSTITUTIONS

Samuel Paul*

There is a substantial measure of agreement among development thinkers and practitioners today on the important role of local institutions in sustaining development^{1/}. Though individuals are central to the development process, there are many areas in which they need to collaborate and act collectively in order to be effective. A variety of support systems and services are necessary for individuals to perform optimally in their environments. There is considerable evidence to show that institutions which act as a medium for collaboration or the provision of services are most effective when they are close to their clients. It is in this context that local institutions assume special significance. For example, when services have to be tailored to the varying needs of beneficiaries and their feedback is essential for redesigning and adapting services, local institutions have a comparative advantage. Where the mobilization of local resources and the participation of the local public in managing facilities are critical to the sustainability of project benefits, local institutions have been found to be superior to distant, central institutions.

Local institutions may belong to the public, private or voluntary sectors. Local government is a typical example of a public sector institution. There are sectoral institutions which may focus on specific functions relevant to a local community. The local school, research station, health center, etc., are some examples. Private institutions are local business enterprises and cooperatives. NGO and community groups are voluntary agencies.

In spite of the rhetoric about the critical importance of local institutions in development, their actual role and power in less developed countries (LDCs) remain modest and compare unfavorably with developed countries. In the latter, economic growth has been followed by a significant growth in the size, efficiency and effectiveness of local government relative to the center whereas in LDCs, the role of the central government has increased relative to that of the local government^{2/}. The

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^{1/} Institutions may be defined as complexes of norms and behaviors that persist over time by serving collectively valued purposes. Some of them may have an organizational form and structure (banks, courts) while others exist as influences on behavior (law, arts). In this paper, we are concerned with the former set.

^{2/} G. Cochrane, Policies for Strengthening Local Government in Developing Countries, WB Staff Working Paper, No. 582, 1983, p.1.

International Union of Local Authorities (Hague) which examined the development plans of 54 LDCs in 1981 found that none of them explicitly considered the role of local government in the promotion of economic growth^{3/}. The sources of revenue of rural local governments are often limited, with 70-90 percent of the resources being allocated to them as grants by central governments. Their personnel resources are invariably weaker in terms of skills and their training and development tend to receive the lowest priority. Community organizations and non-governmental organizations (NGOs) exist in many LDCs, but are seldom used in the development process to the extent they are in more developed countries. The record of local cooperatives is good only in some sectors and some countries. The relative neglect of local governments and local institutions as instruments of development may well have led to a slowing down of the pace of progress and self reliance in LDCs. As the focus of development strategies shifts from general infrastructure building to the delivery of services (economic and social) to the vast masses of poor beneficiaries, this problem is likely to become even more acute.

Key Issues

What accounts for the sad neglect of local institutions? Proposals for correcting this imbalance need to be based on a careful diagnosis of the problem. While the underlying causes might vary from one country/sector to another, some generalizations apply across the board.

Centralization of Planning and Control

Development planning, in general, and the design and implementation of individual projects have been concentrated in central planning agencies and ministries of governments in LDCs. The dominant role of technology and economics in sectoral allocations have meant in agriculture, for example, that central technocrats formulated policies and projects. They tend to lay down standardized designs and implementation guidelines which those at the local level are asked to follow. Local institutions and their staff have limited scope for initiative and adaptation in this regime. A strong central role in planning and control has thus emaciated the capacity, autonomy and incentives of local governments and institutions.

Centralization of Resources

Consistent with central control, most governments have also centralized the mobilization of resources (taxes, loans, etc.), leaving very few sources of untied funds at the local level. The funds transferred to the local level were usually tied to specific central programs and projects which limited the ability of the local institutions to respond to

^{3/} G. Cochrane, Policies for Strengthening Local Government in Developing Countries, WB Staff Working Paper, No. 582, 1983, p.5.

what they perceive to be their priority needs and preferred ways of dealing with them. A serious consequence (unintended, perhaps) of this approach is that local institutions' opportunities for initiating, innovating and learning from their experience were considerably reduced.

Misguided Decentralization

It is a paradox that in some countries, decentralization reforms have turned out to be counter productive for local governments. Legislation was regarded as a sufficient pre-condition for decentralization to succeed. It was not realized by some governments that local institutions need to be prepared and assisted in the transition to decentralization^{4/}. Training of staff, careful selection of personnel to perform new functions, provision of resources to achieve new goals, and advisory support to see the new experiments through inspite of errors are essential elements in the strategy for decentralization which were missed by some governments. The costs of decentralization were thus poorly anticipated and local institutions were declared as unfit or unprepared for the challenge of greater responsibility.

Inequality and Elite Domination

Local governments and other local institutions have in some cases performed poorly because of the high degree of inequality in the community and the tendency of elites to expropriate the benefits of development at the cost of the weaker sections. Political and socio-cultural factors have played a major role in this outcome. Bureaucrats and political leaders have justified central control under these conditions on the ground that the central government will be more fair to the poor. In general, countries with rigid socio-economic groupings at the community level have found it more difficult to sustain healthy local institutions^{5/}.

Strengthening Local Institutions

The mix of factors discussed above shows how the dominant planning (design) paradigm, the lack of understanding (and sometimes the vested interests) of central leadership and the socio-economic environment in LDCs may have conspired to stunt the growth and effectiveness of their local institutions. In agriculture, for instance, centrally designed projects have been handed down to local agencies for implementation without regard to the need to adapt to differing local features and needs. Complex

4/ N. Uphoff, Local Institutional Development (in press), Chapter 2.

5/ D. Leonard & D. Marshall, Institutions of Rural Development for the Poor, Berkeley, 1982.

projects are passed on to local officials without enhancing their capacity to manage them or giving them the resources to coordinate the inputs required. The tension between central control and local autonomy, concentrated technical capacity at the center and weak skills at the periphery and the conflict between the central concern for equitable distribution of benefits and the fear of the capture of local institutions by elites can be amply illustrated by examples from the agriculture sector. Similar dilemmas and conflicts are evident in most other sectors of the economy. What can be done to minimize these conflicts and strengthen local institutions and their long term capacity?

A Long Term Strategy for Capacity Building

When capacity exists, the approach should be to devise ways and means to utilize it efficiently. But when it is weak and emaciated as a result of decades of neglect, the strategy should focus on the long term building of capacity with patience. In planning, there are clearly macro dimensions and allocations (infrastructure building, investment in research, etc.) which must be dealt with centrally. But certainly in project design and implementation, there is greater room for partnership. In fact, there is scope for reversing the flow of information and decisions. Local governments and institutions, for example, could be encouraged to generate new design ideas or at least an assessment of priorities. Clearly, they would need technical support and advice. Similarly, certain functions could be entrusted to local institutions. There are well known examples in agriculture such as water users groups, custom hire services, cooperatives and NGOs acting as service delivery channels. There is a need to assess these institutional alternatives well before the design stage so that local institutional resources are used and such capacity augmented in the process. Capacity building may take the form of investment in training, formal and non-formal, and the development of systems for management at the micro level. The T & V approach, the simple accounting system used by the village cooperatives of Amul Dairy in India and the information system used by the Indonesian population program at the local level are good examples. Micro-computer technology is beginning to unfold exciting possibilities in this area.

Augment Resources at the Local Level

Decentralization, as has been explained above, implies the need for greater support in terms of resources at the local level. The basic strategy here is to encourage increased generation and retention of revenues at the local level and the provision of untied resources to encourage local initiative and adaptation. In some countries, the central government has allocated to local governments a specified proportion of funds for local projects. There are cases where a fund is made available to the local communities for certain broad purposes, without specifying the project design (Brazil's community development fund). In the field of health, local communities have raised resources for building health facilities with government providing the technical services and drugs (Nigeria). Local resources are thus mobilized in a cost sharing mode.

Enhance Local Incentives for Action

Increased local autonomy and augmented resources are bound to strengthen local institutional incentives for a more active role in development. This can, of course, be further reinforced by increased empowerment at the local level (e.g., through elections, a greater role in decision making, etc.). It is here that inequality and elite domination could render local institutions dysfunctional. NGOs which are committed to the cause of the poor could play a significant role in the management of activities which are susceptible to elite domination. Beneficiary groups and information campaigns can be used to minimize this threat.

Redefine the Role of Central Government

All of the above imply that the central governments of LDCs should be encouraged to play a different role vis-a-vis their local institutions. The central government's focus should shift from direct management to the creation of an enabling environment in which local institutions can perform efficiently and effectively, and supporting them through certain functions in a reinforcing manner (e.g., macro policies, sector strategies, careful monitoring of performance, identification and encouragement of institutional channels that minimize elite domination if existing local institutions are inadequate, etc.). This calls for a reorientation of the bureaucracy and a long term vision on the part of the political leaders in LDCs.

The relevance of the issues raised above to the agriculture sector of LDCs may vary with the level of development and unique context of each country. The experience of agricultural planning and implementation in several countries, however, underscores the need to probe these issues further.

- (1) Does the balance between the central and local roles in agricultural project design and implementation seem right in light of the foregoing diagnosis? Are there innovative experiments and lessons in this area which deserve to be studied and disseminated?
- (2) What is the potential for using agricultural projects to augment the resources available to local governments or other local institutions in LDCs?
- (3) Which activities/services in the sector lend themselves to be managed through local institutions? To what extent are NGOs or community organizations used in the delivery of agricultural services? What is their impact?
- (4) What reforms (in policies, structures and systems) of the key sector institutions (Ministry of Agriculture, central research, extension and input service agencies, etc.) are required in order to enhance the role of local institutions in agricultural development? How should the Bank facilitate this process?

LOCAL GOVERNMENT AND LOCAL INSTITUTIONS

RAPPORTEUR'S COMMENTS

Myrna Alexander*

The speaker, Mr. Samuel Paul (PPDPS), began the session on local institutions by questioning the Bank's wide-spread interest in this area of development, noting the general neglect evident in development literature and practice. He cited a few key reasons for this, notably, pervasive centralized planning and resource allocation, highly controlled financing and revenue generation, and a misguided approach towards decentralization focussing unduly on the legal aspects. A final reason often cited is the overriding concern for equity and fairness, in the premise that local institutions are controlled by elites and politically motivated and more subject to discrimination and abuse. Nevertheless, local institutions are capable of being agents of development, and much evidence is mounting of their effectiveness, especially in the water and urban, health and population sectors. They are particularly appropriate if there is a high demand to adapt to client needs (particularly, in a large, diverse client group), and if there is the need to mobilize resources locally (e.g. user fees). He left the participants with a series of questions, asking what is the agriculture sector's record; how should typical project activities in the sector be assigned to different levels; what can best be managed locally; how to deal with elites; and, finally, whether the Bank should not work towards strengthening local institutional capabilities.

Following this introduction and a brief rejoinder by the session chairman, Mr. Robert Hindle (WAPAB), the first question from the floor began with statement of general support for involving local institutions in the Bank's project work even though there may be good excuses for not doing so. However, this should not stop us from dealing directly with local levels, especially if the central government is weak. The question raised was: was the Bank limited to dealing with central governments? In response, the speaker indicated that the Bank already deals with local institutions (e.g. NGO's) and we can devise more ways to do that.

The next participant cited the case of work in Nepal on community forestry development, where the Bank was only becoming aware of the policy intricacies of dealing at the local level, especially concerning revenue sharing between levels of government. This eventually required the leverage of a SAL in order to achieve the needed policy reform because of the role of the Ministry of Finance in these questions. Experience on this project also highlighted the need to take a long-term look at these questions, which was often not compatible with the short-term objectives of our projects. In reaction to these points, the speaker supported the need to pursue high-level policy dialogue, using projects to highlight key issues. He further supported the judgement that the Bank expects too much too soon, citing a recent example of administrative reform in the CAR.

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Continuing on this theme, the following comment from the floor pointed out the need to change criteria for evaluating projects and the time frame over which to expect results, with the example of privatization in Bangladesh cited to illustrate the problem. In that case, the Bank's demands for policy change clearly outstripped political developments at the local level. Since borrowers are responsible for project implementation and the Bank is not directly involved, there may be a stand off on certain issues. The question raised was then: are we willing to take the risk of becoming more involved in implementation? The speaker responded by saying that the Bank already does delve into detailed questions of design and implementation but it should do so with the least amount of disruption to governmental affairs. What we need to do is become conceptually clearer on the functions that ought to be performed at various levels, differentiate among countries, and build an inventory of typical approaches to decentralization that seem to work in different sectors.

The next question pursued the definition of local institutions: is the local branch of a central ministry considered a local institution? As a general reaction, the speaker indicated that we should not address the issue as an either-or situation, but look at the type of tasks to be done. This should open up our horizons beyond central governments. More specifically, he thought that branches of central government run the risk of not being accountable to local interests.

The next point raised from the floor was that the Bank definitely puts more weight on central institutions, but if sustainability and cost effectiveness are serious concerns, this trend should be reversed. To do so, he suggested that we should identify those development activities that were particularly suited to, or indeed require, involvement of local institutions (for example, functional literacy) as a deliberate way of encouraging decentralization. We should, moreover, use the opportunity of the forthcoming Bank-wide reorganization to think of ways to reinforce our ability to deal with local institutions. It was also noted in passing that many of the features of the T and V approach to extension support centralization and it was asked how this fitted with local institution building.

In response it was pointed out that a coherent approach to institution building must articulate which functions can be effectively performed at the center and which at the local level. For instance, in the case of extension and research some centralized focus is necessary although there is also the need for decentralized messages flowing up to the center. What the speaker was arguing for was a conscious choice about which functions should be centralized and which not, and based on this advice an appropriate mix of Bank products.

It was noted from the floor that the key question in looking at institutional development in the agriculture sector, particularly at the local level, is the definition of farmer interests and the existence of local communities of interest. Indeed, in most cases there are reasonably strong local groups (usually non-official) which can define and interpret

individual farm intents and organize themselves if the official channels are ineffective. The difficulty is to sustain these organizations rather than the centralized, unrepresentative ones.

The next participant pursued the question of extension and noted that the T and V approach must not be seen as a monolithic model. He pointed out that in Argentina and Chile, extension is essentially private, and that in Spain the research/extension linkage is informal rather than structured. He went on to observe that while the Bank may not in the past have had a specific approach to institution building at different levels, by not taking sides and ignoring power relationships, the Bank unwittingly favored centralization. He went on to note successful efforts at decentralization in Burkina Faso, Brazil and the Philippines.

It was pointed out from the floor that a leaner Bank in the future might make it even more difficult to pay attention to local institution building. It is a labor intensive task and one wondered if the Bank were prepared to equip itself for this endeavor. The speaker reasserted his view that the Bank should equip itself for this task, but pointed out that it need not necessarily be labor intensive. Some of this work could be spun off to others. The important objective was to recognize the problem, carry out the analysis and then see that this was built into project design.

Two final important points made by participants were: (a) effective local institution depended on a high degree of general democratic involvement; and (b) that the long term sustainability of local institutions depends on steady and self-generated funding. The speaker pointed out that one should not think of local institutions only as governmental ones, and that the question of local revenue generation affects public and private institutions differently. He also stressed that local accountability of officials should be encouraged, for example, by including locally elected representatives to participate in programming activities, monitor local developmental activities and feedback to the central levels.

MAKING MINISTRIES MORE EFFECTIVE

W. Bowman Cutter *

Due to time constraints, a written paper was not received from Mr. Cutter. However, a summary of Mr. Bowman's presentation is included in the following Rapporteur's Comments from Josue Tanaka, World Bank.

* Partner, Coopers and Lybrand, Washington, D.C.

MAKING MINISTRIES MORE EFFECTIVE

RAPPORTEUR'S COMMENTS

Josue Tanaka*

It has become widely recognized that effective institutions are an essential component to the sustainability of the development process. This session examined how to set up and sustain in practical terms a change process leading to increased institutional effectiveness. The speaker, Mr. W. Bowman Cutter, brought his considerable experience in this area to provide a much needed pragmatic approach to institutional change. He adopted an open presentation format eliciting continuous participation throughout the session.

The essential point of the presentation was that in order to increase institutional effectiveness, particular attention should be given to the process of change itself. Recommendations from analytical work do not lead by themselves to institutional improvements, and a change process is necessary to implement those recommendations in a sustainable way. The speaker started his presentation by describing the growing importance of institutional skills in the Bank's business. He pursued this theme by outlining major concepts and issues related to the process of institutional change. A case study was used to illustrate the application of these concepts.

The evolution of the Bank's business has significantly increased its needs for institutional skills as lending instruments become associated with higher levels of institutional change. As long as the emphasis of the Bank's business focused on reconstruction in countries with an established institutional fabric or on the execution of large-scale infrastructures, the need for institutional skills remained limited. In contrast, the growing importance of policy conditionality and the focus on sustainability of impacts have been requiring increasing levels of institutional skills to make Bank lending instruments effective.

The importance of focusing on the change process to implement any institutional strengthening activity derives from the complex and unstable environment within which institutional measures are most generally set. This complexity can be described, among other dimensions, in terms of multiplicity of objectives being pursued at any point in time, the high turn over of administration officials, the general lack of consensus and commitment sustained over extended periods of time, and the variability of problem definition within a single institution. Recommendations from analytical work tend in such an environment to be partially implemented requiring a series of incremental adjustments. In order to achieve sustainable results within such an environment, it is consequently necessary to focus on the process of change and not assume that the quality

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of analysis will by itself determine the rate of implementation. Analytical models tend indeed not to reflect the intricacies of institutional decision-making because reality does not generally correspond with the analytical framework adopted. In particular, analytical frameworks generally do not reflect the lack of linearity of the change process as objectives and priorities change over time, different actors intervene, and implementation proceeds unevenly. Within such an environment, a change process to sustain implementation is necessary and requires time, patience, incrementalism and tenaciousness.

The case study reflected the speaker's experience in implementing change in the Kenyan agricultural resource allocation process. Initial analysis revealed wide discrepancies between the formal highly articulated resource allocation system and the way it actually operates. These discrepancies eventually rendered the formal system inoperative, resulting in terms of impacts on the Bank, in projects not being included in the budget, reimbursements in arrears, no priorities and delayed audits. A process approach was selected instead of the analysis/report approach, which is likely to have been unproductive. A budget task force was created as the main instrument of change. It served to formalize the agenda, define issues and adopt recommendations while involving all the interested parties and allowing open debate of issues. Today the task force operates with minimum expatriate technical support, and has become an effective management tool. In fact, it has served as a model for the Budget Task Force created by the Ministry of Finance to deal with budget and financing issues at the country level.

Summary of Discussions

Effectiveness of Change

The discontinuity of the implementation environment described by the speaker drew questions on the measurement of the effectiveness of institutional change. Mr. Cutter answered by initially noticing that the measurement of effectiveness is more complex in the public sector than in the private sector where shareholder value is the basic reference. The measurement of effectiveness in the public sector requires judgement and a clear definition of the objectives to be pursued. A participant then raised the issue of how to deal with partial objectives and segmentation within institutions, which can lead to cases where significant results are obtained within a specific organizational unit while the overall organization of a Ministry remains inadequate. Mr. Cutter considered that the operating assumption in such cases was that specific improvements had the potential to bring large organizational change. He also felt that limited change objectives could be adequate in cases where problems are precisely constrained.

Problem Definition

Recognizing the frequent occurrence of diverging problem definitions across an organization, a participant felt that this divergence was reinforced by a mismatch between education and field knowledge as lower-

level staff closer to the field had no analytical tools whereas more educated high-level staff had limited field experience. Mr. Cutter agreed by emphasizing the inherent difficulties of problem identification. He also mentioned that issues tend not to be identified and are often viewed as recurrent incidents. In the Kenya case, the Task Force mechanism was used to deal with discrete issues and to internalize an issue identification process. As a result, he observed that the ratio of externally defined issues to the issues identified by the Kenyans decreased significantly over time. By the last meeting of the Task Force, all issues in the agenda had been brought up by the Kenyans. A participant pursued this topic by wondering whether problem specification at the top of the hierarchy did not dominate perceptions of lower level staff. The speaker mentioned that in the Kenyan case, this had not occurred because the Task Force was found to be a forum of live discussions across hierarchical levels, and lower-level staff showed little hesitation in questioning their superiors.

Kenya Case Study Background

Several questions followed the presentation of the Kenya case study. Initial questions concerned the resistance to and the pretext for the creation of the Task Force. Mr. Cutter considered that the Task Force concept was easily implemented since it was perceived as non-threatening to most participants. The Kenya Structural Adjustment Loan constituted the initial impetus even though the creation of the Task Force was not part of the conditionality. Considering the role of the Task Force in national resource allocation, a participant inquired why the Bank had been involved instead of the IMF, which has a unit on budgetary processes. The speaker perceived that the IMF had the analytical knowledge for this type of work, but did not deal directly with institutional aspects. The Chairman added that this work was started within the agricultural sector through the Technical Assistance Project because it was perceived as a less threatening approach to the issue of national budgetary processes included as part of the Structural Adjustment Loan work.

World Environment for Process Work

A participant raised the issue of whether the Bank provided an adequate environment for staff to get involved in change processes. The speaker felt that the Bank has had a tendency to emphasize analysis and to overlook the importance of the change process. In addition, change processes are time consuming and do not require significant investment, making them less attractive in terms of certain priorities of the Bank. Referring to the Kenya experience, Mr. Cutter believed that the Bank had obtained significant results from a small investment: the degree of frankness in relations between the Bank and officials increased significantly, resource allocation processes were improved, and the Bank had legitimacy to bring in issues. The speaker was not in a position to respond to a question on the possibility of including and sustaining change activities in the context of Bank divisional budgets. He emphasized, however, that institutional change would not occur if the role of the staff was limited to producing reports. A staff member felt also that a

pervasive tendency to focus on appraisal while being lighter on supervision did not favor the involvement of staff in change processes.

Sustaining Change

While noticing that the Bank is more flexible than is generally acknowledged, a staff member emphasized that the notion of commitment played a central role in any process of institutional change. Mr Cutter agreed in some respects with this view, but felt that he had never been in any project where there had been a continuous minimum level of commitment. Referring to the Kenya case, Mr. Cutter mentioned that there had been five Permanent Secretaries in the Ministry since the start of implementation of the Technical Assistance Project, and that three of them had very little commitment to the activities of the Task Force. A change process requires external tenaciousness and sufficient interest towards change within an institution to survive through unfavorable periods. It is also important to accelerate the change process in periods of high commitment, and focus on keeping the process alive in periods of low commitment. The speaker agreed with the opinion of a participant on the need to internalize change in order to make it sustainable. Then he stated that in the case of Kenya, internalization had occurred and there was no further need for an external support to the change process.

Process Versus Structure

Focusing on the definition of institutional actions during appraisal, a staff member asked whether there was any basic model of organization which could be used to derive required organizational changes to be included in appraisal reports. Mr. Cutter replied by stating that there is no single organizational grid or set of possible changes which can be defined. What is important is to set up a process within the organization which will support the implementation of desired improvements. The emphasis should be on process rather than organizational structure. The process can rely, however, on the definition of certain precise technical activities and procedures as a support to the change process. The adoption of a calendar and priorities, the understanding and adoption of procedures or the tackling of broader issues by the organization are indicators that a change process is being successfully internalized by an institution.

Resource Allocation

The following question dealt with the possibility of replicating budgetary process change in another environment, such as, the Indian context. After acknowledging the quality of the Indian bureaucracy, Mr. Cutter responded that budgetary processes have generic characteristics which make it possible to replicate an approach in different environments. The final two questions sought to determine to what extent the change process in the Kenyan case had led to improvements in resource allocation and budgetary processes. Mr. Cutter perceived that the establishment of priorities, of communication channels among the various parties involved in the budget process, of a project management system and of the capability to define appropriate forward budgets represented significant improvements

in the resource allocation process. The speaker noted, however, that no process can outweigh the political realities of resource allocation. He also said that the simple statement of issues is inadequate, and that it is necessary to set up issue identification as part of the change process. In the Kenyan case, the Task Force represented an instrument to define issues.

In concluding, Mr. Cutter considered that institutional change requires an analytical capability to define the substance of change, and a process capability which allows implementing recommendations from the analysis within an unstable environment. The process requires patience and flexibility on the part of the external agent, and should outlast the change for which the process was initially conceived. The maintenance of the process over time and issues constitutes a major determinant of the sustainability of institutional change.

The Chairman closed the session by thanking the speaker and participants for a very interesting, action-oriented and lively session.

AGRICULTURAL MARKETING INSTITUTIONS AND PRIVATIZATION

Martin J. Staab*

The theme for this year's symposium is "sustainability" and I would like to approach the subject of marketing institutions essentially from this perspective. Clearly the issue of sustainability applies as much to marketing institutions as it does to such obvious areas as natural resource management and farming systems.

To illustrate this point, take the case of those developing countries which have adopted marketing systems that rely heavily on centrally controlled prices, administered by large government-owned marketing organizations. In many, if not most, of these countries, neither the needed marketing information nor the required managerial/organizational expertise is available in the country to make this system work efficiently. Large debts are accumulated by these institutions until eventually they are either disbanded or reorganized. The lesson this raises, although not new, is nonetheless worth mentioning; a marketing system that depends on institutions which rely on the intensive use of some of the scarcest resources in the country (large enterprise management, centralized information, budget funds, etc.), and neglects, if not prohibits, the use of what is more abundantly available (namely, individual commercial resourcefulness) is unlikely to be sustainable.

Practical, non-ideological considerations such as these, coupled with a concern for the immediate impact that marketing institutions have on farmer incentives have led the Bank, in numerous operations, including most recently in Structural Adjustment Loans, to recommend removing the legal and economic barriers to market entry in order to allow for more private sector participation. Today, removing the restrictions on market entry is probably the single most contentious point in the Bank's discussions with governments on needed reforms in the agricultural sector. For this reason it is appropriate that we discuss why these objections arise, how one might respond to them and why, under some circumstances, market liberalization measures may need to be accompanied by more active encouragement and support of the private sector.

Before turning to these matters, however, I would like to mention, if it is not already apparent, that I am using the term "privatization" in the broadest sense of introducing or increasing private sector participation, which does not necessarily imply a transfer of designated state-owned assets to the private sector, as the term is frequently used. Indeed, in agricultural marketing, the problem is rarely the existence of a state-owned enterprise but rather its monopoly status resulting from the exclusion of all other potential entrants to the market.

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The Setting

In some countries in the world, notably in Sub Saharan Africa, agricultural marketing is dominated by public sector institutions. Parastatal marketing boards, or authorities as they are sometimes called, having monopoly/monopsony powers, are the most common type of agricultural marketing institution. In other countries, particularly in South East Asia and in Latin America, the private sector, under varying degrees of competition, performs most, if not all, of the agricultural marketing functions. And in a third set of countries, mainly in the Middle East, South Asia and most recently in China, both private and public sector agricultural marketing institutions co-exist, sometimes competing in the same markets (e.g., when the public marketing institutions serve as residual buyers and/or sellers).

The Case for Allowing Private Sector Participation

Generally, the record indicates that those countries which have not prevented the private sector from at least participating in agricultural marketing have fared better, from the standpoint of keeping marketing margins down, than those countries which have not. Not surprisingly, therefore, the former set of countries has also been more successful in stimulating production. The results have been even more impressive when private sector participation has been accompanied by a high degree of competition.

The reasons for this result are familiar to many of us: (a) exclusive or heavy dependence on public sector marketing institutions normally manifests itself in the form of a large monolithic organization that is characterized by fairly large diseconomies of scale, especially at the farm gate level--a problem that is further exacerbated by widely disbursed farm settlement patterns and relatively underdeveloped road infrastructure (Ironically, the countries least suited for these large institutions have tended to adopt them or, more accurately stated, have tended to retain them since in most cases these institutions were inherited at Independence); (b) the administrative and managerial requirements of such large and complex marketing institutions generally exceed what limited capacity exists in the country; (c) such public institutions often become part of the patronage system and are susceptible to political influence and corruption; and (d) in contrast, the private marketing institutions, depending on the degree of competition, are generally small (often a single operator), have low overheads, are well managed because the owners' livelihood depends on it, and are able to provide what might be described

as a custom-made type of service. ^{1/} In view of all of the above, why then have some governments chosen to exclude the private sector from agricultural marketing?

Objections to Private Sector Participation

Some of the most frequently cited objections to private sector participation in agricultural marketing are: (a) that the private trader exploits the farmer and/or consumer--an argument that takes on various forms, ranging from pure ideological dogma to judgments on what actually happens; (b) that the supply of food is a national security matter and, therefore, the obligation of government, not the private sector; (c) that competition from the private trader leads either to the demise or reduced role of existing government marketing institutions and, consequently, to the abandonment of valuable public facilities and the displacement of a large (not to mention vocal) labor force; (d) that the private trader under-reports export transactions, and thereby cheats the government of needed foreign exchange; (e) that the private traders tend to be represented by one particular ethnic, racial or tribal group that is less favored politically; (f) that the introduction of multiple trading channels undermines the so-called "stop order" credit recovery system (if one exists) which depends on one marketing institution deducting the credit charges from the farmers' crop payment in order to repay loans owed by the farmers to the agricultural bank; and (g) that there is a need to protect marketing cooperatives (which are, or are supposed to be, private institutions themselves) from the cut-throat competition of private traders.

Responding to the Objections

It is not my intention to prepare a specific counterargument for each of the above objections. Hopefully I have stimulated sufficient thinking on the subject to have an interesting discussion should any one of these objections strike a familiar chord. However, I would like to suggest here a few ideas that might be of help in our dialogue with governments--ideas that I think we have tended to neglect in the Bank.

International Marketing Margin Comparisons

The Bank has a wealth of information on the marketing margins associated with specific institutions in particular countries. For example, in Thailand the marketing margins for rice are in the order of one percent, whereas in Tanzania the marketing margin for cotton (processing

^{1/} Of course, under some circumstances, private sector participation can also result in the creation of large, unwieldy privately-owned monopolies. This could happen, for example, by restricting entry into a particular market through licensing controls. Such government-promoted private monopolies represent the worst of both worlds and normally lead to a situation in which the licenses (which determine who gets the monopoly profits or economic rents) are distributed for some remuneration. This highlights the crucial importance of keeping markets open.

included) is close to 40 percent. I believe we have not yet put comparative information of this kind (albeit for different crops in countries with quite different physical features and transport networks) to maximum use. After all, marketing margins represent the bottom line in judging the efficiency of marketing institutions. Although this does not reflect economic efficiency, in the sense of being able to judge whether more or less of the marketing service in question should be provided in the first place, such data do indicate what it costs a country to provide a particular service and clearly some countries are better at it than others. We should use these comparisons between countries to illustrate what kinds of institutions are cost-effective, which are not, and under what circumstances these results obtain. Such comparisons, I believe, would be extremely useful in our dialogue with governments.

Notwithstanding the above, I realize of course that cross-country economic comparisons of any kind are difficult to make and involve as many theoretical as they do empirical problems. Nevertheless, one can specify the necessary caveats. We do this all the time when we use per capita GDP to compare different economies. Similarly, a standard index needs to be derived for marketing margins which will allow us to make meaningful comparisons across a large and diverse group of countries.

The Role of Power

We sometimes forget that the real (as opposed to stated) objection to private sector participation in agricultural marketing is the anticipated loss of political and economic power. Government control of the country's primary exports, and particularly its food supply, confers definite political and economic gains on certain individuals. This privileged class is normally not the same group of people (senior civil servants) with whom the Bank has most of its dealings. These people, minority though they may be, have the most to lose from giving up government monopolies and frequently they have the political power to maintain them. At the same time, the principal beneficiaries of marketing reform (the rural farm population) normally do not have a strong political base. We in the Bank rarely think in terms of developing strategies to at least neutralize if not enlist the support of those politically powerful groups that stand to lose something from marketing reform. Perhaps we need to consider including in the reform package some form of compensation (e.g., tax credit, salary or wage adjustment, exemption from particular import levies) for these groups. While such adjustments might be considered unorthodox from some points of view, it may be a small price to pay for significant reform that benefits the nation as a whole. Obviously, the appropriate modalities for accomplishing this would need to be worked out in each case.

The development of the skills needed to identify what groups should be courted and how this should be done is certainly as important as increasing our analytical capacity to demonstrate the advantages of marketing reform. In general, we need to know more about how to build a constituency for agricultural marketing reform, particularly among those groups that have a reason to block it and the necessary political power to succeed. Although this is a sensitive area, it is hard to imagine how the Bank can be effective in countries where the reform process has not yet begun, without at least making some inroad in this area.

Promoting Private Sector Participation

It is sometimes argued that in some countries where commercial trading has either been suppressed for a long time or has not had a tradition, removing the barriers to market entry is unlikely to make much difference since the entrepreneurial class is simply not there to respond. If this were the case, however, it seems strange that there would be any resistance to removing the barriers to entry. In fact, the evidence suggests something to the contrary. We find, in case after case, that the private sector is quite resilient and that when the opportunity arises, there are always some persons willing to take advantage. In most cases, all that is required for the private sector to flourish is a policy of benign neglect. Unfortunately, too often the argument of an under-developed or non-existent trading class is used as an excuse for not taking any action on removing entry restrictions; this usually has the effect, whether intended or not, of protecting the state monopoly, and preventing the growth of more efficient alternatives.

Notwithstanding the above, there are, however, good reasons why, under some circumstances, in addition to removing market entry barriers, it may also be desirable to encourage private participation more actively and directly. One such reason for doing this would be to promote competition. In some countries, markets may be too distant from each other and too small individually to attract a large number of commercial traders. This is likely to be the case in the more sparsely populated countries. Under these circumstances, more direct measures may need to be taken to induce competition to prevent price collusion and other forms of market control. The regular dissemination of important market information, improved transport infrastructure or sometimes even the provision of public market space and related support services can be helpful in stimulating competition.

A second justification for directly supporting private sector participation in agricultural marketing would be to create a more diverse trading class--i.e., one that has greater social and political acceptance than the one at present. This might entail promoting the participation of traders having particular ethnic, racial or tribal affiliations. The creation of this more diverse class of traders may be essential if trading is to become a more widely accepted and hence sustainable economic activity.

Another possible justification for providing direct support to the private sector relates to government commitment to the reform program. In some countries which have undertaken to introduce market reforms, the commitment to take the necessary action is not very strong. In fact, adoption of the reforms may be something only agreed to reluctantly in order to receive external aid. Unfortunately, this situation exists in several countries. Under these circumstances, in order to prevent backsliding, it may be necessary to build up a politically powerful commercial trading class as quickly as possible. I believe that the Bank, in collaboration with IFC, can play a crucial role in this regard by moving quickly to support newly emergent trading enterprises, particularly those which can form the basis for a strong political coalition.

AGRICULTURAL MARKETING INSTITUTIONS AND PRIVATIZATION

RAPPORTEUR'S COMMENTS

Roy Southworth*

Mr. Staab began by noting that market institutions must be compatible with the existing resource base to ensure sustainability. Of particular importance are financial and human resources as well as the level of existing infrastructure. He argued that parastatals are complex organizations and are often incompatible with the existing resource base found in many developing countries. Consequently they are often inefficient vehicles for providing incentives to farmers. Nevertheless, developing countries almost universally rely on these organizations to provide marketing services to the farm sector.

In response to the poor performance of parastatals the Bank, through its policy based operations, has been active in encouraging governments to remove legal and economic barriers to private sector involvement in agricultural marketing. However, such reform measures often evoke strong resistance from Government officials. Such resistance is often ideological in nature and is based on the belief that any form of market intermediation by private agents is exploitative. Resistance also stems from the belief that foodstuffs are too important and politically sensitive to be left to the private sector. Other concerns include loss of control over export revenues; excessive market power in the hands of ethnic minorities; adverse impact on stop-order credit systems and; the need to protect state supported co-operatives.

Mr. Staab said that an effective policy dialogue on market reform requires recognition of existing power relations. Those in government are often potential losers in any exercise to remove barriers to private trade. Thus consideration could be given to some form of compensation to reduce resistance to market reforms. At the same time Mr. Staab noted that once barriers were removed, little else was required for the development of an effective private based system. However, scattered and sparsely settled areas might require additional interventions to ensure sufficient private sector activity. Where ethnic monopolies were a government concern interventions might also be required to encourage broader ethnic participation.

Discussion: The discussion focussed first on whether the Bank was being too ideological in its approach to agricultural marketing. A speaker noted that parastatals in many instances had been crucial particularly in the development of export crops. He added that perhaps it was not the organizational structure of the parastatals that was at fault but rather the conflicting objectives they pursued. He felt that parastatals could operate efficiently if given appropriate guidance and clear and compatible objectives. In response several speakers noted that the question of appropriate marketing institutions could not be answered by

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a blanket prescription to let the private sector handle all marketing services. It was argued that the government had an important role to play, though one speaker felt this role should be limited to providing supporting infrastructure while the private sector undertook all market intermediation functions. Mr. Staab said that the Bank should not place itself in a position of advising government on the particular structure of markets. Instead the policy dialogue should focus on removing the entry barriers to marketing and eliminating the favored position of parastatals, thereby creating an environment conducive to the development of marketing channels best suited to the resource base. However, some speakers felt that more detailed prescriptions were required.

Considerable discussion also focussed on the role of parastatals in stabilizing prices for agricultural commodities. Several speakers cited examples of where this function appeared to be carried out successfully. However, a speaker from ERS cited a study that examined the role of parastatals in price stabilization in 13 countries. The study analyzed the effects of the parastatals' operations on domestic price stability and income stability. The results demonstrated that the parastatals were in most instances unsuccessful in stabilizing either incomes or prices. It appeared that attempts to fix prices often gave rise to parallel markets where prices fluctuated more widely than would have otherwise been the case. In a few instances parastatals were successful in offsetting short-term fluctuation, but this was largely through some type of variable levy scheme and not through direct involvement in marketing.

Another speaker was concerned about the ability of governments to carry out market reform programs. He cited the experience of Zaire where sweeping attempts at economic reform and market liberalization yielded little in terms of improved productivity. He posited that other constraints prevented the reform measures from having their desired effect. Of particular importance was the existing power relations that served as a barrier to market liberalization. In essence public rules in support of open markets were offset by "shadow" rules that continued to act as barriers to trade.

In summing up a speaker noted that involvement in marketing was a new area for the Bank as its focus in the past had been largely production oriented. The Bank was forging new ground and particularly for export marketing it was not clear what should be advocated. In this context a speaker wondered whether the timing was right to establish an international research center devoted to marketing. Others felt, however, that such an approach would be counterproductive. Donors would not likely support such an endeavor and it would be impossible to avoid politicizing the debate. The danger would be that positions would become more dogmatic than they already were. Instead, it was agreed that some form of research networking among existing institutions would provide more valuable results. It was cautioned, however, that pressure for research results may also result in too dogmatic an approach and lead to the application of broad and inappropriate prescriptions. What was needed was careful analysis of each situation, well-tailored interventions, and skillful implementation of the liberalization process. Without care and sensitivity in promoting market liberalization, one would run the risk of repeating such experiences as recently occurred in Zambia.

FARMER ORGANIZATIONS AND INSTITUTION BUILDING FOR SUSTAINABLE DEVELOPMENT

Michael M. Cernea *

This paper discusses the necessity of building institutional and organizational structures for ensuring the long term sustainability of investments in agricultural development programs and projects.

Recognizing ab initio the importance of establishing adequate (sometimes new) patterns of social organization, and of building durable organizational structures at the grass roots, is crucial for the manner in which development projects and strategies are conceptualized, designed and implemented. Much too often the organizational variables have received insufficient recognition in both the theory and the practice of development. Consequently, less knowledge and funding and fewer skills than necessary have been allocated to address these variables through social science research and in actual development interventions. The penalty for neglecting them in program design or execution is high: either less effectiveness or outright failure. Indeed, many development projects which have underestimated or ignored these dimensions have paid, or are paying, this high price.

The experience of many unsuccessful, or only marginally effective, development projects has shown that the long-term sustainability or non-sustainability of such projects cannot be attributed only to factors of an economic and/or technological nature, but is related to institutional and organizational factors as well. However, the evidence for this relationship is unsystematic, anecdotal and intuitive. The research devoted to this topic has been chronically insufficient. A long time student of the relationship between institutional, technical and economic change has noted that "almost no attention has been devoted by economists to the role of cultural endowments in development" (Ruttan, 1984).

This paper reports and discusses the findings of a recent systematic analysis of the correlation between the sustainability of development projects and several factors assumed to affect it, including institutional and organizational factors. The analysis covered 25 large-scale development projects financed by the World Bank. It sheds light on the premises of sustainability and, conversely, on the causes of non-sustainable development interventions.

The concept of sustainability of development interventions, while not new, is recently acquiring high visibility. Sustainability should be a sine-qua-non of every financially induced development program. Without the building bricks of sustainability, much financing is condemned to inducing only short-lived "development spurts".

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The concern for sustainability is being powerfully reinforced now by the international debt crisis, which has thrown glaring light on a profound paradox of both nationally and internationally financed development programs. Such programs are undertaken with the expectation that their benefits will not only allow recovering the investments and repaying the loans that made them possible, but will also generate a net surplus. However, if such projects do not foster sustainable development, then instead of surplus benefits the borrowing party ends up increasing its accumulated debts. In part, the international debt crisis is a product of repeated investments in non-sustainable development programs.

The following sections of this paper will (i) present the empirical findings produced by a the study of 25 development projects financed by the World Bank in agriculture and rural development; (ii) discuss the implications of these findings, and (iii) define some issues and lessons relevant for designing strategies for sustainable development, particularly in agriculture. These issues refer to specific organization building and social engineering approaches required in development programs and to the social science research and applied work needed for their realization.

The Findings of a Sustainability Analysis

To identify those factors that have an important bearing upon the sustainability of project benefits, a study was carried out on a group of 25 completed agriculture projects financed by the World Bank. Three methodological aspects of this study need to be briefly explained for a better understanding of its findings: (a) the selection of the set of projects for study; (b) the procedure for the secondary analysis; and (c) the definition of sustainability.

The set of 25 projects covered by the study was not constructed as a representative random sample of Bank-financed projects, but rather as an aggregate of projects that were previously subject of an in-depth impact evaluation analysis after project completion. Nonetheless, the resulting set was quite diverse in terms of sectors covered, geographic areas, design, results, etc. The 25 projects were all started between 1969 and 1975: nine were in East African countries, six in East Asian countries, four in Latin America and six in West Africa. They financed development in various agricultural subsectors: irrigation (eight projects), livestock (two), perennial crops (five), area development (four), land settlement (two), forestry (two), agricultural credit (two).

The secondary analysis for determining the factors of sustainability was based on the empirical material supplied by the individual impact evaluation study (IES) of each one of the 25 projects. Usually, when the implementation of a Bank-assisted project is completed (some five to seven years after project start) the project is submitted to an evaluation study, called the Project Performance Audit Report (PPAR). This audit generates comparative information on actual results at

completion vis-a-vis the goals set at inception. However, because the PPAR is carried out as soon as the project is physically completed, it comes too early to assess the long-term impact of the investment made for it. Moreover, full development in many projects should by design be expected years after, not on, completion of all investments. Therefore, the World Bank's Operations Evaluation Department (OED) is also doing in-depth impact evaluation studies (IES) on selected projects, timed at intervals of 4 to 10 years after project completion, thus long after the initial PPAR was written.

The impact evaluation studies are more elaborate than the PPARs. In the 25 projects under discussion the impact studies were carried out by sociologists, social anthropologists, economists and other researchers^{1/}, either consultants or senior OED staff. These impact studies took place between 1980 and 1984, on projects which were implemented during various intervals between 1969 and 1980.

Subsequent to the completion of these individual impact studies, a decision was made to carry out an aggregate secondary analysis of their findings. This analysis was carried out in 1984 and took as its "primary" material the findings (field data and conclusions) of the 25 IES completed earlier on various agricultural projects. The secondary analysis attempted to identify and aggregate the characteristics of sustainable development, empirically observable several years after project completion. It focused on the socio-economic processes that followed the completion of the project's investments and on the durability of success. It also sought to identify those factors whose presence was most likely to ensure continued success or whose absence could lead to impact erosion even after the project had been accepted as a long-term success.

The definition of sustainability used for the purposes of that analysis was essentially an economic definition. Project sustainability over time was defined as the maintenance of an acceptable net flow of benefits from the project's investments after its completion, i.e., after the project ceased to receive Bank financial and technical support. The actual (as opposed to the anticipated) economic rate of return (ERR) was recalculated at the time of the IES. The standard for determining economic sustainability has been to assess whether the ERR was equal to, or greater than, the opportunity cost of capital.

The above definition begs some comment. Notwithstanding the crucial importance of the economic content of sustainability, we cannot

^{1/} Among the authors of these impact evaluation case studies were several well-known social anthropologists, such as N. Dyson-Hudson, who evaluated the Kenya First Livestock Project; Repeli Hau'ofa, who evaluated the Papua New Guinea Agricultural Development Project; James Anderson, who evaluated the Philippine Rural Credit Project; and Conrad Phillip Kottack, who evaluated the Madagascar Lake Alaotra Irrigation Project. A detailed discussion of Dyson-Hudson's findings is contained in his published paper on pastoral production systems in East Africa (see further the reference list).

regard sustainable development as exclusively a matter of ERR. Moreover, I have reservations about the accuracy of this widespread economic measure, as well as about the extent of its validity. Therefore, I will return to the definition of sustainability further, discussing its institutional dimension and pointing out briefly its environmental dimension, both of which should be part of the overall definition. For better or for worse, however, the simpler economic measure of sustainability is quite frequently used, and it was the measure employed in that sustainability analysis.

It is important to note that all of the 25 projects submitted to impact evaluation studies were selected from among those projects which at the audit (PPAR) time were judged to be successful and with good long-term prospects following completion. No projects which appeared marginal or uncertain at time of audit were submitted to IES, because their chances for durable post-completion sustainability already seemed impaired.

The prognosis of long-term post-completion success made at the audit stage was based not strictly on assumed ERRs for the following years, but also on other qualitative and quantitative indications offered by the audit exercise. Thus, based on facts established by the audit, it was assumed inter alia that the physical assets created by the project's investments will be maintained and efficiently used; that the new technologies introduced by the project will continue to be applied and renewed over time; that the institutional arrangements will remain capable; and that the overall policy environment will remain in place and be propitious for the development promoted by the project. Thus, albeit in a general manner, the OED study regarded sustainability of project benefits not only as a matter of ERR, but as involving other circumstances as well.

What were the main findings of the sustainability study?

The secondary analysis concluded that 12 out of the 25 projects appeared to have successfully achieved long-term sustainability, while 13 did not. In 5 of the 12 successful projects, the flow of benefits at impact evaluation time was even significantly higher than the level of returns at completion time as measured by the PPAR, while in the other 7 projects the level stayed constant. By area, the highest success durability rate was in East Asia (6 projects) and Latin America (4 projects); the lowest rate was in East Africa and West Africa, with only 2 out of 15 projects able to sustain their initial good results.

The remaining 13 projects failed to sustain the minimum flow of benefits to qualify for an assessment of continued, lasting success. At the time of project completion, the rate of return projections for these 13 projects had been satisfactory and ranged between 15 percent and 30 percent. However, at impact evaluation they had all declined to less than 10 percent and in two projects the ERR had turned negative. The average rate of return assessed for these 13 projects at impact evaluation time was as low as 2.7 percent; this rate reflects the inability to sustain project activities in the post-completion period.

These are serious findings, even if they cannot be extrapolated, for the reasons shown, to the Bank's overall agricultural experience. Such a high number of unsustainable projects was certainly not expected.

Even more surprising, at least for the technical planners, were some of the conclusions of the OED study about the factors that accounted for sustainability or for the lack of it. These conclusions provide strong empirical support to the argument developed further in the present paper.

Five main factors or sets of factors were found to have a decisive bearing on the sustainability of the 25 projects analyzed. These elements were derived by contrasting the experiences of the projects which performed significantly above expectations at audit against those which performed worst:

- (a) institutional build-up and participation of beneficiaries;
- (b) technological improvements;
- (c) socio-economic compatibility;
- (d) favorable policy environment;
- (e) recurrent cost financing/recovery.

I will briefly address factors (a) and (c), referring to the evidence from several specific projects. Then, I will discuss the lessons which I read in these findings about building into development strategies the elements able to enhance the post-completion sustainability of investments.

Farmer Organizations and the Durability of Success

While institution building is by no means a novel idea in development practice in general, two conclusions are forcefully asserted by the study: (i) the strong association that exists between economic sustainability and institutional development; and (ii) the need for organizational structures at the farmer level.

The OED study (World Bank, 1985) indeed concluded that the institutional development consistent with the new technology introduced by the project, and the nature, strength, autonomy and flexibility of this institutional development was a dominant factor in determining long-term economic sustainability.

With the benefit of hindsight, the study also established empirically that in the projects which failed to achieve sustainability, institutional development objectives were notably lacking from the outset in the project design. Conversely, it was found that the successful projects had in common a clear attempt, by design, to enhance the institutional capacity in some form.

Contrasting examples in this aspect are provided by two Bank-assisted projects, one in Malaysia (the Muda Irrigation Project) and one in Benin (the Hinvi Agricultural Development Project). Both attempted to promote the establishment of farmer organizations, but one succeeded in

creating viable groups while the other took the wrong approach and failed. In the Malaysia-Muda Irrigation project, organizations of water users were established carefully, patiently, and successfully, taking into account farmers' resource needs, their willingness to cooperate, the physical location of their plots in the same vicinity as a criterion for owner association, etc. ^{2/} The evaluation concluded that the success of this irrigation project in increasing its flow of benefits during the post-completion period was attributable more to grass roots institutional development and to the endurance of farmers' water users organizations than to any other single cause.

By contrast, in the Benin-Hinvi project, with a negative rate of return at time of impact evaluation, the basic cause of failure was the disintegration of the network of cooperatives, a network that had been designed as the institutional support for project-promoted activities. It disintegrated because these cooperatives were not genuine farmer organizations but were imposed on the farmers and were run by a parastatal, with no self-management allowed to the farmers. The technical/agricultural package financed and promoted through the project failed to take account of the socio-economic practices, the traditional land-tenure systems and cultural behavior of the area farmers. The farmers' opposed the organizational arrangements imposed upon them, and when these collapsed, the technical innovation (cultivation of oil palm) collapsed as well. By 1983, seven years after project completion, more than 75 percent of the membership had opted out of the system refusing to work on cooperative blocks. The farmers returned to food-crops for subsistence and the projects investments were largely lost.

A similar conclusion was derived from a settlement project in Senegal's Terres Neuves, which created several new settlements. Although the new settlements did achieve higher income levels for the settlers for a time, the overall results were less than expected. That was traced to the facts that the settlers did not establish their own organizations in the new settlement. When the strong and active agency that executed the settlement terminated its responsibilities following completion and withdrew from the area, a sudden "organizational vacuum" was felt. The capacity of the national level institutions was too weak for that remote area; there was a growing need for services in the settlement area, which were not provided, including input distribution, credit, marketing, maintenance, etc. and the settlers did not have their own organizations to take over and exercise these functions. The project had not been concerned with organizational development measures to create the capacity necessary for self-sustained management of the technical packages proposed for the area. As a result, the main technical and economic objectives--increasing production through the introduction of intensive farming techniques and by diversifying the traditional cropping pattern--were not achieved on a continuing basis.

^{2/} An interesting corroboration of some of the conclusions of the OED impact report can be found in an independent sociological and economic study on the farmer organizations in the Muda Irrigation System carried out by Fredericks, Kalshaven and Daane in 1980 (see reference list).

In other projects as well, a direct relationship was identified between sustainability and the establishment of effective organizations supporting the productive activities. This was the case of the Peru-San Lorenzo Irrigation project, where the IE study found that

five years after project completion, the most notable accomplishment of the project was the establishment of strong farmer organizations, specifically water users associations.

These associations assumed the responsibility for water allocation and canal maintenance; the well organized beneficiaries became able gradually to assume the responsibility for management of project activities and to relieve agencies of this burden.

In the Mexico Third Irrigation Project, long-term post-completion success in operating the irrigation system introduced by the project together with new cropping patterns was possible due to a revitalization of the ejido organization, a cooperative type group of farmers which had been established in the '30s but had virtually disappeared before appraisal took place. Membership in the ejidos in the post-completion period has doubled over levels in the early years of the project. More than 90 percent of the project's benefits accrued to ejido members, resulting in a threefold raise over pre-project levels in the average farm income of ejidatorios throughout the after-project period, to increased capital formation within the ejidos, and to the establishment of some new groups jointly undertaking livestock development and milk processing factories.

Generalizing the common features of the sustainable projects, the secondary analysis study reached the following overall conclusion:

A major contribution to sustainability came from the development of grass roots organizations, whereby project beneficiaries gradually assumed increasing responsibility for project activities during implementation and particularly following completion...Where grass roots organizations thrived there were certain distinct qualities inherent in their growth and in their relationships to project activities. These included some form of decision-making input into project activities, a high degree of autonomy and self-reliance, a measure of beneficiary control over the management of the organization and the continuing alignment of the project activities with the needs of the beneficiaries.

Socio-Cultural Compatibility

Compatibility of the type of development promoted by the project with the cultural context of the area's population and with people's needs,

motivations and aspirations was identified as another factor directly associated with the sustainability of project investments ^{3/}. This is no surprise discovery for social scientists. Nevertheless, the fact that it is proven through empirical analysis is a strong argument against the matter-of-factly manner in which this correlation is dismissed when, time and again, a good number of development projects are designed technocratically, without an attempt to understand the social fabric of the area in order to make the project compatible with, and acceptable to, the socio-cultural context at which it is directed.

It is worth mentioning here another study which reached convergent conclusions. A group of 57 agriculture and rural development projects financed by the World Bank were analyzed on the basis of audit data at the completion stage, for a retrospective assessment of their socio-cultural compatibility (Kottack, 1985). It was found that the 30 projects whose design was judged to be compatible with the traditional cultural and local socio-economic context had an estimated economic rate of return of 18.3 percent, while the 27 projects in which serious socio-cultural incompatibilities were found had an average ERR of less than half that amount: only 8.6 percent. Not only does the failure to consider the cultural context of a project undercut the technical package promoted by that investment, it leads to projects that at best are less effective than they could be, and at worst are outright failures.

The theme of the present paper does not allow me to elaborate on the other factors determining sustainable development interventions identified in the OED study. It is necessary, however, to note that those factors are in turn strongly interlinked with the institutional and socio-cultural parameters. For instance, the existence and participation of farmer organizations contributed to recurrent costs reduction, financing and recovery. Conversely, an unfavorable change in the policy environment wiped out the advanced in constructing farmer organizations and destroyed long-term sustainability.

If the set of five factors mentioned above are critical determinants of sustainability, it can also be hypothesized that an association exists between the levels of sustainability, crudely reflected in the levels and continuity of benefit flows, and the intensity with which

^{3/} There is, of course, a certain contradiction and tension in any attempt to encompass the dual objectives within the design of the same development program: "compatibility" and "change". Particularly when the traditional production-and-sustenance systems stand to undergo change and innovation, the scope for socio-cultural compatibility is by definition reduced--yet it is not annihilated. This built-in difficulty makes it mandatory to have a good in-depth knowledge of the existing social system. Informed by such knowledge, a culturally sensitive social engineering approach can be incorporated into the program can be sensitive and imaginative; this inherent tension can best be overcome by designing and carrying out the project with the informed participation of the population.

those determinants are present in the design and implementation of projects. In this context, another evaluation finding invites reflection. The annual evaluations undertaken on World Bank assisted projects over six years (1978-1984) signaled a downward trend in the weighted average of the re-estimated ERRs of all projects reviewed annually. The decrease was from levels between 23 percent to 21 percent reported for 1978-1982 to levels of only 15 percent in 1983 and 16.1 percent in 1984. For the agricultural projects evaluated in 1984, the weighted average ERR was 13.7 percent (World Bank, 1986). This weakened flow of benefits suggests a less favorable perspective, in the aggregate, for the long-term sustainability of these recent specific investments.

The range of causes accounting for this trend is broader than the five factors discussed above. Yet these factors are encompassed within this range, and therefore the trend revealed by these evaluations also calls for stronger attention to the institutional scaffolding of sustainability.

The Institutional Determinants of Sustainability

The findings of the studies summarized above bring to the forefront, once again, the correlation between resource endowments and technological change, on the one hand, and institutional developments, on the other hand. The scientific discussion around these issues has been expanding in recent years, yet it seems that it has exercised too little influence on policies and planning models. One of the most interesting contributions to this discussion is the attempt to develop a theory of induced institutional innovation (Ruttan, 1975; Ruttan and Hayami, 1984), which states that "changes in the demand for institutional innovation are induced by changes in relative resource endowments and by technical change".

The above analysis of the 25 World Bank financed projects and the findings about their differential sustainability rates appear to provide confirming evidence to this theory. Each one of these projects is an explicit case of a sudden increase in resource endowments in the service of promoting technological change. Each one has "induced" institutional demands and it was found that long term economic and technological success or failure in these projects has been dependent on whether or not their institutional demands have been satisfied.

Two clarifications could be useful in understanding adequately the explanatory and prescriptive power of the theory of induced institutional innovation. First, the term "induced" should not be interpreted as suggesting an automatic process; in other words, the institutional changes are not happening as automatic consequences of changes in material resources endowments. Second, the "institutional innovations" that must parallel the development of material and technical resources could be defined more precisely as changes in institutions and organizations, or in the patterns of social organization of the actors of the development processes. The implications of these clarifications are important.

At their very essence, development projects themselves are plans for financially induced changes. Planned development, which not so long ago was still an ideologically loaded concept, has become over the last three decades a virtually ubiquitous practice in the developing countries. And planned development is induced primarily through sudden infusion of financial means, originating largely from outside the system or area under planned development. However, while the financial stimuli for growth are important, they are not everything. Yet government agencies and donor agencies alike have often found it easier to place the infusion of financial resources at the heart of the development strategy, as its prime mover rather than to focus on organizing the actors of development.

Social economic systems do not develop evenly, in other words, all the components of these systems do not advance uniformly and simultaneously. Substantial evidence indicates that change in institutions tends to lag behind change in resource endowments and in technology. What is "induced", in Ruttan and Hayami's term, is the demand for institutional change, not the actual change, which is by no means an automatic and immediately entailed consequence. If the demand is not met, the unevenness of development is aggravated and disequilibrium occur. Such disequilibrium, at the limit, may annihilate the gains achieved for the system components advancing first. Therefore, if policy makers and program designers use financial inducements for setting in motion accelerated development processes, they must substantially change the current way they conceptualize, recognize and knit institutional variables into the fabric of development strategies.

The development of organization in human populations is a fundamental type of human response to both the natural and social environments. Such a response can be facilitated and accelerated purposively. A common characteristic of many developing societies is that the degree of their rural populations' formal organization lags far behind that of urban populations. Low organizational density is one of the most telling characteristics of underdevelopment. Societies in which this characteristic is present need a special emphasis on bridging this gap and enhancing the degree of social organization in both rural and urban settings as an essential part of every development intervention.

Development projects will fail to lay the foundations of sustainable development unless they build enduring institutional and organizational structures which will last beyond the initial financial investment and will continue to service the growth processes. The economic and technical premises of development, no matter how innovative and important, are not alone sufficient for achieving sustainable development. Also, the relative underorganization of rural societies is a cause of, and a fundamental constraint on, their overall progress. Therefore, truly innovative programs must focus on social organization in as much as they focus on technology. Thus, in the specific domain of agriculture programs discussed here, sound innovative strategies are only those which do not perpetuate the existing underdevelopment of organization in rural societies but instead adopt organization building as a goal and explicitly allocate financial and human resources to further this goal.

Many costly development programs and approaches, loudly launched at the outset as development innovations, have sooner or later ended in quiet failure and oblivion after the initial spurt in resource endowments has stopped. I have often been struck by how little interest there has been in learning the true reason for failure: was the investment intrinsically faulty? Or did it support a viable idea, but was crippled or killed by inept implementation? Why is there such a high mortality rate among development innovations? What is needed to reduce this perishability ratio and enhance the viability and self-sustainability of such innovations?

Weak institutional mechanisms have undermined the implementation chances of many genuine development innovations, sometimes discarded even before they had a true chance to prove themselves. If implementation structures have not been capable of absorbing and sustaining a new approach, then the logical lesson should be a recognition of the need to turn towards strengthening these structures. Instead, however, we have witnessed a continuous rush towards the introduction of yet other new programs. Such a rush is based on the fallacious assumption that program innovation by itself will overcome demonstrated institutional weaknesses.

Thus, the overall conclusion is that the institutional/organizational determinants of sustainability must be incorporated from the outset in the strategy design. The deliberate and patient "construction" and build up of these determinants during actual program execution must ensure that these institutions become enduring components of each planned development process.

Institutional development is defined often as "the strengthening of the capacity of institutions to use human and financial resources effectively in the pursuit of development objectives". This definition, however, is imprecise and somehow confusing. While not wrong, it is vaguely tautological. In its imprecision, it slips right around the point, rather than catching it. Institutional development is not in itself, or even primarily, an increase in the capacity (whose capacity?) "to use" human resources. Institutions are human resources. First and foremost, institution building is the purposive arrangement of human resources into modeled sets of social interaction and normatively regulated behavioral patterns for performing definite functions and attain predefined objectives. These patterned sets of normatively regulated interactions are "organizations" and "institutions". Organizations are networks of roles, some similar and some different and specialized, articulated into hierarchies and obeying a system of rules, which elicit individual behavior and coordinated actions. They enhance the capacity for joint action of their individual members in achieving the set objectives.^{4/}

^{4/} In sociology, definitional distinctions are usually made between organizations and institutions. Without disputing the validity of such distinctions here, this article is more concerned with their commonalities than with their differences; for the purpose of the present argument, this paper refers to organizations and institutions together.

While institutional development is still largely underestimated in many development strategies and programs, the degree of recognition or neglect varies from one segment to another of the institutional/organizational spectrum. Some of these segments benefit in recent years from much increased attention and even increased financial resources: this, for instance, is the case of public sector management agencies. Other segments, however, are much less present on the planners and resource allocations agenda, and among these are, in agriculture, the various forms of farmer organizations at the grass roots level. By such organizations I have in mind various forms of production and production-related associations like water users societies, rotating credit and saving associations, ejidos, marketing and other kinds of cooperatives, pastoral and grazing associations, tree-growing associations, labor exchange societies, etc. whose degree of organizational coherence range from the informal and customary to the formal and tightly structured.

The contribution of such farmer organizations to the durability and sustainability of accelerated induced development has emerged clearly even in macro-interventions like the 25 World Bank-financed projects analyzed before: e.g., the successful San Lorenzo Water Users associations in Peru or those in Muda-Malaysia, the revived ejidos in Mexico, or the collapsing cooperatives in the Hinvi, Benin.

Convergent findings and conclusions emerge also from other recent studies. Numerous micro-studies, focusing on local communities have recently pointed out to similar development lessons. Two of the analytical case studies prepared for the UNCRD Conference on local development--one on Pakistan (Ghafoor, 1986) and the other on the Philippines (Cuyno, 1986)--have analyzed at micro-scale levels two local communities and their recent developments: Orangi near Karachi in Pakistan and Soro-Soro in the Philippines. Coming from the other end of the macro-micro spectrum than the World Bank analysis, these case studies speak about organizations at the grass roots whose establishment and operation became the efficient mechanisms that have articulated local energies and initiatives and have provided the scaffolding for sustaining development processes in those communities.

Despite such recurrent evidence, the syndrom of top heavy approach to institution building is clearly visible in development strategies. Even the analysis of programs that do recognize the institutional variables in development reveal that broad-based institution building necessary for development activities is often substituted by a narrow focus on strengthening public sector management. Although public sector bodies are but one part of the overall institution building, many current strategies for institution building concentrate on public service agencies, addressing, for instance: the size and productivity of the public service; the role and performance of public enterprises; the efficiency of state organizations and agencies in providing productive and social services. While legitimate, these organizational aspects are all clustered at one end of the institutional spectrum, leaving an insufficient effort for building the other end of the spectrum.

The concentration of efforts on macro-organizations accentuates the relative institutional lag: it makes the approach top-heavy and dangerously unsupported at the base. True enough, organization building at the grass roots is not an easy task. "Difficulties in starting or sustaining effective local institutions have kept many agencies from making organizations a central part of their development strategy...The fact that establishing local organizations is more an organic than a mechanical process--that it is not predictable, takes time and does not obviously move money in large amounts--has kept government agencies and donors from developing much enthusiasm for this approach" (Esman and Uphoff, 1984). But a thinly organized base cannot sustain or be an effective counterpart to the increasingly sophisticated top and central organizations. Progress on a national scale in institutional development cannot be accomplished through one-sided advance at the central/macro levels and near-stagnation at the periphery--specifically, at the grass roots and middle levels.

To conclude, it appears logical and necessary to include the institutional/organizational dimension in the very definition of sustainability. Sustainable agricultural development, sustainable projects and investment programs are not just those likely to generate an acceptable net flow of benefits, but are those which also incorporate the establishment and/or strengthening of the institutional and organizational structures that will endure as capable frameworks for the economic and technological processes promoted through financially induced planned development.^{5/}

Current Issues in Organizational Strategy

In light of the findings of the sustainability study presented in the first part, and of the discussion of the organizational determinants of sustainability, I will now point out briefly several conceptual and operational aspects that I perceive as requiring particular attention when organizational components of development strategies are formulated.

^{5/} There is a third essential dimension of sustainability in agriculture, which is not the object of the present paper, but which needs to be pointed out since the definitions of sustainability currently used are so often incomplete. This is the environmental dimension of sustainable agricultural developments, which concerns the use and management of the natural resources necessary to expand agricultural production and maintain it at sustainable rather than decreasing levels. A comprehensive definition of sustainability should encompass at least these three main dimensions--economics, social organization, and natural resources--together. It is worth noting at least in passing that farmer organizations are crucial for sustainability in agricultural development inter alia just because they can act as institutions for resource management and control; they can enforce rules, incentives and penalties for eliciting behavior conducive to a rational and effective use and conservation of natural resources.

Differential Organizational Demands of Development Strategies

No development program can afford to bypass the need for formulating an explicit organizational strategy as part and parcel of that program. However, financially induced development programs pose not only one but rather several types of organizational demands: at the macro level, on the managers of the investment process; and, at the micro level, on the ultimate users and beneficiaries of the investment's outputs. Addressing one without the other in program design is a recipe for uneven development. Both types of demands need to be recognized and each should be addressed through properly tailored methodologies and resources.

Grass Roots Organization

The counterbalance to the top-heavy syndrom in the approach to building institution is to focus on strengthening and diversifying the organization of the key actors of development--the people who are often described as the target groups or beneficiaries of development programs. Can the emergence of such organizations and institutions, as patterns of normatively regulated behavior, be accelerated? The empirical evidence from macro projects and micro cases confirms undoubtedly that such an acceleration is possible.

There is one major proviso: adequate social methodologies or social strategies are necessary to accelerate this emergence (see below the section on Methodologies for Social Action). But the field for building such grass root organizations is practically unlimited--from water users associations to funeral societies or fishermen's groups or mutual credit circles, etc. In fact, an enormous variety of such organizations, mostly informal, traditionally exist already in peasant societies (Belloncle, 1985; Cernea, 1981; Horowitz, 1986; Uphoff, 1986; Uphoff and Esman, 1984). Axin (1975) makes a functional distinction among them and calls such organizations "stimulation systems" and "acquisition systems." Many of them can be strengthened and connected to development programs. Even if we do not share the somewhat naive metaphor of some researchers (Siebel and Massing, 1976) that modern technologies can simply be implanted as a new engine into the organizational framework of traditional peasant organizations that would serve as their "vehicles," there is enormous potential in applying the mobilization capacity of such traditional, informal, soft, sometime amorphous but still working organizations to the task of purposively pursued development programs.

Grass Without Roots: Limitations of Administrative Apparatuses

The question is sometimes raised whether such grass roots organizations are not a wasteful duplication of the local governmental apparatus which allegedly could perform similar services.

In fact, the case for self-sustaining organizations of the producers as non-governmental organizations (NGOs) is strengthened by comparing them with the state administrative bodies at the local level. Much empirical evidence confirms that in-built limitations constraint the

effectiveness of administrative bureaucracies in reaching the mass of rural poor when they deliver development services to the grass roots. When the authors of a recent report in India--who contrasted the 30-year performance of the administrative delivery mechanisms set up by state agencies with the potential of people's organizations--summed up their conclusions, they decided to change the initial title of their report to Grass Without Roots.^{6/}

However, it would be a grave mistake to dismiss or underestimate the important functions that state organizations can and do play in development strategies, particularly when the weight of the financial investments manipulated by the state for inducing growth is so enormous. The trends towards decentralization (Rondinelli, Nellis and Cheema, 1983) discernible in many developing countries involve the transfer of authority to plan, make decision and manage public functions from the national to the subnational and local levels; thus, concomitant with the proliferation of non-governmental organizations, the local governmental or parastatal bodies may gradually become a more meaningful partner to non-governmental organizations.

Organizational Intensity of Development Strategies

The various development options or investments possible in any situation are likely to have organizational demands of different intensity. Organizational intensity may become an important concept and measure. Further, organizational density as a product of the articulation of organizations in agriculture is very important as well. The lessons of

^{6/} The authors of that book offered the following summation of their findings and explanation for the final title of their report:

A review of rural development over the past 30 years suggests that we are not making a significant dent on either poverty or inequality. Failure is inherent in the approach and methods adopted for their removal. The people have been substituted by the State, with serious short - and long-term consequences for development and democracy. The development administration is impervious to lessons from the field. The study ...examined the structure and suitability of the institutional arrangements made for the delivery of rural development programmes, especially those addressed to the poor. The Working title was A Study of Rural Development Delivery Arrangements - at the Village, Block and District Level. But our findings prompted us to change it to the present title, Grass Without Roots. These three words represent not only the sum and substance of the findings but also the feelings they invoked...Confidence in the bureaucracy as a better agent of social change...has turned out to be misplaced. If present arrangements persist they would lead not only to a loss of scarce resources but also to an accentuation of inequality and corruption and an incalculable loss of respect for governments as a just and honest institution. (L. C. Jain, B. V. Krishnamurthi, and P. M. Tripathi, Grass Without Roots: Rural Development under Government Auspices, New Delhi; London: Sage Publications, 1985).

the ex-post sustainability analysis underscore the need to examine in terms of its organizational content each development strategy at the time of its formulation. Therefore, the intensity of organizational content should be regarded as an effective and acceptable indicator among those used to judge, ex-ante, the suitability and feasibility of a given development strategy. There is significant evidence from the performance of various agricultural commodity production systems that high organizational density can increase returns to the producers. Multiple organizational membership of farmers in village and non-village based organizations is a characteristic which varies culturally; for instance, it is much stronger in countries like Korea and Thailand than in India and Pakistan. The impacts of multiple organizational membership of social coherence and mobilization levels are still to be studied and the findings can prove revealing for formulating purposive organizational development strategies.

Financial Investments in Organization Building

If organizational intensity is to be regarded as an indicator for the adequacy of development strategies, it follows that this should apply to investment allocation as well. There is little use in speaking rhetorically about institution building in policies or in the general design of programs, if this rhetoric is not matched by resource allocation in the budgets under-writing these programs.

Investing in accelerated institution building, particularly at the grass roots, is one of the least traveled avenues in development work. There is little knowledge and few imaginative approaches about how to do this, besides what is being done (still on an insufficient scale) through training: training of community organizers, of change agents, training of trainers (Sazanami, 1984) and of group leaders. Yet social organization is a resource for development and investing in organization building is a major form of investment in human capital. The continuous improvement of a society's institutional arrangements is, and should be regarded as, a form of capital accumulation (Schuh, 1986). Innovative strategies for local development, aiming not only at good economic returns but also at higher levels of social organizations, need financial support for putting their software components in place.

Vulnerability and Failure in Group Endeavors

Group actions sometimes fail. The advocacy of organizational development and group endeavors cannot afford to simply turn a blind eye to such failures and their lessons. Frequently groups or grass root organizations do not fail outright, but they still fall short of the level of performance anticipated at their establishment. While the empirical evidence documenting failure or mediocre achievement of set goals is abundant about every type of group or grass root organization (like about every type of business venture), my argument is that it is too often wrongly interpreted; from such evidence, too quick and unwarranted generalizations are being made about the ineffectiveness of groups and the futility of organizing them. The development literature is replete with such contentions, which in turn influence development programs and

approaches. Policy makers and development practitioners become influenced by the lowered confidence in organized groups, and decrease resources for them, which in turn is generally conducive to more organizational weakness and less support for group formation. This is happening as predicted by Merton's famous paradigm of the self-fulfilling prophecy and is almost always self defeating in the medium and long term.

While specific reasons for group ineffectiveness or failure may be numerous in various contexts, one general--and normal--cause of low performance is usually overlooked. This is the necessary period of disequilibrium behavior, to use a concept employed by T. W. Schultz (1975) in analyzing the introduction of new technologies in a production process. Schultz pointed out that the adoption of a technological innovation in a farm results in a temporary disequilibrium behavior, during which resources are not utilized efficiently by the individual farm. Through a process of experimentation and learning, a reordering of resources takes place, the disequilibrium is overcome and new equilibrium levels commensurate with the new technology are attained.

Clearly, a comparable process of disequilibrium occurs with the introduction of a social innovation, such as group action over individual action. During this period of disequilibrium, the reordering of action patterns, norm setting and role adjustments are the necessary growth costs which may temporarily constrain the expected performance of the group in the short run. But these temporary effects can be overcome in the normal process of organization growth and adaptive response, if the "innovation" is not dropped too quickly.

Besides this type of normal disequilibrium, there are also many common errors in group formation or organization building processes, both spontaneous or induced, such as: errors in goal formulation; vague group objectives; non-definition of members' obligations; non-defined patterns of benefits distribution; undefined accountability, etc. Learning processes need to be institutionalized (Korten, 1986a) to absorb error and to experiment with the new institutional arrangements. Overcoming weaknesses and failure in organizational arrangements is intrinsic to the effort of building the institutional structures for sustainable development. And it can be argued, as Hirschman (1984) did with his "principle of conservation and mutation of social energy", that even error or failure in initial experiences of collective action may ultimately have constructive outcome: what people had learned about group actions in one unsuccessful attempt will resurface in a renewed (and better informed) attempt of collective action at a later time.

Methodologies for Social Action

To conclude, I would touch upon an issue related to the role of sociological or social science knowledge in formulating and implementing novel strategies that recognize the organizational/institutional variables. Building organizational/institutional structures at various levels--grass roots, middle-level (intermediate) or macro level--is a task of social engineering. Social engineering is performed every day and by

almost everybody in development work, but unfortunately almost everybody--like the famous character of Moliere's play--is not aware that they are doing it. There is, therefore, an imperative need for working out adequate methodologies of social engineering, based on the systematic use of the body of sociological knowledge (or even more broadly, of social science knowledge) for designing institutions able to accomplish definite purposes. Methodologies for social action can be developed and formulated based on culturally sensitive and operationally oriented applied sociology and anthropology work (Cernea, 1985, 1987). Such social methodologies are needed to replace the improvised and amateurish social engineering practiced by technical experts or economists, who may have good intentions but usually are not professionally trained to address the social and cultural dimensions of development processes.

Sociological methodologies for building institutional and organizational structures or revitalizing existing ones are scarce. Recent advances in social sciences can increase the knowledge usable for the design of institutional improvements and can reduce the costs of institutional change, as Ruttan (1984) has correctly pointed out. The use of sociological/anthropological knowledge for sound social engineering would increase the supply and decrease the costs of institutional/organizational components of development programs in agriculture. Such methodologies should be developed, tested, improved through learning processes, and disseminated through systematic training for development work. This will be a significant step towards a less painful and more durable translation of innovative development strategies into reality.

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FARMERS' ORGANIZATIONS AND SUSTAINABILITY

RAPPORTEUR'S COMMENTS

Turto Turtiainen *

The main speaker, Mr. Michael Cernea, started his paper from a working definition of sustainability of projects that was used by the Bank's Operations Evaluation Department. This definition states that sustainability is the maintenance of an acceptable flow of benefits after the project's financing ceases to be available. An acceptable flow of benefits would be a return at least equivalent to the opportunity cost of capital. The speaker argued, however, that economic sustainability alone is not enough to make development interventions fully sustainable, and that development projects will fail to lay the foundations of sustainable development unless they help build the institutional and organizational structures of sustainability.

A summary of Mr. Cernea's presentation follows:

In agricultural programs, if only the technical and economic premises of development are introduced, no matter how innovative and important they might be, they are not sufficient for achieving sustainable development. They need to be complemented with the establishment of suitable patterns of social organization, encompassing the people engaged in productive farming activities. This is why the sociological variables are so crucial to the design and overall effectiveness of rural development projects. These patterns of social organization are the format, or the framework, within which new technologies can be introduced, absorbed and put to work effectively.

Farmers' organizations established for carrying out production or production-related activities are an integral part of the institutional and organizational structures for sustainability. Such organizations are, for instance, the water users associations, the marketing cooperatives, the dairy cooperatives, the rotating credit and savings associations, the pastoral associations, the tree-growers groups, and a multiplicity of other forms of self-help groups, labor-exchange groups, etc. Therefore, agricultural development projects should deliberately and explicitly provide for the establishment and strengthening of such organizational and institutional arrangements at the same time that they provide resources for technical progress in agriculture.

A major study of sustainability factors was carried out in the Bank by OED on a set (not a sample) of 25 completed agricultural and rural development projects. The projects were all started between 1969 and 1975 and financed irrigation (eight projects), livestock (two), perennial crops (five), area development (four), land settlement (two), forestry (two), and agricultural credit (two). Impact evaluation studies (IES) were undertaken on each project several years after disbursement ended (and after the PCR and PPAR were written). Subsequently these IES were aggregated and

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analyzed for sustainability performance factors. Sustainability was defined as the maintenance of an acceptable net flow of benefits from the project's investments after its completion, i.e. after the project ceased to receive Bank financial and technical support.

The main findings of this analysis was that only 12 out of the 25 projects appeared to have successfully achieved sustainability, while 13 did not. It is interesting to note that at the time of project completion, the revised expected economic rates of return (ERR) of these 13 projects was satisfactory, ranging between 15 and 30 percent; however, during the next several years these ERRs declined to less than 10 percent. The projects and their investments thus became non-self-sustainable.

The speaker noted that even more interesting were the findings regarding the causes of non-sustainability. Five main sets of factors were found to have a decisive bearing on the sustainability of the 25 projects analyzed. Significant for the present discussion regarding "Farmers' Organizations and Sustainability" is that, among the five factors identified, the first was "institutional build-up and participation of beneficiaries." The others were (b) technology improvements; (c) socio-cultural compatibility; (d) favorable policy environments; and (e) recurrent cost financing and recovery.

While each one of these factors deserve a detailed discussion, Mr. Cernea suggested that the group explore in depth the central OED conclusion, namely, that

"the institutional organization, its nature, strength, autonomy and flexibility were the dominant factors in determining project sustainability."

The speaker also proposed that the group discussion could address one or more of the following issues:

- project experiences in different regions with farmers' organizations: their short-term and long-term contributions to reaching project objectives;
- staff experiences with sustainability: personal assessments; prerequisites; determining factors; consequences of non-sustainability;
- the controversial performance, or outright failure of some farmer organizations, cooperatives, etc.
- the fallacy of one-sided, top-heavy institution building through Bank-financed projects;
- how to invest in institution/organization building at the grass roots?

Discussions

The Chairman, Mr. C. G. Ramasubbu, opened the discussion by emphasizing that institutions are the most important elements for project sustainability. If we can improve them, the projects and their sustainability will also improve. He added that the participants of the sessions having come from different backgrounds and different disciplines, should be able to relate different experiences for the discussion, observe what the Bank has done in relation to farmers' organizations (FOs), and suggest ways through which the Bank could support farmers' institutions and involve them in our projects.

A participant mentioned that there are several problems when we consider farmers' organizations in the project work:

- usually we write in the reports that "the Government will establish..." We should rather talk about identification and strengthening of these groups, preferably those that already exist in the field;
- in some cases, we may be responding to the Bank's or the government's needs rather than to those of the farmers when we assist to establish these groups, because they are a less expensive form to distribute farm inputs and provide small farmers with credit;
- we often try to rush and develop newborn groups to full-grown organizations when we rather should be satisfied with what is possible; that is, we must proceed slowly.

The main speaker observed that "establishment" of new farmers' organizations is sometimes necessary and that generally projects cannot rely always on already existing FOs. Novelties and innovations are important for development and they do not come to the rural sector always spontaneously. Of course, we should strengthen FOs where they exist. In any event, FOs do not have a chance to succeed if they do not have the support of farmers.

Another speaker mentioned that in some countries in Asia the governments may not look upon FOs favorably because of their potential political clout; therefore, the political will to promote them is sometimes lacking. Also some Cooperative Departments may be obstructive to promotion of FOs. We talk about FOs, but do we know very much about them? Where is the research on them? (Rapporteur's note: there is a substantial body of literature on Revolving Savings and Credit Associations (ROSCAs) and People's Participation Program which belong to these organizations).

Another participant supported this concern and mentioned that often the project promoters are uncertain to speak about FOs to Government officers even when they already exist, because they do not know whether our projects (and the government's interest) are good or bad for these organizations. The chairman reminded the group that we provide loans to promote development in the countries within the framework of their political system and government policies, and have to accept that the governments have to have tools to attain development goals. Sometimes these are farmers' organizations.

Others observed that the governments are sometimes very interested in promoting the establishment of various types of farmer groups (e.g., in East Africa) as a means to reach small farmers in a cost-effective manner in credit and farm input supply activities.

A participant had observed that (after the very initial stage) most FOs have administrative and accounting problems. Non-government organizations (NGOs) exist in many places and can assist in solving these problems and help process the necessary papers through the bureaucracies. Another person asked about the Bank's and the Government's role in promotion and provision of technical assistance, indicating that there are numerous activities which could be done on a private basis or individually (e.g., land preparation).

A participant noted that private development companies had established and supported FOs, at least in West Africa (the cotton sector in Mali and Senegal). The best FOs are those which are well-organized and profitable. This implies outside assistance and advice, which should preferably come from NGOs or interested organizations (such as cotton companies) in the respective fields. These can also "protect" FOs in relation to various outside interests whether these were from the government or elsewhere. But it should be noted that if the government felt that in some sector there was no economic basis for FOs irrespective of any steps they might take, usually the farmers had little chance to succeed by any means.

The participants agreed that for a more lasting success of FOs, the prior existence of traditional institutions or groups on which to build the more economically oriented organizations, would be a highly desirable circumstance. Even in these cases, a "felt need," usually in expected economic benefit, for the new organization was essential for its success.

Some participants had observed great difficulties in making water users' associations work. This was especially true if this organization was not able to influence the supply of water to the irrigation area (apparently because of government control or already existing regulation on water use and payments). Also, pastoral associations have proved very difficult to organize; the know-how of pastoral people in organizational matters is so low that requirements for their organizations are more elementary than for other FOs. On the side of positive experiences, lending to smallholder and other poverty groups in Bangladesh has succeeded well, when the group is used as a control mechanism. (Rapporteur: usually the loans are given individually, but the group provides a new type of collateral, "social guarantee.")

A participant suggested that the following factors are conducive to success of FOs (according to USAID experience, particularly in Latin America):

- a clear benefit and purpose;
- well-defined and limited tasks;
- accomplishments in the initial stages;

- a certain measure of independence, and the resulting internal authority and feeling of responsibility;
- an adequate resources base (the unit has to have some profitable operations);
- an opportunity to build up management experience;
- direct funding of FOs or financing through a parent organization (rather than through the government).

Another participant suggested that FOs (and cooperatives) need to improve their internal control mechanisms. With illiterate members this may be difficult, and external management and control may be necessary. Accounting agencies may be better bodies for this than the government departments. Sometimes literacy programs are necessary if the membership has too little education. Also, FOs should be able to operate in the marketplace, i.e., be competitive.

Others mentioned that farmers' organizations tend to be strong in democratic practices but this is not always enough. They need to be strong also in financial terms. One of the problems is that if FOs are to be sustained, they need to improve their economy. On the other hand, if they succeed in this, they easily become a potential power base and will attract political aspirants.

A participant had observed that, on many occasions, farmers belong to several groups at the same time. Others noted that this is quite possible and sometimes even desirable, because in these cases the groups can specialize and their functions are not so demanding and extensive that they would need full-time staff.

An observer noted that a problem often arises in deciding what support should be given to FOs (and cooperatives). Should they be allocated credit and should they be given monopoly powers to help them through the stage of infancy? A possibility would be that assistance and privileges would be given for a limited period, e.g., for five years, or they could be given a partial monopoly such as guaranteed marketing of 40 percent of produce as in India. Apparently, assistance is important, but it should not be excessive. The chairman noted that if the cooperatives are to become true cooperatives, farmers need to have a stake in them, i.e., they have to make financial contributions to their cooperatives.

Two participants mentioned that cooperatives are formed to help people who are not well served. Although the need is not so great later, they may be difficult to terminate, because the other alternatives would be too expensive as development tools. Cooperatives, as other organizations, go through cycles, and they would need to adapt to new circumstances.

Others observed that not all FOs are sustained; they emerge when they are needed, and some are operating well although they "close down" annually and start again before the next season. Cooperatives could be regarded as a later step, during which such temporary organizations would become more formally institutionalized.

The main speaker concluded that we need not be too afraid now of "excessive support" from the side of financial institutions to cooperatives and other FOs; first we should try to correct the existing imbalance (of too little support) and increase the technical and social assistance to these organizations and give them a fair chance to help in development. Several sociological variables need to be addressed for developing farmers' organizations (as in all development efforts), such as structure, functions, size, authority systems and rules, and social benefits and penalties. Although conditions vary in different countries and continents, it is possible to find basic common denominators for the success of FOs. Research on such parameters and variables should be continued in a manner which can yield knowledge usable in Bank projects.

The chairman concluded that the session had covered a wide ground about formal and informal FOs. However, the sociological and operational implications of this topic are so extensive that there is a need to continue the discussion about how to make farmers' organizations affective and enduring. Only sustainable organizations at the grass roots can help advance the Bank's development efforts in the rural sector.

ISSUES IN EXTENSION AND RESEARCH

John A. Hayward*

The challenges now facing agricultural research and extension throughout the developing world are formidable. Rapidly increasing populations demand ever more from a declining resource base; efficient agricultural production must be balanced against minimal environment disruption; risk-averse farmers must be persuaded to introduce innovations into traditional systems; new crop varieties must be produced one step ahead of pest and disease resistance; and all this must be achieved against a background of fluctuating commodity prices, fluctuating policies and increasing budget stringency. Faced with this unique challenge, developing country research and extension systems, many still in their infancy, frequently collapse before their credibility can be established. The result is a vicious spiral in which lack of new technology leads to unrealized production and development targets, lack of sustained growth results in political disillusionment, research and extension budget cuts, further reductions in technology diffusion and further agricultural decline.

Yet improved technology development, diffusion and adoption, is at the heart of sustained agricultural advancement. Traditional agricultural systems, developed by trial and error over generations, could be sustained indefinitely as long as the demands on the resource base did not exceed the rejuvenation capacity of that base. Increased population demands have disrupted the balance, and technology must be continuously pumped into agricultural systems to sustain them above their natural steady state levels.

In recognition of the critical importance of this technology leverage, massive investment has been made in research and extension by public and private sectors, at international, national and local levels. For over 20 years the World Bank has supported agricultural research and extension in a total of over 600 projects, either through free standing projects or through research and extension components in agricultural projects. The impact of that involvement and of the enormous investment in research and extension in the developing world has at times produced dramatic technological breakthroughs but in general has been less than anticipated.

This paper briefly looks at aspects of investment in research and extension and then highlights some of the issues which prevent that investment being fully translated into improved agriculture. Fragmentation of the research extension continuum leads to distortions in funding and inefficiencies in the information diffusion system. The paper then

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discusses how the information system might be funded, with particular reference to cost sharing and cost recovery and their influence on sustainability. The issue of an apparent lack of available technology is discussed and alternative sources are suggested.

The paper considers the implications of the heterogeneity of agricultural communities in technology diffusion. It then discusses the lack of quality manpower in public sector organizations, support service coordination and the problems of single service supply and multi-service needs in extension.

To serve the needs of the Symposium, to promote discussion on a range of issues affecting sustainability, the paper has deliberately adopted an eclectic approach to the problems of research and extension. The wide range of conditions under which we operate makes this essential. Other authors might have provided different items and different emphasis but the points raised here should start our deliberations.

Investment in Research and Extension

As an indication of the magnitude of investment in research and extension, Table 1 gives estimates of worldwide public sector expenditure for the three years 1959, 1970 and 1980. Total public sector research spending in 1980 alone was approximately US\$7.4 billion; extension spending added a further US\$ 3.6 billion. In the period 1959-80, public sector expenditure rose by a factor of 2.6 with research spending increasing at almost twice the rate of extension spending. These figures exclude all private sector research which would add substantially. For example, it has been estimated that the annual investment in agricultural research by one company (Monsanto) exceeds that for the entire public sector in Latin America.

Apart from the sheer magnitude of these investments, several significant features emerge from an analysis of the data in Table 1. Firstly, the industrialized world continued to spend the largest sums on agricultural research and extension (64 percent and 59 percent of total public sector expenditure in 1980). Such expenditure was considered essential to sustain earlier gains and to make further advances in exploiting the potential of those countries. Secondly, Asia's expenditure on research during the 1960s - the Green Revolution build up - increased sixfold. Thirdly, Latin America and Africa show little change over the twenty years in their proportion of world spending on research, whereas there was a dramatic increase in extension expenditure in Latin American (Table 2).

9. The ratios of research expenditure to extension expenditure over the period 1959 to 1980 are given in Table 3. In industrialized countries research consistently received significantly more public funding than did extension, with the balance shifting even more towards research during the

Table 1 - Public Sector Expenditure on Research (Extension)
(millions of constant 1980 US\$)

Region/Sub-Region	1959	1970	1980
Western Europe	275 (234)	918 (458)	1,490 (514)
Eastern Europe & USSR	568 (367)	1,282 (563)	1,493 (750)
N. America & Oceania	760 (383)	1,485 (602)	1,722 (760)
<u>Latin America</u>	80 (61)	216 (206)	462 (397)
Temperate	31 (6)	57 (44)	80 (44)
Tropical	35 (47)	129 (137)	269 (294)
Caribbean and Central	14 (8)	30 (25)	113 (58)
<u>Africa</u>	119 (238)	252 (481)	425 (515)
North	21 (84)	50 (176)	62 (173)
West	44 (54)	92 (181)	206 (205)
East	13 (39)	49 (86)	75 (106)
Southern	41 (60)	61 (37)	82 (31)
<u>Asia</u>	261 (114)	1,205 (413)	1,798 (507)
West	24 (28)	71 (97)	125 (120)
South	32 (56)	73 (88)	191 (82)
Southeast	9 (19)	37 (55)	103 (64)
East	141 (39)	522 (172)	735 (241)
China	54 (n.a.)	502 (n.a.)	644 (n.a.)
World Total	2,064 (1,428)	5,359 (2,723)	7,390 (3,443)
World Total	3,492	8,082	10,833
Research and Extension			

Note: Figures are for research followed by extension in parentheses.
Source: From Judd, Boyce, and Evenson (1983).

Table 2 - Percentage of World Public Sector Expenditure on Research and (Extension)

Region/Sub-Region	1959	1970	1980
Industrialized Countries	78 (69)	69 (59)	64 (59)
Latin America	4 (4)	4 (8)	6 (11)
Africa	6 (17)	5 (18)	6 (15)
Asia	12 (10)	22 (15)	24 (15)

Source: See Table 1.

Table 3 - The Ratio of Research to Extension Spending

Region/Sub-Region	1959	1970	1980
Industrialized Countries	1.62	2.27	2.32
Latin America	1.31	1.05	1.16
Africa	0.50	0.52	0.83
Asia	2.29	2.92	3.55

Source: See Table 1.

twenty years. This picture was precisely reflected in Asia. In Latin America, research and extension received about equal funding. In Africa, however, the share of expenditure was totally unbalanced; extension expenditure far exceeded research spending. These figures do not, of course, indicate the quality of research and extension, nor indeed the quality of farmers who can absorb more from research in industrialized countries without direct involvement of extension. However, the message is clear. Substantially more funds must be spent on research in Latin America, and particularly in Africa, if those continents are to overcome their highly specific technical problems. Stimulation of donor funding and coordination of agricultural research in Africa is being undertaken by the SPAAR program, but similar initiative may be needed for Latin America.

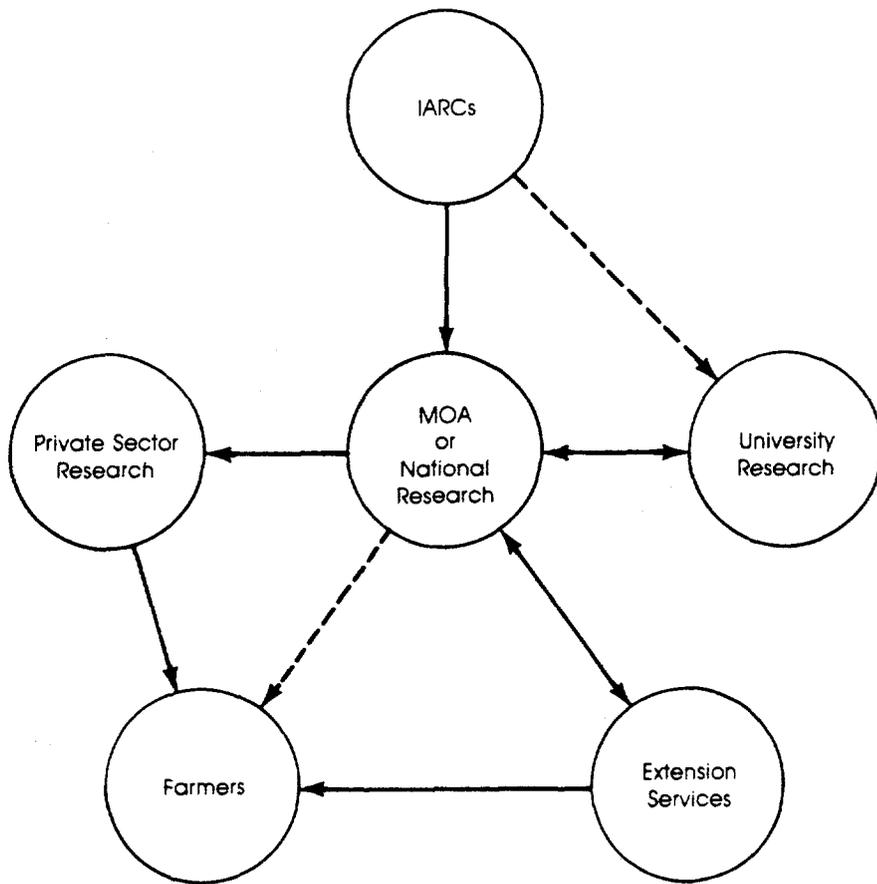
Fragmentation of Research and Extension

One of the strengths of the US land grant college system has been that, since 1914, research and extension have operated under the same administrative umbrella. Today, the county agent is a local educational representative of the USDA as well as a faculty member of the state land grant university. In Illinois for example, 125 faculty members are Subject Matter Specialists, and many have three-way appointments with responsibilities for teaching, research and extension. This system, which obviously depends for its continuing success and credibility on staff of the highest calibre, recognizes that research and extension, fundamentally and essentially, are part of the same education system.

When extension was introduced to third world countries, few had well established university systems. It was, therefore, logical to attach extension to the Ministry of Agriculture. Similarly, research institutions often arose independently, in response to export commodity requirements, and were later absorbed under various ministries, including separate commodity ministries, and universities. Even where today, research and extension are part of the same ministry, they have their own department administrations, staff cadres and salary scales.

The outcome of this divergent history of research and extension is that, in developing countries, what should be a continuous information diffusion process is parcelled into responsibility orbits. Frequently one sees in the literature and in Bank and Government documents, diagram such as that in Figure 1. Each organizational unit - extension service or national research - is perceived as a separate entity. Linkage pathways are optimistically shown, but ignore the fact that these cut across administrative boundaries e.g. between research and extension, across policy boundaries, e.g. between IARCs and national research, across traditional boundaries e.g. between research and farmers, and across cultural boundaries e.g. between extension and farmers. Formal linkage mechanisms (committees) established to shore up the inherent weaknesses in

Figure 1
ILLUSTRATION OF RESEARCH-EXTENSION LINKAGES



From Watts, L.H. (1984)

the institution framework, may operate satisfactorily for a time, particularly at higher administrative levels. However, at grass roots level, they are rarely sustainable.

Such fragmented organizations are extremely inefficient as information diffusion systems. Knowledge, awareness, and experience become locked within responsibility orbits and lost to the system as a whole. Introspective agencies fall into the trap of protecting their own turf, synergistic opportunities are minimal and much duplication of effort occurs.

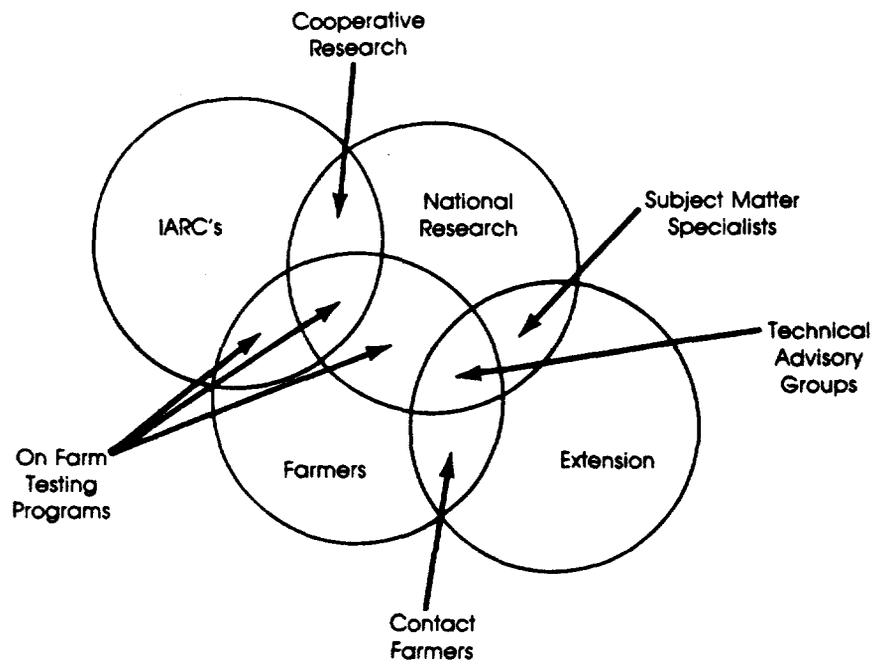
One inherent danger in the fragmented administrative system is that government administrators, and donors, focus on individual components, e.g. national research or extension or the agricultural universities, instead of on the information diffusion system as a whole. In times of budget stringency, funds are often apportioned according to the political visibility of a component, rather than to priority programs within the entire system. Donors further distort the picture by providing ad hoc support to specific components; the result is an unbalanced information system.

Examples of how funding can become distorted at Region level was indicated in para 9. At country level, examples of this distortion can be seen in West Africa, (e.g. Cote d'Ivoire) where research has been promoted far ahead of extension, and in parts of East Africa (e.g. Somalia) where extension has become the dominant service. These distortions results in agencies growing further apart. Eventually each agency attempts to make up weaknesses perceived in other components of the system by undertaking operation for which they are not equipped. A good example of this is in Somalia, where extension undertakes field trial work with little or no research expertise. Many examples can be sited of research workers undertaking extension.

Figure 2, modified from Swanson et al (1984), illustrates the concept of the information diffusion system. The overlapping areas indicate the functions of cooperative responsibility and, importantly in some cases, joint funding. The differences in presentation between Figures 1 and 2 are far more than cosmetic. The essential feature of the second is that attention is focused on the system as a whole. The flow of information through the system, either from farmers to research or vice versa, can be readily envisioned and the critical importance of the overlap areas is obvious.

Despite historical fragmentation, a coordinated technology generation and diffusion system is beginning to take shape in India. Prompted by the Bank's National Agricultural Research Project, State Agricultural Universities focus their research programs on specified agro-ecological zones. The Bank-supported National Agricultural Extension Project concentrates on implementing T and V extension within each of these

Figure 2
THE AGRICULTURAL INFORMATION DIFFUSION SYSTEM



Modified from Swanson, B.E., Röling, N and Jiggins, J (1984)

agro-ecological zones. Zonal committees, consisting of farmers, extension staff and research workers, meet twice a year to agree joint seasonal work plans for research and extension. Gradually, barriers between research and extension are breaking down. There are problems of course; research workers under the universities and extension workers under the Department of Agriculture are still subject to different regulations and pay scales. Mutual respect for the skills of scientists, extensionists and farmers is taking time to become established. The principle of joint responsibility is being fostered but this still has to be translated into budget items of programs rather than of administrative units.

Fragmentation of systems is at the heart of many issues in research and extension. Lack of motivation, of monitoring, of accountability and incentive problems are all linked to compartmentalization. The implication for donor action is that coordinated support should be given to programs in the information diffusion system, and not to extension or research per se. Project components should be designed to strengthen the overlap areas of responsibility, and appraisal and supervision should focus specifically on those functions.

Financing the Information System

Ruttan (1986) provides examples from all Regions of extremely high rates of return which can arise from investments in research. Such technology-driven returns would obviously not be produced unless some form of information system were in place. The potential returns to research and extension are obvious, yet the trend is for policymakers and donors to question the increasing costs of agricultural information. One aspect of research budgeting, frequently overlooked, is that a substantial proportion of funds must be allocated to maintenance research. Plucknett and Smith (1986) point out that as productivity rises so investment must rise to protect the gains already made. Current estimates suggest that about 70 percent of investment in US agricultural research is for defense of gains. Discussions at IRRRI also indicate that at least 70 percent of its budget is for maintenance research. Increasing levels of funding are needed to ensure a steady output of new technology. As production frontiers are pushed forward, so environmental pressures build up to shift the system back to its steady, low level state. Pests and diseases mutate to produce more resistant or virulent forms, plant resistance breaks down and micronutrient deficiencies are induced in intensive crop production systems. Maintenance research is therefore essential for agriculture to sustain improved production levels. It is critical that policymakers and donors realise that the baseline requirement of agricultural research funding must rise to accommodate the needs of maintenance research. New research should not be started until funding for maintenance research is first secured.

Pressure to use scarce funds effectively should be consistently and firmly applied to information systems. If shortage of funds for research and extension were to result in priority programs being identified and fully supported, then tightening of belts would have a positive impact. However, social pressures in developing countries always result in budget cuts impacting disproportionately on operating expenses. Travel is always the first item to be cut. This isolates scientists and extension staff from farmers, feedback mechanisms weaken and research becomes de-linked from field problems. Government and donor procedures should identify specific programs, from research through extension to farmers, and isolate appropriate supporting expenditure from the normal recurrent budget. Disbursement should be against key indicators of operating impact rather than on investment items.

Research Fund Sharing

But governments are caught between two forces. Budget stringency measures are demanded, yet allocations to the agricultural information system must increase. The question is how best to shift the burden of financing from the public sector to the end-user. Private sector research and development is only realistic where a patented end-product can be marketed. Companies must be able to realise profits from the massive investments needed. Bringing a new pesticide to market now costs a fully established scientific company a minimum of US\$15 million and costs would be far higher if a company were starting from scratch. It seems likely, therefore, that in the foreseeable future, developing countries must rely, for research and development of new products, on public sector national research, supported by internationally established institutions and private research companies.

International private sector research, particularly in the rapidly developing field of biotechnology, has much to offer national research systems. Yet, far from encouraging such cooperation, many countries and research institutions erect barriers to joint public and private sector research. Policymakers are by nature suspicious of profit-oriented research and discourage it. Even donors are reluctant to support research investment which would promote such cooperative ventures. Clearly, control must be exercised by government agencies, but national research should be seeking areas where the comparative advantages of developing country situations can be combined with the expertise and funds available in foreign research organizations. Far from adopting a xenophobic attitude to technical assistance and private sector research, governments should be developing the legal framework for apportioning the profits from cooperative research fairly between collaborative organizations.

Extension Cost Recovery

Attempts to achieve end-user funding of extension in developing countries have mostly been unsuccessful. A major obstacle to achieving this end is that, unlike other inputs, advice is not tangible and varies in value depending upon the technology offered, the skill of the communicator and the perception of the farmer. However, experience in several European countries e.g. Finland, shows that gradually, as farmers become more aware of the value of advice, they will fund extension, and will eventually employ their own advisers to interact directly with research and government agencies. In developing countries, recovery of extension costs has been possible in export commodity programs, where farm gate prices are reduced to offset extension and input costs, and in irrigation projects, where water charges have included an element for extension costs.

However, if rainfed food crops are involved, the chances of collecting payment for extension becomes more remote. In Brazil, a tax equal to 2 percent of the value of product is levied to offset research and extension costs. Collection of this tax is obviously difficult. One mechanism for obtaining revenues for research and extension might be the imposition of a land tax. Schuh (1986) has pointed out that a properly designed land tax is ideal because it has very little impact on resource use. The problem with introducing a land tax in developing countries is that land registration systems are mostly unsatisfactory, tenurial arrangements are often obscure, land holdings are exceedingly fragmented and land ownership is a political and socially emotive issue. Despite these problems, however, the increasing burden of extension and research costs demand that analytical work be undertaken to study their funding by means of a land tax system.

Sustaining Extension

A major issue of sustaining extension in developing countries is that expanding public sector extension makes increasing demands on dwindling recurrent budgets. The greatest investment in extension must be in the early stages, when manpower is being recruited and trained. Governments become concerned at these high cost commitments, especially in countries where security of public sector employment is a cornerstone of the social fabric. A repeated concern of government agencies encouraged to adopt a T and V system is that this requires a pyramid system of reporting and a dedicated, exclusive, extension service. Both of these requirements involve shifting manpower responsibilities, recruiting staff and increasing funding. The requirement for sustaining this level of funding, particularly after donor involvement ceases, causes some Governments to resist recruitment.

Governments should, however, be encouraged to adopt cost sharing mechanisms and to gradually spread extension costs, by enabling trained extension staff to interact with farmer groups, and by blending face to face extension with the judicious use of mass media.

In Mexico and in Brazil, farmers are increasingly sharing the costs of extension staff, and Bank projects have been designed with the express purpose of gradually shedding extension costs from Government budgets. In India, farmers in some villages have taken up the costs of extension housing and transport. And, as a final stage, in Europe farmers themselves employ the extension agents.

Care must be taken in substituting mass media for face to face communication. Some agencies have proposed that mass media systems can largely replace human contact. This view, however, ignores the essential difference between awareness and training. Where farmers are unaware of an innovation, mass media may get the message across. Where, however, farmers are to be trained in a new skill, the involvement of an extension worker provides the most effective system.

If governments are faced with proposals to increase extension staff, they will, quite rightly, be concerned over the prospects of sustaining the system. Where, however, as in the case of Mexico, Governments can be convinced that cost saving systems are not only feasible but are part of project design, they more readily adopt the need for initial investment in a fully operational extension system. Sustaining extension is vital to agricultural development but policy should determine that the cost burden must be taken up by extension beneficiaries and not sustained indefinitely by government budgets.

Availability of Technology

A concern in most developing countries is that appropriate technology for particular farmers or particular crops is lacking. To compensate for this lack, research components are often included in project structures in the hope that technology will rapidly emerge. However, such ad hoc interventions mostly run counter to institution building, reinforce responsibility domains, and do little to encourage information diffusion. Research is essentially a mid to long term undertaking. Unfortunately, most farming situations demand immediate innovation and sources of innovations must be rapidly identified.

Sources of Technology

There are many sources of agricultural technology national research, international research including the CGIAR centers, the scientific literature, private sector agencies and farmers themselves. The problem with relying on external sources of knowledge is that agricultural technology is simply not easily transferable. If technology transfer were

easy, then a strategy of heavy investment in extension could in itself be highly productive. However, early attempts to screen internationally available technology and extend this directly to farmers have achieved little. Even where striking new varieties are produced, they mostly require adaptation by national research to fit local circumstances. Such adaptation has the added benefit of widening the genetic resource base and hence reducing risk.

A source of technology frequently overlooked is within the archives of research institutions. Unfortunately a search of prior results and a re-assessment of genetic material to suit new circumstances is less scientifically glamorous than pushing forward the frontiers of knowledge. Scientists should, however, be expected to search the resource base before embarking on new research.

The most frequently ignored technology source is the local farming community. The range of farmers' yields is often high yet the source of this variation is overlooked. By adopting, as its extension recommendations, techniques employed on the highest yielding farms, Japan was able to transform its agricultural production quickly and with little recourse to outside information. Experimentation with traditional farming systems shows that these have been fine-tuned over time to fit agricultural and social environments. Recent work by experienced scientists in Nigeria, for example, has shown that monocrop recommendations are not acceptable to farmers for sound economic and agronomic reasons. Yet minor changes in cropping patterns, using local varieties, can bring improvements in production. The skill lies in being able to identify and select applicable technology from farmers' fields. Training scientists and extension workers in this skill could have an extremely high pay off.

Homogeneous Technology for Heterogeneous Clients

The trickle-down principles of knowledge transfer was based on the assumption that agricultural populations were homogeneous. The error of this assumption is now recognized, yet research and extension systems and agricultural project designs are only slowly coming to terms with the implications of this new knowledge.

Agricultural communities are extremely heterogeneous. Not only are farmers distinguished by gender, age and ethnic characteristics but also by their resource base, by differential access to inputs and credit, by land tenure and by geographic location. These complex strata of society produce complex problems for research and extension. They do, however, offer excellent opportunities for technology diffusion. Once a homogeneous stratum has been defined, diffusion of appropriate information through that stratum occurs extremely rapidly. Thus recognition and definition of the different socio-economic categories in rural communities is a critical functions of extension. The specific characteristics of each major category must be fed back to research, and appropriate technology developed for that category.

At issue here is that research is almost invariably geared towards optimum production. Technical messages relay the best way to grow a crop. The question of optimum or best for whom is rarely asked. Fertilizer response trials produce precise recommendations but research rarely offers assistance to a farmer who can afford little or is capable of transporting only a limited quantity. Answers to such practical questions are what makes technology 'appropriate'. Roling (1982) suggests that, rather than grouping farmers as being progressive or traditional, a more accurate categorization would be high access and low access; these terms recognize that farmers have differential access to resources. It is in Roling's words 'nonsensical to expect innovations to diffuse from high access farmers to low access ones'.

Without knowing client characteristics we cannot know what technology is appropriate. Just as agriculturists have a responsibility to define agro-ecological zones, so extension workers have a responsibility to define socio-economic or client zones. The differences between these zones must be matched by appropriate differences between technology packages. To achieve maximum extension impact, visit schedules should be programmed to specific target groups. Similarly, training sessions, technical messages and communication methods should be designed to fit the different strata of agricultural societies.

This approach, of defining agro-ecological zones and socio-economic zones, followed by joint research and extension to match technical packages to perceived needs, may be beyond the capacity of some institutions. Donor support and technical assistance may be needed to develop these procedures. But the pay off, in terms of rapid and sustainable production increases, could be considerable.

Lack of Quality Manpower

The most scarce resource throughout research and extension systems of the developing world is quality manpower. More research and extension projects fail to achieve their objectives for lack of skilled manpower than for any other reason. Examples will always be cited where scientists and extension workers cannot carry out their work because of lack of funds, lack of equipment, lack of transport etc. Yet experience suggests that even in times of budget constraint, funds follow success. And visible success in any enterprise depends essentially upon the calibre and commitment of managers and staff.

Manpower of the highest quality, entrepreneurship and commitment exists in developing countries. The issue is that such manpower is mostly confined to the private sector where incentives are higher, or is concentrated into a few agencies e.g. the CGIAR centers and special donor funded projects, or has been captured by overseas agencies.

Incentives must be created in research and extension to attract and hold the best scientists and managers in the system. Such incentives do not have to be confined to higher pay. Salaries must, of course, be at a level to allow staff to concentrate on their work, and differential pay scales reflecting value to the institution, should be introduced. However, good working conditions and recognition for achievements would do a lot to motivate staff.

This is a difficult issue. Rigid adherence to public sector pay scales and anachronistic promotion schemes are the norm in most developing countries. But changes must be made, and made quickly, if the best brains and entrepreneurs are not to be lost from the system. Policy-based lending should be geared to bring about major changes in attitude to public sector promotion and differential salaries. Government should be encouraged to sustain quality manpower by offering working conditions and incentives truly commensurate with individual value.

Support-Service Coordination

Irrespective of the efficiency of information diffusion systems, agricultural improvement can only be sustained if efficient ancillary support services, such as credit and input supply systems, are in place. Effective research and extension build up demands on these systems and parallel programs of reinforcement must be supported.

Prior to the introduction of T and V, extension workers were involved in many aspects of rural needs. Restricting the scope of extension work strengthened extension, but tended to weaken grass roots level support services. These deficiencies have been made up in some cases by quasi-government organizations, NGOs and private commercial operations. While this initiative should be encouraged, the linkages between these agencies and government extension are often very weak. Yet, if extension is performing effectively, it should provide essential information on supply and demand requirements to the private sector. Mostly, however, governments guard information jealously, forcing non-government agencies to establish their own parallel information systems. This is wasteful of resources. Extension systems should be seen as a source of market research for the agricultural sector as a whole. Similarly, extension has a responsibility to advise farmers on all possible sources of inputs and credit and must therefore be aware of the operations of support services. Much more attention needs to be given in extension training programs to these aspects of the information system continuum.

Single-service Supply and Multi-service Needs

Government administrations in all developing countries have operated on the principle of parallel departments: livestock, forestry, irrigation etc., each with its own research and extension organization. This structure satisfies bureaucratic requirements but fosters a system of parallel services to farmers. The business of farming is, however, multi-dimensional; at any one time farmers need advice on a range of problems. The Bank has promoted unified extension, where the village extension worker - the farm adviser - has recourse to assistance from subject matter specialists from different departments. This, theoretically, overcomes the problem of parallel service supply, but problems remain.

Attempts to unify the extension services of different agencies has been a significant issue in several Bank-supported projects. Examples can be cited from rainfed and irrigated sub-sectors in countries such as Pakistan and Bangladesh. Problems stem from irrigation departments having developed not only the physical irrigation systems but also the advisory services for water usage. Irrigation departments, in much the same way as veterinary departments, insist that pertinent advice is so specific that general extension staff cannot offer an effective service. The problem has been hotly debated and extension unification plans have sometimes foundered. A study of the situation in countries such as Pakistan and Bangladesh is urgently needed to determine whether the problems are real, whether unified extension is a feasible goal or whether alternative solutions can be found.

In theory, water should be treated as any other input, to be made available by a support service at the right time and in the right quantity. Extension staff, operating on the T and V principles and under the same administrative agency, should advise either rainfed or irrigation farmers, or in some cases both. This system has been implemented in some countries e.g. Mexico, but obviously will take time to establish worldwide. Experience across countries needs to be pooled and methods of easing the transition should be investigated.

Summary

The collection of issues in this brief review is, of necessity, eclectic. Bank staff working in different countries will each list issues, some of which will not have been touched on above. In each of our countries priorities will differ. The issues are also far from exhaustive. For example, I have not dealt with the whole question of the policy environment and its impact on research and extension. I am fully aware that shifts in policy, from promotion of export crops to food self-sufficiency, from commodity based research to the sudden need for diversification, from the drive for maximum production to the emphasis on environment protection, all bring enormous pressures and conflicting signals to research and extension. But more general matters such as these are brought to the fore in many Bank discussions and, I believe, can be better dealt with elsewhere.

My intention has been to illustrate that no amount of funding per se can sustain agricultural production. Pumping funds into isolated components of the technology diffusion system, far from promoting institutional development, is disruptive and distorts the development picture. We have a responsibility to view the diffusion system as a whole, to identify and define overlap areas in operations, and through selective funding, to strengthen linkages.

We must encourage extension services to identify strata in agricultural communities and to work with research to provide technology geared specifically to those strata. Cost sharing and cost recovery systems must be introduced to sustain research and extension.

I believe that far more technology is available than is generally recognized. Research scientists must be trained to extract pertinent information from prior results and particularly from the real agricultural specialists - farmers. I have made a plea for Governments to support one of their most valuable resources, skilled manpower, with incentives, good working conditions and recognition of achievements leading to increased agricultural production.

Finally I briefly touched on the problems of parallel organizations each feeding information to clients who require multi-service coordinated answers to whole-farm problems.

Most, if not all, of the issues I have raised have occurred in the evolution of research and extension systems of developed countries. Some of these issues have been solved, some are still being faced and some are re-emerging. History proves that institution development is a dynamic process of successes and failures, each contributing to what is hopefully a building process towards sustained improvement.

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RESEARCH AND EXTENSION

RAPPORTEUR'S COMMENTS

Herb Floyd*

The presentation was followed by a lively discussion during which occasional disagreement was expressed with the points made by the speaker. One participant asked whether the speaker felt that there were good or bad research/extension expenditure ratios. The speaker replied that there was no such thing as a good or bad ratio; this would change with the situation. The important part was to avoid looking at parts of the technology diffusion system in isolation. We need to be careful about the balance between research and extension, particularly in Africa, and about the need to maintain the absolute level of overall research and extension expenditures in relation to agricultural production. For example, several countries in Latin America may be operating agriculture on the benefits of past investments in research and extension; present levels of expenditure appear inadequate to sustain agricultural improvement.

Another participant commented that many developing countries tried to copy developed countries by creating a similar research and extension infrastructure. This sometimes resulted in agricultural extension agents giving uniform advice when the problems they were addressing were characterized by their diversity. Extension agents also had to deal with farmers, who, unlike those in developed countries, were tenants or lacked credit and therefore were not in a position to make independent decisions.

One participant queried if prices were not a more decisive factor than extension in increasing agricultural production. He cited the results of Saudi Arabia's price policies which resulted in a large increase in wheat production with little or no increase in extension. A similar example could be cited from rice in the Ivory Coast. Price was obviously a highly important factor in encouraging production.

The speaker replied that it was undeniably true that high prices would stimulate production although this was often through increased area rather than increased productivity. One should also consider the cost of relying on this approach. If price alone were used as the incentive, technology adoption might require price levels several times world market prices to be an effective stimulant. Clearly the economy could not sustain this approach.

A participant remarked that in Pakistan, extension agents had little incentive and served more as collection and information agents. There seem to be some confusion among Bank staff as to whether irrigation specialists or extension agents should take care of extension in irrigation projects. The speaker replied that in Bangladesh the Bank was attempting

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to unify extension services for irrigation and dryland agriculture but this was proving extremely difficult. There were about 600 extension agents who were dealing only with irrigation and who were not in the main stream of agricultural extension. There had been great resistance to unifying the two services. The speaker felt strongly that the principles embodied in T&V should apply to all extension services. However, unification should not be an essential feature of the Bank's extension interventions. A participant said that Brazil had a unified service, however, agents were dissipating their efforts on a wide variety of tasks. Funding was also coming from scattered sources and as a result agents were unsure of their priorities. The speaker pointed out that this was a weakness of extension services which were not adopting the principles of T&V.

The moderator drew the discussion back to the question of sustainability and asked if the Bank could be expected to finance research and extension for ever. Should not farmers be charged for some of the research and extension services which they received? One participant stated that too much investment was being made in research and extension overheads and not enough expenditure was going into operating funds. He questioned whether getting farmers to pay for research and extension should be a priority; farmer participation in research and extension was never easy to achieve. The moderator said that he had observed efforts to put farmers on research governing councils. Most of these efforts failed; it is very difficult to get farmer participation because travel funds were frequently unavailable and there was little mutual understanding between researchers and farmers. He felt that while farmer-oriented research was desirable, farmer-designed research was not necessarily a good idea.

The moderator stated that the Bank should take into consideration the need to reduce overall administrative and civil service costs. He added that there were frequently too many unproductive agents. A new extension project in Mexico is encouraging the government either to employ fully effective agents or to abandon the business of extension. Under this project the government will be obliged to furnish trained staff in irrigated areas and to recover half of the costs. Farmers in these areas will be expected to pay part of the costs of extension services. The participant stated that cost recovery and sustainability are two separate issues. It seems premature to focus on cost recovery for agricultural extension until it is addressed in other areas. The speaker added that governments were sometimes reluctant to adopt T&V methodology because of the apparent high costs and long term commitment involved in civil service recruitment. Another participant stated that an attempt was made to incorporate cost recovery for extension services in the Sudan. This proved extremely difficult to achieve. It was suggested that cost recovery should not be limited to farmers alone; cost recovery for extension services should be shared by the whole community and consumers should pay some extension costs. A participant felt there was nothing new in the idea of a

land tax but that this was frequently not collected. The community was left without any financial base from which to finance extension costs. One participant stated that one could not expect people to pay for extension services where technology was not available. Similarly one could not expect sustainability where there was no technology. He disagreed with the speaker's point that very little technology was directly transferable. A thrust of his remarks was that much technology could be transferred and that there was frequently little need for adaptive research. He pointed out that East African agriculture had adopted much technology wholesale with little or no modification. The difficulty was in getting the technology to percolate throughout the different farming strata since different strata had different resource bases. Where the resource base permitted, farmers within a given stratum would indeed adopt new technology. The speaker replied that if adoption was not taking place through a stratum, then the stratum and matching technology had probably not been identified and targetted.

Another participant agreed with the speaker that it was difficult to take technology which had been adopted by one farming community and transfer it directly to another because of the differences in resource levels. He felt that off the shelf technology is not easily transferable even within a stratum. Micro level adaptive research was therefore essential.

On another topic, a participant observed that we lack knowledge of which extension systems work and which are less efficient. In Pakistan, for example, there are diverse opinions as to whether extension is or is not successful. He felt that experts cannot even agree over the precise definition of what constitutes the T&V system. He questioned whether there had been any serious attempt to evaluate different extension systems. In Burma, for example, rice production had increased dramatically without T&V extension. Other countries use T&V and it appeared to work. He questioned whether there had been any study on the effectiveness of extension. A participant responded that there had been a detailed study in India to evaluate the impact of T&V extension. The study indicated that investment in this type of research gave a 15% rate of return.

The speaker pointed out that his paper was in no way meant to support the creation of research or extension services in isolation. The technology generation and diffusion system is not an end in itself and research/extension components of projects could only be justified where such inputs were expected to produce worthwhile returns.

SESSION II. NATURAL RESOURCES MANAGEMENT

MANAGING NATURAL RESOURCES FOR SUSTAINABILITY

Robert Repetto *

Natural Resource Asset Management and Sustainable Development

It is a privilege to initiate today's discussion of this important subject in such an expert gathering, and on behalf of the World Resources Institute, I would like to thank Ed Schuh, Ted Davis, and others in the Agriculture and Rural Development Department responsible for this symposium for their invitation, and -- more significantly -- for their sagacity in putting the management of natural resources for sustainable development on today's agenda. The brief remarks I have to make to initiate the session are by no means based on our own studies at WRI and those of other environmental research institutions, but indeed draw considerably on work carried on within the Bank, -- the Operations Policy Department's studies of natural resource management, EDI's training program on land and water management, and a number of important assessments of specific resource management issues carried out by Bank staff. These have contributed to a growing understanding of the significance of natural resource management issues in agriculture.

I think it's appropriate to open this session on a note of optimism. Certainly, one of the fundamental conditions for agricultural sustainability in a world of widespread poverty and malnutrition is that production increase sufficiently to meet rising food demands and keep food prices steady or declining. For the large majority of the Third World's people, despite dire warnings in the 1970s of impending global scarcity, this has been accomplished -- even in the face of difficult economic conditions. Countries such as China, India, Pakistan, Indonesia, and the Philippines, which together are home to over half the Third World population, have made remarkable strides in raising foodgrains production through a combination of incentive reforms, applied research, and investment in agricultural support programs. Neither dense farm populations, limited resources, nor relatively intensive initial levels of cultivation have proven to be binding constraints on further rapid output increase.

Further, the prospects for satisfactory production increases in the future are good. Large productivity gains are possible within current technologies, as comparisons between average and best practice demonstrate. Much of the world's agricultural land is still used primitively and unproductively. The World Bank's experience with improved extension services using the T&V system shows that farmers can obtain significantly higher yields through relatively simple improvements in cultural practices. Irrigation water, fertilizers, and other inputs can be applied with much greater efficiency than they are now, to generate additional production at relatively small incremental cost.

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On the horizon, whether one is facing forward or back one also sees significant opportunities. Traditional agriculture offers many underexploited opportunities for progress, especially in difficult agro-climatic regions. Underexploited traditional crops have large potential: the ipil-ipil (*leucaena leucocephala*) and other tropical legumes, have an important role in mixed agroforestry systems for degraded watersheds. Amaranth and the winged bean have received considerable attention as "poor people's crops." Jojoba, guar, buffalo gourd, and acacia species are promising crops for semi-arid environments. Pest-resistant, drought-resistant, or salt-resistant strains and species offer the plant breeder wide opportunities for further progress. Multiple cropping systems analogous to those evolved in traditional agriculture are agroecosystems requiring few external inputs for sustained high productivity.

Facing the future, the potential contributions of genetic engineering to Third World agriculture, which the National Research Council of the National Academy of Sciences has called "awesome," is not regarded as significantly closer to realization than had been forecast just a few years ago. Scientists are working to improve specific plant characteristics, by manipulating or introducing genes to improve the quantity or quality of protein in the plant, to increase photosynthetic efficiency, or to strengthen resistance to diseases, drought, and other environmental factors. Similar genetic improvements are in the offing for animal breeds. According to the National Research Council, the impact of emerging genetic techniques "will likely have an impact on agriculture comparable to that of Mendel's laws of inheritance in the late 1800s." Thus, there is ample ground for optimism that the basic criterion of agricultural sustainability, its ability to provide for the needs of a still increasing world population in the next century, can be met.

Yet, that does not imply that sustainability issues can be safely neglected. "Sustainable development" is now the reigning development slogan, succeeding a long list of other ambiguous catchphrases that, at the least, have sustained writers of articles on development policy, but may also have roughly summarized the policy preoccupations of the time. "Balanced growth" and "basic needs" are distinguished predecessors.

To me, the value of the phrase "sustainable development" is that it refers to the intertemporal conditions for continuing economic growth, and directs attention to the asset base -- particularly, to the natural resource asset base. It is conventional economic theory to regard income as a return on natural resource, human, and physical assets -- (land, labor, and capital, in the vocabulary of the classical economists). Yet, in development policy, the emphasis has shifted substantially over time. In the early years of the World Bank, lending was largely for large infrastructure projects, reflecting the prevailing development theory that growth was limited by the accumulation of physical capital, while the human contribution was the supply of labor -- usually in "surplus" -- and nothing else much mattered. The shift in Bank lending to include nutrition, health, and education projects followed and depended on recognition that human capital -- the productivity and creativity of the population -- made a key contribution to development. Many initially believed that human resource projects were welfare programs that developing countries could not

afford, but now, the concept of human capital is well-established and the World Bank has certainly helped significantly to estimate the benefits from investing in human resources.

We are now in an analogous position with respect to natural resource assets. Until recently, many perceived environmental protection and resource conservation as consumption items that developing countries could ill afford. The usefulness of the slogan "sustainable development" is its suggestion that natural resources must also be understood as productive capital, not just when they are mined or harvested as a flow of commodities to the market, but as a working stock that contributes critically to production as it stands.

Of course, the composition of the asset base changes dramatically over the course of development. Recent studies of the national balance sheet of the United States, for example, show that human capital, measured conservatively as the discounted present value of productivity gains from educational investments, is now by far the largest component in national wealth. This was not true in the early days of the Republic. And it is not true in most developing countries, which depend much more heavily on their natural resources for production. As an approximate indicator, in most low income countries, agriculture and other primary production account for over half of total income, and virtually all of merchandise exports. Looking more closely within Third World countries, one finds that easily degradable marginal lands are typically worked by marginal households on the brink of poverty.

Economists have vastly underestimated the contribution of natural resource stocks to production and income, for some defensible and some less defensible reasons. Such stocks are conventionally regarded as immutable and beyond the control of human allocational decisions, and therefore justifiably ignored in production analysis. This is a peculiar assumption (even for economists) in the fact of widespread impacts from economic activities on soil and water quality, the habitat and regeneration rates of valuable biological species, the composition of the atmosphere, and even climate.

A fundamental reason for chronic undervaluation of the production services natural resource assets provide is, of course, that many such services do not flow through market transactions and their asset values are consequently non-appropriable. Although wetlands can be bought and sold, for example, the services they provide in regulating stream flows to moderate floods, cleansing the waters of pollutants, and providing breeding grounds and habitat for fish, birds, and other animals, cannot be sold to the beneficiaries, and so are not reflected in their market price.

Thus, a dangerous asymmetry has arisen in the way we think about and measure natural resources and other assets. Buildings and equipment are valued as productive capital, and are written off against the value of

production as they depreciate. But natural resources are not so valued, and their loss or deterioration entails no charge against current income that would reflect the decrease in future production potential. A country could exhaust its aquifers, cut down its forests, erode its soils, and hunt its wildlife and fisheries to extinction, but measured income would rise steadily as these assets disappeared.

A correct definition of current income, taken directly from a text on accounting principles, is the "the maximum that can be consumed in the current period without impairing consumption possibilities in future periods." Under this conventional economic definition, activities that impair the productivity of soils, biological resources, water, or climate should not be regarded as only generating income, because they reduce potential production in the future. Standard methodologies for national income accounting and benefit: cost accounting, which omit the depreciation of natural resource assets from the cost accounts, lead us to undervalue the importance of resource conservation and to overstate economic performance.

Some of these omitted costs soon turn up in the conventional accounts. Perhaps over time more fertilizers and pesticides must be used to maintain yields as soil structure and composition deteriorates, and as pest resistance builds. Perhaps more economic losses are experienced over time from flooding or salt water intrusion in rivers as upper watersheds deteriorate. Though not taken adequately into account, the costs are nonetheless real.

I believe that sustainability with respect to natural resource management thus has a solid economic underpinning. It implies maintaining the productivity of the resource base. In fact, it implies more. In precisely those countries where populations are rising most rapidly, -- the poorest -- the relative importance of natural resources in total productive capital is greatest. If those larger populations are to be enabled to improve their standards of consumption, the productivity of the asset base must increase. Yet, in these same countries and others, a wide range of natural resources are becoming less productive through depletion and deterioration. There is an issue of intergenerational equity. I do not propose to plunge into the arcane subject of social rates of time discount -- one I gladly leave to more sophisticated theorists. But I raise the question: Is it fair to leave for a population that will inevitably be much larger (whatever to be much better off, a natural resource base that has been depleted and rendered significantly less productive than it is today?

Deterioration of Natural Resource Assets in Third World Countries

All attempts to provide an overview of the condition of the world's natural resources, as we at the World Resources Institute are attempting to do in our World Resource Reports, soon run up against the sparseness, inexactitude, and noncomparability of available data sources. Efforts are being made to improve the knowledge base, in part through the use of more sophisticated monitoring and assessment techniques such as remote sensing. Much has been made by Julian Simon and others about the lack of reliable trend data documenting the deterioration of natural resources. However, following the precept that "it is better to light a

candle than to embrace the darkness," and to introduce the more detailed discussions to follow, I will try to summarize available information on land, water, and biological resources especially relevant to agricultural sustainability.

Rangelands and Semi-Arid Areas: Desertification

The term desertification applied to semi-arid areas describes a process involving the impoverishment and depletion of vegetative cover, exposure of the soil surface to accelerated wind and water erosion, reduction of the soil's organic and nutrient content, and deterioration of its structure and water-retention capacity. Desertification of rangelands, in proximate terms, results mainly from overstocking and removal of plant cover, which may in time be driven by more basic forces such as population increase, agricultural encroachment, economic pressures, and political instability.

As used in recent assessments, "moderate" desertification generally involves a loss of productivity of up to 25 percent, while "severe" desertification causes a loss of productivity of up to 50 percent. Current estimates imply that over 60 percent of the world's rangelands are moderately to very severely desertified, and that over 80 percent of rangelands in Africa, the Near East and South Asia are in this condition. It has been estimated that 65 million hectares of once productive land in Africa have become desert in the course of the last fifty years. Country by country assessments in the Third World suggest that in most regions the trend is one of continuing deterioration. Range conditions can improve under better management, if stocking and grazing pressures are controlled. In the United States, for example, range conditions reached nadir in the 1930s and have substantially improved since. In the developing countries, the problems still remain to be resolved. In Africa, for example, fuelwood removals exceed annual growth in most semi-arid areas by considerable margins or even multiples, and effective controls on overgrazing are distinguished mainly by their absence.

Watershed and Upland Areas: Soil Erosion

According to Tropical Forests: A Call for Action, the report of an international task force convened by the World Bank, UNDP, and the World Resources Institute, an estimated 160 million hectares of upland watersheds in the tropical developing countries have been seriously degraded. Below the Himalayan range, over 400 million people in the plains of Pakistan, India, Nepal, and Bangladesh are hostage to unsustainable land use practices in the hills. Watersheds are seriously deteriorating in the steep foothills of the Andes, in the Central American highlands, in the Central Highlands of Ethiopia, on densely populated Java, and elsewhere. Estimated rates of erosion for entire upland regions typically range from 30 to 60 tons per hectare per year -- Alfredo Sfeir-Younis' recent, extremely valuable study chose an average figure around 50. In many smaller, severely eroding watersheds measured rates exceed 100 tons/ha./year.

The effects are serious. Numerous studies show the yields decline at an increasing rate as fertile topsoil is lost. Eroded sediments typically are at least twice as rich in nutrients and organic matter as the soils left behind. Thin, nutrient-poor soils widely distributed in tropical and semi-arid areas are much more susceptible to productivity loss through erosion than temperate soils. In Indonesia, at least a million hectares have been rendered unproductive through erosion, and 200,000 additional hectares are being lost each year. In Guatemala, 40 percent of the productive capacity of the land has been lost through erosion. In Turkey, 54 percent of the arable area is severely or very severely affected. In Mexico, roughly two-thirds of the land is moderately, severely, or totally eroded. Across all developing countries, the FAO has estimated that, unless effectively checked, erosion would cost 20 percent of potential agricultural production by the end of the century.

The off-site economic costs are also huge. Considerable attention has been given to the effectively irreversible loss of hydroelectric and irrigation storage capacity created at enormous expense. Reservoirs around the developing world are filling up with silt much faster than anticipated when the investments were made, -- typically, two or three times faster in South Asia -- cutting short their useful lifetimes when their replacement costs are rising rapidly. Pakistan's Mangla Reservoir is case in point. Built with a 100-year life expectancy, it may fill up with silt as much as 50 years ahead of its time. The giant Tarbela Dam will be useless within just 40 years at current rates of siltation. In India, the expected lifespan of the Tehri Dam, the world's sixth largest when finished, has already been reduced from 100 to 40 years due to deforestation of the watershed. These are merely indicative of downstream costs. Abrasion of turbines, increases in water treatment costs, effect on fish populations, and changes in river flows add to the damages of heavy sediment loads. Flooding after the rainy season and reduced dry season flows in many rivers have followed the devegetation of upstream watersheds.

A great deal of technical and economic knowledge has been accumulated about watershed protection and rehabilitation, and about appropriate farming systems for upland areas. Pilot projects and local programs have been carried out in many regions, a goodly number with the support of the World Bank and other development assistance agencies. However, it seems fair to say, as Lester Brown and Erik Eckholm did some years ago, that we are "losing ground" in the battle. The extent of areas brought under protective programs each year probably falls short of the area rendered totally unproductive, while the quiet, much more widespread, erosion of future productivity goes on.

Irrigated Lands: Waterlogging and Salinization

The costs of bringing additional acreage under irrigation have risen rapidly, while the productivity of large tracts of already irrigated land is declining through salinization and waterlogging. This is not a new sustainability issue: six thousand years ago on the Tigris-Euphrates floodplain in Mesopotamia, Sumerian irrigation practices led to a salt build-up in water and soils that contributed to the decline of Sumerian culture. Today, FAO estimates that, half the world's irrigated land is so salinized badly yields are affected, with some 1-1.5 million hectares --

mostly of prime agricultural land -- becoming salinized each year. In India, waterlogging has made about 10 million hectares uncultivable, and salinization threatens some 25 million hectares. In Pakistan, more than half the Indus Basin canal command system, some 12 million hectares, is waterlogged, and 40 percent is saline. Salinization is also a persistent problem in the plains of Eastern China, Central Asia and Asia Minor, the Middle East and North Africa, and in North America. In the United States, including such highly productive areas as the San Joaquin Valley, 20 to 25 percent of all irrigated land suffers from salt-caused yield reductions.

High water tables markedly concentrate salts in the root zones. In many irrigated areas, in India and Pakistan for example, where irrigation has been practiced without adequate provision for drainage, water tables have risen to within a few meters of the surface across broad zones. Providing drainage, where needed, can add substantially to water resource project costs and has frequently been deferred or neglected. However, the actual standards of water use efficiency achieved in large irrigation projects -- as a result of poor operation, maintenance, and design as well as the absence of incentives for water conservation, have resulted in problems of waterlogging and salinization much more serious than envisaged in planning studies. Excessive water losses in conveyance systems and field application have increased salt loadings in return flows and aquifers as well as soils. Many aquifers underlying irrigated areas have become so brackish that their usefulness has been impaired or destroyed.

The process of salinization can be retarded and controlled through a variety of methods, including improvements in the efficiency of water application and conjunctive use of ground and surface water supplies. Drainage requirements can be more realistically taken into account when projects are planned. If the loss of irrigated lands are valued at their replacement cost, currently running at about \$2,000 to \$10,000 per hectare, such investments in the sustained productivity of this important resource may be widely justifiable.

Depletion of Tropical Forests and Biological Diversity

The forested area in temperate regions is now stable or increasing, although since the beginnings of settled agriculture it has been reduced in extent by about one-third. In tropical areas, by contrast, current rates of deforestation are high and rising. Each year more than 11 million hectares of forests are cleared for other uses -- 7.5 million hectares of closed forests and 3.8 million hectares of open forests. Between 1950 and 1983, the area of forest and woodland dropped 38 percent in Central America and 24 percent in Africa. Annual rates of deforestation for the years 1981-1985 exceeding 2 percent of the remaining stock are reported or estimated for 16 developing countries, including the Ivory Coast (5.9%), Paraguay (4.6%), Nigeria (4.0%), Nepal (3.9%), Costa Rica (3.9%), Haiti (3.1%), El Salvador (2.9%), and Nicaragua (2.7%). An additional 10 countries now suffer deforestation at rates exceeding one percent per year, including Colombia, Mexico, and Malaysia. The countries where deforestation is proceeding most rapidly in absolute terms, Brazil and Indonesia, which together account for over 2 million hectares each year, are not even among those with the highest rates.

In semi-arid regions of the Third World, as in the Sahelian zone, deforestation of open savannahs is also rapid. The annual consumption of fuelwood by itself exceeds the annual growth of remaining tree stocks by an estimated 30 percent; in Niger, by an estimated 30 percent; in Niger, by 200 percent; in Northern Nigeria, by 75 percent; in Ethiopia, by 150 percent; and in the Sudan, by 70 percent. Worldwide, the FAO estimates that 1.5 billion of the 2.0 billion people who rely mostly on fuelwood are cutting wood faster than it is growing back, and 125 million in 23 countries even then cannot find enough wood to meet their needs. Turning to other organic matter, such as dung, for fuel, they deplete soil fertility, aggravate erosion and desertification, and reduce food production.

In the humid tropics, not only has the exploitation and conversion of forest resources often been wasteful and uneconomic, it has imperiled the principal source of the world's biological diversity: millions of plant, animal, and insect species whose potential value to agriculture, medicine, and science has yet to be explored. The total rate of species loss cannot be estimated with any realibility, because scientists, who so far have named and classified 1.5 million species, don't even know whether there remain to be classified another 1.5 million, 15 million, or 30 million. Yet, the situation in critical ecosystems illustrates the larger problem.

In Madagascar, there were until recently 9500 documented plant species and an estimated 190,000 animal species, 60 percent of them endemic to the island's eastern strip of forest. Ninety-three percent of that forest has already been eliminated, dooming at least 60,000 species.

In the Cape Floristic Kingdom of South Africa, there are 6,000 known plant species, 70 percent of them endemic, in only 18,000 square kilometers. The area suffers acutely from encroaching farms, frequent first, and invasions by exotic plants, threatening at least 2,000 plant species (almost as many as exist in the entire United States).

The forests of western Ecuador are reputed to have once contained somewhere between 8,000 and 10,000 plant species, with an endemism rate of 40 to 60 percent. Drawing on detailed inventories from sample plots, one can estimate that there are 10 to 30 animal species for each plant species, implying a total species resource of about 200,000. Since 1960, virtually the entire forest cover of western Ecuador has been eliminated to make way for banana plantations and other land uses. Tens of thousands of species have necessarily been eliminated.

There are many such exceptionally rich, exceptionally threatened ecosystems. Not all are in the tropical forests. In Central Africa, for example, the 29,000 square kilometer Lake Malawi contains more than 500 cichlid fish species (which include the tilapia species valuable for aquaculture), 99 percent of them endemic. This lake is one-tenth the size of the Great Lakes of North America, which contain only 173 species, only 10 percent of them endemic. Lake Malawi's fish are threatened by industrial pollution and the introduction of alien predator species.

Deforestation can be arrested through increased investments and appropriate policy changes, as outlined in the recent report, Tropical Forests: A Call to Action, co-sponsored by the World Bank, UNDP, FAO, and WRI. The initiatives identified there offer substantial economic and ecological benefits, but also discuss the serious stresses that must be dealt with if current trends are to be reversed -- including population growth, invasion of forested areas by land-hungry farmers, tenurial problems affecting incentives to make long-term forestry investments, neglect by development agencies, management weaknesses in public forests, and short-sighted, exploitative, policy orientations.

Atmospheric Concerns

These losses to the natural resources asset base that supports agricultural production are current and obvious. Their economic impacts are measurable, and in some regions are already significant. Other potential future losses -- through changes in global climate, for example -- are in the making, as emissions with long resident times cumulate in the atmosphere. Such changes involve management of uncertainty and risk. Climate models imply that over the next fifty years mean global temperatures are likely to rise by 2 degrees centigrade or more, as concentrations of CO₂, methane, and other greenhouse gases increase. rked changes in precipitation and run-off will result. The likelihood of extreme weather events, such as heat waves and droughts, will also increase. While a warmer world with much higher atmospheric CO₂ concentrations, greater total evaporation, precipitation and atmospheric moisture, is unlikely to be unambiguously less favorable to agricultural production, regional impacts are impossible to predict at this point. There may be broad zones in which water rather than temperature is the operative constraint on agricultural production where productive potential is impaired and instability increases.

Atmospheric accumulations of chloroflorocarbons are likely to deplete stratospheric ozone concentrations significantly over the same time horizon and add to the greenhouse effect. The known results -- higher surface exposures to ultraviolet radiation -- adversely affect many plant cultivars, affect the larval stages of many fish species, and raise risks of skin cancers among humans. Less is known about the interactive effects on plants of ultraviolet radiation and other environmental stresses, such as temperature and drought.

Strengthening Natural Resource Management

What are the best ways for the World Bank to address these problems of resource deterioration, and to promote sustainable agricultural development growth? This is the obvious question for the detailed discussions that will shortly begin in this symposium. I will not pretend to have the answers, but instead, will try to indicate some areas where effective intervention would seem to offer high pay-offs. In some of these, I realize the Bank has been active.

Institutional Strengthening

Many of the greatest opportunities involve institutional adaptation and reinforcement. Resource deterioration stems largely from institutional failure: on the one hand, the failure of private market processes to conserve resources for future use; on the other hand, the failure of public institutions to respond adequately to the needs of effective resource management.

Private market processes often fail for well-known structural reasons. Insecurity, ambiguity, or absence of property rights in many renewable resources -- ground and surface water, wild species, woodlands, parturage -- undermine private incentives to preserve or improve the resource for future use. Common tenures shared among village or kinship groups in pastoral, fishing, and swidden farming societies lead to effective resource management only if the local society can maintain its cohesion and authority against internal and external pressures -- of population growth, cultural and political domination, and market penetration. Otherwise, traditional restraints give way to anarchic exploitation of the resource, however disastrous the long-term consequences to the society.

In addition, widespread poverty grossly distorts resource use by compelling households to ignore considerations of future productivity in order to wrest today's subsistence from inadequate holdings by overexploiting them. In many countries, this is an artifact of highly skewed distributions of wealth, such that -- at the other extreme -- very generous holdings are underexploited, sacrificing potential output, income, and employment.

How can the World Bank help resolve these tenurial issues? There are successful examples of stimulating household investment and greater conservation efforts by establishing secure individual property rights -- by ceding rights to forest plots or tree plantings on wastelands to individual households, for example. There are also less successful examples of privatization of resources that have exacerbated inequalities without appreciable gains in the quality of resource management.

How can the World Bank build more effectively and sensitively on local traditions of community resource management -- in traditional fisheries, irrigation societies, and pastoral communities, for example. Very often, such traditions have been undermined as the political authority of local communities has been taken over by central governments. Their ecological wisdom, evolved over thousands of years, has been ignored or derided by foreign technical "experts". The World Bank and other development agencies, as the financiers and technical advisors of central governments, have often indirectly -- or even directly -- participated in undermining local communities and their resource management traditions. On the other hand, efforts have been made with varying degrees of success, in the context of irrigation, livestock, and other agricultural lending, to form or reform local associations to participate in resource management decisions.

How can the World Bank help in making clear the fact that economic growth in most of the Third World, in a period of retrenchment and austerity measures that fall most heavily on the poor, is insufficient to reduce substantially the numbers of households unable to look beyond the need to sustain themselves today, whatever the costs tomorrow? Not only in Africa, but also in Latin America and Asia, the economic conditions of hundreds of millions of households have not improved significantly in the last decade, and are unlikely to do so in the next without major changes in national and international economic policies. The wastage of human resources, the association between underdevelopment and rapid population growth, and the impact of poverty on marginal lands and other natural resources, should figure more prominently in policy decisions.

In addition to these issues of tenure and access to resources, physical externalities divorce the costs of resource deterioration from the decisionmaking calculus of those responsible for the impacts. Inappropriate land uses in upland watersheds impose heavy costs of flooding and sedimentation on populations in the plains below. Conversion or pollution of wetlands, estuaries, and mangroves impose costs on fishing communities dependent on fish populations whose spawning grounds are reduced. Destruction of critical ecosystems impose costs on those who would benefit from the new plant varieties and pharmaceutical products that the lost genetic resources might provide.

These external effects are a principal justification for government intervention and attempts at public management of the resources. Yet, public management also suffers from institutional weaknesses. While the number of countries that have set up specialized agencies to manage environmental concern has increased dramatically in the last decade, most of these fledgeling institutions are grappling with multiple shortcomings: shortages of trained staff and financial resources, inadequate information systems for assessing environmental conditions and monitoring performance, uncertainties about the most appropriate legal, regulatory, and economic approaches to adopt, and subordination to other development agencies within the overall government and political hierarchy. Strengthening these agencies technically, financially, and politically is an opportunity to contribute mightily to natural resource sustainability at relatively insignificant cost. How can development assistance agencies do more than they are now doing to meet this obvious need?

Along with the need to strengthen these specialized agencies go broader jurisdictional issues that affect public management of natural resources. One is the fragmentation of authority -- vertically among layers of government, and horizontally among different functional agencies. This fragmentation makes it extremely difficult to deal adequately with management problems that spill over from one sector to another and from one geographical jurisdiction to another. A clear example is watershed management, which requires a new "unit of account" that integrates water, agricultural, energy, and industrial concerns as well as upstream and downstream administrative and political authorities. The World Bank experiences these organizational problems even internally in its own efforts to deal effectively with natural resource management issues. How can it assist its clients to address them?

Finally, we should not ignore politics. In most developing countries there are not the organized, vociferous environmental lobbies that can command the attention of elected politicians and even large bureaucracies. As a consequence, deterioration of natural resources is easy to ignore if it accompanies expensive projects and programs that command the support of influential elites but undermine the welfare of a diffuse majority or a marginal minority. As we all know, politicians often choose paths that will win immediate support from powerful constituencies despite the considerable long-term costs. This is a major obstacle to a reworking of development priorities to give more weight to future productivity, and to the kinds of policy changes I am about to discuss to promote natural resource sustainability. In a closely related area, the World Bank has worked hard and effectively to enlist political leaders in support of population and family planning programs, despite the short-term political risks. What can be done to enlist their support for measures that will preserve the integrity and productivity of the resource base?

Policy Opportunities

There would be little debate that much attention must be given in the design and selection of projects to take advantage of economically feasible opportunities to enhance natural resource productivity and avoid potentially adverse impacts. It is also widely recognized, I believe, that a project approach to issues of natural resource sustainability is inadequate. The incentive framework that influences the behavior of households and farmers must be addressed, and conversely, in the shift to policy-based lending ongoing in the World Bank, issues of long-range sustainability must be considered.

As with other development objectives, there is a natural complementarity between policy reforms and project initiatives.

- ° Well designed programs to promote integrated pest management are unlikely to be effective as long as chemical pesticide sales are so heavily subsidized that farmers see spraying as a practically costless, prophylactic measure.
- ° Projects to improve irrigation water management are crippled from the start if policies on irrigation financing impose no discipline over investment decision, no accountability on the performance of irrigation agencies, and no pressure on farmers to use water with greater efficiency.
- ° Reafforestation projects will not arrest the deforestation process so long as forest revenue systems promote exploitative mining of the resource, and broader agricultural policies marginalize large numbers of peasants, driving them into forested areas as colonists and shifting cultivators.

The broader policy question of sustainability for this symposium is whether the framework of agricultural incentives, taken as a whole, does not massively and inappropriately bias the evolution and adoption of farming systems. I refer to the widespread direct and indirect subsidization of fertilizers, pesticides, water, machinery, and credit -- and the equally widespread implicit taxes on farm production. Impositions on agricultural output reduce the benefits of investment in soil conservation and land improvement. Subsidies reduce the costs of external inputs to the farm, including fertilizers to restore soil fertility, and heavily discriminate against alternative agricultural systems that rely on nutrient recycling, inter-species population balancing, and labor inputs for sustained productivity. Even in the United States and other industrial countries where purchased inputs are relatively cheap, farms using alternative "regenerative" technologies are close to commercial viability, and would probably be competitive were the external costs of chemical run-off and soil erosion internalized into farm production costs. In the Third World, the World Bank has helped to develop and demonstrate alternative farming systems involving multiple cropping and integrated animal, tree, and crop production that are capable of sustained high productivity with fewer external inputs. However, even if such an alternative approach were more productive and sustainable over the long run, will it emerge in the face of the overwhelming policy-induced bias in incentive against it?

Economics is about the allocation of scarce resources. As natural resources are increasingly stressed by the pressures of growing demands, it would be surprising if mismanaging them could be good economics. Generally, it is not. Numerous government policies not only fail to reflect the true opportunity cost of resource use, they perversely encourage more rapid and extensive degradation of soils, water, and biota than market forces alone would. Many current policies -- subsidies, fiscal incentives, and market interventions -- artificially increase the profitability of activities that result in serious resource deterioration. Changing these policies would often raise current welfare by reducing economic distortions, and also reduce long-term environmental damage. Typically, these changes would also reduce fiscal burdens on government and eliminate important sources of inequity within the economy as well.

Eliminating these perverse incentives has large payoffs. They raise important issues for policy dialogue with borrowing countries, and for policy-based lending. Like other policy changes that reallocate resources significantly, they arouse political opposition from interests that have captured the benefits of existing arrangements. How can the World Bank effectively promote long-run sustainability in its policy-based operations?

MANAGING NATURAL RESOURCES FOR SUSTAINABILITY

RAPPORTEUR'S COMMENTS

Richard O. Ackermann*

The brief discussion that followed Mr. Repetto's presentation revolved mostly around the following two issues:

- How can we better define what is meant by sustainability of natural resource management?
- How do we deal with the problem that the greatest burden to improve natural resource management appears to fall on the poorest countries?

The Speaker expanded on his view of how national income accounts should be amended to take into account the decrease in wealth due to natural resource degradation, and affirmed that a legitimate case could be made to set up a mechanism for international cost-sharing that would address the global nature of many of today's environmental problems.

The Chairman started out the discussion by asking whether it would be possible to have universally agreed standards of national income accounting, as a way of going beyond the often repeated, but poorly defined call for sustainable development.

The Speaker pointed out that World Resources Institute, jointly with Bank staff, developing guidelines to improve the way economic performance is measured. Because there is no depreciation account for natural resources like there is for built capital assets, the national income accounts fundamentally overstate the income growth of economies that rely heavily on exploitation of their natural resources. Thus, because measures such as the GNP are particularly influential as indicators of the success of economic performance, it is important that natural resource depletion be taken into account consistently.

In response to a question later on, the Speaker expanded on this by stressing that a country's natural resource base represents an asset which should be protected, preserved and enhanced if it is to provide a future flow of services, i.e., if it is to be used sustainably. In other words, the productivity of the assets with which a country is actually endowed should be seen as equally important as capital formation, investment and savings rates, etc.

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The burden to prevent natural resource degradation appears to fall disproportionately on some of the poorest developing countries which cannot afford to make the necessary long-term investments. Moreover, it could be argued that many of today's industrialized countries developed their wealth through rapid and massive conversion or depletion of renewable resources. One questioner wondered therefore how we might be able to better help the developing countries bear the costs of dealing with natural resource problems, keeping in mind that many of the benefits accrue to the world community as a whole.

The Speaker suggested that a distinction be made between environmental damages that are national, regional or even local, and those that are international in scope. For the most part, soil erosion and loss of agricultural productivity tends to be a national or regional concern. On the other hand, tropical deforestation, loss of species, and climate change is very much an international problem, for which the distribution of costs and benefits is skewed between developing and industrialized countries. The Speaker affirmed that there was a very good case for international cost-sharing to help ensure preservation of tropical forests and conserve biological resources, and that this kind of activity legitimately falls within the purview of international organizations. An interesting example of a different kind is that of China which plans to use its vast coal resources as the main energy source to fuel industrial growth. The likely impact of this on the atmosphere should spur efforts in other countries to help the Chinese raise their energy efficiency and promote energy conservation.

In his presentation, the Speaker had mentioned the conflict between government policies and participation of traditional associations in the management of natural resources. A question was raised in this regard whether one shouldn't also focus on examples of successful cooperation that could be, and had been, achieved between users of natural resources -- the farmers -- and government/donor institutions. (Examples include protection of rangeland and rotational grazing in Africa.)

The Speaker agreed that it would be wrong to overemphasize the conflict between government and natural resource users. In fact, many government/development agencies provide a service, and their goal is to raise the productivity and income of farmers. It is well known of course that complementarity of interests is not complete, and that the services provided are not always adequate.

Finally, a member of the audience made a couple of comments and observations. He was pleased to note that the Speaker had not put all the blame for natural resource degradation on population pressure. The principal underlying factor is poverty, he argued, and inappropriate technology contributes to the problem. Referring to a different issue, he then went on to suggest that recent evidence indicates that the cost of irrigation development may not be increasing as the Speaker had stated in his presentation.

SOIL CONSERVATION AND SMALL WATERSHED DEVELOPMENT

Pierre Crosson*

Soil erosion may reduce the productivity of the soil by removing nutrients, damaging soil tilth, and lessening the water holding capacity of the soil. In parts of many countries present rates of erosion are high enough to have these unfavorable effects on soil productivity. Henceforth I refer to these effects as on-farm damages of erosion.

Erosion also produces sediment which clogs irrigation drainage ditches, reduces the life of reservoirs, increases shipping costs or imposes costs of dredging to keep harbors and inland waterways clear, impairs water based recreation, and damages aquatic ecological systems. I refer to these effects as off-farm damages of erosion.

The on-farm and off-farm damages of erosion may raise sustainability issues, depending on circumstances. What needs sustaining is the capacity of societies to produce indefinitely increasing food and fiber, hydroelectric power, flood control, shipping services and recreation at reasonable costs while protecting socially valuable ecological systems. The more narrow the range of substitution of other resources for soil in production of food and fiber and of clean water in production of the other services, the more likely the on-farm and off-farm damages of erosion will raise sustainability issues. The severity of the threat to sustainability cannot be assessed with attention to these substitution possibilities.

There is no reason to believe that erosion poses a greater threat to sustainability in small watershed than in large. On the contrary, in most countries today, the range of resource substitutions for people in a small watershed must, in general, be greater than those for people in a large watershed, other things the same. Substitute resources can be obtained through trade or if that is inadequate, by migration from the watershed. In general, opportunities for interwatershed trade and migration must increase as watershed size diminishes, unless all or most watershed are under severe threat to sustainability. With the latter condition favorable trade and migration opportunities are limited for everyone, regardless of size of watershed.

It follows then that the threat to sustainability of a given per hectare amount of erosion over an area increases with the size of the area. Why, then, focus on the threat in small watersheds? There is no good answer to the question if only a few such watersheds are under threat. However, if the number is large enough that erosion in all of them together poses a threat to sustainable development in a major region or the country as a whole, then a small watershed focus may make sense. Notice that I say "may," not "will." I will present an argument for the hypothesis that the more severe threat of off-farm erosion damage relative to on-farm damage, the less likely a small watershed focus will be most appropriate for policies to protect sustainability.

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I do not pretend that the argument makes a definitive case for the hypothesis. We lack sufficient information about on-farm and off-farm damage to do this in the United States, which has more of the needed information than any other country. The lack of data is far more marked in the developing countries. Despite this, we know enough about erosion damages and other conditions in these countries to give the argument for the hypothesis some plausibility. That is all I claim here.

The first step in developing the argument is to assess the relative importance of on-farm and off-farm erosion damages in developing countries.

On-Farm Damage

The first thing to note is that we know very little about present rates of erosion in developing countries, let alone the damage it does to soil productivity. El-Swaify et al (1982, p. 1), authors of the most comprehensive published study of erosion in the developing countries, assert that "...there is little or no documentation of the extent, impact or causes of erosion..." in tropical environments. A report by the Worldwatch Institute (1984) may appear to contradict this, but a close reading indicates that in fact it does not. Except for India, Worldwatch estimates erosion in developing countries by multiplying estimates of sediment delivered to the mouths of major rivers by so-called sediment delivery ratios (SDRs). Apart from substantial uncertainty about the estimates of sediment, delivered, SDRs are highly variable among watersheds, depending on topography, soil texture, drainage, climate, type of ground cover, and other factors. The SDRs used by Worldwatch do not reflect this variability, hence they must be subject to large but unknown errors.

Such estimates as we have of erosion-induced losses of soil productivity in developing countries rely on so-called "tolerable" levels of soil loss (T values). T values define the maximum amount of annual per hectare erosion that can be sustained indefinitely without impairing the productivity of the soil. The original T values were developed by the U.S. Soil Conservation Service (SCS) for U.S. soils, but they now are widely used to estimate erosion-induced productivity loss in the developing countries. These estimates typically, e.g. in the work of El-Swaify et al and Worldwatch Institute, do not adjust T values to reflect the differences between U.S. soils and soils in developing countries. The estimates of productivity loss cannot be taken seriously for at least three reasons: (1) T values are back-of-the-envelope estimates with little standing among soil scientists, including those in SCS; (2) the estimates assume that the soil eroded by water and wind is forever lost to agriculture, when the evidence is clear that most of it is moved a relatively short distance from a higher to a lower place on the landscape; (3) the measures of erosion in the developing countries include soil eroded not just from agricultural and forest land but also from stream channels, road building and urban construction sites, as well as from land of little present or potential productivity in agriculture. Erosion from these various sources is high in many areas, but it poses little if any threat to the long-term capacity of

the soil to produce food and fiber because the capacity of these soils already is low.

The growth of crop yields in Asia and Latin America over the last several decades indicates that whatever the effect of erosion on soil productivity in these areas it was more than compensated by advances in technology and management. Yields in Africa generally have declined, but Eicher's (1982) account of the African experience strongly suggests that the poor yield performance in African countries is owed primarily to government policies and other socio-economic factors, not soil erosion.

Much experimental evidence indicates that the yield response to fertilizer is suppressed on severely eroded soil because of reduced water holding capacity. Yield growth in Latin-America and Asia over the last several decades, owed in considerable part to increased use of fertilizer, has been comparable to that in the United States, where it is known that erosion effects on soil productivity are small (Crosson and Stout, 1983; Larson et al, 1983). This suggests that yields in Asia and Latin America could not have increased as they did had erosion damage to soil productivity been markedly higher than in the United States.

None of this is to say that erosion poses no threat to soil productivity in developing countries. Experimental work by soil scientists in Africa, Asia and Latin America (reviewed by El-Swaify et al, 1982) shows clearly that soil productivity is adversely affected by the loss of soil nutrients and damage to soil structure resulting from erosion. Anecdotal evidence from hilly regions in the developing countries points in the same direction. Thus some erosion-induced loss of soil productivity in these countries is certain. But that it presents a major threat to sustainability, in my judgment, is unlikely. The judgment, however, is not based on hard evidence, for there is none.

Off-Farm Damages

Information about off-farm damages also is anecdotal, but it is more abundant than that for productivity loss, and it suggests that the costs of off-farm damage are high. The best documented damages are those for loss of reservoir capacity resulting from accelerated siltation. Eckholm (1976) cites cases in Colombia, Taiwan and the Philippines indicating that present rates of reservoir capacity loss could cost these countries as a group some billions of dollars over the next several decades. El-Swaify et al (1982) present data for reservoirs in Pakistan and India which also show rates of siltation running substantially ahead of design rates.

The cases cited are only for losses of reservoir capacity. This of course is only one form of off-site erosion damage. Comparable information about losses of recreational values, costs of increased flooding because of sediment deposition in river beds, and of dredging to keep rivers and harbors clear for shipping are not available. Any reasonable allowance for these costs, when added to those reflecting lost reservoir capacity, suggests that total off-site damages of erosion in developing countries are high.

Implications for Thinking about Policy

If I am right about the relative importance of on-farm and off-farm erosion damage in the developing countries, then off-farm damage is the greater threat to sustainability of the development process. This has two implications for soil and water conservation policy in these countries which are relevant to this discussion. The first, and obvious one, is that policy should focus primarily on reducing off-farm sediment damage, not on reducing on-farm damage to productivity. The second, and not so obvious implication, is that a large watershed strategy probably would be more cost-effective in dealing with the problem than a small watershed strategy. It is this second implication that I want to discuss here.

To begin, note that to reduce off-farm sediment damage policy makers have three options: they can concentrate on reducing erosion on the land, or on measures to block or divert sediment from entering places where it does damage, or on some combination of these. But to reduce on-farm damage to soil productivity policy makers have only one alternative: reduce erosion on the land where productivity is under threat.

It follows, not as a matter of logic but as a practical matter, that if damage to soil productivity were the main threat a small watershed strategy for soil conservation policy would make most sense. Indeed, it is hard to see how any other policy could be as cost-effective. Where erosion is a significant threat to productivity it results from the farming operations of thousands, perhaps hundreds of thousands of farm families. They may be spread across one, or several large watersheds, but these typically consist of many smaller watershed. A soil conservation policy aimed at protecting soil productivity must reach all of the farm families contributing significantly to the problem. This would appear to dictate a small watershed strategy, for these families live in small watersheds.

I argue as a general proposition that such a strategy is inappropriate, however, for dealing with off-farm erosion damage. A small watershed strategy for this problem implies that the most cost-effective way to reduce off-farm erosion damage is to reduce erosion on the land. There is good reason to doubt this. Inducing or requiring the numerous farm families responsible for erosion to adopt less erosive practices requires an administrative apparatus capable of reaching into all the erosion generating nooks and crannies of the region and effectively conveying the message, backed by financial incentives or the threat of sanctions, that erosion should be reduced. The U.S. has had such an apparatus in place for 50 years, and it has operated with only modest success. The resources available to developing countries for comparable efforts are far more limited, and their opportunity cost in this use, therefore, must be relatively higher.

The effectiveness of erosion control for reducing off-farm erosion damage also is open to serious question. There are a couple of reasons. One is the difficulty of linking erosion sites on the land with sites of sediment damage downstream. The processes by which sediment moves

through a watershed are poorly understood, but the evidence is clear that movement is halting and subject to long delays. Indeed, studies in the U.S. show that the time between detachment of soil in upland areas and its delivery at the watershed mouth may be measured in decades, or even centuries (e.g., Trimble, 1974). Consequently, the relationship between erosion observed at any time in parts of the watershed and sediment There can be no assurance, therefore, that reducing erosion in places where it is high will produce proportionate reductions in sediment damage downstream. Even where a roughly proportionate reduction in damage is achieved the time lag tends to produce a low benefit-cost ratio for the control project.

Erosion control to reduce off-farm sediment damage is complicated also because the reduction in overland delivery of sediment to streams may cause increased erosion of the stream banks and beds. Moving water has a certain capacity to carry sediment, depending upon the velocity and amount of water and the texture and other characteristics of the sediment. If erosion control reduces the sediment delivered to the stream, the stream will attempt to compensate by scouring its channel.

These characteristics of sediment movement suggest that a policy which focuses on preventing sediment from getting into places where it does damage may be more cost-effective in dealing with off-farm erosion damage than a policy of erosion control. Two arguments support this. One is that sediment management can be closely targeted on places where sediment damage occurs. For reasons given above, erosion control cannot. Moreover, the delay between initiation of a sediment management project, e.g. building a sediment trap above a reservoir to be protected, and the resulting flow of benefits in many instances will be less than for an erosion control project with the same objective.

The second argument for sediment management strategy is ease of implementation. An erosion control strategy relies on inducing or requiring many farmers, perhaps thousands or tens of thousands, to adopt erosion control practices which typically they do not believe to be in their economic interest. And since the damage their practices incur are off the farm, they undoubtedly are right, at least in the general case. Achieving the necessary change in practices, therefore, requires an exercise in social engineering, something which experience shows most countries are not very good at and which typically is costly in administrative and financial resources.

A sediment management strategy relies much less on changing farmer behavior. It is more an exercise in civil engineering, if you will. Sediment management uses physical works, e.g. check dams, holding ponds or small reservoirs, grassy strips bordering streams, reservoirs or other water bodies to be protected, and so on. Moreover, these works can be placed in those relatively few places in the watershed best calculated to protect the resources under threat from sediment damage. Arguably, the administrative costs of such a strategy would be less than for an erosion control strategy designed to the same end.

It can be fairly easily shown that the cost per ton of sediment captured in a storage reservoir is substantially higher than the cost per

ton of erosion reduction by, say, conservation tillage, or even terraces. These comparisons miss two crucial points, however. One is that they leave out the costs of administration, including the political costs of making farmers do something they do not want to do. The other is that the objective is reduction of sediment damage, not reduction of tons of sediment or of eroded soil. By this standard sediment management will compare more favorably with erosion control because, unlike erosion control, it can be precisely targeted to reduce damage.

Lest I be misunderstood, I here emphasize that I do not argue that developing countries should cease worrying about erosion control and start worrying only about sediment management. There clearly are places in those countries where the erosion threat to soil productivity justifies erosion control measures. Moreover, there must be places where erosion control is a more cost-effective approach to reduction of off-farm damage than sediment management.

What I am arguing for is a fresh look at soil and water conservation policy to reflect the evidence that off-farm damage may be a more serious threat to sustainability than on-farm damage, and that in the general case a sediment management strategy likely is more cost-effective than an erosion control strategy in reducing off-farm damage. The new look I am urging does not imply abandonment of erosion control. It does imply a soil and water conservation policy that gives sediment management a much more prominent role than it now has. One of the likely consequences of this would be a shift from a small watershed to a large watershed focus in policy implementation.

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SOIL CONSERVATION AND SMALL WATERSHED DEVELOPMENT

RAPPORTEUR'S COMMENTS

W. Beattie*

Mr. Pierre Crosson's paper, "Soil Conservation and Small Watershed Development," pointed out that the costs of or damages caused by soil erosion are generally grouped into two categories: (a) the "on site" costs, in particular, the loss of soil productivity; and (b) the "off site" costs such as the silting in of dams and irrigation canals and the pollution of water for downstream users. Of these two categories of costs, Mr. Crosson felt that the first had been given an inordinate amount of importance by policy makers. He suggested that while existing policies, aimed at correcting both types of damages should be continued, more emphasis should be placed on remedies for the "off site" problems through what he called "sediment management" policies.

He supported this position by saying that on-site investments to reduce erosion are difficult to justify because little information is available on the cause/effect relationship between erosion and the loss of soil productivity. He also noted that what information is available indicates that those losses have not, in fact, been all that great. Also, fertilizers and other technology have, in fact, gradually increased worldwide productivity as measured by per hectare crop yields. Finally, Mr. Crosson pointed out that the linkage between upstream soil conservation practices and downstream benefits is extremely difficult to measure and usually takes place over many years. This gives such upstream investments very low benefit/cost ratios and subsequently makes them unattractive to upstream land users (especially small farmers who see little direct benefits from these practices). On the other hand, there is abundant information available on the level of "off site" damages which are easily measured and usually great. Mr. Crosson's presentation was followed by questions and comments from the audience.

The first speaker said that the presentation left him with the impression that we should not worry about on-farm erosion problems as long as overall agricultural productivity was being maintained. He thought that such a position was wrong as productivity could be maintained artificially (e.g., with increased fertilizer inputs) and the effects of erosion on the gradual loss of soils' natural fertility could be cumulative and have dire consequences in the longer term. A second speaker agreed and noted that productivity statistics do not reflect the fact that many farmers are moving from one plot of land to another, depleting soil as they go but maintaining their farms' productivity. Mr. Crosson said that he wanted to make clear that he agrees that on-farm erosion and soil productivity losses were indeed serious problems and should continue to be addressed. He repeated his position, however, that more emphasis should be given to downstream damages since they were the more serious consequences of erosion and could be more easily and directly dealt with.

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A third speaker disagreed with Mr. Crosson's statement that little information was available on soil productivity losses from erosion. He states that there is considerable information showing the correlation between cultivation practices, erosion and soil productivity. A fourth speaker agreed and noted that simple conservation techniques can be both highly beneficial and financially viable to the farmer. The problem is not so much one of developing new conservation techniques as it is one of getting the information to the farmers. Mr. Crosson said he did not agree that available information on soil erosion and soil productivity losses was easily transformed to other areas or that adequate soil conservation technical packages were as readily available as the speakers implied.

The fifth speaker noted that insufficient water is often a more serious cause of crop yield losses than soil fertility loss and that proper water management could kill two birds with one stone by assuring both better water availability and reduced erosion. Mr. Crosson agreed.

The sixth speaker felt that Mr. Crosson was implying that prevention is not, in fact, better than cure by emphasizing the correction of downstream siltation rather than the reduction of upstream erosion. Mr. Crosson replied that he would again like to repeat that he was strongly in favor of up-stream erosion control and soil conservation practices but that the off-site damages were greater, more readily corrected and should therefore receive more emphasis than they had traditionally been getting.

The chairman tried to summarize the discussion by pointing out that everybody seemed to agree that relatively balanced policies and downstream "silt management" (correction of damages) were desirable but that there should be no attempt to link the costs and benefits of each in economic analyses since it is too difficult to establish such cause and effect links and because of the long time frame between upstream erosion and the subsequent silting damage.

The next speaker stated that he saw a danger in using productivity to measure the relative damage caused by erosion since the increasing use of fertilizers is masking that damage. He felt that there are serious potential problems in what is effectively the substitution of natural for artificial plant nutrients. Mr. Crosson agreed but felt that others have exaggerated the losses of soil fertility through erosion which has led to excessive emphasis on soil conservation policies.

The last speaker stated that one should not measure the benefits of soil conservation practices solely in terms of reducing productivity losses. The agriculturalist is still primarily interested in increasing productivity by any means available but soil conservation should be practiced for numerous ends of which increased productivity on farms was just one. Mr. Crosson agreed and noted that while it is necessary for governments and groups such as the Bank to take into consideration the long-term benefits from soil conservation when evaluating each investment they should primarily address the critical short-term problems of siltation.

LAND MANAGEMENT, TITLING AND TENANCY

François Falloux

"On my word, I know not whom you are for, but I am for my field".

"Par ma foi, je ne sais pas pour qui vous etes, mais moi, je suis pour mon champ".

(French chronicle, 16th century)

Land-related issues^{1/} are creating increasing difficulties in implementing of agricultural and rural development projects. Agricultural land scarcity is increasing with population density. Anomalies in land use, land distribution and tenure security, which were less crucial when land was plentiful, can no longer be ignored with a growing population facing food shortage. Progress in agricultural technologies are de facto denied to a large number of farmers who do not have enough land security to warrant the investment risk involved. Similarly, agricultural credit programs are blocked because many farmers do not have the proper land documents which are regarded as essential collateral by rural banks. In many countries, the technical/legal basis for establishing land security is confused, with key components either inadequate or missing. It is common to find thousands of cases of land disputes piling up in the judicial system; another frequent situation is a land registry that is totally out of date or non-existent; in too many instances, it may take five to ten years to get a land title and then not being sure of its validity. For governments--particularly for local governments--there is another crucial issue: the minimal--if not zero--revenue from land taxation, which is, or could be, the principal source for financing the operation and maintenance costs of rural infrastructure. This results from an inadequate or non-existent land cadastre which makes, tax collection

1/ Land-related issues correspond here to all the various facets of land management (sociological, technical, financial, legal, fiscal and economic).

tax collection almost impossible. This may also result from a mere lack of enforcement.

Many of these land-related issues are, to some extent, country- or region-specific. In areas of long-stabilized agriculture (Europe, the Middle East, South Asia), farms have become fragmented into myriads of smalls scattered plots. This implies a lot of time, energy and money spent in transport, and it prevents farmers from modernizing and mechanizing their farms. In areas of the New World (Central and South America), land distribution is very unbalanced, with a few large-scale landlords involved in extensive farming, and with countless landless farmers and workers. SubSaharan Africa is a special case in the sense that regarding land tenure it has always been regarded by many as a problem-free continent. Current desertification and land degradation, however, show that, unfortunately the African continent has problems of its own which need to be dealt with quickly and efficiently 2/.

This paper is focused on the past and present experience of the World Bank in land tenure 3/, titling and management. The paper discusses a series of issues and my personal views on the possible directions we should take. This paper goes beyond rural land, in a restricted sense, by including some comments on semi-urban and urban lands because of the difficulty in distinguishing what is rural from what is urban, particularly in city surroundings. This paper also occasionally deals with more general aspects of land policy and macro-economic issues because land tenure, titling and management are only pieces of a larger puzzle.

Retrospective of World Bank Involvement in Land Tenure

Before 1975

Before 1975, the Bank was not much involved in land tenure and particularly not in land reform, which was considered too political, time-consuming and as inappropriate for Bank financing. The Bank focused instead on agricultural development projects such as irrigation schemes, commodity development, tree crop plantations, agribusinesses and credit

2/ See "Improving Land Tenure as a Means Toward Rational Resource Management" by F. Falloux and A. Rochegude, a paper presented to the West African Workshop on Desertification Control and Management of Renewable Natural Resources, Oslo, Norway June 1986.

3/ Here I prefer to use the concept of land tenure (the act, right, manner or term of holding a landed property) because it is broader than land tenancy (the temporary possession or occupancy of a landed property that belongs to another).

schemes . Land tenure issues were often overlooked. When they were considered during project preparation, the purpose was only to make sure that the project area was problem-free in this domain. If a major land problem was identified during preparation, it either had to be resolved before implementation or the project was moved to a problem-free area.

The 1975 Policy Paper on Land Reform

The Bank's attitude towards land tenure changed in 1974-75 with the publication of the 1975 policy paper on land reform. This change was partly induced by the new Bank policy on poverty-oriented rural development; it reflected the need to deal with land-related issues because of their often detrimental consequences on hundreds of millions of poor farmers. In the policy paper, the Bank announced its full support to "land reform" activities. More specifically, policy guidelines, inter alia, stated that:

- (a) "The Bank will intensify its efforts through sector and country economic work to identify and draw attention to the need and opportunities for land reform with respect to existing tenurial situations and their economic effects";
- (b) "The Bank will cooperate with FAO and UNDP to provide support and assistance to member governments seeking help with the specifications and design of land reform programs. This support will include financial and technical aid with cadastral surveys, registration of land titles and similar services";
- (c) "The Bank will not support projects where land rights are such that a major share of the benefits will accrue to high income groups unless increases in output and improvement in the balance of payments are overriding considerations; in such cases, it will carefully consider whether the fiscal arrangements are appropriate to ensure that a reasonable share of the benefits accrues to the Government";
- (d) "In circumstances where increased productivity can effectively be achieved only subsequent to land reform, the Bank will not support projects which do not include land reform"; and
- (e) "The Bank will support and encourage research related to the economics of land reform in its broadest aspects".

It was also stated that:

"More needs to be known about the distribution of land, conditions governing tenancy, and the policy and programs instituted to influence the distribution of land and rural incomes. It is only with a thorough analysis of conditions within member countries that the Bank will be in a position to discuss land policy options with member governments"

It was finally recommended that:

" Even in countries where governments are not interested in land reform, the Bank should study the situation in all cases..."

After 1975

Despite the Bank's clear commitment to support land reform and land-related projects--including titling--results in terms of both lending and sector work represented a small percentage of the total up to 1981. Only 7 percent--40 projects--of the total number of agricultural and rural development projects approved from FY75 to FY81 inclusive, had land-related components. About half of these projects (19) were focused on land settlements with heavy emphasis on building infrastructure and providing agricultural and social support services. Only three projects were actually related to land registration and cadastral services. Even in those cases, much more emphasis was put on agricultural production and support services than on the tools and mechanisms of land surveys, cadastre and land registration. Likewise, in agricultural sector work, very few reviews included a thorough analysis of land issues.

There are four possible reasons for this lack of action on land issues:

- (a) the Bank's policy paper came at a time when most land reform activities, initiated by quite a few governments in the 1950s and 1960s, were waning due to political and technical difficulties encountered in their implementation;
- (b) the Bank was not well equipped to fulfill its commitment: its experience and expertise in land matters were limited;
- (c) in the absence of only recently-improved surveying technology, titling and cadastral operations were still extremely lengthy and not compatible with Bank's project procedures; and
- (d) this process was also very costly and not affordable by many of our borrowers.

Recent Bank Experience in Land Titling/Management Operations

The Bank has recently increased its focus on land resource management. This is demonstrated by (i) a new generation of land titling/management projects and a substantial increase in corresponding lending; (ii) a greater attention paid to land issues in sector work and research; (iii) the appearance of land affairs in structural adjustment

(e.g., Argentina); and (iv) a steady effort to enhance Bank expertise in land matters.

New Generation of Land Operations and Increased Lending

Since the beginning of the 1980s, the Bank has implemented a series of new projects with a new approach to land-related issues. This approach is based much more on gradual and region-specific land interventions than on technically and politically difficult nationwide land reform. In addition, emphasis has been put on land titling and the establishment of a reliable cadastre which constitute the basic tools for further land actions, such as correcting land distribution, consolidating agricultural land and establishing or improving land taxation.

Among these projects is the Brazil Piauí Rural Development Project (Loan N. 2015 BR) whose initial objectives were, *inter alia*, (i) to acquire some 200,000 ha on the land market and redistribute them to approximately 5000 landless farmers; (ii) to regularize land tenure on about 900,000 ha; and (iii) to establish and strengthen state land institutions with adequate cadastral services, including an efficient updating system. This project, now near completion, has fulfilled its basic objectives. Partially based on the Piauí experience, other state projects were approved (Bahia, Maranhao) and, in June 1985, a regional Bank-supported land titling/cadastral project (Loan N. 2573.BR) began implementation over the whole of Northeast Brazil. This implementation however has been slower than expected because of organization, management and procurement difficulties. Another difficulty has emerged from the National Agrarian Reform recently introduced by the Brazilian Administration. In this new context, doubts remain on how the regional project is going to fit in the National Reform. This shows that, in Brazil, a series of land projects decentralized at the state level may be easier to manage and have a stronger impact on agricultural development than regional or national ones. At the risk of being controversial, one can even argue that political idealists may slow down the implementation pace of technically sound projects.

Outside Brazil and the rest of Latin America, the number of approved land titling/cadastral projects has also increased dramatically, except in SubSaharan Africa where only a few projects, mainly urban-based, have been approved as I will comment on in chapter VI. From less than US\$100 million in 1981, the total consolidated lending for these projects has reached about US\$800 million today. This figure is likely to continue increasing because of the large number of projects now being prepared.

This renewed interest by the Bank in land titling/cadastral projects, may be explained by the following four reasons:

- (a) the repeated signals from PCRs and OED reports showing land tenure to be a major constraint, even in areas where it was originally thought not to be a constraining factor;
- (b) the emergence of improved technologies in land surveys and registration (geodetics, aerophotogrammetry, computerized

cadastral systems), that dramatically lessen the time required to establish a reliable land cadastre while improving its cost-effectiveness. In the past, total cadastral costs frequently ranged from US\$20 to US\$30 per hectare in rural areas. It is now possible to keep them below US\$10 and even US\$5 in the case of simplified cadastral systems;

- (c) the increasing willingness of borrower countries to set up a reliable land cadastre as a basic tool of rural and urban development policies; and
- (d) the building up of Bank's experience and expertise in land matters .

Sector Work and Research

Since 1982/83, increased attention has been paid to land issues in sector work in practically all the regions. Land issues have even been the exclusive topics of a few sector studies as in Kenya (Land Issues Paper, September 1983), Zimbabwe (Land subsector study, WB report No 5878 ZIM, 1986), Malawi (Land subsector study, white cover 1986) and Burkina Faso (Agricultural Resource Management Study, April 1986). It is noteworthy that outside agencies (e.g. ADB, USAID) have also financed more land-related studies than in the past. One can expect and hope that the Bank together with the other agencies will continue increasing its sector work and policy dialogue with its borrowers on land issues to pave the way for more projects and possibly more structural adjustment.

Besides sector work, the World Bank Agriculture and Rural Department has initiated more basic research in land matters. A first study has been completed in Thailand^{4/}; and similar studies are to be launched in SubSaharan Africa. Simultaneously a review of the literature on land tenure systems has been carried out, particularly relating to SubSaharan Africa^{5/}, and a working paper has been prepared on "Traditional Land Tenures and Land Use Systems in the Design of Agricultural Projects" ^{6/}.

Land Affairs in Structural Adjustments

Land matters have just begun to appear in structural adjustment

^{4/} "Land Ownership Security, Farm Productivity, and Land Policies in rural Thailand" by Y. Chalamwong, T. Onchan, C. Hongladarom and G. Feder. A proposed manuscript for World Bank Publication, August 1986.

^{5/} "A Review of the Literature on Land Tenure Systems in SubSaharan Africa" by R. Noronha. Discussion paper. AGR/Research Unit. World Bank.

^{6/} World Bank Working Paper n. 561F by R. Noronha and F. Lethem. 1983.

operations. The first case is Argentina, where one of the objectives is to partially replace export duties and rural income tax with land taxation. This measure is expected to stimulate agricultural productivity by taxing not the agricultural products but rather one of the main production factors: land. Although Argentina has relatively good cadastral services, this measure will require their strengthening, particularly in provinces outside the Pampa Humida (Buenos Aires' region). Based on this case, can we expect more consideration to be given to land matters in future structural adjustments? I personally hope so. I will argue that improving land tenure/land use is a priority adjustment required in the economy of many of our borrower countries where the agricultural sector is predominant.

Enhancing Bank Expertise

At the beginning of the 1980s both agricultural and urban project staff felt the need for in-house training on land matters, particularly on land information systems (LIS). A few individuals, particularly concerned by the lack of expertise within the Bank, created a special working group whose first activity was to organize a training seminar with the assistance of the Training Division. The first one-week training seminar was tested in 1985 and repeated in 1986; the third one is now being prepared and is scheduled for March 1987. Simultaneously, the working group is organizing meetings and one-day seminars on land matters and LIS several times a year.

Profile of a Land Titling and Cadastral Project

Objectives and Strategy

In comparing the various Bank-supported land titling projects that are either under preparation or implementation, one can find many similarities in terms of objectives and strategy. The main objective is usually to provide farmers with increased land security and thereby stimulate the establishment of self-sustained production systems through increased long-term farm investment; other associated objectives may be to correct a biased land distribution, improve land use planning and eventually establish a reliable data base as a tool for both land management and land taxation. To reach these objectives, these projects attempt to:

- (a) develop a low-cost, but technically sound surveying approach, as a first step towards land titling;
- (b) improve the technology for, and simultaneously reduce the cost of, mapping activities by centralizing and streamlining processes and integrating cadastral mapping into a coherent national cartographic program;
- (c) establish the foundations of a land information system (LIS) that would regroup, update and retrieve relevant natural

resource information and other technical, legal and fiscal land records; and

- (d) develop the related institutional capacity to deal more efficiently with land matters and improve the integration of technical, fiscal and legal aspects.

From a technological viewpoint, these projects aim to:

- (e) establish/upgrade the geodetic network by using recent cost-effective techniques (now the Global Positioning System - GPS);
- (f) speed up the rhythm of cadastral surveys through an extensive use of aerophotogrammetric methodology where possible;
- (g) simplify the titling process and improve the land recording system by streamlining procedures and by progressively computerizing the different operations involved; and
- (h) emphasize staff training on these new technologies

Usually this type of land titling project, to be implemented in five years, only represents a slice of a longer national titling and cadastral program that may require 10 to 15 years to be completed. The same program would have required a full century to be completed if traditional topographic techniques were used instead of the technologies proposed above.

Bank Processing

Although titling and cadastral projects are basically processed the same way as other Bank projects, there are some differences:

- (a) during project preparation, greater attention is paid to the legal framework in order to be sure that the benefits from improved technology are not going to be erased by cumbersome procedures imposed by the land law and registration system; if they are needed, changes have to be made prior to implementation;
- (b) surveying and cadastral technologies are evolving quickly. From a cost viewpoint, there is a wide range of possibilities. This means that finding the proper set of technologies that is adapted to, and affordable by a particular country is a delicate matter; similarly, selecting surveying contractors is not easy and requires expertise. Usually these services are procured under International Competitive Bidding;
- (c) when land titling is associated with land transfer operations (acquisition and redistribution, expropriation), the Bank does not finance the costs of the operations; and

- (d) regarding financial and economic analysis, land titling and cadastral projects were initially difficult to appraise in the same way as the usual Bank-financed projects because of the lack of data and supporting research. Only a qualitative judgement based on the economic theory could be made such as the likely increase in farm investment due to expected higher land security. It is now possible to carry out a quantitative analysis based on the findings of the Thai study. Briefly, social benefits of a land titling/cadastral project are reflected by the increase in land values due to titling. Recent computations, particularly in the Thai case, show an extremely high return^{7/}, which indicates that titling may be one of the best investments in the agricultural sector.
- (e) Finally from a fiscal viewpoint, some quantitative estimates can be made such as the possible increase in public revenue due to better land tax collection and, on that basis, the time required for public investment repayment; equally, public savings can be expected from a better institutional organization in the cadastral and cartographic field.

Some considerations need to be given to the relationship between the cost of establishing a land cadastre including titling and the actual value of land in the market. As a rule of thumb, this cost should be around 2% of the land market value according to the International Institute for Cadastre and should definitely not go beyond 5%. This means that the technologies and the methodology used have to be adapted to regional and local conditions. A country cannot afford to have the same standard of precision in cadastral surveys for every region. In Brazil, for example, it would be unrealistic to use the same standards for surveying highly developed agricultural land around Sao Paulo as for the Sertao in the Northeast.

Finally, the Bank in all the projects it supports, particularly those providing services to farmers (water supply, irrigation), insists on a reasonable cost recovery scheme. Land titling, because it increases land security and usually has a positive impact on the land market value, may be considered a service and as such its cost should be recovered at least partially. The recovery rate can be determined according to farmers' repayment capacity and the recurrent costs of cadastral services. A case can be made, however, that land titling should be free of charge for smallholders, particularly those who were previously landless.

^{7/} Increases in land values due to titling are usually fairly substantial (30 to 80% in the Thai case). Assuming that the cost of titling and establishing a cadastre is lower than 5% of the value of land (between 2.4 and 4.1 in the Thai case), it put titling as probably the investment with the highest rate of return in the agricultural sector.

Land and Structural Adjustment

As mentioned before, Argentina is the first case where land policy aspects have been included in a SAL. Since land issues constitute a major constraint in the agricultural economy of many of our member countries, structural adjustments can be expected to include land policy components in the near future. In this chapter, I will present land measures that could be included in structural adjustments and, simultaneously, I will defend the complementarity and synergy between structural adjustments and land-related projects. Six categories of land policy adjustments will be reviewed: (i) restructuring the legal framework to provide farmers with land security; (ii) adjusting land distribution; (iii) streamlining and decentralizing land institutions; (iv) reducing public expenditures; (v) establishing or improving the data base; and (vi) eventually improving the fiscal revenue. Before discussing item (ii), I will make a few comments on land tenure.

Restructuring the Legal Framework

Restructuring the legal framework should be done only where it is badly needed since it is a difficult, time-consuming process. Three cases may be encountered:

- (a) the first is a country in need of a total redrafting of its land laws, which have become inconsistent and ultimately ill-adapted to the actual situation in the field. This case is frequent in SubSaharan Africa where, in some instances, three sets of conflicting rules may overlap: the first comes from the customary system(s); the second from the statutory land laws promulgated by the colonial administrations; and the third from the new laws that have been published since independence. Some countries have already "cleaned up" their land laws in order to establish a coherent legal system (e.g. Cameroon, Ghana, Mali); others are about to begin (e.g. Niger);
- (b) the second and most frequent case, is a country having a fairly coherent set of land laws but very cumbersome and expensive procedures for surveying and titling. Obviously these procedures have to be streamlined before any surveying and titling operation; and
- (c) the third case is a country with an inadequate or inefficient agrarian court system. This results in a huge number of unresolved land conflicts which in turn decreases land security.

Points (a) and (c) may be addressed as part of a structural adjustment package. This, for example, is done in Niger where the drafting of the new code rural is to be one of the conditions for disbursing the last tranche of the Structural Adjustment Credit. This drafting is being carried out with the assistance of specialized consultants. Point (b) could also be implemented through a Structural Adjustment Loan/Credit (SAL/SAC), although it may be easier to include it in a land

titling project because improving surveying and titling procedures can only be done on the basis of field experience.

A Few Comments on Land Tenure

Assuming that restructuring the land legal framework is part of an SAL/SAC, should we have a say regarding land tenure? Should we favor individual ownership and discourage communal tenure systems? This is a delicate matter, almost an "adventure in theology" as R.Noronha says ^{8/}. Let us review the most-frequently cited pros and cons of individual versus communal ownership from the view points of both efficiency and equity ^{9/}. This comparison refers mainly to SubSaharan Africa where I am currently working:

- (a) Individual ownership. From an efficiency viewpoint, a title of individual landownership is regarded as providing a high land security and therefore as favoring long-term investments. The existence of such title makes access to credit easier because it provides the collateral to guarantee loans. Individual ownership also allows the emergence of the best farmer/entrepreneurs, who adapt quickly to technological changes and evolving market conditions. It has, however, two drawbacks: (i) the emergence of a land market is usually associated with land speculation and the progressive appearance of large-scale landowners who often extract excessive land rents from their tenants or sharecroppers; and (ii) private ownership leads to agricultural decapitalization through the combination of inheritance and urban migration. From an equity viewpoint, private landownership tends to increase social differences and to lead to more and more biased income distribution. The formal introduction of private ownership may also reinforce the power of rural elites and a gerontocracy which in turn may render evolution and changes difficult. Finally, private ownership is often a hindrance for migrant farmers and herdsman.

- (b) Communal ownership ^{10/}. From an efficiency viewpoint, communal ownership avoids agricultural decapitalization, land speculation

^{8/} A review of the literature on land tenure systems in Subsaharan Africa. by R.Noronha, Research Unit, Agriculture and Rural Development Department, World Bank, July 1985.

^{9/} Parts of this comparison come from "Land structures and land use patterns. Alternatives for Subsaharan Africa", a paper written by A. de Janvry, Professor of Agricultural Economics, University of Berkeley (California).

^{10/} Communal ownership here mainly refers to the situation that is/was encountered in many african villages where land belongs to the community. It does not refer at all to modern systems of communal ownership found in socialist countries. In particular, state farms are not discussed in this paper because experience worldwide has showed that the cons overwhelm the pros.

and extraction of excessive rents. Moreover, this type of ownership which involves a group of farmers is likely to make the dissemination of new technologies easier because the agricultural support services, particularly extension, can focus on a group instead of dispersing the effort to contacting individual farmers. This is particularly important when a communal land use program or a watershed management plan has to be implemented. Communal ownership also has a series of drawbacks: (i) power usually belongs to the elders, which leads to conservative behavior in land use and often eliminates young farmers and women from decision-making; (ii) decisions in land use and land allocation are often made according to non-economic criteria; (iii) communal ownership usually does not provide enough land security to stimulate long-term investments, particularly in land conservation; when population density increases, customary systems are often a hindrance to the necessary change from shifting cultivation to more intensive production systems; and (iv) the absence of individual land titles make agricultural credit to individuals difficult. From an equity viewpoint, communal ownership is regarded as the best although gerontocratic power and ethnocentrism may lead to abusive appropriation detrimental to members of the communities and migrant farmers.

What can be derived from the above? I do not want to defend one tenure system versus the other because their respective adequacy is likely to be related to social habits and existing land tenure situations that vary widely from one country to another, or even from one region to another, particularly in SubSaharan Africa. I believe that medium- to long-term land security is the key requirement for farmers and does not necessarily imply individual ownership because long-term usufruct rights or renting equally provide this security. I also believe that only tenancy formulae that fit in with local societies are likely to be accepted ^{11/}. Finally let us remember that communal and individual ownerships are not necessarily mutually exclusive; one can find well-balanced situations where individually-owned plots coexist with communal lands for grazing and/or forestry.

Adjusting Land Distribution

Historically the usual way for poor land distribution has been to launch a nationwide land reform. Numerous land reforms were implemented in the late 1940s, in the 1950s and in the 1960s; few were successful (Japan, Korea, Taiwan); many encountered technical, economic and political

^{11/} "Law follows social changes. Occasionally law may attempt to modify social practices to a limited extent but if popular will is in strong opposition, that is the law that will eventually be modified" Professor Schiller, Paris University.

difficulties: (i) technically, these reforms were ill-prepared with unreliable cadastral data bases and cumbersome, time-consuming surveying and titling procedures; (ii) economically, the total costs were very high including the direct cost of land redistribution and the indirect cost resulting from disruption in farm operations; and (iii) politically, the initial support for land reform eroded quickly because the initial results were far from expectations. Hopes were also probably too high and based on "the empirical finding that small farms tend to have higher land productivity than do large farms. This led many to conclude that breaking up large farms into small units would raise overall output" ^{12/}. This may be true and has been demonstrated in some cases, such as in Northeast Brazil where many large estates are underdeveloped and ill-managed; it may also be wrong in other situations where on the one hand large farms are well-managed and on the other management capacity, rather than land, is the most limiting resource.

If adjusting land distribution through nationwide land reform is politically less palatable and difficult to implement, there is a need for alternatives that are better adapted to the needs and resources of our member countries. Among these alternatives, one regional, gradual approach is worth considering. It consists of buying land mainly on the market, and reselling it to landless farmers and/or small holders in the form of viable lots. This system ^{13/} has been used for years in Western Europe, particularly in France ^{14/}; it has been successfully tested in Brazil Piaui ^{15/}. To ensure its successful implementation, a series of conditions are required:

- (a) This system can only work in countries where the tradition of private ownership has been firmly established. One could,

^{12/} "Approaches to Basic Needs and to Equity that Distort Incentives in Agriculture" by G. E. Schuh in Distortions of Agricultural Incentives, Indiana University Press, 1978.

^{13/} This system has been described in a draft paper "Land Acquisition and Redistribution, a Gradualist Way to Correct Land Distribution" by F. Falloux, Agriculture and Rural Development Department, World Bank, February 1982.

^{14/} In France, land acquisition and redistribution programs are implemented by regional agencies called SAFERs (Societes d'Aménagement Foncier et d'Etablissement Rural - Company for Land Improvement and Rural Settlement). A particular SAFER has three types of shareholders: the farmers' associations, Credit Agricole (the french rural bank) and Government. Since its inception, the SAFER system has bought and sold between 1 and 2 million ha.

^{15/} Land acquisition and redistribution, however, may not be pursued within the context of the National Agrarian Reform, which is likely to favor expropriation.

however, argue that in countries where private ownership is legally being introduced, a stock of land could be kept in the hands of the rural communities to avoid speculation and make land settlement easier;

- (b) Land titling is a prerequisite, in order to have a clear picture of who owns what;
- (c) Land agencies have to be created at the regional level. They can be state agencies as in Piauí, Brazil ^{16/}. They can also be mixed companies as in France where farmers' associations are shareholders; even a dynamic rural bank could run such a program;
- (d) In the resale process, the size of the lots have to be viable and the buyers have to be experienced farmers;
- (e) Land resale price and repayment schemes have to be affordable by farmers while allowing the land agencies to recover their costs. These two conditions may be difficult to reconcile in situations where (i) land values on the market are higher than what the actual land productivity would reflect because of social, fiscal and/or political amenities associated with land ownership; and (ii) beneficiaries are landless farmers with very limited repayment capacity. Regarding (i), a well-designed actually enforced land taxation may contribute to keeping land prices in line with land productivity. In Piauí for example, some large landlords who probably evaded land taxation when cadastral records were unreliable and out-of-date, have been eager to sell at a relatively low price because the poor development of their estates would not have allowed them to pay the newly-enforced land tax. Tax arrears, once fully documented through land titling review, may also have forced them to sell part of their properties. Regarding (ii), there is a need for a long grace period and long-term repayment; in some instances, there may be a case to subsidize a land repayment scheme insofar as the subsidy is sized to offset the fraction of the land value corresponding to amenities as mentioned in (i); and
- (f) There may be a legal need to provide the land agencies with preemption rights on the land market, i.e., to give them the status of preference buyer.

This system of land acquisition and redistribution can also work for a land consolidation program, the land agency having a stock of land to make

^{16/} Instituto de Terras do Piauí (INTERPI).

exchanges of plots easier. This again has been done for years in Western Europe.

Changing land distribution patterns where they are highly skewed is a key long-term adjustment in the agricultural sector. Projects would probably be the best vehicle to carry out such an adjustment. SAL/SAC however could be instrumental in laying the ground for such projects from technical, economic, legal and political viewpoints.

Streamlining and Decentralizing Land Institutions

Most developing countries need to reduce the excessively high number of institutions involved in land management. They usually are public, highly centralized, ill-managed with overlapping responsibilities 17/ . In the Philippines, for example, ten different national agencies are involved, almost all of them having some sort of land management/mapping capacity which means expensive equipment and highly-trained staff, usually under-utilized. Other examples may be found in francophone Africa, where the colonial administrations have left a complex and expensive system. As a result, in one particular area, topographic or aerial surveys may be carried out several times on the same site by different agencies while only one survey could have been done for the various client agencies. By contrast, in Australia for example, all the facets of land management (legal, fiscal, geodetic, cartographic, environment) are dealt with by only one agency, the Department of Lands, which established, and maintains and updates one multipurpose Land Information System.

All too often at agency headquarters one finds impressive land use planning, sophisticated analysis of natural resources, beautifully-colored soil maps, a set of new far-reaching land laws but, at the village level, everything remains the same. There is thus a need to decentralize part of land administration. Down to what level? I believe for the following reasons that, to the extent possible, land should be administered at the village level under the responsibility of the village community :

- (a) land administration/management ought to be as close as possible to farmers;
- (b) giving land management responsibility to the farmers is certainly more cost-effective than decentralizing land agencies down to the village level;

17/ This does not mean that the land institutional set-up of the developed countries is well designed and cost-effective everywhere. West Germany, Sweden, Australia are usually cited as good models but that it is not the case for the U.S., France and the UK.

- (c) in many instances, village communities have, or had, a long tradition of land administration; and
- (d) many of our operations in the agricultural sector are based on building up the communities' responsibilities; land administration is likely to be synergistic with these other development responsibilities.

This above proposal may be difficult to implement because (i) central governments may not be prepared to release part of their power to the villages; and (ii) some villages may not be prepared to receive it. In the first case, some external pressure may be needed, whereas the second case requires that the village communities be trained, equipped and permanently assisted in assuming their land administration responsibility. Regarding the land agency, its decentralization requires a good judgement of what needs to be decentralized from what has to remain central because of economy of scale (e.g., mapping, computerized systems). By mentioning here the land agency in singular, I have assumed that all the land agencies have been merged into one (the Australian case). I fully understand that it is easier to say than to do but expected savings and increased cost-effectiveness preach for it. Finally, the land agency, in order to minimize its usual top-down approach and become more client-oriented, should work out and sign formal service contracts with the village communities.

Restructuring land institutions into only one agency could easily be a component of a SAL/SAC since it is part of the restructuring of the public sector. Decentralizing administration down to the village communities could be initiated under a SAL/SAC but should then be followed by a project because this devolution of power must be closely supported. Now what type of project would be involved? It could be a land titling/cadastral project as presented previously; it could also include operations of land improvement at the village level as it envisaged in Burkina Faso ^{18/}.

Reducing Public Expenditures

As mentioned in various parts of this paper, potential public savings in land administration would come from four different areas: (i) restructuring public agencies; (ii) simplifying administrative titling procedures; (iii) using cost-effective technologies; and (iv) better coordinating surveying in order to avoid too frequent duplication. Potential annual savings may be substantial. In the Philippines, the proposed Land Titling Project

^{18/} A Village Land Management Project is being prepared; objectives would be to improve land security through simplified land delimitation (village boundaries to begin with), to promote better land use and finance village land improvements through a rural development fund.

would save US\$5 to US \$8 million yearly through actions related to (ii), (iii) and (iv) alone; adding (i) may raise this figure beyond US\$10 million. From a different viewpoint, some countries are spending as much as US\$20 to US\$30 per ha for land titling and establishment of cadastral services; combining cost-effective technology with simplified administrative procedures should allow a saving of US\$10 to US\$20 per ha for the initial investment and a drastic reduction in recurrent costs as well.

Establishing/Improving the Data Base

Besides improving land security and avoiding land conflicts, establishing reliable cadastral data results in a vast improvement of the general data base. In many of our member countries, the general geographic frame is not firmly established: (i) administrative boundaries (village, provinces, regions) are not well defined; (ii) maps cannot be overlaid because of inconsistent or absent geodetic networks; (iii) existing sets of data are not compatible because the reference systems are inconsistent. This situation can be disastrous when decisions have to be made for readjusting the economies and frightening when decisions are made on the basis of such fragile data. There is thus a good case to seek a strong commitment of our member countries to improving their data base within a structural adjustment process. This could further be implemented within a cadastral/mapping project.

Improving Fiscal Revenue

Establishing or improving cadastral records introduces the possibility of taxing land or increasing the yield of a land tax if it already exists. Three different cases may be considered:

- (a) The first and easiest case to deal with is a country already having almost satisfactory cadastral services and an enforced land taxation system (e.g., Argentina.) In this case, as it is proposed in the Argentinian SAL, it is easy to modify land taxation if, for macroeconomic reasons, the overall fiscal system has to be altered;
- (b) The second case is a country with cadastral services and land taxation systems that do not work well: cadastral records are outdated; land conflicts are frequent because of uncertainty on titled and untitled land; and farm investment is low because of insufficient land security. Properties are not well assessed and tax evasion results. In this case, the priority is to regularize titling and strengthen cadastral services in order to provide a greater land security and simultaneously improve the tax collection. This may also be an opportunity to modify the land tax itself and make it more conducive to increasing land productivity. This is recommended in situations where large landlords have kept their estates for fiscal or socio-political reasons minimizing their investment while extracting an excessive rent through sharecropping (e.g., Northeast Brazil).

Assuming that the land tax is high enough to discourage low-input extensive farming, these landlords may be forced to change their strategy by either greatly increasing their investment to intensify their farming and be in a position to easily afford the new land tax; or, if they do not want to invest, by selling their properties. Regularizing titling and improving cadastral services requires a project; modifying land taxation and initiating the preparation of this project could be a useful component of a SAL/SAC.

- (c) The third and most difficult case is a country which has neither actual cadastral services nor a land taxation system. In this case, providing a greater land security through titling should be the priority. Land taxation however should not be introduced at the same time as titling because farmers might oppose titling if they perceive it as a means to levy a land tax. This tax has to be introduced progressively; a point of departure would be to set up a cadastral cost recovery scheme and have it accepted by farmers by using the collected money for titling land and maintaining records at their level (village, microregion); an additional contribution on a per hectare basis could then be introduced to partially finance collective land improvement at the village level. Then full-fledged land taxation may be considered. In this case a SAL/SAC may only be a way to get Government committed to land titling and to initiate project preparation.

Concluding Comments

I would like to propose seven recommendations:

- (a) the Bank should emphasize land issues in country dialogue;
- (b) the Bank should continue increasing its land titling/cadastral projects;
- (c) SAC/SALs should be used more and more as a vehicle to adjust land policy and to lead to land adjustment operations;
- (d) the Bank should increase its land-related sector work because of (a) and (b);
- (e) the Bank should clarify its policy in land affairs and then disseminate it. In order to do so: (i) the sector policy paper on land reform should be updated; and (ii) more seminars and training should be organized on land affairs for officials of our member countries;
- (f) the Bank should continue enhancing its experience/expertise through: (i) internal training; (ii) better monitoring of its

land portfolio; and (iii) and better-organized internal support for sector and project work in land affairs; and

- (g) SubSaharan Africa deserves special attention because it is at a turning point in terms of land management between traditional extensive systems and new intensive ones. Risks are probably higher than in the other continents, particularly in terms of land degradation.

Finally I would like to make three remarks:

- (a) The above recommendations are not the panacea: it is necessary to look at land issues to remove constraints, if any; but this is far from being sufficient. It only aims at improving the framework within which farmers can operate efficiently, which in turn implies good technologies and adequate support services.
- (i) I have dealt with land management and administration aspects mainly from a macro viewpoint because too often they are neglected. Land management at the farm level is equally important but usually better known.
- (j) Sustainability, the main theme of our symposium, is not a word that frequently appears in this paper. In fact, it is implicitly behind the main thrust of this presentation because providing and increasing land security is a necessary condition to establish sustainable production systems.

LAND MANAGEMENT, TITLING AND TENANCY

RAPPORTEUR'S COMMENTS

William Panton*

The session dealt with the increasing importance of land related issues in agricultural and rural development projects, and the approach taken by the Bank in addressing this subject in sector and project work.

Following a short introduction by the chairman, the author summarized his paper with particular emphasis on a few issues which he felt would be appropriate for discussion.

The discussion opened with several speakers questioning the value of titling in situations where land is "owned" by the community and farmed by individuals or families on a usufruct basis. The author and others explained that such systems, are, in general, only acceptable in situations where population density is low or cultivation systems are primitive. Increasing population pressures on land, or introduction of technological improvements in agricultural methods, inevitably create a desire for more secure occupancy rights to land than is possible under most traditional systems. The necessary security requires clear definition of plot boundaries. Evidence of formal ownership provided on the basis of survey improves access to credit, which encourages investment in land improvement, leading to higher yields and incomes.

The author added that Africa affords many examples of systems in transition. Where community adherence to traditional systems is strong, the communal ownership and customary occupancy approach can persist. But in other situations the systems are breaking down in the face of population pressures and technological changes.

A speaker added that the mobility of population necessary to support development, including urban migration, is facilitated when land ownership is transferrable. An active market in land is encouraged by the existence of titles to land.

Another speaker asked what the Bank position should be when addressing situations where women were the predominant farmers but were excluded from ownership rights to land. A speaker quoted the Thailand situation, where the land code is not gender specific and where women often hold titles and are frequently seen transacting business at land offices.

The Indonesian situation, where the titling agency is faced with a considerable backlog of surveying and title issuance work, was referred to. The author suggested that such a situation could represent an excellent opportunity for the Bank to become involved, either through sector dialogue or through a specific project outlined at improving the land administration system and speeding up the output of titles.

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Referring to the author's paper, a speaker pointed out that land issues had been addressed in other countries besides Argentina, including Jamaica, Kenya, Thailand and the Philippines.

On the issue of sustainability, the theme for the symposium, it was remarked that titling of land was instrumental in increasing production with sustainability, through resolving conflicts in ownership, establishing rights to land and improving access to credit.

The question of whether beneficiaries should pay for cadastral services was answered by the author with the suggestion that initial adjudication and survey of land could be provided as a public service, but that future transaction costs should be borne by beneficiaries.

A speaker remarked that land issues were important not only in Africa, and that the Bank had not given sufficient attention to this subject in the past. In Latin America powerful vested interests were able to hold up much needed land reforms, and the Bank should be more active in addressing the development problems resulting from such situations.

Another speaker referred to the situation in the Masai rangelands of Africa where communal rangelands are being allocated to individuals through adjudication and title issuance. The process is inevitable and the resulting change will introduce a new set of problems.

The often paternalistic attitude of some governments, which opposed issuance of titles on the grounds that such instruments can encourage small peasant owners to sell their land to their ultimate detriment was mentioned. On the contrary, de facto land markets exist even in the absence of official titles, while the excessive accumulation of wealth through land can be prevented through progressive taxation supported by a land and property valuation system based on an accurate cadaster. Security of tenure was also considered to be a safeguard against excessive land fragmentation.

In conclusion, the author referred to the historic record of several developed countries where common lands gradually gave way to individually owned or rented plots. The same evolutionary process can be seen taking place in many developing countries, and change in this direction appears inevitable. The Bank can play an important role in encouraging this trend.

FORESTRY

J. E. M. Arnold *

The focus in this paper is on managed tree resources outside the forest. It is principally concerned with trees grown on-farm by individuals and with woodlots managed by user groups as a common property resource. It excludes those situations where tree products are still harvested from unmanaged open access resources.

A feature of virtually all the systems covered by this definition, which distinguishes them from conventional forestry, is the integration of the trees into predominantly agricultural land use patterns. Other distinguishing features are their small scale, the orientation to meeting local needs and the involvement of the users in the management of the resource.

Until recently the issues relating to management of such tree resources received remarkably little attention. The mandate of most forest services and forestry research organizations confined their attention to forest areas, and agricultural services were concerned only with those tree species which had been domesticated and adopted as agricultural crops. It is only during the past ten to twenty years, with the growing attention to the place of the rural sector in the development process, with environmental issues, and with rising energy costs, that the importance of tree products in the rural economy, and of local tree resources to supply those products, has become widely recognized.

Because it has attracted attention only recently, the management of farm and communal resources is as yet only imperfectly understood. By comparison with other aspects of developing country agriculture there is a severe shortage of quantitative information. However, experience is accumulating rapidly, and now allows us to formulate a number of propositions about some of the issues involved. 1/

Existing Tree Management Systems

One outcome of recent work has been to show the extent and variety of indigenous tree management systems. Almost everywhere, rural communities have recognized that a certain standing stock of different types of trees is necessary in order to provide one or more locally important goods and services. Prominent among these are construction timber, fuel, fruits, etc., to meet household needs; fodder, soil nutrients, shade, protection and other inputs into the farm system; and saleable products and raw materials which generate income and employment.

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1/ The paper is based primarily on a review of experience with programmes to support participatory forestry which was carried out by FAO, entitled "Tree Growing by Rural People", FAO Forestry Paper 64, FAO 1985. The reader is referred to this study for a more detailed discussion, and for sources.

Some of these usages of tree outputs are very large indeed. Fuelwood, for example, which has been estimated to be by far the largest household energy source in developing countries, accounts for upwards of three quarters of all wood used by the latter. As most of it is still subsistence use, gathered or harvested by users in their immediate vicinity, it is principally drawn from trees and other woody plants outside the forest. Arboreal sources of fodder similarly provide large proportions of overall fodder supplies in arid Africa and upland areas in Asia.

To meet such needs trees have been incorporated into crop and grazing systems across a wide spectrum of agroecological, landuse and population density situations. Table 1 outlines the extent of such tree management systems and their diversity . ^{2/}

Most such systems have evolved through a process whereby, as removal of nearby forests progressed, trees of economic or environmental (or religious or cultural) value have in the past been progressively incorporated into farming systems and associated land use practices.

Where resources are locally abundant and population densities are low tree management is usually passive, relying on natural regeneration to offset any offtake of products or of damage to the resource. With increasing population pressure on the resource and land, people respond first by conservation and management of existing trees in a number of ways. Initially this may constitute no more than preserving and protecting desired species during land clearing. Control systems to limit the quantities of products harvested, or the size and grazing patterns of livestock herds, are other types of management at this level. Avoiding destructive damage from fire, etc., is another. Restricting access to trees is yet another.

As pressures increase further, more intensive forms of management are adopted, to increase the lifetime contribution of existing trees above what it would be if they were simply felled. A variety of different pollarding, coppicing and pruning techniques are widely practised; permitting a sustained yield of wood or fodder over a long period of time.

The next stage of intensifying tree management is likely to be intervention to stimulate regeneration; for example through protecting, transplanting and cultivating naturally germinating seedlings. Enriching fallow through selective encouragement of nutrient restoring and other desirable species is widely practised in both wet and dry land systems.

Though some people have always cultivated trees, the planting and farming of trees usually emerges as the final stage in this sequence of management options which enable people to respond to different intensities of interaction between population pressure and existing tree resources. Planting trees is therefore only one of the several alternatives open to rural populations as a means of bringing a local tree resource under management. The almost exclusive focus in recent programmes on encouraging farmers and communal groups to plant trees is therefore open to question.

^{2/} These examples are drawn from results from the Agroforestry Systems Inventory Project of ICRAF. For an account of this inventory and of the classification used see "Classification of Agroforestry Systems" by P.K.R. Nair, Agroforestry Systems 3: 97-128, 1985.

Table 1: SOME EXAMPLES OF PROMINENT AGROFORESTRY SYSTEMS AND PRACTICES IN THE DEVELOPING COUNTRIES¹

Major Systems	EXAMPLES FROM DIFFERENT GEOGRAPHIC REGIONS ¹							
	Sub-Systems/Practices	South Pacific	Southeast Asia	South Asia	Middle East and Mediterranean	East and Central Africa	West Africa	American Tropics
AGROSILVICULTURAL SYSTEMS	Improved "Fallow" (in shifting cultivation areas)		Forest villages of Thailand. Various fruit trees & plantation crops used as "fallow" species in Indonesia	Improvements to Shifting Cultivation; several approaches e.g. in the north-eastern parts of India		Improvements to Shifting Cultivation e.g. gum gardens of the Sudan	<i>Acacia baronii</i> , <i>Anthoponthe macrophylla</i> , <i>Gliricidia sepium</i> , etc. used as "fallow" species	Several forms
	The Taungya System	(e.g. Taro with <i>Cedrelia</i> and <i>Anthocaphalus</i> trees)	Widely practised. Forest villages of Thailand is an improved form	Several forms, several names		The "Shamba" System	Several Forms	Several forms
	Tree Gardens	Involving fruit trees	Dominated by fruit trees	In all ecological regions	The Deheesa system "Parc arboree"			e.g. "Paraso Woodlot of Paraguay"
	Hedgerow Intercropping (Alley Cropping)		Extensive use of <i>Sesbania grandiflora</i> , <i>Leucaena leucocephala</i> and <i>Calliandra calothyrsus</i>	Several experimental approaches e.g. Conservation Farming in Sri Lanka		The Corridor System of Zaire	Experimental systems on alley cropping with <i>Leucaena</i> and other woody perennial species	Experimental
	Multipurpose Trees and Shrubs on Farmlands	Mainly fruit or nut trees (e.g. <i>Canarium</i> , <i>Pometia</i> , <i>Barringtonia</i> , <i>F. indiana</i> , <i>Artocarpus albi</i> , etc.)	Dominated by fruit trees; also <i>Acacia nesaria</i> - cropping system, Indonesia	Several forms both in lowlands and highlands e.g. Hill Farming in Nepal; "Khejn" - based system in the dry parts of India	The Oasis system. Crop combinations with the Carob tree; The Deheesa system; Irrigated systems; Olive trees + cereals	Various forms; The Chagga system of Tanzanian highlands; The Nyabisindu system of Rwanda	<i>Acacia albid</i> -based food production systems in dry areas; <i>Butyrospermum + Parkia</i> systems; "Parc arboree"	Various forms in all ecological regions
	Crop Combination with Plantation Crops	Plantation crops and other multipurpose trees, e.g. <i>Casuarina</i> and coffee in the highlands of PNG; also <i>Gliricidia</i> and <i>Leucaena</i> with cacao	Plantation crops + fruit trees; smallholder systems of crop combinations with plantation crops; plantation crops with spice trees	Integrated production systems in smallholdings; shade trees in plantations; other crop mixtures including various tree species	Irrigated systems; Olive trees + cereals	Integrated production; shade trees in commercial plantations; mixed systems in the highlands	Plantation crop mixtures; smallholder production systems	Plantation crop mixtures; shade trees in commercial plantations; mixed systems in smallholdings; spice trees; babassu palm-based systems
	AF Fuelwood Production	Multipurpose fuelwood trees around settlements	Several examples in different ecological regions	Various forms including some forms of social forestry		Various forms	Common in the dry regions	Several forms in the dry regions
	Shelterbelts, Windbreaks, Soil Conservation Hedges	<i>Casuarina oligodon</i> in the highlands as shelterbelts and soil improver	Terrace stabilization in steep slopes	Use of <i>Casuarina</i> spp. as shelterbelts; several windbreaks	Tree species for erosion control	The Nyabisindu system of Rwanda	Various forms	Live fences, windbreaks especially in highlands
SYLVOPASTORAL SYSTEMS	Protein Bank (Cut-and-carry Fodder Production)	Rare	Very common, especially in highlands	Multipurpose fodder trees on or around farmlands especially in highlands		Very common	Very common	Very common
	Living Fence of Fodder Trees and Hedges	Occasional	<i>Leucaena</i> , <i>Calliandra</i> , etc. used extensively	<i>Sesbania</i> , <i>Euphorbia</i> , <i>Syzgium</i> etc. common		Very common in all ecological regions		Very common in the highlands
	Trees and Shrubs on Pastures	Cattle under coconuts, pines and <i>Eucalyptus deglupta</i>	Grazing under coconuts and other plantations	Several tree species being used very widely	Very common in the dry regions; the Deheesa system	The Acacia-dominated system in the arid parts of Kenya, Somalia and Ethiopia	Cattle under oil palm. Cattle and sheep under coconut	Common in humid as well as dry regions e.g. Grazing under plantation crops in Brazil
AGROSILVOPASTORAL SYSTEMS	Woody Hedges for Browse, Mulch, Green Manure, Soil Conservation, etc	Various forms; <i>Casuarina oligodon</i> widely used to provide mulch and compost	Various forms	Various forms especially in lowlands		Common; variants of the "Shamba" system	Very common	Especially in hilly regions
	Home Gardens (involving a large number of herbaceous and woody plants with or without animals)	Several types of homegardens and kitchen gardens	Very common; Java Home Gardens often quoted as good examples; involving several fruit trees	Common in all ecological regions, usually involving fruit trees	The Oasis system	Various forms (The Chagga homegardens, the Nyabisindu system)	Compound farms of humid lowlands	Very common in the thickly populated areas
OTHER SYSTEMS	Agro-Silvo-Fishery (Aquaforestry)		Silviculture in mangrove areas; trees on bunds of fish-breeding ponds	Occasional				
	Various forms of Shifting Cultivation	Common	e.g. Swidden Farming	Very common, various names		Very common	Very common in the lowlands	Very common in all ecological regions
	Apiculture with Trees	Common	Common	Common	Common	Common	Common	

Source: ICRAF and NAIR, P.K.R. (1985).

The scope for intensifying management of existing tree resources probably deserves much wider attention than it usually receives at present.

Pressure on Existing Tree Management Systems

The sequential process outlined above suggests that recourse to tree planting increases as land is used more intensively. The most intensive forms of treefarming are in fact found in areas where land is used particularly heavily - the home gardens of Java, the village forests of Bangladesh, the command farms of southern Nigeria, the tree gardens of southern Mexico, for example. However, it is equally the case that increasing pressures and changing demands and land use practices lead to the removal of trees, including existing smallholder grown trees, without a viable response emerging in the form of increased management of trees. The principal reasons for this are reviewed briefly below.

Changes in Land Use and Control

Increasing pressures for more land for crop production adversely affect farm and communal tree stocks directly in a number of ways. Shortening and even elimination of the tree fallow period of rotational agriculture has been widespread, even where this includes planted species of economic value such as the Acacia senegal traditionally grown as a fallow crop in Sudan to produce gum arabic. Increased competition on farm land between trees and crops for water, light and nutrients as land becomes more fully used also widely leads to removal of trees. Fragmentation of land holdings can reduce farm size to a point where trees have to be sacrificed to meet more urgent household needs. Even such highly productive tree components of farm systems as the home gardens in Java tend to be abandoned once farm size and income fall below a certain level in order to leave enough land for production of food staples.

Changes in broader land-use practices can also threaten tree management, such as the removal of tree cover in order to eradicate tsetse fly. Shifts towards monocrops and mechanization also militate against tree growing, as trees get in the way of tractor operation. Serial tenure patterns where animals are allowed to roam freely on farmers' lands after the harvest make the protection of privately planted trees difficult. Practices such as burning associated with pasture management also impede the growing of trees.

With increased pressures many traditional land tenure arrangements and customary practices which defined land-use rights have been weakened. Changes such as the privatization which has occurred in Kenya may curb access to wood supplies on what was previously communal or open access land. In other cases, where there has been a tradition of land borrowing but where settlement pressures have increased, landowners may discourage planting trees because of the fear that tenants will attempt to assert a personal claim to the land. The spread of tenant, squatter and other land use situations with insecure tenure has also militated against tree management, because of its long term nature.

Burdensome bureaucratic procedures to obtain supplies of wood or other forest products encourage illegal harvesting and disregard for conservation measures. The nationalization of forest land for protective reasons, e.g., in Nepal and Honduras, has had the unintended consequence of decreasing local incentives for tree conservation and management. Elsewhere, regulations or practices which give those who clear it right to land have encouraged tree removal. Legislation, local customs or local practices widely vest ownership or control of forest land in government or local authorities, discouraging tree planting or tree conservation because of fear that land so used will be expropriated.

Access to Other Factors of Production

The availability of labor may become a constraint to tree growing, as trees need to be planted at the same time as demands for agricultural labor are highest. Outmigration to urban areas and seasonal migration patterns in search of work may reduce the availability of on-farm labor for tree growing and management. In some situations, however, tree growing seems to have emerged as labor availability declines because it is less labor intensive than alternative uses of the land.

Access to planting stock, fertilizer, etc., and to technical knowledge, may also become a constraining factor. Traditional tree management systems tend to be very conservative and restrictive. Increased competition for land may require different tree species, or tree/crop combinations, which are not known and not available locally. Particular species of local value may be difficult for farmers to raise.

It has been widely argued that costs of investment have also become a significant impediment, either directly or because of the risk element involved in investing in a long term activity. However, in some situations tree growing seems to have flourished because of the low capital inputs it requires.

Shifts in Demand for Tree Products

Growing needs for essential products such as fuelwood have widely meant that trees maintained or planted for other purposes such as shade or fruit have eventually been diverted to these uses. This has often been accentuated by the decline in forest sources of such products. The increasing commercialization of wood products such as fuelwood has also had a marked effect on tree management, particularly near urban areas and wood using industries. Although, as has been noted earlier, growing demand for tree outputs, and consequent increases in their value, has apparently been traditionally one of the main factors leading to increased management and growing of trees, in at least the short term it has usually resulted in depletion of existing tree resources and in diversion of tree products from subsistence use to commercial markets.

Lagged Behavioural Responses

It has been widely observed that people do not respond to a diminishing tree resource until it has declined to the point where severe impacts are being felt. Little success has been achieved in launching tree growing programmes to prevent excessive tree removal.

Where there has previously always been an abundant resource, substantial time lags can occur before people adjust to the notion of trees as a scarce commodity. The successful existing or past treefarming systems which have emerged throughout the tropics and subtropics were responses to change which was taking place only slowly. People had sufficient time to work out over time the most appropriate ways to adapt to change. The recent acceleration of the process of change consequent upon population pressure has clearly widely left rural people confronted with situations outside their range of experience, and beyond their capacity to respond within the framework of their existing knowledge, resources or institutions.

Rapid deforestation has exposed populations which previously enjoyed an abundant tree resource to scarcity for the first time. Elsewhere, people who were already managing trees in order to maintain supplies have been exposed to a variety of changes which have weakened or even overwhelmed their traditional systems.

Strengthening Farm Forestry

Some of the impediments to farm or communal tree management outlined above reflect effective limits to its adoption or further evolution. Many people do not have access to land for tree growing; a variety of physical and economic factors prevent viable tree growing by many others; and institutional restrictions exclude yet others from participation. The failure or poor performance of many support programmes in particular in arid areas, often seem to reflect insufficient appreciation of the presence and nature of constraining or limiting factors.

However, over the greater part of the range of land use situations in developing countries, constraints tend to be mainly problems of adapting to the pace and nature of the changes confronting the farmer or community; problems which can be often reduced or removed by outside intervention, for example:

- providing technical advice on new or improved species, on different production or management systems, or on new products and market opportunities.
- providing access to land, planting stock or other inputs not otherwise available to the farmer;
- providing subsidies, credit or other measures to overcome financing impediments to farmer or communal involvement in treefarming;

- amending tenure or other legislation, regulations or practices discouraging the management of trees by farmers or communities.

Interventions may also be needed in order to try to provide more equitable access to treefarming opportunities by particular groups such as small farmers or women, or to control negative impacts of tree growing.

The objectives set for the many programmes and projects to support farm forestry which have emerged, have varied considerably. Some have pursued tree management within a framework of broader, and often ambitious environmental and social goals. Others have been intended to encourage production of tree products to meet subsistence or market demands, or to contribute to income and employment generation.

Project design, and performance, have sometimes suffered from a lack of clarity as to which of these objectives is being pursued, or if there are multiple objectives, over which one has priority. Although some may be congruent or reinforce each other, others may be in conflict. Environmental objectives are likely to constrain production of economic outputs; on occasion to the point where the latter is no longer attractive to the farmer. Successful pursuit of production objectives is unlikely in itself to achieve distributional and other social aims.

Effective project design has also been hampered by the gaps in our knowledge about how trees and tree products fit into particular household, farm and communal systems. Even now, this has been systematically investigated in only a very small number of situations; with much of this work still in progress. Nevertheless, it is possible to identify at least three different categories of situation - communal forestry, farm forestry for household use, and farm forestry for market - and some of the distinguishing features of each which determine how best the support process might be approached.

Communal Forestry

This includes both management of a common property tree resource on common land, or public land allocated to the community for this purpose, and tree growing on private lands organized by community organizations such as cooperatives.

Communal approaches to forestry have a number of advantages. Existing forest can be better managed on this scale than at the level of the individual. Common land is often the most appropriate location for tree growing. Some forest products can only be obtained from the forest as a functioning ecosystem, and not from individual trees or small groups of trees.

In addition, communal systems usually provide the only way in which all members of the community can have access to forest outputs. They have therefore been strongly promoted as a means for benefitting the landless and the poorer sections of rural societies.

In practice, collective forestry has had a mixed record. In the hill areas of Nepal, encouraging progress is being made in building on a strong existing tradition of user group management of local areas of forest, and in introducing more productive management systems needed to better meet increasing demands for forest outputs. In the Republic of Korea, again building on an existing structure, that of village cooperatives, a major restoration of local tree cover was achieved during the 1970's through a national system of Village Forestry Associations.

In general, however, collective approaches have made only slow progress, encountering a number of constraints. Most of these limitations relate to the ways people cooperate, and to internal conflicts of interest within a community exhibiting social, economic or political heterogeneity.

Land use conflicts have been amongst the most prevalent obstacles. Common lands are seldom "unutilized", and by planting trees on them some existing land use practise is likely to be affected. The task of getting agreement to changes in use of common land is often complicated by the complexity of several overlapping uses - grazing, collecting, cultivation, etc., - by groups within the community.

Complex control and tenure situations provide other obstacles. Common land may in practice be controlled by particular persons. Tree tenure may be different from land tenure, with planting of trees having a significant impact on land control.

The distribution of benefits from communal forestry activities is another frequent cause of problems. Apart from the usual problems of ensuring equitable distribution within a structured community, pressure to obtain income for the community from the activity conflict with the aims of providing benefits in kind (fuelwood, fodder, etc.,) to the poorer members which are often stipulated as aims of the project. A tendency to postpone this task of defining and agreeing upon a method of benefit-sharing until harvest usually simply aggravates suspicions about the final outcome, and lessens the likelihood of effective participation.

The problems of getting agreement on benefit-sharing have often been compounded by burdening communal forestry projects with an implicit or explicit institutions building or strengthening role, and with social goals. Community level forestry activities are very unlikely to be able to make greater progress in either group management or redistribution of wealth than society as a whole, and it is usually unrealistic to expect this.

From this experience a number of promising approaches have been emerging. Perhaps the most important is that of building forest management not necessarily into institutional structures of the community as a whole but into smaller user groups with shared interest in the use of the resource.

A second is the need to work out clear and precise arrangements for management and benefit sharing with and within the user group at the very outset of the activity. A third, related to this, is the need to work out management systems which respond to the actual needs which the group seeks to meet through forest management, and which are within their technical competence and ability to control in practice.

Farm Forestry for Household Use

This encompasses the growing of trees to provide on-farm inputs such as fuelwood, construction timbers and arboreal foods needed for household use; fodder, green mulch and other inputs into the farm system; and to reduce exposure to environmental risk by providing shade and protection against soil erosion and soil degradation. Such on-farm tree growing to produce particular outputs often coexists with communal forests which provide other tree products.

A basic characteristic of most such tree growing practices, which are essentially supplementary or complementary to the crop production objectives, is that they are usually pursued through low intensity minimal input approaches, with the trees being cultivated in ways which do not conflict with food and cash crop production. Because the aim is optimal integration of trees and agricultural crops, these systems seldom achieve, or seek, high yields of tree products.

The strong concerns with alleviating fuelwood shortages which underlay most early programmes to stimulate and support more on-farm tree growing tended to obscure, and conflict with, the broad systems approach to trees characteristic of most existing farmer practices. Farmer surveys carried out as part of such projects have consistently confirmed farmer preferences for tree systems which provide multiple outputs and benefits. They have also shown that generally they value fuelwood for own use as a lower priority than some other tree products - e.g., fodder in Nepal, construction poles in Malawi. Fuelwood is usually produced as a byproduct or coproduct of other outputs of locally greater value.

Projects which have been tailored to such local priorities and possibilities have often made encouraging progress. Successful strategies have tended to be those that build on existing tree growing knowledge, that introduce change in an incremental fashion, that provide farmers with a range of alternatives to choose from and, where increasing the tree stock is not a local priority, which link tree growing with perceived high priority actions.

Support activities have concentrated on developing networks of rural nurseries to provide planting stock, usually allied with demonstration and extension. Their effectiveness has varied with their ability to make available species which best meet local needs and conditions, in sufficient quantity and at the right time. Where this has been achieved, for example in parts of Nepal, farmer planting of trees has often increased several fold.

A constraint on expanding such support has been the cost of doing so, associated with the widespread practice of providing the planting stock to farmers free or at a subsidized price. The extent to which this is necessary in order to encourage or enable farmer tree growing is very unclear; it remains one of the issues most in need of research in farm forestry.

Perhaps the most widespread constraints to expanding smallholder tree growing of this nature are those stemming from the land and tree tenure problems outlined earlier. Insecurity of tenure of the land discourages farmer investment in a relatively long term crop such as trees. Farmers will also avoid treeplanting if under the provisions of tree tenure, legislation or practice this could cause control of the land to pass to the landlord, the community or the state; and landowners will prevent tenants planting trees if this could enhance their claim to the land. The potential for reducing or removing such tenurial impediments needs more attention than it has usually received to date.

Farm Forestry for the Market

Though there is no clear dividing line with the previous category, which usually includes some sale of products, in general farm forestry for the market can be characterized as the growing of trees primarily or exclusively to produce wood or some other product for sale. Tree growing then takes on the character of an agricultural crop, and is likely to be pursued with a similar intensity of inputs.

Such tree growing has grown rapidly in recent years in several parts of the developing world in response to growing urban and industrial markets for wood, poles and fuelwood, and the decline in accessible sources of supply from natural forests. In India, for example, it is fast becoming a major source of wood.

Production to date has been heavily concentrated in the higher valued products - construction poles, pulpwood, etc. Little commercial tree growing has yet been entered into primarily to supply fuelwood markets, and it is still unclear whether fuelwood prices, which are subject to a ceiling determined by the costs of alternative fuels, will result in this happening on a large scale. As is the case with supplies for substance use, fuelwood supplies seem to be generated usually more as a by-product of higher valued outputs.

Programmes to support this type of tree management have also focussed on provision of planting stock, often at subsidized prices and extension. Again the question of the extent and form of intervention that is appropriate and necessary arises. Spontaneous local commercial production of planting stock is growing in others (e.g., in India). It is argued that incentives of this nature are necessary to enable smaller farmers to participate in market-oriented farm forestry opportunities. A number of interesting initiatives, notably in India, have extended such opportunities also to landless by allocating public land to individuals for this purpose.

As production builds up, more attention may be needed to providing assistance to growers in gaining access to markets and to market information. Access to credit may also be important. Although recent work suggests that it is the low capital requirements which attract farmers in Kenya into small scale commercial tree growing, larger scale farmer involvement in the Philippines has been found to encounter substantial needs for funding at particular points in the production cycle such as harvesting.

Commercial farm forestry has been criticized, in particular in India, for failing to provide fuelwood and other tree outputs to the poorer members of Society, for benefitting only larger farmers and for diverting land from food production. This perception seems to largely reflect the failure that widely prevails, not least in project documents, to differentiate between the several purposes being pursued through tree growing; a confusion compounded by the often inappropriate use of the term "social" forestry for activities addressed mainly at raising farmer incomes. Nevertheless, care clearly does need to be taken to ensure that farm forestry for the market does not worsen the situation of those who cannot participate, and where necessary to promote complementary activities which do meet other needs for tree outputs.

Concluding Remarks

Farm forestry is the principal means whereby, once natural forest diminishes or disappears in their vicinity, rural populations maintain stocks of trees locally to provide needed foods and materials and protection of their soil and water resource. It needs to be recognized that such a strategy is not intended to reproduce or replace forest lost through deforestation - it is intended to substitute a stock of selected tree species integrated into predominantly agricultural or pastoral land use patterns. It therefore will not, and should be expected to, recreate large contiguous areas of tree cover or the environmental and other properties of such cover - though by providing an alternative source of supply it can relieve some of the pressures on remaining forests.

Its most important attribute is that the dispersed tree resource it creates is located close to those who need to draw on it. In addition, by disaggregating the task of producing products such as fuelwood which are required in huge quantities to the level that can be executed by individual households or user groups largely with their own resources, it enables tree stocks to be built up far more rapidly than would be possible with the resources which most countries have available within the public sector. It is therefore being increasingly recognized to be a major component of most national forestry, and overall natural resource, strategies.

Central to the success of programmes to support farm forestry is the need to structure this to ensure active and effective participation of those involved. In common with most rural development assistance, most farm forestry projects have had only limited success to date in actually achieving effective participation. A particular difficulty for the forestry sector is the lack of relevant institutional experience and mechanisms. The mandate of forest services has traditionally been confined to the management of public lands set aside as forests, pursuing management

objectives directed at timber production and protection which have often resulted in exclusion of local people from most forest activities. The build up of farm forestry is therefore widely requiring significant institutional changes, often requiring complementary revision of underlying government policies and legislation.

Resolution of these institutional issues is closely linked with the issue with which the present paper has been principally concerned; improving our understanding of the interrelationships between people, trees and landuse. Improved performance of farm forestry support programmes clearly needs an expansion of present research efforts aimed at defining it more clearly and systematically, and a strong component of information gathering within projects through baseline and monitoring and evaluation studies.

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FARM FORESTRY

RAPPORTEUR'S COMMENTS

Robert Winterbottom*

Introduction and Presentation

John Spears introduced Mr. Mike Arnold by making reference to the rather precipitous increase in funding of farm forestry activities by the World Bank over the past 7-8 years, following the completion of the World Bank forestry sector review in 1978. Since that time, about \$700 million have been invested by the bank in this area, and much has been learned about farm forestry. Spears also noted that the FAO, in the person of Mr. Arnold and others, has been closely associated with the World Bank's program throughout this learning process.

In his presentation, Mr. Arnold pointed out that foresters and others have historically overlooked the importance of trees in contributing to rural development and sustaining agricultural production. Up until very recently, little was known about the extent of trees outside of forests, trends in the use of these on-farm forest resources, and systems for their management.

He defined farm forestry as that which deals with locally managed tree stocks, maintained to meet local needs for fuelwood, mulch, shade, income and various other raw materials, products and services. Farm forestry activities are characteristically small-scale, and controlled by the local people; they are not a substitute for conventional forestry, but can contribute significantly to total tree stocks.

Although some aspects of farm forestry are still not well understood, the rapidly accumulating experience in this field allows us to identify many of the main constraints and opportunities in farm forestry. Arnold then drew attention to a number of issues raised in the paper which he felt merited further discussion. They included:

- a) Farm forestry involves more than tree planting, and includes both passive and active management of existing natural vegetation; have past efforts designed to support farm forestry given too many emphasis to tree planting?
- b) A key ingredient for the success of any farm forestry activity is community participation: given the frequently encountered problems in ensuring local involvement, as well as the large number of parameters which affect it, do we know enough to encourage adequate participation in farm forestry projects?
- c) Has adequate attention been given to the "boundaries" of farm forestry? It appears to be significantly affected by environmental and other conditions which may favorably or unfavorably influence the prospects for a successful farm forestry program.

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- d) A number of farm forestry projects have encountered difficulties in reaching a wide range of often imprecise or conflicting objectives; project objectives must be clarified and a decision made as to what the primary objective really is (i.e. enhanced production, environmental protection, social equity, etc.)
- e) Programs to support farm forestry are needed most where changes in land use, tenure, availability of labor, capital, demand for forest products and technologies are so rapid and complex as to have made traditional forestry practices unsustainable and insufficient; are these changes sufficiently well understood to design a program which helps the farmer adapt farm forestry practices to these changed or changing conditions?
- f) While increased demand for various "forest" products can, in the long run, stimulate more intensive management of local tree stocks, it can also, in the short term, cause their overuse and lead to depletion of these tree stocks; how can increased demand serve to more rapidly and directly encourage more intensive management, without depleting local tree stocks?
- g) Has sufficient attention been given to working with small user groups in communal farm forestry activities, in order to overcome some of the constraints or disadvantages of communal forestry while still benefiting from its advantages?
- h) How can farm forestry for household use best be assisted? What are the most needed and appropriate technical packages? Is it necessary to provide free planting stock or other subsidies?
- i) Are farm forestry projects sufficiently oriented to supporting the production of cash crops? Can farmers be better assisted, with credit, information on markets, improved access to markets? Which products should be promoted?
- j) How can farm forestry projects deal with equity issues, and avoid making the rich richer and the poor poorer?

Mr. Arnold concluded his presentation by underlining the need to address the institutional and policy issues which relate to the question of local participation in farm forestry, and to improve our understanding of the inter-relationships between people, trees and land use.

Summary of Discussions

Bill Jones (ASPAC) led off the discussion by commenting that he was relieved that farm forestry was not just setting aside blocks of land in rural areas for tree-planting, but addressed the potential to improve land use by planting trees on field borders and other underutilized spaces. His question related to extension work in farm forestry. The forestry department was hampered by a preoccupation with law enforcement, and agricultural extension workers may not be well trained in tree growing; what is the best approach for extension work with farmers in this area?

Arnold replied that this issue has been and continues to be argued energetically, but that there did not appear to be an easy, universal solution. Both options presented some problems, and required

changes in policy and measures aimed at institutional strengthening. However, Arnold did caution against creating an entirely new extension service, when an existing service could be effectively strengthened. Foresters can usefully become more involved with agricultural extension workers, and learn more about farmers in the process, as they must if they are to assist in farm forestry.

Spears mentioned that the Bank has completed three studies which deal with extension issues in farm forestry: the India sector review, the Kenya sector review, and a review in Malawi (where agriculture and forestry are better integrated). They could provide a starting point for further discussion in the Bank on what has so far been learned about extension. Clearly much further testing of alternative approaches is needed. Michael Pease (EMPAL) asked if Arnold could expand upon the issue of subsidies in farm forestry, and comment upon a possible justification for subsidies in the event that farm forestry helps to reverse severe environmental degradation.

Arnold replied that the control of environmental degradation frequently has been used in the past to justify subsidies for farm forestry activities, and that projects need to more carefully examine whether subsidies are actually justified in all cases. The Bank is, in fact, currently formulating a research proposal to evaluate why and where subsidies or other incentives are needed.

Pricilla Reining of the AAAS then noted that many tree products can be collected without actually harvesting the tree itself, thus making productive use of the resource while still contributing towards environmental protection.

Horst Wagner (EAPSA) commented that many farmers will not plant trees unless they anticipate receiving income from the sale of harvested forest products. A number of projects have provided subsidized inputs for the production of fuelwood, in the expectation that it would help to supply local markets; the farmers, however, have continued to burn dung, or collect fuelwood from the remaining natural forest, and prefer to harvest poles and other higher priced products from the planted trees, which are then sold to generate more income for the farmer.

Arnold remarked that while it was true that farmers must perceive an economic benefit in order to become involved in farm forestry, the benefits can be fairly indirect; in case of Nepal, farmers plant trees to produce fodder, to feed their livestock so that manure will be available to help renew soil fertility and sustain crop yields.

Mikael Grut (EAPCA) remarked that he was interested in discussing further how farm forestry involves more than tree planting, but also the protection of existing tree and forest resources. He asked if there were many known examples in Africa of improved management of local tree resources, similar to the local management of panchayat forests in Nepal. He also commented that most forest products are still coming from local resources, and it was important that these resources be better managed and adequately protected with the full cooperation and support of local communities. The government forest service obviously cannot manage

these resources himself; perhaps a village-level authority could be given a greater role in the management of local forest resources, and even receive a portion of receipts generated by forest management activities.

Arnold noted in turn that regeneration of natural forests can be greatly influenced by controlling use (especially grazing). Tom Catterson (USAID Africa Bureau Forestry Advisor) pointed out that local people do recognize the need for controlling use and protecting the remaining forest resources, as evidenced by the work done in the Guesselbodi forest reserve, close to Niamey, Niger. In that case, the greatest incentive to local participation in forest management activities turned out to be the offer of employment of local people in the management of the forest.

At this point, John Spears suggested that the discussion focus on the potential for trees to contribute towards sustained agricultural productivity which is the main concern of the symposium, what do the agronomists think about recent research by ICRAF (International Council for Research in Agroforestry) and at IITA (International Institute of Tropical Agriculture) on alley-cropping for example?

Bill Jones (ASPAC) indicated that one should be cautious about interpreting the research on alley-cropping; he noted that farmers at Nyabisindu (Rwanda) were still reticent about fully adopting such a practice, apparently because of concerns about the effect of shading from trees on the cultivated food crops.

Diana de Treville (Equity Policy Center) commented that one should be careful about focussing exclusively on the relationships between trees and crops; she was involved in studies of the potential for income generation from trees (from the sale of bark, woven baskets, etc.) and viewed this as an equally important contribution of trees. Arnold noted that FAO had also been researching the amount of rural income which was derived from trees and forests, and their research suggested that forest products were indeed one of the most important sources of income for rural communities.

A question pertaining to research in farm forestry was then raised by Sam Frieburg; he wanted to know if such research was done by forestry departments, or as part of farming systems research. Spears replied that five years ago, the FAO and World Bank suggested a reappraisal of forestry research priorities, and a shift from an emphasis on topics related to industrial forestry to research on multi-purpose trees and other topics relevant to farm forestry. Since then, several regional workshops have been organized by IUFRO (International Union of Forestry Research Organizations) to identify developing country forestry research priorities in agroforestry, farm forestry and other areas. The International Council for Research in Agroforestry (ICRAF), established in 1977, plays a major role in agroforestry research. However, much remains to be done to strengthen agroforest research at the national level, where agricultural research is focussed on annual crops and forestry research is preoccupied with the management of forests.

Lennart Ljungman (ASPAB) then raised the question of sustainability of forestry activities. Sometimes even forestry activities can lead to erosion or overgrazing, if one fails to examine the overall

land use systems. Spears agreed, noting that this was a weakness of World Bank assistance, which is generally provided through projects designed along sectoral lines. Wagner then asked how the Bank might provide its assistance more effectively, with due regard to sustainable land use. Arnold suggested that better monitoring of projects, and increased research in this area can improve our understanding of the inter-relationships between the various components that influence land use. Catterson added that it was also helpful for the various specialists dealing with different aspects of land use and rural development to talk to one another more often.

Wayne Ringlien (EMENA) then asked if there has been any measurable impact on national economies in countries where farm forestry was being promoted? Arnold was not aware of data on that subject at FAO; Spears replied that the Bank was looking at that aspect, but only in isolated cases (e.g. India). Arnold also commented that most of the evidence about the influences of trees on agricultural production is related to experimental work, but not to actual impacts on farm productivity. One exception would be the data available on the influence of shelterbelts and windbreaks on farms.

A final comment was made about the experience gained with a reforestation project in eastern Sudan; a survey showed that the subsidized tree seedlings which were distributed were planted mostly for shade and ornamental purposes, not for agroforestry uses. Also, local non-governmental organizations involved with the project gained valuable knowledge about tree-planting practices, but it appeared that little of this knowledge was being passed on to government agencies.

DESERTIFICATION

David R. Steeds *

Desertification will be defined as a continued decline of the productivity of semi-arid land. The desertification process will be examined by reference to the Sahelian and Sudanian zones (SSZ) of West Africa where the rainfall and soil conditions make sustainable management of natural resources a formidable challenge: rainfall is 200-800 mm/year, highly variable both within and between seasons, and much of it falls as torrential downpours; soils are structurally fragile and easily erodable.

This paper will examine eight issues, selected because they are controversial, four in the realm of the diagnosis of the desertification process, and four in the realm of possible remedies. These issues are:

- (a) is desertification caused principally by increasing aridity or by poor resource management?
- (b) is desertification most threatening at the edge of the desert (200-300 mm) or further south in the wetter but still semi-arid areas?
- (c) are traditional production systems irretrievably broken down or recuperable?
- (d) are spontaneous adjustments to the desertification process taking place quickly and constructively or slowly and destructively?
- (e) are there (or not) any proven techniques for intensifying land use in the areas most threatened by the desertification process?
- (f) is there (or not) any significant scope for developing irrigation as a means of increasing carrying capacity?
- (g) is there (or not) any real scope to mobilize group endeavors for better resource management?
- (h) is there (or not) any role for public policy in guiding spontaneous settlement?

These eight issues will now be examined, although in some cases the discussion will provoke more questions than answers. I would add that most of these issues are best addressed in site-specific contexts but, in view of the diversity of experience of the participants in this Symposium.

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I will endeavor to avoid specific cases (and thereby run the risk of over-generalization.

Causes of Desertification

One view is that aridity is increasing, will inexorably destroy the vegetative cover, and will thereby desertify what are already marginal areas of limited productivity: resistance to such desertification is futile. Indeed, the period since 1968 has been dry, and in marked contrast to the preceding 20 'wet' years. Another view is that the human population of the SSZ is growing much faster than ever before, is putting increasing pressure on the limited carrying capacity of the land, and that responsive management methods and production techniques have not yet been developed: according to this view, the desertification process is an example of conflict between public and private interests, between long-term resource use and a preoccupation with short-term survival which entails resource abuse. Moreover, climatologists disagree on whether or not the recent 'dry' period indicates increasing aridity.

I consider that this issue, although hotly debated, has no operational consequence since rainfall patterns cannot yet be modified nor even predicted, whereas human behavior can be changed. Increasing aridity, even if a reality, is a slow process with many oscillations, and resource management needs improvement whether or not increasing aridity is a factor. The desertification process is slow and insidious, and governments and rural communities have consequently been slow to react despite the rapid growth of population. So long as better management methods and production techniques have not been exhausted, it would be short-sighted to ignore them by assuming, on inconclusive evidence, that aridity is increasing and is the principal cause of desertification.

Where is the Threat Most Pressing

One view is that the most pressing threat is on the fringe of the Sahara itself, either that the desert will somehow 'advance' southward or, more plausibly, that cultivation in such extremely marginal conditions will expose the fragile soil to the agents of erosion. This view was at the origin of the demarcation of Pastoral Zones in some of the French territories just prior to independence and, in its simpler form, is at the root of proposals that are made from time to time for the establishment of desert-stopping Green Belts. Another view, based on comparing carrying capacities with actual populations, is that the actual population most clearly exceeds carrying capacity - using traditional production systems - in the Sahelo-Sudanian zone (350-600 mm), not in the desert fringe, nor in the better-watered areas further south. Although this approach requires some rather heroic assumptions and expressly overlooks special features, such as shallow groundwater, in small, better endowed areas within zones, the principal findings are quite striking (and they correspond to my own unscientific observations and anecdotal baggage).

Traditional Production Systems

Recent social science literature has pointed to the merits of traditional production systems that have been tailored over time to contend with particular and highly variable circumstances. Schematically, three such systems have been found in much of the SSZ and they have commanded attention because they do permit fairly large populations to exploit marginal lands in a sustainable manner. This is now quite uncontroversial. It is also generally agreed that these systems are no longer operating as effectively as in the past. The controversy is over whether such systems, or elements of them, can be revived. longer operating as in the past. The controversy is over whether such systems, or elements of them, can be revived.

One view is that the pressures that have disrupted traditional production systems are so pervasive that the systems are irrecuperable: increasingly centralized political authority has challenged the power of local decision-making bodies in all respects, including resource management; increasingly urban-biased economic policies, by promoting cheap food and fuel for urban consumers, have discouraged more intensive land use and conservation of forest cover; and, above all, population is nearing or has already exceeded the carrying capacity. In the face of these pressures, traditional production systems are being overwhelmed. Another view is that traditional production systems were systems in two senses: technical, with adequate fallow periods and dry season grazing resources at the core; and managerial, with local decision-making capability, although not necessarily democratic, in the essence. The second view recognizes that the technical features of traditional production systems are being or have already been overwhelmed but suggests that the managerial features can be recuperated. Indeed, in the last few years, two of the pressures on traditional production systems have been attenuated to some extent; some political authorities have recognized the disadvantages of promoting new organizations such as cooperatives to challenge traditional authorities; and economic policies are in many countries nowhere near as urban-biased as in the past. The second view is that, since effective resource management must take account of site-specific conditions, local managerial capabilities must, and indeed can, be harnessed. I favor the second view largely because of the fairly widespread change in governments' attitudes to local decision-making; if such bodies will be permitted to flourish, and if the enabling rules will be changed, then those who are most affected by resource degradation can increasingly be expected to do something about it.

Spontaneous Adjustments

Three kinds of spontaneous adjustments can be expected: more intensive land use leading to increased productivity; more conservationist land use leading to arrest of the decline in productivity; and migration away from the most threatened zones toward more promising areas. There is little evidence of more intensive land use in the most threatened areas; the exceptions are rare. There is some recent evidence of more conservationist land use, particularly in the most threatened areas. These two points are not controversial (although we will return to a controversial aspect of the former in para. 9). There is controversy, however, on the question of migration - both its magnitude and its

effects. It is surprising that the extent of migration should be in dispute, since it ought to be easily ascertainable. Some argue that the extent is quite peripheral, others claim that it is substantial. I take the latter view (although the geographical context is clearly important). There is controversy, moreover, on the effects of migration - both for departure areas (depletion of human capital) and for new settlement areas (unsustainable land management practices). I take the view that the depletion of human capital in the departure areas is simply a necessary result of population having overtaken carrying capacity - although one could have a normative debate about it - and the land management practices of new settlers are probably a good deal less destructive than is often reported. This ought to be simply an empirical question but, as is often the case in the SSZ, good data are rare.

Intensification in Rainfed Farming

In the most threatened area, the Sahelo-Sudanian zone, the project record is disappointing. The few Bank projects in this zone have been quite unsuccessful: Senegal Sine Saloum was reappraised but later halted; Mali OACV led to a pilot follow-up project; Niger Dosso was closed with 80% of the Credit proceeds unspent; and Niger Maradi would have been closed along with Dosso had there not been an opportunity to reorient it to test new approaches. Two of these projects, moreover, were mainly located in more southerly, more favorable, areas rather than in the Sahelo-Sudanian zone proper. All four projects were based, essentially, on the promotion of chemical fertilizers and animal traction for which profitable techniques were thought to be known. Nobody has yet analyzed these failures as a group, as well as other failures funded by other financiers in the same area, and there is still some controversy surrounding reach failure considered separately.

I suggest that there are two encouraging lessons that can be learned, and one discouraging one. First, I think that little attention was paid to basic crop and animal husbandry or to water harvesting in the pursuit of ever-increasing volumes of fertilizer sales and animal traction units distributed. Indeed, the efficiency of fertilizer and even animal traction depends on having mastered the essentials of sound crop and animal husbandry. It is tempting to argue that the projects should have concentrated on such essentials but, in Sine Saloum at least, the consensus among the agronomists in the extension service was that basic crop husbandry techniques had already been mastered by 1975. While I side with the Sine Saloum extension service, in the other project areas I think that basic husbandry techniques had not already been mastered; in these drier areas, water harvesting techniques had certainly not been mastered. Second, the ostensible profitability of the improved technical packages had been calculated on averages. There was early recognition, in Sine Saloum in particular, that the average farm type was a misleading concept; good monitoring work established that there were six typical farm types, with different endowments of land, labor and capital, and that adoption of improved packages reflected those endowments. But in none of the projects was there any attempt to assess probable rather than average farm income to be expected from adoption of the proffered packages. This is not a simple matter how to weigh the different risks? but unless it is done the package being extended will not have been assessed by one of the main criteria that

farmers use. Third, by the test of whether farmers were willing to adopt the proffered packages, even with generously subsidized prices and lenient credit terms, the projects nonetheless failed. With respect to the original objectives, the failure was particularly noticeable in fertilizer, which is generally thought to be an essential ingredient of a crop-intensification, anti-desertification strategy. The conclusions that I draw are that chemical fertilizer at full cost is simply not sufficiently profitable below some threshold isoyhet (800 mm?) to warrant its use of any extension effort to promote it; and that cheaper solutions to the fertilization problem must be researched, by looking for combinations of organic and chemical fertilizers in a mixed farming system together with good crop and animal husbandry and water harvesting. Others, however, follow a different, 'structuralist' logic and argue that, since chemical fertilizers are an essential yet privately - unprofitable element of an anti-desertification strategy, they should be applied regardless of cost, or at whatever (subsidized) cost that farmers would be willing to pay. The reader is invited to select his view.

Scope for Irrigation

Irrigation clearly has the potential to change carrying capacity dramatically. Even at a large farm size of three ha per family, and eight people per family, irrigation would permit a carrying capacity of 250 people per square kilometer, or more than five times the carrying capacity under rainfed farming using traditional production techniques. Moreover, most of the potentially irrigable areas are along the Senegal, Niger and Chari/Logone rivers in the Sahelo-Sudanian zone, where desertification is most threatening. Within this zone, however, the areas of densest population are several hundred kilometers away from the potentially irrigable areas. Furthermore, the realization and management of the irrigation potential will be in doubt until the poor performance in existing irrigation schemes can be improved, in respect of yields, incomes, cost recover, and maintenance. One view is that improvements in these respects are prerequisites for further investment in new irrigation perimeters. Another view, structuralist again, is that such investment offers the only hope of dramatic improvement in carrying capacity and must therefore be pursued even if it will not be economically worthwhile in the short run. A refinement of this view is that scale economies will be realized in capital costs by a faster pace of investment, and that operating costs may also be reduced by emulation. The reader is invited to select his view. It should also be noted, however, that even if new investment were to attain 20,000 ha per year, and assuming a small farm size of one ha per family of eight, the 160,000 people who could be accommodated each year would represent only one-half of the current annual increment in the populations of the Sahelo-Sudanian and Sudanian zones. In the broader content of desertification, this does not amount to a strategically significant change in the nature of the problem. I suggest, therefore, that irrigation as a means of increasing carrying capacity is only a long-term partial solution; in the short term, priority should be given to improving the poor performance on the existing irrigated perimeters, precisely in order to overcome the obstacles to realizing the long-term potential.

Group Endeavors

We have suggested, at para 7, that the management methods of traditional production systems are recuperable, even if the production techniques are not. We now have to examine the extent to which group endeavors can complement activities that can be undertaken on individual holdings. Some activities can only be undertaken, or some benefits can only be fully captured, by group endeavors; such activities include small watershed management and such benefits include water harvesting and soil conservation across a slope when land holdings run down the slope (as is often the case). In such cases, I believe that the collective interest will prevail and earlier management methods would flourish - if the legal, administrative and other barriers were removed. Belief, and removal of the obstacles to group endeavors are not enough, however; incentives that would make group endeavors more appealing must also be devised, such as matching grants, tax concessions, and exclusive grazing or watering rights. Another view holds that the earlier management methods are dead and that it is simple wishful thinking to imagine that collective interests can be a spur to action. Again, the reader is invited to select his view.

Spontaneous Settlement

Migration has a long tradition in the SSZ countries, both within the countries and further south into the coastal countries. Today, spontaneous settlement into the Sudanian-Guinean zone, although little known or understood (para 8), far exceeds the numbers of people being resettled under government-sponsored schemes. The latter have proven to be costly per family settled and may not even have had any net impact on the total number of settlers. Yet there are severe difficulties facing would be settlers in the Sudanian-Guinean zone, notably human and animal diseases as well as pests and predators unknown further north, lack of infrastructure in difficult terrain, and the fragility, after clearing of soils under forest cover particularly in hilly areas. Given these problems, but recognizing the unquestionable potential of the Sudanian-Guinean zone to relieve population pressure further north, it is surprising that settlement policies - in contrast to projects - have not attracted more attention. This has changed in the last two years but there are still wide differences of opinion.

One view holds that policies are unenforceable in such 'frontier' areas and that it would be illusory to pretend otherwise. A second view is that spontaneous settlement will necessarily be something of a land-grab and therefore environmentally destructive; it should be prohibited, with would-be settlers energies channeled into settlement projects, ostensibly more environmentally-sound. An intermediate view is that settlement projects, even if we knew how to do them, would always be overwhelmed by the numbers of spontaneous settlers and that the challenge is therefore (i) to find readily-enforceable land use regulations to promote sustainable settlement in those areas to which spontaneous settlers are moving, and (ii) to identify what additional role, if any, the public sector can usefully play to promote spontaneous settlement. This role would likely be a land-use planning one, whereby the location of investments in roads, wells, medical facilities and schools would be selected to favor those areas - and within them, those villages - suitable for accommodation of

spontaneous settlers. This role would require that special attention be paid to health programs in disease-prone settlement areas. I clearly favor the third, intermediate, view since it directs attention to how the public sector might assist existing private initiatives, instead of ignoring or prohibiting them.

Concluding Remarks

There are several other unresolved questions pertaining to the desertification process but they are not matters of controversy, which was my selection criterion for the issues examined above. The unanswered questions are nonetheless important - how to reduce population growth; how to reduce urban wood consumption; how to amend land laws to encourage better resource management; how to provide subsidies for capital works such as soil conservation yet assure the maintenance of such works; participatory approach to the design of remedies for the desertification process. Two years ago, some of these questions would have excited much controversy. Now, there is fairly broad agreement that these are legitimate questions and that the challenge now is to find operational answers. I hope that on some, at least, of the eight issues listed above we will soon be able to say that a broad agreement has been reached, and that we will then be able to devote our energies to finding operational answers.

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RAPPORTEUR'S COMMENTS

Jeffrey Lewis *

Mr. Steeds proposed to concentrate on three of the eight issues raised in his paper. He justified this by arguing that a number of the issues, such whether there is a long term decline in rainfall in the Sahel, were of more academic than operational interest. He also pointed out that there was increasing agreement on such issues as the role of population pressure in desertification, the importance of domestic energy and the need to develop site-specific solutions in which the local people actively participate. There were, nonetheless, a number of points that were still being debated both internally within the Bank, and externally between the Bank and Sahelian Governments.

The three contentions issues to be discussed were:

- i) What spontaneous adjustments are taking place in response to the process of desertification?
- ii) What prospects are there for building on traditional local institutions and organizations?
- iii) Are there proven techniques to combat desertification in areas with between 200 and 800 mm rainfall.

The speaker advanced the view that large, important and constructive spontaneous adjustments are taking place through the Sahel. The general opinion of the meeting supported this view. It was pointed out that all too often Bank staff assume that Government action is necessary to remedy a problem; this is not always the case. Changes in dietary habits, where pastoralists increase the proportion of grain in their diet, the enclosure of previously unfenced land and the development of effective local organizations were given as examples of spontaneous adjustments. Additional examples included an increased dependence on the Sub-Humid savanna areas, greater penetration of the Tsetse belt by livestock, increased integration of crop and livestock production systems and migration from the most severely effected areas. It was noted that although the increased use of the Guinean zone might relieve some of the pressure on the Sahel, it also spread the danger of bad land use and desertification to new areas. Without reliable data it is difficult to gauge how effective these adjustments have been in providing an adequate response to the problem.

The relative importance of livestock and crops in contributing to the process of desertification was debated. This was considered relevant as increases in cropped area is often found as a response to decreasing yields. Examples from Somalia and the Sudan were used to support the view that the expansion of cropping, particularly mechanized cropping, is a much

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more important cause than overgrazing by livestock. (In the Sudan it is estimated that 2.5 million acres are opened for cropping each year.) It was argued that overgrazed rangelands recover relatively easily under the right conditions, but a few years of cropping destroys virtually all the indigenous vegetation and natural recovery is impossible.

Participants from the Sudan stressed that although spontaneous adjustments could be important, they do not replace the need for appropriate policies, accurate basic resource data and developing appropriate technical packages for particular areas.

The discussion on the prospects for building on local traditional institutions produced a positive response and a number of encouraging examples. In the Sudan, for instance, the power of traditional leaders and institutions was, at one time, removed and replaced by appointed government officials. The Government has now realized that this did reestablished. It was pointed out that in Senegal the powers of the Marrabouts had never been reduced and they represented a very important local force. This force, however, was not always used in a constructive way; local institutions are not automatically useful and positive. A question was raised, but not effectively answered, as to whether local institutions could be sufficiently forceful to change farmer's behavior in situations where that change would result in a short-term reduction of the farmer's income.

The discussion on the availability of technology concluded that technology was available to address some problems at some sites, but not all. The solution had to be site specific and must be seen to satisfy local needs. More adaptive research is needed and ways must be found to implement successful packages on a sufficiently large scale to have a real impact. There are many reasons for the failure of apparently appropriate technologies, the most common being a shortage of capital, inappropriate national policies and lack of economic viability.

The speaker made the following concluding comments:

- (a) Site Specific nature of the problem and possible solutions means the generalizations can be dangerous;
- (b) Domestic Energy is a crucial component; the time is right to look carefully at the option of increasing conservation through better use of existing resources;
- (c) The Amazonian Example shows that working through local groups can be effective. This is being more widely acknowledged than before and, although it is easy to be cynical, changes towards more local involvement should be encouraged;
- (d) Migration in search of famine relief is not sustainable. On the other hand, migration that results in a more equal distribution of the demand and supply of resources may be sustainable. This, however, needs to be properly guided and care must be taken to ensure that appropriate land use systems are adopted;

- (e) Food Aid/Labor Payment. There are enough examples of problems with this issue to raise serious long term doubts about the sustainability of initiatives where capital works are subsidized, but maintenance costs are not. It is unlikely that food aid will continue at the present high levels in the long term;
- (f) Spontaneous Adjustments need to be looked at more carefully and an effort should be made to work with existing movements;
- (g) Group Endeavors can not, in many cases, be less successful than existing government initiatives and, therefore, should be encouraged. Individuals frequently lack the resources to tackle specific problems; and
- (h) Technical Improvements such as water harvesting exist, but it is difficult to see hope for the extensive use of technologies requiring substantial cash inputs. More attention needs to be given to techniques which are viable under real, and thus highly variable, environmental conditions rather than the "average" conditions which are never experienced.

SALINITY MANAGEMENT ISSUES

Walter J. Ochs *

Salinity management to sustain a sound irrigated agriculture is particularly important in arid and semi-arid climates. But salinity control can become an issue in some other climatic zones where rainfed agriculture is practiced. Areas in close proximity to oceans or other salt water bodies often require salinity management techniques. Sometimes saline-seep problem areas develop under rainfed agriculture in semi-arid climates. The primary salinity management issues that the Bank staff must deal with involve irrigation projects, thus we should concentrate on this area of concern.

Salinity is a major threat to irrigated agriculture sustainability because many of the soils and waters used for irrigation in the world contain significant amounts of salts. The salts limit crop production due to the total osmotic effects and individual ion toxicities, and excess sodium may reduce soil permeability.

The salts are normally originated from geologic weathering and are transported and accumulated in the soil profile as a result of water movement. Excess quantities of these soluble salts must be removed from the root zone area to sustain productivity. Issues involving salinity management are numerous. The primary items addressed in this paper are: control elements, leaching, seepage control, depth of drains, disposal of drainage water and minimizing adverse effects.

Salinity Control

Salinity control is achieved if a net downward movement of soil water through the root zone is maintained. Soils and irrigation waters in arid and semi-arid climates contain a mixture of soluble salts, with the concentration of these salts in the soil solution usually higher than that in the applied water. This increase in salinity results from plant transpiration and evaporation from the soil surface which selectively remove water, thus concentrating the salts in the remaining soil solution. To prevent soil salinity from reaching harmful levels in crop root zones, one must move a portion of this concentrated solution below the area where roots can be effected by the salinity. Salt will be leached from the soil whenever water inputs, through irrigation or rainfall, exceed evapotranspiration, provided soil infiltration and drainage rates are adequate. The amount of leaching required depends on the quality and uniformity of irrigation and the crop grown. Subsurface drainage is essential for sustained irrigated agriculture where salinity is a hazard. Sometimes it is adequate naturally, but usually artificial subsurface drainage is needed.

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In areas where the groundwater levels are deep, salts accumulated in the root zone can be moved downward by irrigating. Substratas must be permeable for this condition to continue. The process can continue only until the level of groundwater extends up into the crop root zone. Occasionally rainfall is sufficient to leach the salts below the root zone. Extra irrigation water for leaching is not required and, if applied, may cause the water table to rise unnecessarily. Without proper drainage the water table may remain in the root zone too long and reduce crop productivity.

Leaching

Leaching quantities required to maintain a sound irrigated agriculture depend upon several factors:

- salt content of the irrigation water, the soil and the groundwater;
- salt tolerance of the crop;
- climatic conditions; and
- soil and water management.

If leaching is not adequate, harmful salt accumulations can develop within a few cropping seasons. The fraction of the applied water that must pass through the root zone to prevent harmful salt accumulations in the soil is called "the leaching requirement". Once salt has accumulated to the maximum tolerable limit for the crop under a given set of conditions, any added salt from subsequent irrigations must be balanced by a similar amount removed by leaching to prevent a loss in yield.

The optimum management strategy is to apply no more water than is necessary for full crop production and leaching of salts. This leaching requirement has been established for irrigation water of various levels of salinity and for irrigated crops of major importance (Fig. 1 and reference: Hoffman 1985). The salinity level of the applied water can be estimated by multiplying the salt concentration of the irrigation water times the amount of irrigation water applied, and then dividing this product by the sum of irrigation and rainfall minus surface runoff /1, as shown below:

$$C_a = (C_i I) / (I + P - R)$$

/1 For convenience, salt concentration in water is normally measured as the electrical conductivity of water and reported in units of decisiemens per meter (dS/m). The units of dS/m are numerically equal to millimhos per centimeter (mmho/cm).

where C_a is the average salinity of the applied water that enters the root zone, C_i is the salinity of the irrigation water, I , P is precipitation and R is surface runoff. The amount of salt that crops can tolerate in the soil profile is the salt tolerance threshold (reference: Maas and Hoffman 1977). The threshold (C_t) is the maximum soil salinity permitted without crop yield reduction.

Table 1 shows threshold values for a number of crops. As an example, if farmers use river water for irrigation ($C_i = 1.2$ dS/m) and no rainfall occurs, a tomato crop ($C_t = 2.5$ dS/m) would require an additional portion of water to be applied above that needed for evapotranspiration. If rainfall was 250 mm, the depth of irrigation with river water was 600 mm and about 100 mm of the applied water was surface runoff, then the average salinity of the applied water would be 1.1 dS/m (according to the equation) and the leaching requirement (L_r) for tomatoes would be 0.08 (Fig. 1). This means that 600 mm of the net amount of water applied must drain below the root zone to avoid losses in tomato yields from excess salinity.

Seepage Control

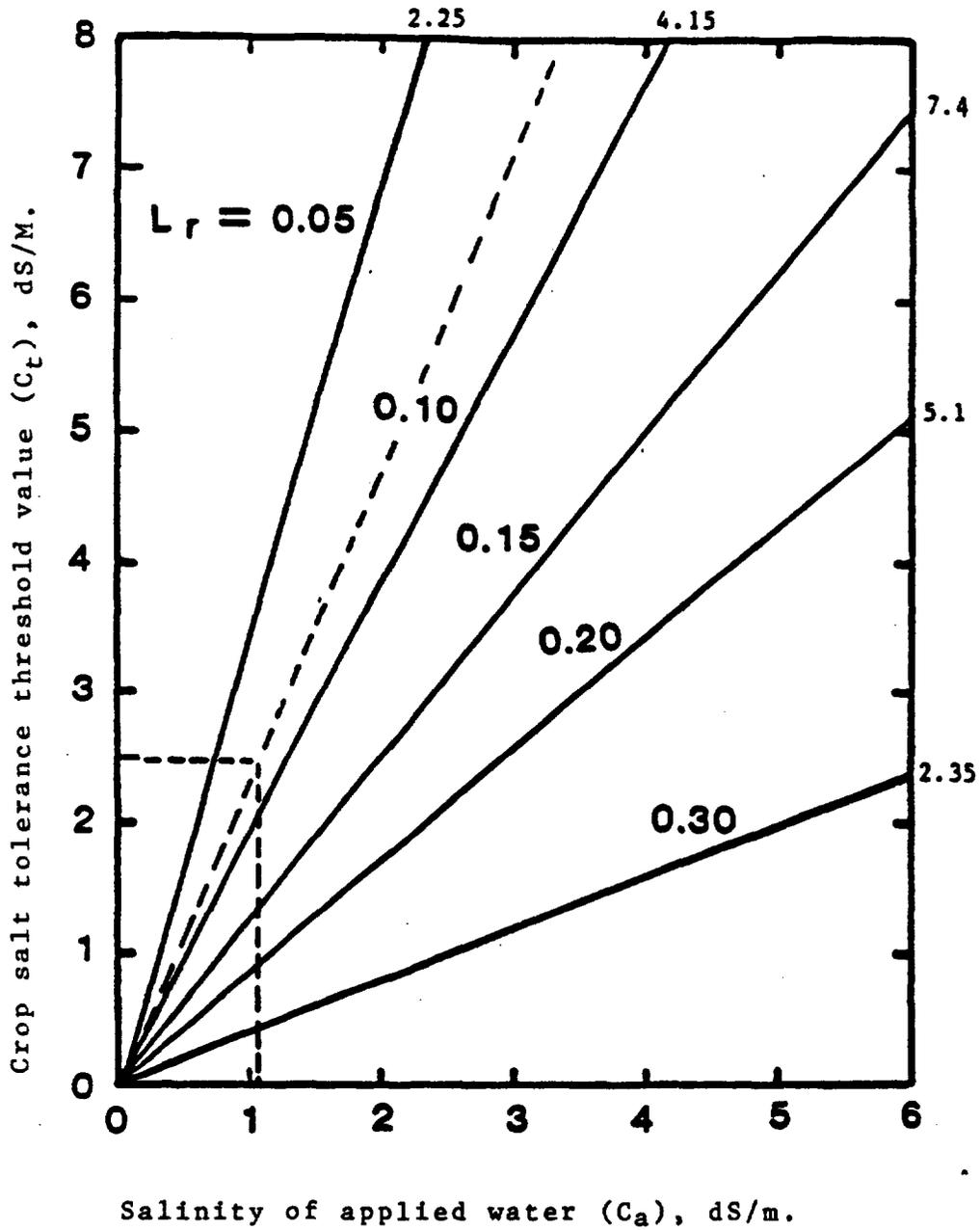
Water requiring removal by drainage may originate from a number of sources. A significant part of the water contributing to the drainage system often is the result of seepage from irrigation canals or from irrigated areas some distance from the area under consideration, such as the desert area west of the Nile Delta (reference: Kirkham and Prunty 1977). It is sometimes possible to have water leaving the area through deep seepage. When Chang and others (1983) attempted to match their computed water-table heights with measured ones for various fields in California, they obtained their best match when the assumed seepage rate was several times the rate of water removal through the drains.

The magnitude of this deep seepage indicates the important difference between the natural drainage rate and the rate of drainage through installed systems. When a new irrigation project is contemplated for an area, the natural water table may be tens of meters deep, making the potential rate of water removal from such a region difficult to estimate. The requirements of any drainage system, however, are obviously reduced by the amount of natural drainage.

Depth of Drains

In irrigated areas with arid climates, relatively deep drains are normally specified. The US Bureau of Reclamation, for example, typically specifies depths between 2 and 3 meters. Such deep installations are costly, and the question arises whether they are needed. Doering and others (1981) concluded from studies in North Dakota that water-table depths of approximately 1 meter provided maximum crop yield with minimal supplemental irrigation for several crops. In an evaluation of extensive field data from Pakistan, Oosterbaan (1981) found that the water-table depth required to prevent

Fig. 1, Solving for the Leaching Requirements from the Salinity of the Applied Water and the Salt Tolerance Threshold Value for the Crop.



Source: Hoffman and van Schilfgaarde (1986).

Table 1. Salt Tolerance of crops as a function of the electrical conductivity of the soil saturation extract (C), where relative yield (Y) in percent = $100 - S (C - C_t)$, C C_t .

Crop	Salt Tolerance Threshold (A) (C_t) /1	Percent Yield Decline (B) (S) /2	Qualitative Salt Tolerance Rating /3
	dS/m /4	Percent (dS/m)	
Alfalfa	2.0	7.3	MS
Almond	1.5	19.0	S
Apricot	1.6	24.0	S
Barley	8.0	5.0	T
Bean	1.0	19.0	S
Beet, red	4.0	9.0	MT
Broccoli	2.8	9.2	MS
Cabbage	1.8	9.7	MS
Clover, Red	1.5	12.0	MS
Corn	1.7	12.0	MS
Carrot	1.0	14.0	S
Cotton	7.7	5.2	T
Cowpea	1.3	14.0	MS
Cucumber	2.5	13.0	MS
Date Palm	4.0	3.6	T
Grape	1.5	9.6	MS
Grapefruit	1.8	16.0	S
Lettuce	1.3	13.0	MS
Onion	1.2	16.0	S
Orange	1.7	16.0	S
Peach	1.7	21.0	S
Peanut	3.2	29.0	MS
Pepper	1.5	14.0	MS
Plum	1.5	18.0	S
Potato	1.7	12.0	MS
Radish	1.2	13.0	MS
Sorghum	6.8	16.0	MT
Soybean	5.0	20.0	MT
Spinach	2.0	7.6	MS
Strawberry	1.0	33.0	S
Sugar Beet	7.0	5.9	T
Sugar Cane	1.7	5.9	MS
Sweet Potato	1.5	11.0	MS
Tomato	2.5	9.9	MS
Wheat	6.0	7.1	MT

/1 Salt tolerance threshold is the mean soil salinity at initial yield decline.

/2 Percent yield decline is the rate of yield reduction per unit increase in salinity beyond the threshold.

/3 Qualitative salt tolerance ratings are sensitive (S), moderately sensitive (MS), moderately tolerant (MT) and tolerant (T).

/4 dS/ = decisiemens per meter = 1 millimho per cm, referenced to 25° C.

Source: Maas and Hoffman, (1977)

an adverse effect on the yields of sorghum and cotton was 60 centimeters. Such data provide some support for the contention that the drain depth typically recommended may be deeper than necessary. Recent changes in installation techniques may support this contention. The equipment needed to install drains to a depth of 1.5 meters by trenching is less cumbersome and less expensive than that needed for greater depths. Trenchless installations may be practical at the shallower depths with significant cost reduction.

Disposal of Drainage Water

In addition to the benefits to the land being drained, one needs to consider disposal of drainage water. This can be a matter of serious concern and high cost as illustrated by the as yet unresolved drainage problems in the San Joaquin Valley of California. An excellent on-farm and project drainage system has no value unless an adequate outlet exists for disposal of the drainage water. Depending on its quality, drainage water may be a total or partial substitute source of irrigation water.

Drainage water collected by tile lines and ditches or removed by the pumping of wells can, in some cases, be disposed of in ways that do not reduce the quality of surface and ground waters. For example, the highly saline drainage water collected in ditches from the San Juan irrigation project in Mexico, and formerly discharged to the Rio Grande River, is now being conveyed directly to the Gulf of Mexico in a separate channel. Also, a special channel has been constructed for conveying the highly saline, pumped drainage water from the Wellton-Mohawk Irrigation Project in southwestern Arizona to a point on the Colorado River below the last place where water is taken from the river for beneficial use. Conveyance to sumps for evaporation or reclamation by desalination are other possibilities for disposal. In many cases, however, the disposal of drainage water in a way that does not harm stream and ground waters is not practical or possible. There may be several reasons for this---the cost is prohibitive; the drainage water is neither collected nor pumped but moves by underground flow to streams and groundwater basin; or the quality of the drainage water, though somewhat diminished, is such that it still has value for irrigation or other purposes.

Where the flow of agriculture drainage water to bodies of surface and groundwater cannot be eliminated, quality degradation can be reduced by minimizing the amount of salt leaving the root zone. That amount can be reduced by decreasing evapotranspiration or by removing accumulated salts in the smallest volume of water compatible with the leaching requirement. Simultaneously reducing evapotranspiration and the amount of water applied decreases the amount of salt that must be removed from the drainage water. This can be achieved in a variety of ways, such as using closed water conveyance systems, eliminating non-beneficial vegetation and growing crops with lower evapotranspiration requirements as a consequence of the season or

length of their growth period. Removal of excess dissolved salts consistent with the leaching requirement maximizes the salt concentration of the soil solution and drainage waters and helps produce harmless, slightly soluble salts (lime and gypsum) in the soil. It also minimizes the solution of soil minerals and fossil salt deposits which commonly occur in geologic materials below the root zones (reference: Hoffman and van Schilfgaarde, 1986).

Unusually high and non-uniform soil permeability and an excessive and non-uniform application of irrigation water are the chief causes of excessive leaching. Minimizing the amount of salt leaving the root zone in drainage water is, therefore, strongly influenced by irrigation efficiency. The leaching of dissolved salts is more efficient, and the problems of excessively high and non-uniform soil permeability are reduced when applied water moves through the soil by unsaturated flow.

Agricultural drainage water sometimes contain nutrients and chemicals in sufficient concentrations to help or harm users of the water or the aquatic environment. Aside from the salt associated with salinity, subsurface drainage may contain nitrates and trace elements that harm the environment.

Nitrogen in drainage effluent is normally in the form of nitrate because it is not absorbed on soil particles. After reaching surface waters, these nitrates may contribute to eutrophication (a situation where minerals and certain nutrients rob water of oxygen, and thus favor plants over animal life). In high concentrations, nitrates may cause or at least contribute to methemoglobinemia (a poisoning of the blood) in infants and certain disorders in ruminant animals. High nitrate concentrations in subsurface drainage can originate from a number of sources: geologic deposits, natural organic matter, decomposition of human or animal wastes, or possibly by deep percolation of nitrates because of a lack of complete efficiency of the root system in absorption. The management goal in drainage and fertilizer practice should be to minimize the nitrate concentration of drainage waters (Reference: Hoffman and van Schilfgaarde, 1986).

Minimizing Adverse Effects

In recent years experts have become increasingly concerned about the significance of degradation from irrigation return flow waters, due to leaching of trace elements. These elements have accumulated in the soils, and the drainage water has injured fish and wildlife and could potentially affect human health. As an example, the west side of the San Joaquin Valley in California has serious drainage and salt management problems because the disposed drainage water is damaging valley waterfowl, agricultural lands and the San Joaquin River. The original plan called for the drainage waters to be diverted from the valley through the San Luis drain to the Sacramento-San Joaquin Delta, and thence into the San Francisco Bay and the Pacific Ocean. Construction of the drain began, but it was

not completed because of environmentally based objections and lack of construction funds in the mid-1970s. As a result, no acceptable receiving water was identified, and most drainage was discharged through the incomplete drain to the Kesterson National Wildlife Refuge, where it was expected to evaporate. Deformities in waterfowl observed at Kesterson have called attention to high levels of selenium and other trace metals (boron) in drainage waters from the valley (Reference: Hoffman and van Schilfgaarde, 1986).

19. The potential damage from trace elements in drainage effluent is illustrated in Table 2, where typical concentrations of a number of trace elements in California's San Luis drain are compared with the maximum recommended concentrations for irrigating sensitive crops (Reference: Pratt, 1973). The criteria on which these recommendations are based include:

- toxicities in crops grown in nutrient solutions;
- short-term soil culture experiments in which the amount of an element required to produce toxicities was observed; and
- soil-plant-animal relationships for elements that are toxic to animals through the food chain at levels lower than those that produce toxicities in plants.

The levels of boron and selenium are of paramount concern. This points up how the concentrations of trace elements in drainage effluent is the most pressing new issue in drainage for irrigated agriculture (Reference: Hoffman and van Schilfgaarde, 1986).

Summary

20. Salinity management requires sound planning to assure sustainability in irrigated agriculture. Salinity control involves maintenance of a net downward movement of soil water through the crop root zone area. Leaching actions should be balanced with proper irrigation water management to minimize water-table buildup and conserve valuable water resources. The depth of drains often becomes an economic as well as a technical consideration, and planners as well as designers should have more recognition of this matter. The disposal of drainage water from saline areas is becoming a serious problem in many areas, and special care is needed to provide for proper disposal. Trace elements must be considered in the planning and operation of irrigation projects. Control of concentrations of trace elements in drainage effluent may become the most pressing new issue related to drainage for irrigated agriculture around the world.

Table 2. Recommended maximum concentration of trace elements in waters used to irrigate sensitive crops on soils with low capacity to retain these elements in unavailable forms compared with typical values from the San Luis drain.

Element	Typical Concentrations in San Luis Drain <u>/1</u>	Recommended Concentration of Irrigation <u>/2</u>
	<u>mg/m³, (ppb)</u>	<u>mg/m³, (ppb)</u>
Aluminum	100	5,000
Arsenic	10	100
Boron	14,000	750
Cadmium	10	10
Chromium	18	100
Copper	10	200
Iron	80	5,000
Lead	10	5,000
Lithium	---	2.500 <u>/3</u>
Molybdenum	---	10
Nickel	10	200
Selenium	310	20
Zinc	10	2,000

--- Not available.

/1 Values reported by the California Department of Water Resources during first half of 1984 near Mendota, California.

/2 Recommendations from Pratt, 1973.

/3 Recommended maximum concentration for irrigated citrus in 75 mg/m³.

Source: Hoffman and van Schilfgaarde, (1986).

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SALINITY MANAGEMENT

RAPPORTEUR'S COMMENTS

Warren D. Fairchild*

Opening Remarks

Mr. Tae-Hee Yoon, Chief Irrigation I Division, South Asia Projects, chaired the section, which was attended by 15 World Bank officials. In his opening remarks, Mr. Yoon laid emphasis on the importance of controlling water logging and soil salinity in arid irrigation projects and stated that subsurface drainage in such projects is generally not a question of whether but when. He also referred to several IDA assisted subsurface drainage projects in the Indus Irrigation System in Pakistan, with particular reference to the Left Bank Outfall Drain, which he indicated was one of the largest such projects in the world. In introducing Mr. Ochs, Mr. Yoon gave his personal endorsement of the recent appointment of Mr. Ochs as the Bank's first drainage engineering specialist.

Presentation of Leader's Paper

Mr. Walter Ochs gave a brief review of his formal paper. He used overhead transparencies in his presentation, which followed the major subheads in his paper--salinity control, leaching, seepage control, depth of drains, disposal of drainage water and minimizing adverse effects. He elaborated on the depth of drain material in the formal paper by explaining the different problems and drain design concepts for humid, arid and semi-arid and tropical soils. He stated that surface drains in humid areas are normally placed at a depth of one meter; however, in arid areas subsurface drain pipes are generally placed at a depth of 2 to 3 meters to control salt movement through the root zone. The depth of drain placement is largely a matter of economics.

Question, Answer and Discussion Period

Following Mr. Ochs' presentation a lively question, answer and discussion period ensued. The following is a summary of these discussions.

Question (Mr. Clyde Collins, EMPA3): What is the status of the guidelines developed by FAO in cooperation with World Bank on irrigation land suitability and drainability of soils?

Answer (Mr. Ochs): The FAO document, Guidelines: Land Evaluation for Irrigated Agriculture (1985) is now available and will soon be distributed within the Bank for the guidance of the technical staff.

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Question (Mr. Hans Binswanger, AGRES): What is the basis of the salinity figures quoted by Mr. Robert Repetto, Sr. Economist, World Resources Institute, in his presentation at the plenary session? (Mr. Repetto reported an FAO estimate that half the world's irrigated land is salinized to the extent of affecting crop yields).

Answer (Mr. Guy Le Moigne, AGRPR): Though I cannot verify the FAO estimate, the need for subsurface drainage is extensive.

(Mr. W. Fairchild, ASPAA): FAO's salinity/drainage estimate for Pakistan that about 50% of the Indus Irrigation System is adversely affected would be generally consistent with an 1981 Soil Salinity Survey conducted by Pakistan's Water and Power Development Authority. This report indicates that about 42% of the land in the Indus System had a water table within 3 meters of the surface. However, only about 20% had a water table within the root zone.

Question (Mr. Joma Mohamadi, ASPAA): As noted in your paper, Mr. Ochs, when Syria opted for vertical drainage (tubewells), rather than horizontal (tile) drainage, did they consider recent significant reduction in costs for installing horizontal drainage because of more efficient equipment?

Answer (Mr. Ochs): The groundwater aquifer in Syria is particularly well suited for pump drainage.

Question (Mr. Herve Plusquellec, AGRPR): What is the relative cost of installing and operating horizontal and vertical drainage systems?

Answer (Mr. Ochs): It depends on many variable, i.e., aquifer conditions, quality of effluent and disposal, energy costs, etc. General, horizontal drainage has the higher capital cost for installation, but has a lower O&M cost than does vertical tubewell drainage. When properly installed, tile drainage systems (horizontal) have fewer maintenance problems. Recently, the cost of installing tile drains has been reduced significantly. The decision on subsurface drainage technology must be determined on a site specific basis.

Question (Mr. Le Moigne): The cost of installing tile drainage is high. I would like to know the economics of installing such drainage at a cost of about US\$1200/ha in South Asia.

Answer (Mr. Yoon, ASPAA): The problem is one of timing because not enough is known about the impact of a high water table and soil salinization on agricultural production. It is my opinion that in the case of drainage, because of increasing problematic soil conditions and higher cost associated therewith, the technicians should plan to be on the safe side in justifying drainage schemes.

Question (Mr. Peter Sun, AEPA4): What is the importance of monitoring in drainage projects?

Answer (Mr. Ochs): A good monitoring program is essential to good design and operation of drainage projects.

Question (Mr. Collins): Are there areas where minor (trace) elements prevent recycling drainage water?

Answer (Mr. Ochs): There are such areas, such as the San Luis Drain in California, with the high selenium and boron concentration, as reported in my paper.

Question (Mr. Mohamadi): Do roots pose a problem in tile drains, and if so, what is the solution?

Answer (Mr. Ochs): Tile drains in a tree cropping system would have a problem with roots. Trees should be kept 10 to 20 meters away from drains. Another solution is to place copper sulfate in the tile.

In his concluding remarks, Mr. Ochs stated the importance of a good water management program in deferring the timing for installing drains and also for reducing the drainable surplus. He also said that surface drains should be installed as required to remove excess rainwater because removing such water through a subsurface system would be extremely expensive.

THE PRESERVATION OF GERMLASM

John A. Pino and Michael S. Strauss* 1/

Some people consider germplasm to be the world's most valuable natural resource, yet its great value remains largely unrecognized. Long before people had any knowledge of the basis of heredity they applied selection pressures in propagating the plants and animals they domesticated. It is the manipulation of germplasm that has led to the development of agriculture and, thus, of human society.

Some Definitions

The term "germplasm" has been said to be one that defies clear definition (Witt, 1985). In its simplest sense, agricultural germplasm is nothing more than the plants or animals from which modern agriculture has derived present-day varieties and breeds. Germplasm, although applied to whole organisms or their parts (e.g., seeds, tubers, pollen, semen), also refers to their genetic composition. In essence, the term germplasm refers to the genetic variability within a population. Thus, for example, a germplasm collection of beans may look no different than any other field of beans but it is actually a carefully assembled, genetically diverse grouping that can be used selectively by a breeder to develop new varieties or add novel characteristics to existing ones.

Germplasm can be assembled in many different forms depending on what organisms are of interest. Once isolated and identified, microorganisms are maintained in pure cultures that can be stored dried or at freezing temperatures. Such germplasm collections can consist of little more than a freezer of ampules, each containing populations of specific microorganism. Plant germplasm can be maintained as seeds, tubers, cuttings of branches or shoots, sterile tissue cultures, or field plantings. Animal germplasm is most frequently maintained as herds, flocks, or similar assemblages, but in some cases it can be kept as semen or fertilized eggs stored at ultra-low temperatures. The important element, regardless of the method of storage, is not the specific organism stored but rather the genetic variation that a particular collection represents.

Germplasm resources of crop species can be divided into several categories according to how they are used and where they are found (Hawkes, 1985; Wilkes, 1983).

Wild relatives are plants related to agricultural crops.

They provide new and valuable gene complexes for the development of new varieties or the improvement of existing ones.

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1/ The views expressed are those of the authors and not the National Academy of Sciences, The National Research Council, the Board on Agriculture, or the Committee on Managing Global Genetic Resources.

Primitive cultivars and landraces are the products of indigenous agriculture. They developed through generations of informal selection as farmers kept seed from plants with desired characteristics. These populations can be genetically diverse and often specifically adapted to local environments.

Breeding lines are intermediate forms produced in the process of developing new agricultural varieties. Each breeder may maintain a number of such lines for use in crop development. While not directly useful to farmers, these lines are the immediate predecessors of many of today's most productive varieties.

Cultivated varieties (also called cultivars or agricultural varieties) can include varieties presently under cultivation as well as ones no longer in popular use. (These latter often being referred to as obsolete cultivars.) These are the products of modern breeding programs. Some of the most productive are hybrid varieties obtained by crossing two different breeding lines.

Engineered lines are the products of modern biotechnology. They are produced by tissue or cell culture, or some other process of laboratory manipulation. While genetic engineering and gene splicing have undisputed potential for enabling significant crop improvements, these techniques are, as yet, not widely applied to crop development.

Special genetic stocks are a unique class of materials. Rarely of significance to the breeder developing new varieties, such collections frequently contain cytologic and genetic oddities that are invaluable to scientists studying the mechanisms of inheritance and genetic control of development. These are important research collections.

Animal germplasm exists as wild species, specially-developed breeds, and traditionally developed breeds. To date, the collection and maintenance of animal germplasm is neither as extensive nor as efficient as that of plants.

Germplasm Conservation

It would, perhaps, be ideal to maintain the wild relatives of domesticated species in the environments where they naturally occur and landraces within the indigenous agricultural systems from which they developed. Unfortunately, natural habitats for many wild species are disappearing and indigenous agricultural systems are giving way to the practices and varieties of modern agriculture. The preservation of wild species and landraces in their natural environments (in-situ) is becoming increasingly difficult. Most nations have not taken this matter seriously and there has been a lack of creative thinking about how traditional agroecosystems and natural environments of wild crop relatives could be preserved.

Germplasm used in crop and livestock development has been most frequently and efficiently maintained in ex-situ collections -- collections of plants or animals stored outside of their natural habitat. Preservation of genetic resources as seed or live vegetative materials originated with the collections maintained by plant breeders, botanists, or botanical garden curators (Plucknett et al., 1987). These collections were not conceived originally as complete representations of the total spectrum of genetic diversity for a particular species. Thus, there were significant deficiencies in the collections of major crops and many important crop species were not collected at all.

As a result of the efforts of a few individual and actions of such agencies as the U.S. Department of Agriculture, the Food and Agriculture Organization, and the Rockefeller Foundation, a fundamental change in collection and use of germplasm was introduced in the 1960s. Previously, collections provided breeding materials with little or no concern for future availability of that particular germplasm. Breeders' collections fell short of holding the probable full range of genetic variability. Thus, the International Board for Plant Genetic Resources was organized in 1974 with the objective of assuring that most germplasm of the major crop species was represented in collections. While this effort has done much to improve worldwide maintenance of crop germplasm, considerably more remains to be accomplished, particularly with regard to collection and maintenance of wild relatives of cultivated crops and landraces (Tables 1,2; Lyman, 1984).

Collection and maintenance of germplasm today includes in-situ conservation of natural habitats or planted pure stands in the place of origin; and ex-situ conservation by cold storage, cryogenic preservation, tissue culture, or field collections of plants. In the future it may be possible to maintain germplasm as DNA libraries from which plants or animals could be reconstructed or specific traits selected.

Increased interest in the management of genetic resources is based on several general concerns. First, there is a growing awareness worldwide that species of plants and animals are being lost both due to and in spite of development efforts (Ehrlich and Ehrlich, 1981; IUCN-UNEP-WWF, 1980; Meyers, 1983 Oldfield, 1984; Wilkes, 1983). Second, the emergence of biotechnology and its potentials for crop and livestock development have left many nations, particularly those in the developing world, with concerns about their future ability to compete scientifically on a global scale. Third, a political and regulatory controversy has arisen over proprietary rights to germplasm and the crop varieties derived from it. Along with these specific concerns, has been a frequently stated unsureness about how well present systems for collection, maintenance, and management of crop and livestock germplasm are functioning.

Table 1. Comprehensiveness of Crop Germplasm Collection

Compre- hensiveness ^{1/}	Cereals	Roots & tubers	Grain legumes
Most comprehensive	Maize Wheat Rice Barley	Potato	Cowpea Chickpea Pigeonpea Mung bean
Moderately comprehensive	Sorghum Pearl millet Minor millets	Cassava	Soybean Peanut Lentil Fava bean Runner bean Common bean Winged bean
Least comprehensive	Wild species (except wheat, maize)	Sweet potato Yam Wild species (except potato)	Lima bean Lupin Bambara groundnut Wild species (except soybean and peanut)

^{1/} Most comprehensive = more than 75% of germplasm collected.
 Moderately comprehensive = 50-75% of germplasm collected.
 Least comprehensive = less than 50% of germplasm collected.

Source: Lyman (1984).

Table 2. Summary of the Status of Germplasm Collection of Selected Crops and Their Wild Relatives

Crop	Percent collected	Percent as unique types	Wild Species	
			Percent collected	Urgency
<u>CEREALS</u>				
Wheat	90	25	75	high
Rice	85-90	55	<30	low
Maize	98	57	85	low
Barley	80	20	10	low
Sorghum	75	33	10	high
<u>MILLETS</u>				
Pearl	>70	71	<10	high
Foxtail	>70	20	<10	high
Finger	50	17	<10	high
Kodo	50	19	<10	moderate
<u>ROOTS AND TUBERS</u>				
Potato	80-90	71	60	high
Sweet potato	<50	60	5	moderate
Yam (<u>Dioscorea</u>)	low	37	5	moderate
Cassava	75	50	10-20	moderate
<u>LEGUMES</u>				
Soybean	70	50	mod	moderate
Peanut	70	30	>50	moderate/high
Common bean	>50	50	10	high
Lima bean	<50	50	5	moderate
Runner bean	>50	83	10-30	high
Cowpea	high	67	low	high
Mung bean	70	43	low	high
Bambara ground nut	low	50	low	high
Chickpea	>80	50	<20	high
Pigeonpea	70	82	<50	moderate
Fava bean	50	66	(unknown in the wild)	
Lentil	50-60	52	30	moderate
Lupin	low	59	low	moderate/high
Winged bean	moderate	50	low	low

Source: Lyman (1984)

Genetic Erosion and the Need To Conserve Germplasm

Since the beginning of scientific plant breeding there has been a decline in both the number of crop species and the genetic variation within species (Chang, 1985a; NAS, 1972). In fact, the range of genetic diversity of the world's major crops may well be declining rapidly. The drive to develop high-yielding, uniform crops has significantly increased production, but at the expense of sharply reducing the genetic base (particularly in terms of loss of landraces) on which these crops are founded. As use of these improved varieties has spread, they have accelerated the loss of the genetically diverse traditional landraces through displacement. The result is increased risk of vulnerability to disease and pest losses due to increased genetic uniformity and the loss of the broad genetic base (variation) necessary for continued crop improvement (Chang, 1985a; NAS, 1972; Plucknett and Smith, 1986).

One rationale for preserving genetic diversity is that it is insurance against future agricultural catastrophe, investment for future needs, and a matter of moral principle (Chang, 1985a; IUCN-UNEP-WWF, 1980). Plant breeders have drawn extensively on the genetic diversity of crop germplasm to achieve the tremendous gains seen in the past two decades (Plucknett and Smith, 1986). Future gains, however, will require the continued availability of such materials and the expansion of existing collections (Chang, 1985a; Plucknett and Smith, 1986).

Assembly and management of these collections of genetic resources faces many obstacles. First, genetic erosion--the loss of uncollected materials--continues. Once in collections, materials can still be lost through improper management or neglect. National programs, particularly those in developing nations, need strengthening to enable them to make full use of their materials and to manage them properly. Collaboration is needed at both the national and international level. International efforts that have greatly contributed to present programs need to be further expanded but they lack the resources to meet the tremendous global need.

Conservation and Maintenance of Germplasm: The Issues/Needs

The major needs and issues associated with the collection, maintenance, evaluation, and use of crop and livestock germplasm may be divided these into four general categories: Scientific or Technical, Management, Regulatory, and Resources

Scientific and Technical

Scientific issues include considerations of the theoretical or conceptual bases for collection, maintenance, and use of germplasm. Equally important are the technological barriers to maintenance that must be addressed. Numerous specific technical issues have been reviewed recently (Holden and Williams, 1984) and further amplification is expected in an upcoming report of the U.S. Office by Technology Assessment (Technologies to Maintain Biological Diversity, to be released early in 1987).

Theoretical Issues

Germplasm collections have developed with only minimal consideration of their ideal size or the most appropriate methods for obtaining and maintaining a maximal amount of genetic diversity. The resources needed to perform even minimal maintenance of large collections may limit their size.

Many landraces are closely associated with the agricultural practices under which they developed. In many cases, crops have become coadapted to each other as a result of practices such as intercropping. Such methods--essential to subsistence agriculture--may be lost when materials are collected and stored apart from their natural surroundings. Thus, it has been suggested that the many landrace varieties could best be maintained within traditional agroecosystems. Similarly, it has been argued that in order to allow natural variation to develop wild species related to modern crops are preserved most effectively in-situ.

The question of the most appropriate method for maintaining germplasm, however, is even more complex than whether to use in-situ or ex-situ methods. It is difficult to serve the diverse interests of those using crop germplasm collections when we have inadequate knowledge of what materials would be most appropriate to maintain. For many crops, particularly those for which seed is difficult to obtain or generation times are long (forest species for example), the maintenance of specific genotypes is essential. In other cases, the availability of a broad array of genes is more important. Questions of the most appropriate size of a collection so it both preserves diversity and makes it conveniently available to users have only recently begun to be addressed.

Technical Issues

The emerging biotechnologies have potential to greatly enhance both the maintenance and use of germplasm. Plant breeding relies on the ability to interbreed related individuals. Natural barriers prevent crossing of unrelated individuals. The recombinant DNA technologies promise to change that and enable plant breeders to draw on inter-species diversity. Techniques such as in-vitro cell and tissue culture can lead to methods for preservation of materials that cannot presently be stored as dormant seeds. Many questions remain, however, about the genetic stability of materials in such cultures and appropriate methods of long-term storage. In addition, the methods of biotechnology and tissue culture have been applied to relatively few crop species and considerable additional research remains to be accomplished.

Many of the important crops of the developing world have seed that deteriorates when stored using conventional methods of drying and cooling (i.e., recalcitrant seeds). For many of these species, suitable methods of storage are not yet available. Crops such as banana and coconut that are of major importance to developing nations cannot now be genetically preserved by long-term germplasm storage techniques. Methods to preserve these crops and many vegetatively cultivated crops of the developing world are needed.

Management

Germplasm collections and programs today have local, regional, national, and international implications and interests. Similarly, they are sponsored by individuals, governments, international organizations, multilateral groups, and cooperative agreements. The effectiveness of genetic resources management at each of these levels varies considerably.

A critical need exists, particularly in developing countries, to develop strong efforts to capture and maintain the available crop genetic diversity. However, this is not always perceived as important to the national interest and may be neglected. The International Agricultural Research Centers have contributed significantly to developing the world's genetic resources, particularly in developing countries. But the question remains of how much responsibility individual nations should have (or will they accept) for managing their resources.

Many countries in the developed and developing world desire access to genetic resources and the crop varieties or livestock breeds produced from them. National programs for managing genetic resources vary in scope and extent, but few are comprehensive enough to meet the continuing needs of agriculture. This is particularly true in developing nations where lack of adequately trained personnel, facilities, and funds can be important constraints.

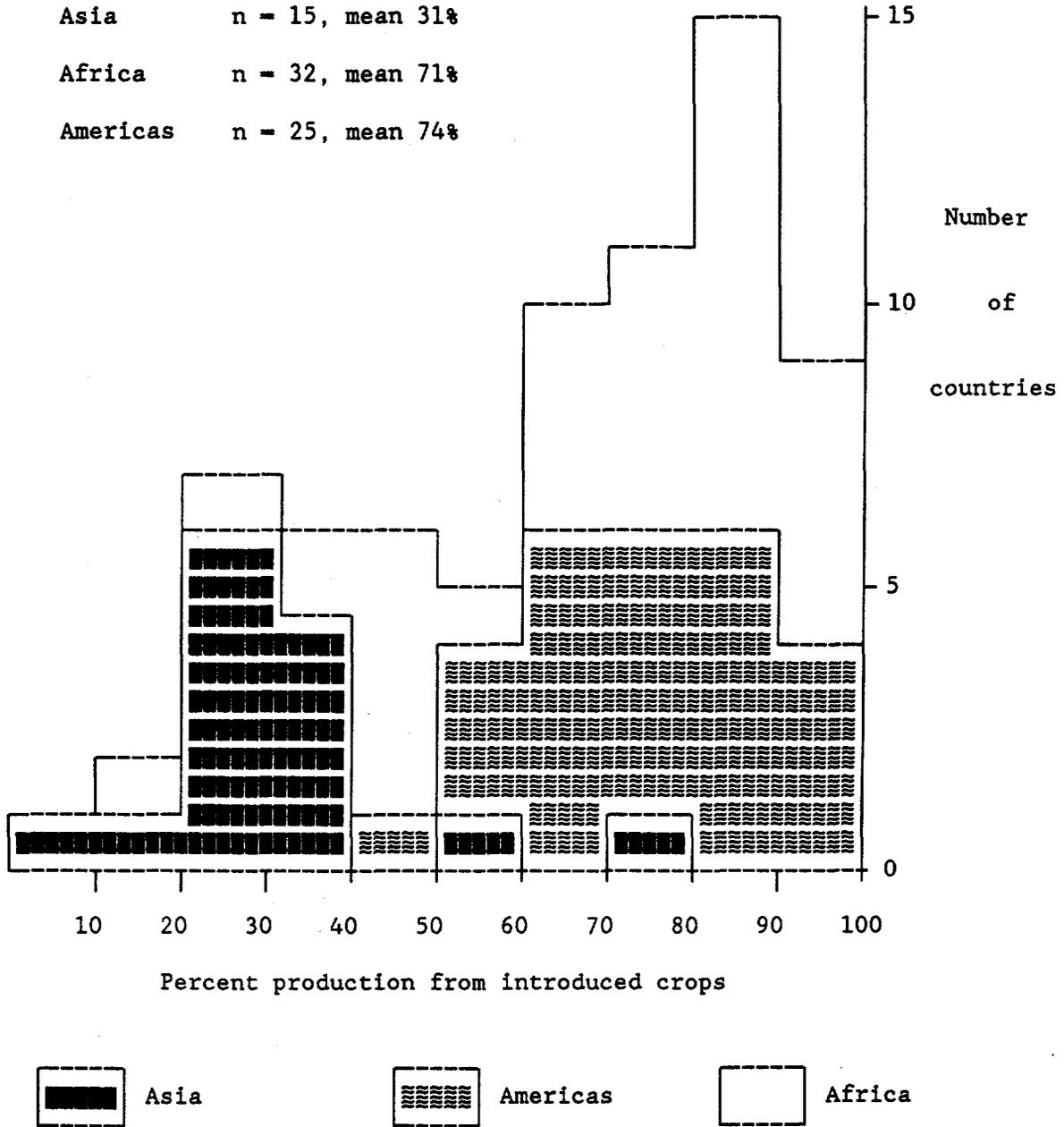
Model Germplasm Systems

A model for guiding the establishment of a national program in germplasm management and use is needed. This could help decisionmakers set priorities for programs as well as focus political and economic interests on the importance of genetic resource management to agriculture and, thus, national stability. Rather than setting forth a distant ideal, this definition should consider the realistic needs and constraints of individual nations in developing germplasm systems.

Plant and animal genetic resources are shared globally. Every nation and region has benefitted from the introduction of germplasm from other regions (Figure 1). This global interdependence suggests the need for a mechanism that can foster interaction among nations with some division of responsibility shared at international, national, and regional levels. Whether such a system can displace or compliment the present system, which is based largely on the free flow of germplasm among plant breeders, is a part of the current international debate concerning genetic resources.

It is unlikely that all nations need or would be able to develop broad systems encompassing all organisms (i.e., plants, animals, and microbes). A model for a national germplasm system should consider how a country can determine its most urgent needs and priorities. It must also define the goals of a national program. The model should clearly establish the link between germplasm conservation activities and crop or livestock breeding and development.

Figure 1. Percent Introduced Crops by Region in Developing Countries Based on the Value of 1984 Production



Source: Wood (unpublished).

Use of Genetic Resources

Despite the range of potential materials available in germplasm collections, they are still often poorly used. This is in part a management problem. A collection is useful only if its materials are accessible to breeders and crop developers. Thus, management is more than simply storing plant materials or maintaining herds. For plants, data on the growth characteristics, structure, collection sites, and agronomic traits all enhance the value and usefulness of a collection. The same is true for animal species, where tolerance to various forms of stress, resistance to disease and pathogens, nutritional value, and suitability in specific culture systems are all important.

Evaluation and Characterization

A lack of evaluation and characterization of germplasm in collections has been recognized as a serious deficiency in global efforts to maintain agricultural plant germplasm (Duvick, 1984; Frey et al., 1986; Williams, 1984). The efforts to date have been more extensive at the International Agricultural Research Centers than in national programs (Chang, 1985b; Huaman, 1984). The process of evaluating and characterizing materials in a collection can be lengthy and complex. However, this data is critical to efficient management of germplasm collections and it increases their utility (Chang, 1985b).

Documentation of Genetic Resource Collections

As characterization and evaluation data accumulates, another management problem will arise: the proper documentation of collections and management of the large amount of data associated with them. A clear definition is needed of the information required to manage collections, develop collection strategies, and satisfy the needs of the breeders who are the primary users of the collections. Standard models that will not only enhance management at individual collections, but also enable exchange of both germplasm and the data accumulated with it, are needed.

Management and exchange of data are important components in the management of genetic resources. In the United States, a computerized database (the Germplasm Resources Information Network, GRIN) is available. This system--even after years of development--remains slow, cumbersome, and is frequently criticized for the large amount of information it still does not contain. Internationally, germplasm collections need information structures appropriate to their activities. Although some facilities possess high quality equipment and efficient systems, many have only limited resources and expertise.

The requirements of a database system suitable for germplasm management need to be examined. GRIN combines the needs of managers (inventory control and monitoring, label printing, order processing) with those of breeders (evaluation and performance data) and planners (exploration and passport data). Systems that enable rapid access of data (and thus germplasm), but that can also interchange information among one

another are necessary. To answer this the first step is definition of (and agreement on) the information needed for the maintenance and use of germplasm.

Regulatory Issues

Germplasm typically has been exchanged freely and openly among researchers and breeders. Movement of germplasm is subject to restriction on imports resulting from quarantine regulations. There have been recently-voiced concerns, however, that this "open system" may not be preserved and access to germplasm will become more restricted. Export and exchange of germplasm has been the subject of arguments for restriction on the basis of proprietary rights or economic value. The controversy has been fueled in part by misunderstandings regarding the uses of germplasm, the functions of a collection, and the bases for present restrictions.

Quarantine. Global exchange of genetic resources raises important questions regarding the potential to spread livestock and crop pests and pathogens. Individual nations deal with these potentials by creating regulations that can range from virtually unrestricted flow to exclusion of essentially all imported materials. The primary goal of such regulations is to protect national agricultural systems (Kahn, 1977). Secondarily, breeders and researchers gain access to valuable germplasm resources, though this can be restricted somewhat.

Even though improved technologies are providing increasingly accurate and sensitive methods for detecting the presence of pathogens, many agriculturally significant pathogens are difficult or impossible to detect in intact living material. Further, not all countries have access to either the facilities or trained personnel to be able to use such technology.

For animal genetic resources, quarantine is not only lengthy, but expensive. Importing new cattle germplasm into the United States is so expensive that relatively few animals are introduced. It could be possible to reduce the time in quarantine (and thus the costs) by developing preshipment quarantine capacities in the country of origin. This also would facilitate the exchange of germplasm while restricting the spread of pathogens among nations. For those nations without adequate quarantine, however, questions of training, program development, and enforcement must be addressed.

An examination of quarantine is needed that first addresses the degree to which such regulations are a constraint to the free flow of germplasm. It may be possible to take advantage of the expertise of scientists at germplasm collections to improve the movement of germplasm into a country. Cooperation between quarantine officials, germplasm scientists, and breeders in the development of regulatory controls and testing protocols could lead to a broad array of germplasm becoming available sooner. Finally, continued development of diagnostic technologies can benefit quarantine and improve the flow of genetic resources into national breeding programs.

Proprietary Rights and Economic Valuation. Many legal issues are involved in the collection and maintenance of germplasm. These include laws regulating patenting of plants, property rights, and ownership of genetic resources. Proposals for resolving these issues often create considerable controversy. The overall concern is how the various legal and political actions or approaches affect the free exchange of germplasm.

One element of the proprietary rights issue is the value of genetic resources in their uncollected state, in collections, and as part of highly developed genetic lines. Although discussions frequently cite the value of genetic resources to agriculture, few detailed treatments exist that define value. Legal and ownership issues assume that individual accessions have value, if only in terms of potential and undiscovered utility. The problem, however, is how to determine the value of an individual accession.

Several examples of attempts to value particular genetic traits in agricultural production exist. Some analyses have suggested, for example, that half of all production increases in grain crops have come from genetic improvement (CGIAR, 1985; Fehr, 1984). Anecdotal information also exists regarding the value in total agricultural production of particular genes (Witt, 1985).

Assigning value to individual accessions, however, can pose significant risks. Such analyses may imply that some accessions are more valuable than others based on things we know they contain. This may fail to consider the value of unknown genetic traits in germplasm. In addition, for any single accession the probability of it contributing a gene of significant value--or of it even being used in a breeding program--is very low. Thus, economic analyses that spread the value of genetic contributions out over all accessions in a collection may underestimate value. It may be complex, if not impossible, to determine value for an individual genetic resource (Duvick, 1986). If that is the case, the question remains of whether there is an equitable system for reimbursement or if such schemes are impractical.

Resources

Development of international, national, and regional systems for the maintenance of genetic resources requires resources in the form of personnel, facilities, and funding. Further, the solution to many specific technological problems will require research efforts by trained scientists. These resource needs are fundamental constraints that can affect the management of global genetic resources.

Personnel. Germplasm systems should be staffed and managed by trained personnel. The range of expertise that is desirable includes such diverse fields as ecology, population genetics, breeding, biochemistry, molecular biology, and cryobiology--to name just a few. Expertise is needed both in the maintenance of genetic resources and the use of germplasm to develop crops and livestock. Few programs specifically train scientists for work with germplasm. Many nations do not (or cannot)

provide the necessary resources to sustain adequate national germplasm systems.

One significant source of loss of materials in germplasm collections is the managerial abilities of curators (IBPGR, 1984). Difficulties include lack of accurate records, and the failure to verify accessions, multiply them, or distribute collected materials. Unqualified managers have, in some cases, been a major cause of germplasm losses.

Facilities. Maintaining germplasm requires facilities for more than simply storage of materials. Availability of land for in-situ collections can, itself become a constraint. When government policies and priorities change lands dedicated to long-term field collections are sometimes converted to other uses, causing the loss of valuable collections (Strauss, unpublished). When governments are unstable, long-term commitments to land use can be difficult to obtain.

Funding. Funding for germplasm systems in most national budgets is generally not a high priority. Prior to 1960 systematic support for germplasm collection and conservation was confined mostly to developed nations (Wilkes, 1983). Even in those countries, collections were (and still are) incomplete and/or poorly managed. More recently, the funds applied to germplasm programs have increased, but these are still far from adequate (Plucknett et al., 1983). Developing nations also have built a number facilities for plant germplasm (Plucknett et al., 1983). Funding for germplasm facilities has come from a wide range of sources, including the World Bank, Asian Development Bank, Inter-American Development Bank, UNEP, UNDP, FAO, IBPGR, Rockefeller, Ford and Kellogg Foundations, as well as the governments of many developed nations.

Beyond the funds necessary to build facilities, however, is a need for resources to operate them. This requires a continued commitment to support the salaries and operational expenses of germplasm facilities and crop improvement efforts; not only to develop collections, but to continue the processes of characterization, evaluation, documentation, genetic management, regeneration, distribution, and incorporation into crop varieties and livestock breeds. It is these continuing expenses that are frequently neglected.

Conclusion

The collection and maintenance of genetic resources in all nations has progressed considerably in the past decade. The advances in developing nations have largely been due to the efforts of international agencies and technical assistance from researchers, institutions, and foundations in the developed world. Although significant international collections exist for the crops of major importance to global agriculture, considerable work remains to be done in establishing national and regional programs for many minor but important food crops, livestock, forages, and forest species as well as those of purely esthetic value. Perhaps most important is the need for many of these nations to develop a germplasm maintenance and plant breeding infrastructure that will lay a foundation for their own food security. The primary constraints to this development are human and financial resources.

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PRESENTATION OF GERMLASM

RAPPORTEUR'S COMMENTS

Bernard W. Van de Poll *

In presenting his paper Dr. Pino pointed out that a major problem facing work on the conservation of genetic resources is the lack of general interest in the subject. The proposals to build large installations like the international research centers cost too much and in any case are unsustainable in the long run.

Plant genetic resources were originally the responsibility of the plant breeders who needed to have access to the basic material for their own breeding programs. Provided that there was enough material available nobody was concerned about the long term problems of conservation. The present genetic base of the major crops is however very narrow and the need to store genetic material is now apparent. The high yielding modern varieties have displaced the original varieties which were once grown by the farmers. As the planting material is becoming uniform the range of genetic diversity is becoming reduced. We now need to collect the whole range of diversity that remains and it is necessary to involve other disciplines in addition to the plant breeders. A critical issue is who will take this responsibility. FAO and The International Board for Plant Genetic Resources (IBPGR) are possible candidates.

Germplasm conservation has also become important because of the recognition of the problem of vulnerability of crops to pest and disease attack. Examples are the effects of potato blight in Europe and the effect of corn leaf blight in USA. The losses could be catastrophic particularly for foodcrops e.g. cereals. Steps are needed to ensure that material is available to respond to such emergencies.

Most of the plant resource collections have been made by the developed world and only recently have seed collections been started in the developing countries (e.g. India, Brazil). Given the small quantities of material required and the expense of its maintenance it is inconceivable that every country should store germplasm. A world-wide system with an open door policy would be much preferred but there have been disputes over access to elite germplasm and commercial companies wish to retain ownership rights over the material they have under their control. Since in the developed world most varieties of major crops are produced by the commercial companies, these must be involved in some way with the germplasm collection and preservation programs. Varieties of the minor crops are produced by other agencies such as the universities and government breeding stations but these crops have received limited attention. Access to

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germplasm of all the cultivated crops will be essential in order to obtain food security in the future, but many crops are not receiving much attention especially those which are difficult to store or those which need vegetative propagation.

The situation with plant germplasm is much better than that with animals. For instance in USA many of the original breeds of poultry have been lost and there are only about five now remaining.

There is much to be learned about the technology of germplasm conservation, especially how much should be saved, how much duplication is needed and how to estimate the genetic characteristics of the material in store. Not everything can be saved and rationalization is needed because of the logistical and organizational problems and costs associated with the evaluation and rejuvenation of the material. Arrangements must be made to ensure that the responsibility is shared.

The questions listed below were discussed during the meeting.

Q. Who should be responsible for germplasm conservation?

A. There has been some urging by different groups to get the responsibility allocated to FAO. IBPGR is viewed as an independent organization. FAO is seeking to gain access to all elite materials and arranging for all breeders to be able to get material from the germplasm banks. This would require the material to be adequately characterised. However some countries e.g. Ethiopia which is restricting access to coffee material, do not wish to share germplasm.

Q. Is it possible to replace the need to keep collections by using techniques to induce genetic variability?

A. Induced variability might be cheaper in the long run if it can be done. We are not at this stage yet and the plant breeder is limited to what he has available. In some cases it would be desirable to obtain genes from other species. When this can be done freely the need to store large amounts of material will be greatly reduced.

Q. What should the Bank's position be with regard to promoting either hybrid or open pollinated varieties of crops?

A. Until the plant breeders come up with open pollinated varieties capable of yielding at the same level as the hybrids farmers will plant hybrid seed and open pollinated varieties will be discriminated against. The seed companies need to sell seed to stay in business and they will continue to press the hybrids for which seed has to be purchased each year.

Q. Where can examples be found in which it can be demonstrated that the seed banks have had played a key role in a breeding program or overcoming a disaster?

A. The National Academy is producing a paper on crop vulnerability which will address the questions as to whether today's crops are more vulnerable now than they were in the past and whether we need to reduce crop uniformity. Since gene banks cannot be used for generating a response to a crop catastrophe there is a need to anticipate problems, for instance the CIMMYT disease surveillance program in the Middle East, and we also need to build into crops the kind of variability needed to overcome future problems. Multilines are possible and have been used where different genes for disease resistance were available. Genes for leaf hopper resistance used in the International Rice Research Institute (IRRI) rice breeding programs and for improved quality in tomatoes came from seed collections. The needs for uniformity in tomato and pea crops to facilitate mechanized harvesting were provided from seed stocks, but this resulted at the same time in the displacement of existing varieties.

Q. Given that the conservation of forestry and animal resources is lagging behind that of crops what should the Bank be doing?

A. A state of the art study is being conducted and a number of seed banks for trees are opening. However many of the forest species do not store well and more research is needed on either improved storage or finding other means of conservation. The situation with forestry is not too bad. An information system is needed and storage arranged separately for the temperate and tropical species. Little is known about how to conserve livestock and there is much controversy on the methods to be used. Some work has been done on methods involving storage of eggs, semen and embryos. The general opinion is that there are still many breeds available and that they are not being lost. This is not the case for pigs and poultry. Many pig breeds have been lost and there is little wild material that can be used. FAO is characterising breeds but most of the conservation work is done privately e.g. the Rare Breeds Trust of UK. World Bank policies and actions have important affects on world opinion. World Bank pronouncements on the problem are needed, clearly recognising the importance of conservation of crop plants, fodders, forestry and tree species, fish, animals and microbes. The Bank should also be encouraging activities that ensure that the system is open and compatible with the systems operated by commercial companies and taking steps to ensure that priority for germplasm conservation remains with the food crops. The new system must provide for a division of labor and a division of the benefits which would accommodate the needs and fears of the developing countries. The Bank should rationalize the system. FAO has taken germplasm conservation into the political arena and we need to get out of this now. The Bank's role should be to bring the major collections in the larger countries within everyone's reach and develop a cooperation and trust so that each country can rely on the conservation activities of the others. Finally the Bank should consider increasing its commitment to the support of national seed production projects.

A RE-EVALUATION OF APPROACHES TO FISHERIES DEVELOPMENT:
THE SPECIAL CHARACTERISTICS OF FISHERIES AND
THE NEED FOR MANAGEMENT

Francis T. Christy, Jr. **

Large potential gains from marine fishery resources can be realized through development projects if two conditions are met: first, the special characteristics that distinguish fishery resources from other natural resources must be fully understood and accommodated in the preparation of the projects; and second, these characteristics must be effectively dealt with by the adoption and implementation of management practices.

There are several special characteristics to fisheries. But the most important ones are the natural limits to the yields from the resources and the free and open access to the resources. There are also several management measures that can deal with these characteristics, the most important of which is the control over the amount of investment in fish catching.

This paper deals with the two conditions for successful fisheries development. It discusses the significance of these and describes some of the tasks that need to be fulfilled in order to meet the conditions. It is restricted to the problems of capture fisheries, primarily those of the marine environment.

Reasons for Re-evaluation or Approaches to Fisheries Development

The paper has been prepared because it has become apparent that the past approaches to fisheries development based on increased production need to be re-evaluated. There are several reasons for this.

One is that there are significantly reduced opportunities for further expansion of marine catches. The rate of growth of fisheries production dropped from 4.2 percent per year prior to 1970 to 2.9 percent

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per year from 1970 to 1978 FAO (FAO, 1981) ^{1/} This drop occurred even though fishing effort was, in all likelihood, continuing to increase through that period. There are numerous individual stocks of fish that are being fished close to, or beyond, their points of maximum sustainable yields. With limited opportunities for increased catches, there are limited opportunities for investment in additional fish catching capacity. As a corollary to this, there are significant opportunities for increasing net revenues from fisheries by improved management and the reduction of excess catching capacity.

A second reason for re-evaluation is the evidence of failure in the past. A recent study by the World Bank estimated that 47 percent of its fishery development projects had failed to produce satisfactory rates of return (World Bank, 1984). In some of the "successful" cases, the rates of return were positive only because the real prices of the fish products rose more rapidly than estimated in the project document.

The report gives several reasons for the low rate of success. For those projects which actually led to increased fishing capacity, the basic problem was insufficient awareness, in the preparation of projects, of the limits of the resources and of the necessity for fisheries management.

Third, re-evaluation is necessary because of the growing awareness that excessive attention has been given to large-scale fisheries and that small-scale fishermen have not generally benefitted from development projects and, in some cases, have actually been damaged (Emmerson, 1980; Kurien and Mathew, 1982). This awareness is reflected in a number of policy statements. The World Bank has stated that the small-scale sector will receive increasing attention (Sfeir-Younis and Donaldson, 1982). The FAO World Conference on Fisheries Management and Development stressed the importance of small-scale fisheries and proposed a special Action Programme (FAO, 1984). An International Conference of Fishworkers and their Supporters was held in Rome in 1984. It "highlighted the desirability of the small-scale fishery sector in unambiguous terms -- it is labour and social skill intensive; capital and fuel saving particularly with the option of multiple energy use. It gives rise to decentralized settlement pattern and does not promote large income disparities.... The desirability of the small-scale fisheries sector to

^{1/} These rates refer to trends of a price-weighted output index. On the basis of simple aggregate tonnage of catches of all species (the usual measure presented) the change was even more dramatic -- from 6-1/2 percent per year to about 1.0 percent per year. This was largely due to the rapid growth and sudden collapse in the early 1970's of the Peruvian fishery for anchoveta, a low-valued species used for fish meal.

developing countries is therefore stressed not only on social and welfare grounds but more for economic, technical, ecological and organizational reasons" (Kurien, 1986).

Many national governments have also recently adopted policies especially geared to improving the welfare of their small-scale fishermen. For example, Indonesia banned all trawling in the waters of Java and Sumatra in 1981 specifically for the purpose of protecting the incomes of the small-scale fishermen.

Finally, the recent developments in the law of the sea also point to the need for re-evaluation of approaches to fisheries development. In a few cases, the extensions of national jurisdiction have led to a transfer of wealth from developed to developing coastal States. More important, however, they have provided coastal States with the authority that is necessary for effective fisheries management. As discussed more fully in Section III, the management functions must be fulfilled by government for the fishery sector as a whole. It is not, for example, desirable to regulate effort in one particular fishery without taking into consideration the effects on other fisheries. For the same reason, fishery development projects should not be considered in isolation from the influences of, and effects on, other national fisheries. As part of the re-evaluation of approaches to fisheries development, therefore, emphasis must be given to understanding the fishery sector as a whole.

Development Opportunities

There are four kinds of development opportunities on which the re-evaluation should focus. First, although the global prospects for expansion in fish production are not great, there are some stocks in areas beyond the reach of present vessels. They are not currently exploited because the density of the stocks, and the catch rates, are low relative to the costs of travel and search time. Other stocks may be lightly exploited because of low demand.

In a few cases, appropriate innovations in technology may make exploitation economically feasible. In other cases, an increase in real prices may be necessary before development takes place. Since such increases are likely to occur (as demand exceeds supply for the preferred species) these stocks offer some prospects for development. Such prospects, however, must be examined with considerable caution in order to avoid damaging spill-over effects on the existing fisheries.

A second opportunity for development can be found in those coastal States which have acquired jurisdiction over resources previously, or currently, being taken by foreign distant-water vessels. The opportunity to replace foreign fishing effort is, however, limited to a very few developing coastal States. Distant-water fishing effort has focussed on a few stocks that could be caught in great abundance at low cost or that have high value. Such stocks are found only off developing coastal States in a few regions of the eastern central and south Atlantic and south eastern and south Pacific (FAO, 1981). The prospects for the exploitation of these stocks by the developing coastal States must also be

approached cautiously. Efficient exploitation, in some cases, may best be achieved through large-scale, mobile vessels and technologies that are beyond the present reach of the States.

A third opportunity for development lies in the shift in emphasis towards small-scale fisheries. In most cases, the expansion of small-scale fishing effort will not be possible without restraining the larger-scale domestic operations, particularly the trawlers and purse seiners. Some developing States (e.g. Indonesia) have already imposed such restraints and have, thereby, provided the opportunity for the expansion of the small-scale sector. Several other States are attempting to do the same by pushing the larger-scale operations further offshore.

The final and perhaps most important opportunity for "development" projects is found in the potential for increasing net benefits by the rationalization of the fisheries. As discussed more fully below, the removal of redundant capital from a fishery can produce very large economic revenues and contribute more to the economy than additional investments in fishing capacity. Rationalization of fishing effort can reduce the total costs of fishing and, in some cases, produce higher total catches and total revenues. Although it might be argued that these are not development projects, since they call for a withdrawal of capital, they should still be considered as appropriate projects by financing institutions.

The Special Characteristics

In order to take advantage of these prospects for development, it is necessary to understand and accommodate the special characteristics that distinguish fisheries from other natural resource industries. The following discussion describes two of the most important characteristics -- limited yields and free and open access -- and the problems they create for planning and the preparation of development. ^{2/}

Limited Yields

A fishery stock in the marine environment can produce only a certain amount of yield. In a few special cases, the yield can be enhanced by cultivation techniques. But, for the most part, this is not possible or economically feasible. Four sets of problems for planning and project preparation derive from the property of limited natural yields.

Decline in catches per unit of effort in single-species fisheries: As the amount of capital and labor increases in a developing single-species fishery, the average catches per unit of input will decline. The decline will occur not only in tonnage of catch per unit but also, in most cases, in the size of individuals caught since the larger individuals will be removed from the stock. Generally, the average value of catch per unit of effort (prices remaining constant) will decline more rapidly than the average quantity.

^{2/} Other important characteristics include the high degree of uncertainty in estimating yields and the multiplicity of products. (See FAO 1986)

Although the declines in catches per vessel for all vessels fishing a particular stock are inevitable with the growth of a fishery, these have not generally been taken into account in project preparation. Instead, it is assumed that the project will lead to higher catches per vessel. This assumption may hold true in the short run for the project vessels in a fishery that is not fully exploited. But, if the fishery is already fully exploited, increased catches per unit of effort cannot be achieved except at the sacrifice of yields to other vessels. If the fishery is not fully exploited at the beginning of the project, initial catch rates may be high but will decline as more vessels enter the fishery. In essence, in a developing fishery, each additional unit of effort carries external diseconomies for all existing units of effort. The problem is the extent to which these diseconomies affect the rates of return.

Declines in total quantity of catch: The annual catches of a particular stock of fish may decline if excessive fishing effort is applied.^{3/} This has already happened in a large number of cases. While such declines may not affect financial feasibility of individual vessels, if prices for the product rise, they will seriously affect economic rates of return for the fishery as a whole. These effects are discussed below in the section on allocation of capital and labor between fisheries and other sectors of the economy.

It should be noted, however, that declines in total catch affect other elements of the fishery sector as well as the harvesting element. Projects designed to increase processing capacity or to enlarge marketing and distribution facilities are based on estimates of certain levels of throughputs. If these projects increase the revenues to fishermen, they will tend to attract excessive amounts of effort and lead to depletion of the stocks. The lower catches, in turn, can make the processing, marketing and distribution facilities uneconomic. Similarly, attempts to increase protein supplies or export earnings by subsidizing increased fishing effort can have the opposite effect where the stocks are subject to depletion. In the preparation of projects which are dependent upon minimum levels of supply of fish, the capacity of the stocks to sustain those levels must be considered.

^{3/} A few species are not readily susceptible to depletion. These are the species which reproduce before reaching harvestable sizes and which do not live long or grow very much after reaching harvestable sizes (e.g. certain species of shrimps). Aside from environmental effects, the annual yields from stocks of these species may be constant over a wide range of fishing effort. But while total catches may remain constant, economic waste will increase with increasing effort.

Shifts in composition of catches in multispecies: There are many fisheries, especially in tropical waters, that take a wide variety of species. This is because the gear (e.g. trawl nets, push nets, small-meshed set nets) is not particularly selective and because there tend to be large numbers of different kinds of species in warm tropical waters. In some cases, although the fishermen may be targetting on a single species (e.g. tiger prawns), they cannot easily avoid large amounts of by-catch of other species.

In multispecies tropical fisheries, increases in fishing efforts may continue to produce increases in total tonnage of catches, and limitations of yields may not be apparent. There will, however, be changes in the composition of the catch. In the case of most shrimp fisheries, the proportion of shrimp in catch declines rapidly during development (often to 20 percent or less of the total landings of trawlers) and the sizes of other fish taken in the nets also decline. In other multispecies fisheries, the species that live longer and reproduce more slowly tend to be replaced by the species with shorter life spans and higher reproduction rates - species that are generally, though not always, less valued and lower priced.

Thus, increased fishing effort in multispecies fisheries generally leads to decreased total value of catches (with constant prices) rather than decreased quantities of catches. Catch statistics normally do not take account of changing values resulting from changing composition of catches. Nevertheless, to improve present development planning and investment project preparation, composition shifts should be anticipated, insofar as possible, and attempts made to assess the changes in economic terms.

Rising real prices: The above discussion has assumed constant prices. However, it can generally be expected that prices for particular species will rise as all the different individual stocks of a particular species become subject to full utilization and as demand continues to grow in response to rising populations and per capita incomes. For agriculture and most other natural resources industries, a higher price stimulates more investment and leads eventually to increased supply. But in fisheries the consequences can be damaging.

An increase in price increases total and average revenues. If access is free and open, the higher average revenues attract additional fishing effort. This puts greater pressures on the stocks and, in some cases, increases depletion and vicious circle which will continue until the product prices itself out of the market.

Shortages of supply and rising prices also affect patterns of consumption. Low income consumers are forced to turn to lower quality products or less preferred species or may have to decrease their

consumption of animal protein. In some cases, the move to less preferred species may be beneficial in opening up new markets and stimulating the development of stocks that have been underexploited because of the lack of sufficient demand.

At present there is little information about the extent to which prices have actually increased and about the ways in which the increases are affecting fishing and consumer behavior.^{4/} The lack of information on price trends and the tendency of fishery administrations to ignore or neglect economic values serve to obscure the consequences of overfishing and to distort national planning for fisheries development. For instance, national statistics may show that current values of fishery catches are increasing. But the increases in total value may be due to increases in real prices rather than catches. For national planning purposes, it is necessary to separate out the factors of real price changes and the shifts in catch composition. This can be done, at least in part, by the construction of price-weighted output indexes. It is also essential for national planning that price increases be anticipated, that the effects on fishing effort and consumers be understood and that plans be made to control, or deal with the consequences.

It might be noted that some fishery development projects have produced satisfactory rates of return on investments only because of significant increases in the real prices of the product rather than in the amount of fish caught, as was intended. If the price increases occurred because of depletion of the stock, it can be questioned whether a satisfactory rate of return on investment is an appropriate measure of the benefits of a project.

Free and Open Access

A critically important characteristic distinguishing fisheries from other natural resources is the lack of satisfactory property rights. The fugitive nature of most fishery resources, together with the mobility of fishing gear, make it difficult to place property boundaries around fish. In the past, this difficulty, together with the assumption that the abundance of the sea's resources precluded the need for property rights, supported arguments in favor of the freedom of the seas. As it became clear that the assumption of abundance was fallacious, countries asserted claims of exclusive jurisdiction to extended areas of the sea.

A number of important fish stocks are found within the zones of two or more coastal States and some also occur both within and beyond

^{4/} A study on trends in real prices for fish is currently underway in FAO.

coastal State jurisdiction. This special characteristic of fisheries creates particularly difficult problems for development planning and certain investment projects, the most obvious of which is the inability to determine the amount of the resource that will be available for harvest by the coastal State planning a development activity. There is a need for the sharing States to reach agreements on the allocation of the yields from the stocks. Where such agreements can be reached and are respected, there is a basis for relatively sound development programmes. But there are few areas, so far, where effective agreements are in place. The difficulty of determining the yields from stocks shared with other States does not preclude development programmes but it does require that the programmes allow for a higher degree of uncertainty in estimating total and average catches than for non-shared stocks.

For non-shared stocks, the extensions of national jurisdiction have provided nations with a generalized property over the resources. A few countries (e.g. Australia and New Zealand) have created more specific rights within their zones by limiting access to the fisheries and providing licences or individual quotas to the fishermen. In some cases more definitive rights are available through territorial use rights over fisheries (TURFs). Such rights have been institutionalized in Japan (Asada, Hirasawa and Nagasaki, 1983) and exist as traditional management systems in a number of isolated small-scale fisheries (Christy, 1982). These systems of property rights allow for highly effective development of fisheries but they have not yet been adopted in most countries.

As a result, access to fishery resources within national zones and to specific stocks and grounds is free and open and is shared by all nationals who wish to enter the fishery. The shared access to resources and grounds has major implications for the allocation of capital, labour and natural resources and also for the distribution of wealth. These implications can be divided into three sets of problems critical for development planning and investment project preparation.

Allocation of capital and labour within the economy: As discussed above, unregulated access to fishery resources can lead to depletion of the stocks. But, in addition to this biological waste, unregulated access also leads to economic waste through the application of excessive amounts of capital and labour. This can occur whether the stock is physically depleted or not.

In agriculture and most other renewable natural resource sectors where satisfactory property rights exist, capital and labour are employed to the point where marginal costs and revenues are equal and the differences between total costs and total revenues is maximized. But, in open access fisheries, the difference between total costs and revenues constitutes a surplus profit (economic rent) that can be shared by the fishing units. Where this difference exists, the surplus profits attract

additional capital and labour up to the point where total costs come to equal total revenue and the surplus profit is dissipated. It is common in an exploited open-access fishery that a reduction in the number of fishing units will reduce total costs to a greater degree than total revenues and, in some cases, actually lead to an increase in total revenues.

At the individual fisherman's level in a fully exploited fishery, the open-access condition means that his share of the total catch is decreased as additional fishermen enter the fishery. "In practical terms this means that the net economic returns from projects implemented where fisheries are already fully or overexploited can be expected to be negative. It is, of course, possible for them to be financially profitable, but the clear implication is that others will then bear the cost of lower catch rates, turning the net economic returns from a project negative, or at the least marginal" (Palfreman, 1986). Over the long run, financial profitability may also be affected as additional fishing units enter the fishery (but this will, of course, depend upon the movements of the prices).

In addition, the open-access condition "implies that projects cannot earn more than normal profits (profits just enough to retain capital in the industry).. This suggests ... that appraisals which have produced high internal rates of return in a fully exploited common property context have been undertaken with a faulty methodology " (Palfreman, 1986). Similarly, appraisals producing increased incomes to fishermen are also based on faulty methodology.

Fishery projects must, therefore, deal with the problems created by free and open access. This, in turn, requires that development planning and project analysis should incorporate measures, costs and benefits for the management of fisheries. The latter point is discussed in Section III.

With regard to analytical methodologies, it is necessary to find ways for placing an appropriate price on the resources or for estimating the external diseconomies associated with additional units of fishing effort. These are difficult tasks since the value of the resource depends, among other things, upon the relationships between yield and effort. Such relationships are seldom very clear, particularly with regard to fisheries which harvest several different species simultaneously. Nevertheless, some estimates must be made in order to avoid projects which lead to a misallocation of capital and labour.

Such analyses may also help to identify "disinvestment" projects. The economic benefits of disinvesting in fisheries capital can be extremely large. For example, it has been hypothesized that a reduction in the number of trawlers operating on the west coast of Peninsular Malaysia might produce economic rents on the order of US\$ 100 million per year (FAO/IPC, 1986). This estimate was derived from information that the value of the

trawler landings in 1978 was 87 percent greater than that of 1982 but was taken with 15 percent fewer trawlers.

For the fishery for cephalopods (octopus, squid, cuttlefish) in the area north of Cape Verde on the West African coast, it was estimated that fishing effort in 1972 was 65 percent greater than that required to take the maximum sustainable yield (MSY) and that, as a consequence, the stocks were overfished to the point where catches were 18 percent less than MSY. In economic terms, this indicated a dissipation of economic rent on the order of US\$ 200 million per year (Christy, 1979; see also Griffin, Warren and Grant, 1979).

A reduction in fisheries capital and labour in such cases can lead not only to the production of net economic revenues that are currently being dissipated but also to more efficient allocation of capital and labour since the redundant units could be transferred to other more productive enterprises (assuming that opportunities exist).

Against these benefits, it is necessary to take account of the costs of controlling access to fisheries. These costs can be high in monetary terms (e.g. the employment of fisheries protection vessels to enforce the controls) and in political terms (because such controls inevitably require a re-distribution of wealth).

There are also some situations where social considerations may outweigh economic ones. Where alternative employment opportunities are non-existent or unsatisfactory (as in the case of many small-scale fishing communities), it would not necessarily be desirable to attempt to improve economic efficiency by removing surplus fishermen but it still may be worthwhile to remove redundant capital.

Nevertheless, the potential contributions to the economy from controlling the amount of capital and labour in fisheries indicate the international financing institutions should consider the possibilities for undertaking fishery disinvestment (restructuring) projects in those situations where the conditions (including government policies) are appropriate.

One of the essential elements of a disinvestment project would be the "buy-back" measures under which the excessive fishing units are purchased from the fishermen and removed from the fishery. Such measures must be complemented by controls against new entry.

A strategy along these lines was proposed in the fishery sector study prepared for Malaysia by the FAO Investment Centre (FAO, 1985). This project supports the Malaysian policy of removing superfluous fishing effort and it proposes measures to make the access controls more effective, improve enforcement capability and facilitate the relocation of fishermen. Although the Asian Development Bank, for whom the study was undertaken, has not yet adopted the proposals, many of them are now being put into effect by the Malaysian Government with some help from the FAO Technical Cooperation.

Allocation between different fisheries on the same ground: Open access frequently results in the same fishing ground being used by different fishing gears for the same or different resources. A common example is that of trawlers operating in inshore areas also used by fishermen with gill nets, trammel nets, traps, etc. The different groups of users may be targetting on the same stock, on stocks that are interrelated or on different stocks.

In the common ground fisheries, development programmes and projects can seriously affect the distribution of wealth. Where aid is given to one group, it may allow them to increase their share of the yield at the expense of another group. Or it may allow them to receive higher prices because of the ability to reach the market first. Where competition is for the space rather than the resource, incompatibility of the gear can lead to conflicts, as when trawl nets damage stationary gear. Such conflicts have been pervasive and severe.

These kinds of externalities need to be taken into account in the preparation of investment projects and in development planning. Calculations need to be made to determine the allocation that will be most efficient in meeting national objectives. Also, it is imperative that a project designed to aid one group of users calculate and evaluate the effects on other groups of users.

Allocation between grounds for the same resources: The same resource, or resources that are closely interrelated, may occur on different grounds and be used by the same or different kinds of gear. One instance of this kind of sharing occurs where foreign fishermen are allowed to fish for stocks also used by domestic fisherman. In this case, it is not so much the quantity of fish that is allocated to the foreigners that is important as it is the effect of foreign fishing on the catches per unit of effort by the domestic fishermen. There are trade-offs between the revenues that can be received from foreign fishermen and the profitability of the domestic enterprise.

Another instance is that of a sequential fishery where the juveniles of a particular stock are harvested in one area by a group of users and the adults are harvested in a different area by a different group of users. ^{5/} Harvesting of the juveniles may be done at relatively low cost to the economy and may produce benefits for artisanal fishermen. But the fishing of juveniles may reduce the quantity of fish available at the adult state where prices are higher.

Allocation between grounds is also of general importance in many fisheries where the stocks are heavily exploited in inshore waters and lightly exploited or not exploited at all in offshore areas. This is generally due to the lower costs and higher yields occurring in the inshore waters. In agriculture, differences in the values of land are accounted for in the price of the land so that the land at the margin commands a low price but is still brought into production. In fisheries, however, where grounds have no value because of free and open access, there is no means for allocating capital and labour efficiently between grounds. The lower

^{5/} A study of a sequential fishery for shrimps has been made by Willmann and Garcia (1985). Models for analysis of sequential fisheries are currently being developed by FAO.

yield or higher cost grounds will remain unused until the average revenues (rather than marginal revenues) of the richer grounds have been reduced to the level of the poorer grounds.

Many countries attempt to deal with this by prohibiting vessels above a certain size from fishing within certain distance offshore. Investment projects are sometimes predicated upon effectiveness in enforcing these regulations. But such enforcement is generally difficult, with the result that the projects lead to the application of additional fishing pressure to stocks already fully exploited and often to conflict between those who acquire the new technology and those who do not.

In these various instances, calculations need to be made to determine the optimal allocation of effort between the different grounds and the different users. As in the case of allocation between gears, the failure to consider the effects of development projects for one set of users upon other users of the same resource can have damaging consequences. In addition, projects designed to develop offshore grounds should incorporate in the analysis the costs to government of ensuring that the offshore effort does not intrude in the inshore area. The inclusion of such enforcement costs seems to be difficult for international financing agencies, and yet this function of enforcement is analagous to the function of a fence around agricultural land.

Management Requirements

The absence of satisfactory property rights is the major cause of misallocation of capital and labour, depletion of stocks and conflicts over the distribution of wealth. In order to deal with these consequences some public body must fulfill the functions of management that are generally and ordinarily fulfilled by the operators or owners of privately owned natural resources in free market economies. ^{6/}

With regard to privately owned agricultural land, these functions include the choice of what to produce and the objective to be obtained, the acquisition of information for making decisions, the allocation of capital and labour, and the surveillance of the property to maintain and protect the exclusive rights of the owner. These are basically the functions of managing the resource. For projects dealing with privately owned resources, it is generally assumed that most of these functions will be automatically fulfilled by the owner.

For common property fisheries, these management functions must be fulfilled by the government (whether at the national, provincial or local community level. Government must determine the objectives to be sought from the use of the resources. It must acquire the information needed for decisions. Most importantly, it must determine both how much and what kinds of capital and labour to use and how to allocate capital and labour

^{6/} In centrally planned economies, the functions of management (e.g. allocation of capital and labour) can, in theory, be fulfilled by the planning bodies. However, it appears that such economies have as much difficulty in managing their fisheries as do market economies (Mena Milla, 1986).

between and among different gears, groups of fishermen and grounds. And, finally, government must ensure compliance with the regulations and controls over access.

This definition of fisheries management differs from that used by many writers in the field. Frequently, "development" is taken to mean an increase in capital and labour and "management" as the regulation (or reduction) of capital and labour. Thus, in this sense, development is contrary to management. But if management is defined in terms of its functions including that of the allocation of capital and labour, then either an increase or a decrease in capital and labour is an act of management. In this sense, fisheries management comprehends both investment and regulation.

Palfreman uses the term management in its more restrictive sense. "Once management is seen as a precondition for development ... the institutional side of development takes on a much greater importance. The management mechanism or the control system for a fishery may be a part of its opportunity costs, and may also be a cost which is properly attributable to projects if it varies with the scale of government intervention" (Palfreman, 1986).

Even though the definition is different, the conclusion is the same. The incremental costs of fulfilling the management functions should be included in the calculation of the economic returns of the project.

The Choice of Objectives

The objectives of individual fishermen are fairly clear -- to produce enough food for his family or to maximize his earnings. But, for governments, the choice of objective is not so clear. Governments may seek to manage fisheries so as to protect or enhance employment opportunities. They may wish to maximize net economic revenues, increase fishermen's incomes, achieve high export earnings, produce low-cost protein, etc.

These different objectives are not entirely compatible and some can be achieved only at the sacrifice of others. For example, the objective of increasing net economic revenues will require control over the amounts of capital and labour which will reduce employment opportunities. The objective of increasing export earnings, in some cases, may be achieved only by increasing large-scale fishing effort on stocks in inshore waters which may damage the interests of small-scale fishermen.

Because of the common property characteristic of fisheries, the choice of management objectives invariably has implications for the distribution of wealth, benefitting one set of users at the cost of another. The choice of a management objective in fisheries, thereby, may have somewhat more direct and significant political implications than do choices for development projects for other natural resources.

Projects which do not take these distributional effects into consideration may not be implemented successfully. In some cases, it will be desirable to take account of the distributional effects to facilitate the relocation of displaced fishermen to other areas or different jobs or by providing funds to buy out surplus vessels. The costs of compensation should be included in the project.

The Acquisition of Information

The management function of acquiring information may be somewhat more costly for fishery development projects than for other projects. One of the special characteristics of fisheries, not discussed above, is that of the relatively high degree of uncertainty in the estimation of total production and production per unit of effort (see FAO, 1986). This uncertainty is due to the fact that it is more difficult to count fish than land animals or agriculture output and to the complexity of the interrelationships among different species of fish and between fish and their natural environment.

Although this lack of certainty can be accommodated in project appraisals (through sensitivity analysis and the use of high risk coefficients), it is particularly critical for fishery projects to allow for information costs during the implementation stage of the project. The consequences of fisheries investment or regulation cannot always be clearly forecast. But experience has shown that regulations on access generally have an extremely powerful effect on economic returns. Thus monitoring of the project can become quite important and it may be desirable to build a research programme into the project to produce the information required.

Allocation of Capital and Labour

The most difficult management function to build into a fishery development project is that of allocating capital and labour. This requires not only determining how many units of capital and labour should be employed but also how to limit investments at the appropriate level. This is difficult in several regards.

First, it is not easy to estimate the optimum level of investment. The theory is far from perfect. It has been developed largely for single-species fisheries in North Atlantic economies and has little relevance for multispecies fisheries in developing countries (Christy, 1986).

Second, the imposition of controls on the amount of fishing effort frequently has distributional effects and is likely to incur political opposition. "The fact that controls affect the distribution of income makes the decisions on control essentially political in nature. The establishment of such controls must, therefore, be supported through the

political process. Without such support fishery administrations will find it difficult to adopt and implement the controls. Thus, it is important that distribution decisions be made at the highest levels of government" (FAO/IPFC, 1983).

And third, the techniques for controlling fishing effort have not been perfected and vary with regard to different fisheries and different situations. For example, it is not sufficient to say that when the optimum number of vessels is in the fishery no new ones will be allowed to enter. This ignores the dynamic nature of the fisheries and the incentive of each individual fisherman to increase the fishing power of his vessel. Thus, if the number of vessels is limited, the fishermen will increase the size of their vessels, add more horsepower, use larger nets or seek other ways to increase their individual catch. Other techniques for controlling fishing effort also have their difficulties.

These difficulties should not be over-emphasized. A number of developing countries have already adopted various forms of controls over fishing effort and, although there may be imperfections in the controls, they still serve to prevent some of the waste resulting from free and open access. ^{7/}

Enforcement

Whatever technique is chosen for controlling fishing effort, there should be a sufficient degree of compliance to ensure that the objectives of the project will be met. The costs of enforcement to achieve this degree of compliance will vary with the situation and the techniques that are chosen. But, in all cases, the costs should be included in the project analysis.

Summary and Conclusions

A re-evaluation of approaches to fishery development projects is desirable for several reasons. Among the most important reasons is the low rate of success of fishery projects and the consequent reluctance of some financing institutions to continue support in this area. It would be regrettable if this reluctance were to persist since both the needs and the opportunities for increasing the net benefits from fishery resources are great.

One of the chief reasons for failure of fisheries projects has been the lack of attention to the special characteristics that distinguish fisheries from other natural resource industries. These characteristics include the natural limits to the yields from fish stocks and the condition of free and open access that generally prevails in most countries.

^{7/} The techniques and problems of regulating fishing effort have been widely discussed. For publications relating primarily to developing countries see: Panayotou (1982); and Christy (1982 and 1986).

Development projects which fail to take account of these characteristics cannot succeed in raising returns to capital and labour beyond their opportunity costs. In some cases, such projects may even be damaging in that they may reduce total yields by depleting the stocks, or reduce fishing opportunities for other fishermen using the same resources or same grounds.

Improvements in fishery project preparation will require two kinds of tasks. First, it is necessary to devise methodologies for analyzing the costs associated with the condition of free and open access and the benefits of controlling access. And, second, it is necessary to devise techniques and institutions that will permit effective management of the fishery. The incremental costs of management will need to be included in the project analysis. The fulfilment of these tasks, and the preparation of guidelines for fishery project analysis, will require contributions from project analysts and from those knowledgeable about fisheries management. "Technical change is costly, but it often promises benefits to individuals willing to take the risk. Institutional change, on the other hand, is not only costly but the benefits -- often diffused over a large group -- do not directly accrue to the innovator ... (However) it is to the area of institutional change that inputs from the public sector should now be channelled" (Cruz, 1982).

With regard to individual projects, it will be necessary to view these in the context of the fishery sector as a whole. The relationship between the proposed target fishery and other fisheries has to be carefully examined because of the mobility of capital and labour between fisheries. Since mobility of labour into and out of fisheries is important, the alternative opportunities for employment must also be evaluated. Furthermore, the imposition of fishery regulations requires not only the will of the government but also the institutional means for implementing effective fisheries management. Even if management is to be performed at the local community (or project) level, decisions by the national government will be necessary. Sector reviews are, therefore, a necessary ingredient in fishery project preparation.

Although the tasks of improving fishery projects may be difficult, the rewards will be very high. Investments in the rationalization of fishing effort can, in many cases, lead to the production of large amounts of economic rents and contributions to national economies. Furthermore, such investments properly prepared and implemented can greatly increase the benefits to small-scale fishermen -- those who are most urgently in need of help.

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A RE EVALUATION OF APPROACHES TO FISHERIES DEVELOPMENT:
THE SPECIAL CHARACTERISTICS OF FISHERIES

RAPPORTEUR'S COMMENTS

Lucian M. Sprague*

In response to the speakers' remarks about a perceived opportunity for disinvestment to correct existing overinvestment in some fisheries, the following question was asked. "Have there been successful disinvestment projects?" The speaker replied that some of the developed economies had implemented such schemes coupled with strict licencing arrangements which effectively conveyed ownership in the fishery to licence holders. Australia's experience was cited as an example.

It was noted that substantial experience in developing countries with such projects had not yet been gained but that there were some substantive proposals being considered or developed.

The question of the environmental impact of land based activities on the marine eco-systems ability to sustain production was asked. The speaker answered that few good estimates on the overall situation were available.

A question was asked about the role of aquaculture in the context of worldwide fisheries production and in what way aquaculture was different from the ocean based fisheries.

A discussion followed indicating that: aquaculture production is still a relatively small part of overall food fish production amounting to about 5% of the total. Aquaculture usually is conducted in the framework of some kind of tenurial system and the aquaculturist (fish farmer) makes investments on this basis with the expectation that he has control of both his inputs and his outputs which differs significantly from the common property framework in which coastal fishermen operate. This led to a discussion of the importance of incorporating management plans in investment projects which in turn led to a discussion of the difficulties which would be faced in doing so. In some situations fisheries are considered as an employer of last resort serving as a kind of social safety net. In these situations management plans involving limited entry would not be appropriate. It was clear from the discussion that various speakers had different perceptions as to the significance of the concept of fisheries as an employer of last resort which may indicate that little good data is available with which better judgments might be made.

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The question was asked whether fisheries and in particularly the small scale fisheries (which the speaker had emphasized) had any special marketing problems, which would set them apart from agriculture. A brief discussion highlighted perishability, seasonal factors and the remoteness of landing places but it did not appear that these were differences which uniquely characterized fisheries in contrast to some other (agricultural) commodities.

A question was asked in the following form. In the light of the generally poor success of fisheries projects what should fisheries technical and administrative personnel do to improve this situation? The speaker responded that it would be desirable to:

- i) improve the institutional framework in which fisheries projects are implemented particularly in the rural setting;
- ii) develop improved fixed gear fishing technologies which will facilitate the acquisition of satisfactory community fishing rights;
- iii) decline to invest in projects which subsidize or foster overinvestment;
- iv) undertake detailed examinations and analyses of the fisheries sectors in order to better quantify the economic benefits which could be captured by improved management; and
- (v) improve our understanding of existing traditional management systems, strengthen existing institutions, or at the least prevent the destruction of traditional systems by replacing them with unworkable "modern" schemes.

The question was asked "Are there opportunities for international agreements to reduce fisheries effort in ways roughly similar to the International Whaling Agreements?" The speaker answered that there are few opportunities for such agreements since small scale fisheries are usually not conducted in an international framework and in larger scale fisheries political difficulties are severe.

The linked questions "What is the state of knowledge of fisheries stocks?" and "Would better knowledge lead to improved management techniques" were asked. The speaker answered that knowledge of major commercial single species stocks is now generally adequate (worldwide), although there may be need for studies of local stocks on a case by case basis, as well as better understanding of multispecies stocks under fishing pressure. A discussion followed on the need for stock assessment research and the adequacy of echo location gear in resources surveys.

Further discussion indicated that better and more social and economic research might be the key to fisheries management since we frequently lack good techniques for identifying and defining key social indicators in the fisheries sector. In particular, the many issues raised by the distribution or allocation of benefits are often barriers to management.

The question was asked How might financing institutions justify investment in "disinvestment?" The speaker responded that a sectoral approach including institutional strengthening, training, and financing of new investment tied to restructuring of existing investment appeared to be the most promising approach.

A comment that fisheries lending experience by the Inter-American Development Bank had been most successful when there was significant involvement of the private sector in the execution of the project was followed by a discussion agreeing in principle but indicating that there are exceptions, pit falls and difficulties. Then a discussion of what happens to the "economic rent" produced by fisheries management followed--coming to the conclusion that a mixed result has been the experientiae. Experience has been strongly affected by the prevailing political philosophy and by the fact that methods to capture economic rent are not well defined and difficult to implement.

Further discussion gave rise to the comment that in the experience of fisheries professionals most failures of fisheries investment projects had little to do with lack of management or overinvestment but were due, first to institutional and political inadequacies in the sector and second to poor project concept and design. The speaker commented that had the failed projects been successful they would have led to overinvestment thereby containing the seeds of their own destruction.

The degree to which the fisheries sectors contributed to measures of Gross Development Product was then discussed. Figures of between 2% to 20% were put forth. (FAO data suggest a range of from about 15¢ for South Yemen to 2% for Indonesia to be reasonable).

The contribution to production and management systems of fish attraction devices, artificial reefs, brush parks, etc. was discussed. Their role in the production process is not well understood as the question of whether they simply focus existing biomass or add to it is an open one. But they do offer an innovative and significant role in management depending on their design, location and ownership, and the type of fishery in which they are concentrated.

SESSION III: DIVERSIFICATION

DIVERSIFICATION, SUSTAINABILITY, AND ECONOMICS

D. L. Winkelmann*

The theme of this workshop is sustainability in agriculture. I have been asked to talk about diversification as it applied to sustainability. I take it as given that sustainability is important and that, for some parts of the globe and from some perspectives, its importance runs well beyond the attention it is receiving. I will concentrate on sustaining productivity in agriculture, with little attention to issues related to other domains and even without going much into spillover effects beyond agriculture per se., e.g., ground water and down-stream pollution. I am then, focusing on the land, the water, and the germplasm employed in agriculture.

I will start by talking about sustainability, technology, and free lunches, then relate diversification to sustainability, talk about agricultural policy, and mention some research issues. Before doing that I would like to identify what I mean by "diversification" and "sustainability" and to review a bit of history. By diversification, I am referring to the addition of activities which place demands upon the land or water base of agriculture.

As for "sustainability" let me observe that the term can easily give rise to misunderstanding or to mischief. In its usual context it relates to causing to continue, maintaining at length without interruption, weakening, or loss of power or quality. Well-tended systems of farming and ranching can function without interrupting quality but, most believe, not at levels of production sufficient to maintain roughly current relative food prices for roughly current populations. To think of sustaining in the context of uninterrupted maintenance of quality and power is too exacting a standard. One more consistent with circumstance, especially as it is conditioned by the dynamism of science, defines sustaining in terms of a natural endowment managed so as to permit the maintenance of yields through the application of relevant new science with roughly constant relative prices.

Amplifying a bit, through time science has given us new technologies, e.g., in fertilizers, in pesticides, in varieties, and in machinery, which make it possible for us to take constant or larger harvests even in the face of declines in initial natural endowments. For example, according to work reported by Duvick, present maize varieties for temperate areas seem better able to withstand the stress of pest and drought than did earlier varieties. They are, then, able to offset drains on the natural environment which would otherwise lead to reductions in production. But that is not enough. Beyond that we need to know something about the cost of that science and about the relative prices of foodstuffs. We would not be sustaining if the benefit cost calculus for

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that science required increases in relative food prices to make its undertaking worthwhile, hence the reference to science and to relative prices.

History gives examples of the fates suffered by civilizations whose agricultural production could no longer be maintained. For the most part, however, the more dramatic cases seem to be related to changes in climates. For more on this I comment to you an imaginative book by Reid Bryson and Thomas Murray called Climates of Hunger. Among others they talk about the mound cultures of Illinois and Missouri, societies which numbered into the thousands with large public works as manifestations of their considerable incomes and populations. These cultures were based on maize. Around the 1300s, according to Bryson and Murray, the climate changed, drying up, with consequences for maize production and for the distribution of game. Over time the people retreated south, leaving that portion of the prairie sparsely populated by the time of the arrival of westward moving European Americans. A whole civilization, then, unravelled because productivity could not be maintained.

Our concern is less with long-term trends in climate, more with maintaining production in the face of the acts of man. Some particularly telling examples are in the overgrazed areas of the Sahel and in the heavily eroded areas of central Mexico. But whether man or climate, the consequences of declining productivity can be staggering.

Sustainability and Free Lunches

Clearly, if we are to sustain we must forego, either in the sense of lower levels of production than would otherwise be possible in the short run, in the sense of reinvesting some portion of the production so as to maintain productivity, or to support research on the new processes which promise great efficiencies. In foregoing, we are in the economists' world, viewing alternative income and cost streams and valuing the options through discounting. The models for undertaking such evaluations are clearly framed and wait only the values of critical parameters to be made operational. Unhappily, for much of the developing world there is little information about those parameters. Even so, we all understand that one such critical parameter is the discount rate -- the higher the discount rate, the lower the present value of future production, and the less the inclination to surrender present consumption from current production in order to sustain that production into the future. Low discount rates favor sustainability, high discount rates mitigate against it. It is no accident that the issue of sustainability is more pressing in poorer countries than in richer ones, for it is precisely the poor who perceive high discount rates.

One of the ways to foster sustainability is through research. The new, more efficient, more stress tolerant varieties, the new pesticides, the innovations in implements -- all products of research -- all reduce the current cost of sustaining productivity.

Let me comment on issues related to germplasm. The higher yield potential of contemporary varieties reflects reallocations of energy within the plant. Shorter maizes capable of producing grain under dense plantings in well-watered environments have sacrificed capacity to compete against weeds and, through the loss of buffering capacity in stem size, are more at risk to drought. With control over the environments of those plants, control achieved through research and physical capital, those tradeoffs are worthwhile. As for the longer future, the replacement of species and land races with improved materials raises the probability of meeting future demands for improved materials.

And the more intensive agriculture of today also raises the cost of sustainability as we must invest more in research in germplasm improvement so as to remain ahead of the now more rapidly mutating pathogens or the burgeoning insect populations. I am frequently struck by our estimate of the energy that our Wheat Program puts into what some call Maintenance Research. Of the total invested in breeding, we now estimate that some 40 percent goes into the effort to maintain yield potential by way of the search for continued disease resistance.

And everywhere we see that increasing intensity in the use of agriculture's resources, especially the land resource. Consider the case of Pakistan and the rice-wheat rotation. Through science-based improvements in technology, production increased rapidly. Now, however, colleagues in the Punjab are calling our attention to declining productivity in the rice-wheat rotations of that region. They point to the apparently stable yields, to rising commitments of inputs and the growing skills of farmers in their management. These emerging problems, hastened by the application of more intensive production practices, are threatening sustainability. Another example of the relationship between more intensive systems and sustainability is in the rising importance of heretofore less important diseases. For CIMMYT a particular example is powdery mildew in wheat.

There is every reason to believe that such problems can be resolved, but there is the need to recognize that their resolution will itself require increased investment. As we increase our demands on agriculture's resources, so as to increase production, we must accept increased costs if we are to sustain that production at the new higher levels.

What does it all mean? Just that the growing intensity of production, itself a response to markets and the inventiveness of science,

carries with it the need for growing investment to sustain the now higher levels of production.

But listen to what Mansanobo Fukuoka tells us about his experiences. Fukuoka is a Japanese pathologist who some 30 years ago decided to try out some ideas that, while unconventional, had captured his imagination. His farming is governed by four principles -- no cultivation, no chemical fertilizer nor prepared compost, no weeding by tillage or herbicides, and no dependence on chemicals. And yes, one would expect that yields would settle to around 2 and a quarter tons of rice per hectare, but that is not the experience Fukuoka reports. He speaks of around 8 tons of rice and 6 tons of barley per year. One would like to see corroborating evidence. One would like to know about other costs, e.g., there might well be high levels of other inputs, with high applications of labor and uncommonly good management among them. Such costs might discourage the average farmer from his approach. Even so, all this clearly merits the consideration of someone.

Sustainability and Diversification

In non-Fukuokan agriculture, the biology of sustaining production relates to restricting erosion, to maintaining soil organic matter, maintaining mineral nutrient levels and avoiding the build up of salts and acidity, and to maintaining the quality of water. You have heard examples of how these problems have affected production in various places. In lowland tropical Africa, for example, the importance of organic matter has been stressed.

Whether we are talking about sustaining high levels of production through the marvels of biochemistry, biotechnology, plant breeding, engineering, or through the subtle interactions emphasized by Mr. Fukuoka, the extent to which that end will be sought is much influenced by economic considerations. New streams of innovations lower the cost of sustaining while high interest rates lower its appeal. And beyond these considerations there are others which might influence sustainable production through their impact on diversification.

Historically the agriculture of any particular place has tended to become less diverse, more specialized. This, of course, abstracts from the circumstance in which something like irrigation opens up new ranges of options for farmers. I speak rather of those agricultural expanses which have essentially the same climate today as, say, half a century ago. In those areas there has been a trend towards specialization. What are the factors which have contributed to that trend?

Several lines converge to foster specialization. One of these emanates from developments in biochemistry. These developments make it possible to maintain nitrogen levels through inorganic chemistry rather

than through rotations. They make it possible to control insects and diseases through pesticides rather than through "break" crops, a technique of great antiquity which formed the basis for most cereals rotations world wide. Such developments reduce the need to rotate, hence encourage specialization.

Plant breeders, too, contribute to specialization as they produce varieties more resistant to the pests which, in an earlier day, required rotations. As well, through their Mendelian magic they have vastly increased the efficiency of various crops within especially well-suited environments. These increases in yield potential have, in many locations, encouraged farmers to drop crops earlier utilized in favor of the now markedly more attractive improved crops. The displacement of pulses and oil seeds by wheat in the Punjab is a case in point.

As well, of course, plant breeders also contribute to diversification, as they develop traits which make crops more appealing than before. One clear example of this is in the spread of wheat and rice rotations in areas formally committed to one or the other, a result of the earlier maturing varieties now available in both crops. On balance, however, science and, I would guess also, the plant breeder have reinforced the trend towards specialization.

In developed countries larger equipment, which facilitates the timely undertaking of activities, encourages specialization. In developing countries more efficient markets, storage, and transport foster it too, encouraging farmers to produce to sell and to buy their needs in those efficient markets. And of course those same efficiencies can encourage the production of speciality crops, contributing to diversification, but this shift will have modest influence on the bulk of agriculture and on the overall balance of sustainability.

These are among the economic considerations that shape the balance between diversification and specialization. Much of what seems desirable for economic growth -- new technologies, more efficient markets, more effective distribution systems, more integrated economies -- will tend to encourage specialization. But what is the relationship between diversification and sustainability? How does the one influence the other?

There is a general impression that diversification contributes to sustaining a system's productivity. Certainly that was the case in the past when farmers diversified not only to more effectively utilize their nonland resources but as well to aid in the control of yield-producing pests and to improve soil structure. I add that, if people become more concerned about their ecologies, they might so restrict the use of chemicals that we will again be compelled to diversify as a substitute for chemicals. But what about continuous mono-cropping without rotation, and with the incorporation of the elements of modern technology?

Oklahoma State University has some plots of land that have been in continuous wheat since 1900. The plots have been farmed with each period's conventional technology. Yields are high and rising. Moreover the yields attained remain comparable to those obtained on plots which have not been in continuous wheat. The same picture comes clear with cereals in eastern Oregon and Washington where the same cereal/fallow rotation has dominated for forty years and yields are far higher today than before. (These examples came to me from Dr. Floyd Bolton.) It also applied to areas in the corn belt which have been in continuous corn for many years. Here, though, there is some emerging apprehension about the interaction of low levels of organic matter with heavy equipment, the resulting compaction, and detrimental effects on water percolation and soil structure. I add that the machinery people are already looking at new wheel alignments so as to alleviate the problems. (Discussion with Dr. Burt Sundquist.)

My agronomist friends tell me that for temperate climates there is no inherent reason why the desire to sustain should imply diversification. They claim that, when farmers have access to inputs and knowledge along with management skills and botanic sensitivities, specialization and sustainability are not all all incongruent. Even so, others point to new endorsements for rotations in temperate agriculture. One example is in maize production in Canada's western Ontario where a recent trend is to break continuous maize with other crops.

But what of developing countries, where the necessary conditions are less frequently met, where high temperatures conspire against organic matter, and where inputs are frequently not available? Here, diversification could help. Even so it is not clear that diversification is a necessary condition to maintaining yields. Claude Charreau and Guy Rouanet reports on experiments covering two decades in northern Nigeria. A constant rotation of sorghum and legumes was followed. Yields dropped quickly and then stabilized with no fertilizers, dropped and stabilized above the no-fertilizer yield with only inorganic fertilizers, but continued increasing over the entire period when inorganic fertilizers were combined with farmyard manure. The broader question is, diversification into what and for whose benefit? For some cases both answers are obvious. For some, the first question will require more study, the second will require actions to ensure that the farmer perceives that he is the beneficiary. If farmers are to adopt practices which contribute to sustaining the land and water resources, then they must perceive that such practices are in their own best interests. It is self evident that current circumstance, with ever increasing population pressure, high interest rates, and increasing economic integration, auger against that perception. Policy and research can help.

Agricultural Policy, Sustainability, and Diversification

Policy shapes the environment in which farmers undertake their activities through its influence on relative prices for products and inputs, on the availability of inputs, on farmer access to supporting infrastructure, and through its influence on research and information. Not all policy is evidently consistent with what informed observers would deem to be in the public interest. Not all policy makers have a strong concern for the long term. What can policy do to encourage farmers to behave in ways which forestall the erosion of agriculture's natural environment?

Before carrying on with this, let us ask why it is that society seems to be more concerned with sustainability than are farmers, why is that? Is it that society perceives more clearly than do farmers the long-term costs of not adequately maintaining nature's bounty? And farmers overestimate the real costs of sustaining production. Clearly we are more concerned with spillover effects than are individual farmers. Do we also perceive a lower discount than do farmers? Do we, as well, simply value sustaining nature more than do farmers? Who comes closest to representing what is "socially" desirable? The answers to such questions will determine the directions that policies should take if they are to induce farmers to invest more in sustaining agricultural resources.

What can be said about various classes of policies? Those favoring trade, whether between regions or between countries, will tend to encourage specialization. So, too, will those which encourage improved infrastructure and lower costs of buying and selling product and inputs. Policies which reduce the risks confronted by farmers can lead to increased specialization to the extent that these favor those crops already favored by farmers. In a general sense those policies which aim at promoting agriculture will tend to foster specialization; how they will affect sustainability is less clear.

Policies which lower the costs of sustaining production will clearly encourage its undertaking. For example, those which lead to lower interest rates will, by lowering the costs of investing in the future, encourage more such investment. As well it seems likely that policies which raise income to agriculture will, by reducing the urgency of the present, favor more attention to the future. There is, of course, an offsetting consideration in that these same policies will tend to encourage more intensive practices and, as earlier discussion suggested, sustaining and maintaining will require higher costs. Even so, the added income from the intensive practices provides a source to support the higher costs. What remains is to galvanize the will to invest.

Tenure policies can have a dramatic effect on sustaining agricultural resources. Those which encourage long horizons among the individuals involved, e.g., privatization, encourage practices consistent with maintaining production over the long term. Some tenure forms seem to encourage a virtual mining of resources, in particular those which do not give decision makers a stake in the future. Common growing rights are a

clear example of this phenomenon. As tenure relationships run to the marrow of agricultural societies, they are difficult to change. Nonetheless, they must be assessed for their impact on the future and modified where that impact has excessive cost.

Research

While one is disposed to say that for temperate agriculture in developed countries there is no necessary connection between diversification and sustainability, that conviction is less strong for tropical areas. There we see a rapid drawdown of nature's endowment, especially in many parts of Africa. What is an open question is the extent to which this is a consequence of whatever specialization has occurred. It can be asked if there are significant areas in which the incorporation of the product of science might arrest or reverse the damage. It is my understanding that we do not have good information on this.

One issue related to research, indeed it runs behind much of what has been said in this presentation, is to establish the relative importance of each of the factors that might separate societal from farmer evaluation of sustaining sector resources. It is, of course, these differing perceptions that foster different responses. And of course it follows that, to bring farmers along, their perceptions must be reshaped or we must develop new technologies whose characteristics will be consistent with farmer requirements and with sustainable production.

We need to do much more research which relates current output to the question of sustainability. Doing so, of course, will imply a much longer research horizon than most currently apply. Given the way much research in the tropics and subtropics is financed and implemented, it is especially important that development assistance agencies lengthen their own horizons, at least with respect to topics related to sustainability. And, of course, before initiating such efforts the research of the past should be carefully reviewed.

Moreover, were one convinced of the arguments presented by those like Fukuoka and where there are reasonable labor and other costs associated with such schemes as his, research should surely incorporate "natural farming" as one of its elements. Our community has gone through the natural farming hoop several times, with attitudes varying from awe and gee-whiz to derision. Surely, though, the stakes are too high to dismiss out of hand anything that holds even apparent promise. This research, too, will require long horizons.

Such research must include not only biology but other circumstances of farmers as well. Resorting to example, it is known that over time alley cropping restores organic matter and nutrients with attendant consequences for yields and stability in production. Even so,

alley cropping is little used. To what extent is this a consequence of high time-preference/high interest rates among farmers? To what extent is it a consequence of land tenure systems? If both considerations play a role, what can be done about either? If little can be done, what can be done to achieve the desired results through technologies which farmers find more acceptable.

Conclusions

The connections among diversification, sustainable agriculture, and practice run through biology, economics, and institutions. We know much about selected facets of those interactions, far too little about most. Much research needs to be reviewed, much research remains to be done and a goodly portion of this research must have long horizons. Development assistance agencies concerned with sustainability should hasten to encourage, foster, and promote such research.

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DIVERSIFICATION, SUSTAINABILITY AND ECONOMICS

RAPPORTEUR'S COMMENTS

John H. Cleave*

Six speakers made comments arising from the paper. One (James Ramuset, University of Hawaii) questioned whether a definition of sustainability as an ability to maintain yields was adequate. In the face of increasing population, the issue becomes one of maintaining per capita incomes or, with growth in the modern sector, sustaining real wages. Moreover, if economies are not to stagnate, the objective has to be sustainable growth in real incomes and wages. Another speaker (John Hayward, Agriculture and Rural Development Department, World Bank) suggested that the paper had not taken into account the cost and risk of levering production above steady state levels, and stressed that diversification does not necessarily imply a move away from the steady state. It was argued, however, that defining sustainability in terms of roughly constant real prices would take account of both of these problems.

In the discussion, Dr. Winkelmann raised a further issue: that in choosing a strategy for sustainability the cost of maintaining a resource should be weighed against the cost of rehabilitating it from a degraded state. He quoted examples from mid-Western USA and from East Africa where the application of modern technology or simple protection had resulted in the restoration of denuded areas. A speaker (Claude Blanchi, Agriculture and Rural Development Department, World Bank) argued, however, that while the ability of overgrazed land to recover was not doubted the problem was that with extreme pressure of population it was not feasible to keep people and stock off for the long period necessary.

Another speaker (from Economic Research Service, U.S. Department of Agriculture) asked for clarification on the level of CIMMYT resources required merely to maintain yields, expressing concern that this was not only high but was also rising. Dr. Winkelmann explained that the proportion of expenditure on maintaining earlier advances varied greatly between crops: in wheat it was extremely high and in the case of spring wheat was about two-thirds of all research on the crop. For other crops it would be lower, and overall the average would be about 50%. This is increasing and the only solution is to ensure a rise in the total energies applied to new advances and maintenance combined.

Finally, a speaker (Stuart Marples, West African Projects, World Bank) suggested an additional point: that one of the most serious impacts of developed country subsidies on their agriculture and the depressed market prices which result is on the sustainability of third world agriculture, and another (Jose Olivares, Department of Agriculture and Rural Development, World Bank) made the observation that the position taken in the paper that it is far from clear that diversification is a necessary condition to maintaining yields should lead to a re-examination of the dogma on the ill effects of export lead monocultures.

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SUSTAINABILITY ISSUES IN AGRICULTURAL DEVELOPMENT
DIVERSIFICATION FROM RICE

Richard Reidinger*

This paper examines the topic "diversification from rice" from the perspective of irrigated areas in the humid tropics of Asia. A major question in these areas is whether irrigation systems designed for wet season rice can support crops other than rice in the dry season. To simplify the topic, the focus here is on irrigation system requirements for diversification, not agronomics. Only selected field crops which have established markets and are already grown under irrigation on a small scale in the dry season are considered, such as soy beans, groundnuts, and mung beans. In addition, diversification is viewed here as a process resulting from farmer response to changing relative crop prices and profits, not as a Government policy objective. As much as possible, irrigation systems should not constrain that process. Two Bank experiences with the topic are summarized below: first, in Eastern India at the micro level; and second, in Thailand at the macro or sectoral level.

Mahanadi Delta Water Management Pilot Project

Background

The Mahanadi Barrages Project in Orissa, India included financing for a Water Management Pilot Project (WMPP). WMPP was located in the old, 300,00 ha Mahanadi Delta irrigation system served by barrages replaced under the project. It was originally conceived as a pilot project to introduce rotational water supply (RWS) or "warabundi" with the aim of increasing efficiency and equity in water allocation and delivery.

During early visits to the proposed WMPP site, extensive discussions with farmers turned up several interesting results later used in planning and implementing WMPP. The first was that RWS appeared to have little value for wet season rice, as farmers felt no water shortage and consequently no need to ration or allocate water. The second was that they wanted to diversify to mung beans and groundnuts in the dry season due to low rice prices and disease problems, but the irrigation system could not provide water delivery as needed for irrigated row crops. Based on these results, WMPP's focus was broadened to include irrigation infrastructure and operating requirements for dry season diversification.

Implementation: A Learning Process

During implementation, a number of problems were encountered which are indicative of the conceptual, technical, and institutional constraints of irrigation systems designed for rice. The following summarizes the learning process through which the constraints were identified and dealt with.

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Land consolidation ongoing in the area was proceeding efficiently. However, it was being done by a separate department without consideration of water management needs. Consolidated plots were often laid out in parallel with the proposed alignment of watercourses and ditches in each chak (the unit service area of one canal outlet). This made little difference for rice which was irrigated paddy-to-paddy anyway. However, for non-rice crops which require service to individual plots, it meant high costs in land acquisition and excessive channel length. Consequently, farmers, while interested in diversification, were not very supportive of the necessary infrastructural changes. The answer was to modify consolidation guidelines to ensure that watercourse alignments were determined ahead of time and that plots were shaped and arranged (end-on) to maximize direct access to the watercourses.

Construction of on-farm development (OFD) works, mostly small watercourses and drains, was included in WMPP at a cost of about US \$180/ha including consolidation (1983 prices). However, the design concept was to divide the flow into smaller and smaller channels as the watercourse and branches progressed further into the chak. This design matched closely the typical procedures for distributing water for rice in which the farmers divide the delivery stream into very small continuous flows for each plot. However, a fundamental requirement for dry season non-rice crops is large flows on a rotational or intermittent basis. Watercourses had to be designed with sufficient capacity to carry the full supply discharge from the canal outlet to any farm plot. OFD design concepts had to be changed.

There was also the related question of how big the canal outlet should be, which had to be answered to determine the size of chak watercourses. Theoretically, outlet discharge capacity should be related to the area of the chak (and crops grown, in this case rice), and that would determine watercourse capacity. In practice, however, existing outlet sizes bore almost no relation to chak size. Over the years, farmers had enlarges outlets to ensure adequate water for rice when canal water levels were low. When water levels were normal, all outlets were overdrawing, on average by 100%, which left the lower part of the system water-short and caused excessive flooding and drainage problems. To provide design flows to chaks, outlets were resized (reduced) to match chak sizes.

Farmers had been very cooperative with WMPP activities and patiently watching as we slowly learned what they already knew. However, they were not amused with the outlet resizing operation, which increased their risk considerably. They began to take a very direct interest in WMPP and raised the question of how they could get enough water when canal water levels were low. The answer was again to move further upstream in the canal system and make improvements to increase water control and stabilized water levels. In addition, to retain farmer cooperation, WMPP agreed that the outlet for any chak reporting shortage of water would be enlarged to its former size. What had started out as a simple RWS pilot project had become a pilot-scale systems improvement project.

A rapid assessment of the delivery canal indicated that selected low-cost improvements and repairs needed in the delivery canals for adequate water control and reliable supply would total about US \$155/ha. The standard slide-gate head regulator of the canal was to be replaced with a constant-flow modular device to insulate the WMPP delivery canal from water level variations in the main canal. A dry season operating plan based on "on/off" operation was devised to accommodate both rice and non-rice crops, and details of canal improvements were developed to enable operation according to the plan. Cross regulators were repaired, replaced and added as needed to maintain adequate water level control, the canal was resized to uniform design cross section, outlets were relocated for more effective command, canal roads were repaired to enable rapid access for operation, and other minor repairs and modifications were made as needed.

Results

With completion of infrastructural improvements, the next stage was operation in which agricultural and farmer organization needs became the top priority. A project-level committee comprising irrigation engineers, OFD engineers and agricultural extension workers was formed to manage operation of WMPP. Unfortunately, for reasons unrelated to WMPP, funding for specialized technical assistance and intensive implementation support was terminated, and the final results for crop diversification are inconclusive, particularly as diversification was not the original objective. However, general improvements were reported. Increased water delivery efficiency and more equitable distribution enabled tail reach villages, normally without water, to receive their share. Farmers in adjoining areas of the same irrigation system began demanding similar improvements in their canals. Irrigation Department operating staff utilized the upgraded water control capabilities to introduce improved operating procedures, based on simplified controlled volume concepts. Surprisingly, there were no complaints of lack of water.

The major problem now reported is in operating the improved facilities. WMPP evolved from simple to more complicated objectives through an experimental learning process. It was therefore not considered as a system problem until the later stages. Although the improvements at each level in the system made sense, taken together they implied a significant increase in operating effort and cost by the Irrigation Department. This was not adequately considered in choosing design improvements. In addition, although farmers cooperated and were consulted, they were not organized or directly involved in planning improvements and operation. They did not understand or commit to their operational responsibilities, further increasing the burden on the Irrigation Department. These two shortcomings now threaten the sustainability of WMPP.

Thailand Irrigation Subsector Review

Background

In contrast to the micro orientation of WMPP, the Thailand Irrigation Subsector Review (TISR) was concerned with overall or macro strategy for the irrigation subsector. It started with a primarily

technical-economic focus on how to raise performance and returns from existing irrigation systems. However, it soon became apparent that such a narrow focus would not meet the Government's major concerns: (a) what strategy to follow for rice; and (b) what strategy to follow for diversification out of rice in irrigated areas.

Findings

Diversification is only one of the issues covered by TISR. In addition, it considers diversification mainly in terms of field crop alternatives to rice in the dry season, such as soybeans and groundnuts, and to some extent sugar cane. Speciality and permanent crops such as vegetables and fruits may have potential but have special market conditions which were beyond TISR's scope.

Irrigated areas offer an important opportunity for diversification. However, in terms of the soils and drainage conditions, only about 15% on average of the country's irrigation service area is technically well suited for general diversification. Most irrigation project sites in Thailand were originally selected because of suitability for rice, which has long been the country's primary crop.

This does not mean that diversified crops cannot be grown in the relatively unsuitable areas. Rather, it is a matter of costs and economics. Speciality fruit and vegetable farms in the heavy clay, poorly drained areas around Bangkok take advantage of the good market nearby. But the investment cost in bunding, raised beds and soil modification is very high, reportedly on the order of US\$5,000/ha or more for on-farm works alone. Normal field crops which have more general but lower value markets cannot generally support such high investments. In addition, farm budget analysis indicates that they are less profitable for hectare than rice.

Technical potential for diversification varies greatly by region. Overall, the best soil and drainage conditions are in the North. However, Northern irrigation projects have relatively little dry season water storage. The Chao Phya Central Plain accounts for most of the country's dry season irrigation. With generally heavy soils and poor drainage, however, it is largely in rice, and as little as 3% of the area may be available and technically well-suited for diversification. In the Northeast, some natural conditions favor diversification, but dry season success despite the availability of stored water. Technical and institutional conditions there limit both diversification and irrigation performance.

Irrigation infrastructure is a serious constraint to dry season diversification, and also to high productivity in rice. Most Thai projects lack dry season storage - only about 25% of the total service area is irrigated in the dry season, and irrigation in Thailand's dry season is essential. In addition, even with storage, canal systems are generally not designed for dry season operation when water supplies are limited and efficiency is at a premium. They are designed for the wet season when water is in excess, to provide supplementary irrigation for wet season rice. Such systems often have inadequate canal capacity to meet full crop

water requirements in the dry season. In addition, they generally achieve adequate reliability by wasting water, not by good water control. In the dry season, greater delivery capacity, high efficiency, and better main system water control are essential. Furthermore, diversified crops require irrigation and drainage for each individual plot because they cannot tolerate constant flooding. Rice, in contrast, thrives under saturated conditions and is generally irrigated paddy-to-paddy. Because they were intended for rice, most Thai systems lack intensive on-farm watercourse and drainage networks to serve diversified crops.

The operation of irrigation systems for non-rice crop is also different and requires a different orientation of operating staff. Non-rice crops require more intensive "water management", both for the canal system and on the farm. In particular, they need a large delivery flow intermittently, compared to rice which receives a small flow continuously. Constant attention in operation is required to rotate supply among canals or outlets, supply water to individual fields for short time periods, adjust water deliveries to match crop water demand, and control water deliveries to ensure suitable streamsize and avoid waste. Furthermore, rapid and efficient drainage is essential for diversification, especially for timely sowing in the dry season. With traditional rice systems, in contrast, and with plenty of water as in the wet season, operators and farmers can more or less "set and forget" the water supply, and drainage is not so critical.

TISR Recommendations

Dry season diversification has some potential in Thailand's irrigated areas, but scope is restricted by natural conditions and the design and operation of irrigation systems. On the other hand, irrigated areas are generally well-suited to rice production, Thailand is an efficient, low-cost rice producer, and millions of Thai farmers have little option but to grow rice for their livelihood. Furthermore, Thailand depends on rice for some 15% of its export earnings, which is not likely to change rapidly. Rice will clearly remain a primary crop for Thailand. In addition, the future is uncertain, and our price and market projections may well be wrong. Overall strategy for Thai irrigation should emphasize productivity, efficiency and quality to maintain a strong competitive position in world rice production, and it should allow for uncertainty by maximizing flexibility to adjust to changing conditions and minimizing the cost of being wrong.

TISR's main recommendations were that: (a) existing irrigation systems and their operation should be modernized and upgraded to provide better water control and operational flexibility,, especially for main canal systems; and (b) more water sources should be developed for existing systems in the dry season when productivity is highest. For rice, these changes are needed to raise productivity and reduce unit production costs.

For diversification, TISR made two specific recommendations which complement the points above. First, main canal systems and drains should be upgraded to provide more water control. This will benefit both rice productivity and diversification through more reliable water supplies. Second, irrigation service areas suitable for diversified crops should be identified, and in those areas the additional investment in intensive OFD facilities needed for non-rice crops should be provided if farmers are willing to bear the cost. These intensive facilities are probably not economically justified in rice-only areas.

Lessons

WMPP indicates several lessons for adapting traditional rice irrigation systems for diversification. First, it is not enough to change "software" or management only, in this case by introducing RWS or warabundi. Operational possibilities depend on "hardware" or infrastructure. Second, changing hardware at only one level in the system may not be enough. With WMPP, it was necessary to move from the farm level progressively upstream in the system with selected improvements. Although the total cost may not be high, the solution is complicated, and there is no single "quick-fix." It is a system problem. And third, in planning improvements, it is essential to consider operational requirements ahead of time. Hardware improvements should be as "user friendly" as possible, and farmers should commit to cooperate together and participate in operations. Planning should also assess operating costs after improvement and whether they fit within realistic Government budget constraints.

TISR's lessons for diversification are that it is important to: (a) be realistic; and (b) plan for uncertainty. Existing irrigation systems in Thailand, and perhaps in other predominantly rice areas as well, were sited and designed for rice. We cannot expect those systems to shift out of rice without substantial time and investment, and markets may shift back in favor of rice. We need to plan for uncertainty through investments which maximize flexibility to meet changing conditions, increase main system water control, and enable better operation. In addition, where diversification pays, as around Bangkok, the private sector has shown it will invest on its own. Public irrigation systems need to provide the quality of service required to support such investment, not supplant it.

DIVERSIFICATION FROM RICE

RAPORTEUR'S COMMENTS

Roy Hewson*

E. Gazit (ASPAC) asked if the costs/ha quoted of \$5,000 - \$10,000 were not overstated and commented that there were few alternatives to rice (for instance, little market opportunities now to switch to wheat in India and Pakistan). He also wondered if irrigation system improvements would not lead to greater rice output. The speaker replied that the above costs/ha referred to bunding and mounding for high value crops such as citrus in the poorly drained areas around Bangkok. Probably \$400 - \$1,000 per hectare was the figure for system improvements in Orissa, India.

W. Panton (OEDDI) commented that in some locations, farmers have the option of growing perennial crops if drainage is installed or irrigation stopped, thus avoiding the need for costly redesign of irrigation systems.

T. Sinha (EAPA4) noted that subsidizing irrigation water mostly through low cost recovery, mitigates against diversification out of rice. Many farmers (e.g. experience with tube wells in Bangladesh) grow more and more rice if water is subsidized. The speaker commented that while this is so, it is costly and difficult to use volumetric charge systems or to allocate less water than needed for rice growing.

R. Hecht (ASPAA) commented on the sudden increase in sector work stimulated by the recent abundance of rice supplies, and wondered if this energy should not have been channelled earlier into identifying crops for which countries such as Thailand would have comparative advantage. This could infer much inter-country sector work on specific crops. The speaker noted that inter-country sector work is very difficult because of specificity of markets and non-market factors. His feeling was that Thailand would have no comparative advantage except in rice.

D. Dalla (USAID) noted that Thailand has not been a major user of high yielding varieties of rice, and has scope for intensifying production and achieving lower output costs. Further, the costs of researching alternative crops such as vegetables are high.

J. Olivares (AGREP) asked if it might not be cheaper to develop new irrigation systems for diversified cropping instead of changing existing systems designed for rice. He also commented that enlarging canals may not make it easier to control water at the micro level. The speaker felt that even within systems designed for rice, particular areas could be identified which were drier, had easier worked soils or were close to urban areas, in which diversification should be focussed. He agreed that other engineering improvements may be needed in addition to larger canals.

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P. Duane (OEDDI) commented on the time lags between investment decisions for irrigation and increased rice output and wondered what impact disinvestment would have in the near future. The speaker replied that he was not advocating disinvestment, only a deferral of new investment. He felt that reducing rice output will be very difficult, though charging for water supplies will assist.

W. Panton (OEDDI) reflected on the growth of perennial crops such as mandarins and agro-forestry for the Bangkok market which were reducing irrigation needs. The chairman noted that urban growth itself was reducing the irrigated area market, also in Indonesia.

J.P. Baudelaire (AEPA4) remarked that Orissa was designed as a command area development project to improve water management and in doing so, to release water for other crops. He felt that it is very difficult to shift systems designed for rice over to different crops. The speaker commented that the costs for shifting systems designed for rice over to serving other crops might be of the order of 5 percent to 10 percent of total costs/ha.

M. Nightingale (AEPA3) was surprised that the rice surplus situation in Thailand had not been predicted and wondered whether the long investment lead times were the most important factor. The speaker noted that we did not know ahead the size of the problem, and if it took two to three years to understand it through a series of intermittent visits. Staff from WAP agreed with the difficulties in predicting investment impact and world commodity trade.

CROP DIVERSIFICATION IN IRRIGATED AGRICULTURE:
WATER MANAGEMENT CONSTRAINTS

Herve Plusquellec *

Besides marketing considerations diversification from rice paddy to non-paddy crops (also called upland crops in this paper) in irrigated agriculture is constrained by several physical and institutional factors such as soils, farmers' experience, credit, extension services and irrigation facilities. This annex will deal only with the physical constraints imposed by the irrigation system both at the distribution level and farm level. The issue of crop diversification will be also limited to surface irrigation which is the predominant method used for more than 90 percent of the 275 million ha currently irrigated in the world. Indeed in the vast areas of lands irrigated in Asia surface irrigation methods are used almost exclusively for both paddy and upland crops. The scope for pressurized irrigated will remain limited to very high value crops in specific areas. Conversion to drip and sprinkler methods will progress slowly and where it will take place, diversification to non paddy crops will be irreversible. In sum, surface irrigation will remain dominant in the foreseeable future.

This paper will review first the different water requirements of paddy and upland crops and review the general technical features of the two dominant surface irrigation methods, basin and furrow irrigation used in developing countries. Then the paper will discuss the issue of improving irrigation facilities to make possible the shift from paddy cultivation to other crops and/or the adoption of mixed cropping. This review will be limited to the aspects relevant to crop diversification and does not pretend to fully cover the above subjects even in a condensed form.

Crop Water Requirements

Rice and upland crops differ by their crop water requirements in terms of volume and scheduling. Upland crops require much less water than rice but greater control over the water.

Seasonal Water Requirements

Adequate irrigation of dry season rice requires a daily supply at the farm of about 1.5 l/sec/ha, compared with about 1.0 l/s/ha for sugarcane and about 0.8 l/s/ha for groundnuts, soybeans, maize and most other upland crops. A shift from dry season rice to upland crops would make cropping possible on twice the area currently producing rice. For that very reason, crop diversification is attractive to water resources development planners. Most diversified crops also have more drought tolerance than does rice, i.e., yields of most upland crops are generally reduced less than those of rice if the supply of water is less than the potential water requirement of the crop.

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Irrigation Scheduling

Upland crops have very specific requirements for extensive production and both excesses and deficits adversely affects yields. Surface irrigation water is provided at variable intervals. Flow rates should be carefully controlled for the sake of distribution efficiency. In contrast excess supply has little impact on rice production as long as the water level in the field can be controlled by release to the drainage system. Rice therefore does well with continuous irrigation which is the dominant method of water distribution at field level in almost all systems whereas upland crops cannot be grown unless surface irrigation water is provided at variable intervals. These basically different requirements have considerable impact on the degree of control over water in the distribution system and the channel network at field level.

Method of Irrigation

Basin Irrigation

Basin irrigation is the most widely used method for irrigating crops in developing countries because it is the simplest method in principle. The fields are divided into small units so that each has a level or nearly level surface. Dikes are constructed around the areas forming basins within which the irrigation water can be controlled. The method is in practice the only one used for rice irrigation. It is also used for many different crops such as grain, groundnuts, maize, soybeans, gram and in some regions for orchards and plantations. It is not used for crops which are sensitive to wet soil conditions around the stems or on soils which crust badly when flooded. For non-paddy crops the basins are filled to the desired depth at appropriate times and the water infiltrates in a few hours into the soils. For rice irrigation, both continuous flooding or intermittent irrigation can be used.

In the traditional rice areas in East and South Asia countries, paddy fields are completely level particularly in the delta plains and flat alluvial areas. Where the natural slope is steep, benches have been constructed at the initiative of local communities, for example in Indonesia, Philippines, Thailand. Land preparation is traditionally done by ponding a shallow depth of water and puddling to obtain a perfectly flat surface. This method is sometimes defined as water levelling. In some circumstances complete or perfect level may not be necessary. Basins can be formed with a minimum amount of land grading on slopes of less than two percent by placing the levees the correct distance apart so that the difference in elevation within each basin remain within acceptable limits. Examples of basins with sloping land may be i) when basins are used for supplementary irrigation of non-paddy crops and ii) when rice cultivation is highly mechanized (see para 23).

The topography of the land surface influence the shape of the basins. Basins are normally rectangular areas if slopes are uniform. Where the topography is rolling the basins have an irrigation pattern which is dictated by the contours of the land surface. Grading to a uniform slope is highly desirable. In contrast to odd-shaped basins, rectangular areas facilitate the layout of road network and irrigation and drainage system.

Furrow Irrigation.

Furrow irrigation is particularly suitable for irrigating crops which are subject to injury if water covers the stems of the plants. Row crops such as vegetables, cotton, sugar beets, maize, and so on, are planted on raised beds and irrigated by furrows placed between the plant rows. Since the entire soil surface is not covered, efficient irrigation depends on the lateral movement of water from the furrows. Considerable experience is needed to divide the water from the supply ditch into a number of furrow streams and maintain correct rates of flow until irrigation is complete. Use of gated pipes or small siphons to facilitate the division of flow has been slowly introduced in developing countries with few exceptions such as the Northwest region of Mexico where it is widely used.

Furrows are sometimes used in combination with basins when the crop must be grown on raised beds to protect the plants from flooding. This method is used for example, in traditional rice areas where the cropping program has been diversified from rice to vegetables or orchards. Broad raised beds 1 to 5 meters wide are enclosed in basins, sometimes surrounded by levees for flood protection.

We will now examine the physical constraints to rice diversification: i) soils; ii) flow capacity of canals and control over water delivery; iii) the issue of continuous versus intermittent irrigation for rice; iv) the density of tertiary systems; v) the lack of slope, and vii) the forming of basin levees.

Soils

In general, first class irrigated rice land can be made to produce upland crops only at considerable cost. High clay content of heavy rice soils reduces the infiltration rate of water, makes upland cultivation impossible except under a narrow range of moisture conditions, and imposes a large power requirement for land preparation following lowland rice. With improvements and careful management, however, heavy rice land can produce satisfactory yields of upland crops. For example numerous fruits and vegetables are grown on heavy clay soils near Bangkok.

Land improvements necessary for converting first-class rice land to productive upland crops are (a) creation of a series of beds 4 - 5 meters wide separated by ditches to raise the elevation of the land, (b) on-farm development to improve the surface drainage, irrigation, and road networks, and in some cases (c) flood embankments to keep out excess water and to protect the surface networks.

In short, first class irrigated rice land can produce high yields of diversified crops, but at substantial cost to farmers or the government. These soils usually do not have comparative advantage for upland crops in view of competitive production costs for rainfed cropping.

Soils with less clay content, and with natural drainage are more suitable for crop diversification. That is the case, for example, of the North and Northeast regions in Thailand and in many non-coastal areas of the gangetic plain and Deccan plateau in India.

Discharge capacity of Canals

Since the peak water requirements for rice are about twice the requirements for non-rice crops, canal systems designed primarily for rice irrigation are largely oversized for irrigation of upland crops. This is generally not a serious problem for systems which have been designed to be operated at variable flows. For canal designs operated on the "on/off" mode i.e., which are run at or nearly full supply or closed, the on/off scheduling would have to be modified to avoid excessive operational losses.

Tertiary systems

In almost all rice systems field to field on a continuous basis is the dominant method of irrigation. The size of service areas can vary from a few hectares to 50 hectares or more depending on the topography and the spacing between minor canals. At the minimum the field system should be such that the entire irrigation area can be commanded at any time from the supply canal - which is not the case everywhere. The density of the tertiary system for rice is often discussed in terms of density of canals i.e. ditch length per area served. However, there is little evidence as to what an optimum density in rice irrigation is or even whether there is an optimum level under conditions of irrigated tropical rice. A case in point is the Muda irrigation project in Malaysia. There is no tertiary system between the secondary canals widely spaced at 1.5 km. intervals and more. The yields (8 tons/ha in 2 crops) and overall water use efficiencies (above 60%) have not significantly increased in areas where tertiary systems have been recently built. The higher density of drains may have even contributed to slight decrease in efficiency. It may, however, be argued that a system giving access to irrigation and drainage on each farm provides greater flexibility in farming and water control. The point is that many public rice irrigation systems in developing countries have a low density of canals. In contrast, most old traditional systems developed by the farmers themselves offer the highest degree of control over water.

In contrast to rice, irrigation of upland crops requires direct access to irrigation and drainage systems to provide intermittent water supply and to prevent soil saturation conditions interfering with crop production. The density of the tertiary system to be built to permit crop diversification depends on a host of factors: the land slope, the nature of soils, the farm size, the proposed method of field application, the degree of farm mechanization. In turn, the cost of a tertiary system required for crop diversification depends also on a number of factors: i) the density of canals; ii) whether canals are lined or not; iii) the density and design standards of the farm road network and the land levelling component generally associated with the irrigation system improvement program; iv) the hauling distance between the irrigable areas and the borrow areas of material for construction of embankment for roads and dikes; and v) the cost of labor and construction equipment in each specific country.

Costs of on farm works for projects currently under implementation in Thailand (Mae Klong projects) range from 400 to 1100 US\$ per hectare. In contrast, cost of on-farm works in Muda project, Malaysia, is in the order of 2000 US\$ /ha. In the latter case all tertiary canals are lined, farm roads are of high standard, and borrow areas for material of high quality are in average 10 km away from the irrigated areas.

Slope and Levees

Because of puddling method used for land preparation, paddy fields in traditional rice areas in developing countries are level. Some local low or high spots may exist depending on the ability of the farmers. (Perfectly levelled fields are found in areas where farmers have recently adopted the method of pregermination). Massive earthmoving works to provide some slope for long well graded furrows for upland crop cultivation is not feasible with the farm machinery available and would be too costly.

For the above reason in most cases of seasonal crop diversification upland crops are cultivated on short horizontal furrows or raised beds -- depending on the nature of the soils -- within the limits of paddy basins. Abundant labor is generally available to construct the furrows by hand. Levees are permanent and remodelled as necessary for repeated use in irrigating annual crops.

As discussed earlier in some areas costly earthworks are undertaken to intercalate wide raised beds with deep-ditches permanently full of water, together with levees to protect these fields against flooding. This conversion process is evidently irreversible.

In areas where agriculture is highly mechanized the levees interfere with the movement of tractors to cultivate or harvest the crops. Under certain conditions, the levees may be constructed temporarily for use in a cropping season. In some projects where farming is highly mechanized, such as in Northwest Mexico, rice and upland crops are alternated twice a year. Farm machinery is used for preparation of sloping land in dry conditions. Levees are rebuilt every rice season after seeding. They are implemented at such intervals that depths of water do not exceed about 5 centimeters. Levees are knocked down during the land preparation for the next crop and rebuilt again.

Mixed Cultivation

Because of the different requirements over water control, mixed cultivation of rice and upland crops raises several problems of water management at both farm and system levels^{1/}. It is only in countries with adequate water control and high density of field irrigation and drainage systems that mixed cultivation is observed. For example, mixed cultivation is practiced in Taiwan, Japan, South China and the Red River Delta in Vietnam.

^{1/} A study of rice, sugarcane, and mixed rice-sugarcane outlet commands in part of Mae Klong Project in Thailand showed that farmers use inputs and improving production practices almost twice as intensively if they are in areas growing only rice, compared with mixed rice-sugarcane areas. Yields of rice were 2.2 t/ha in areas growing only rice, compared with 1.6 t/ha in mixed areas. Sugarcane yields also declined from 39t/ha in homogeneous areas to 29 t/ha in mixed areas. Adverse effects of planting upland crops other than sugarcane adjacent to rice are more severe than those cited above because other upland crops are more sensitive to soil saturation than sugarcane.

Seepages from rice land can create saturated soil conditions on adjacent land which precludes upland cropping. A practical requirement for diversified crop may be that rice and upland crops would not be planted in the same service units. This requires some coordination between farmers.

Control of Water Delivery

As discussed earlier, rice and upland crops have different requirements of water control. Rice is more sensitive to water stress than most upland crops but can be irrigated by excess as long as there is a suitable drainage system. Upland crops require better control over delivery at field level. Furthermore delivery at discrete intervals for upland crops has more operational requirements than continuous delivery, the dominant method of rice irrigation. Consequently control facilities of rice irrigation systems are often but not necessarily crude compared to systems serving primarily upland crops. These systems apply water more appropriately for rice than for most upland crops.

Detailed monitoring of flows delivered at farm level in some projects have shown that there are wide variation flows both over time and across locations. This results in inequity and inefficiency of distribution. These wide variations are a strong obstacle to an organized method of water distribution for upland crops among water users, either by rigid rotation or any other pre-scheduled method. The main causes of these are: (a) many farm turnouts do not deliver at design rates because they are not designed for self-flow control or because of subsequent interference by farmers; (b) fluctuations in water levels in minor supply canals result in severe flow distortion through individual farm turnouts, and (c) the means of estimating and controlling flows through most turnouts are not practical.

It is not intended to discuss here the methods to improve the level of water control for irrigation of upland crops. That is a topic of its own which is broadly addressed in Bank technical reports ^{1/} and will be examined in more detail in forthcoming studies.

Summary

The precise water control needed for diversified field crops requires in general extension of the tertiary networks, improvement and modernization of the main and distribution system, and in some areas improvement of the drainage and flood control conditions.

The issue of improvement/modernization of irrigation systems to permit crop diversification has been complicated by the sharp drop in projection rice prices that occurred since 1982. The 1990 rice price projections dropped from about 600 US\$ in 1982 to 339 US\$ in 1984/85 and recently below 250 US\$. Most of the rice irrigation projects were viable in the early 80s including those for which all the infrastructure from storage or diversion works down to the on-farm water delivery works have to be built. Under the 1984/85 economic conditions, the viable investments in rice projects were those taking advantage of sunk costs in existing infrastructure.

1/ World Bank Technical Paper No. 49, Irrigation Design and Management. The Case of Thailand and Its General Applicability.

In the case of Thailand a fast method for screening viability of projects was developed for the Irrigation Subsector Review issued in April 1986. It was found that development of the tertiary system at a low cost of US\$600/ha (excluding land levelling and land consolidation) is viable with only a modest paddy yield increase of 0.5 ton/ha in each season assuming a cropping intensity of 150%. To justify the investment required for an intensive tertiary system including land levelling (US\$ 1000/ha) a yield increase of at least 0.8 ton/ha for each season should be achieved. With the most recent price projections, a detailed analysis of each project would be needed because of the sensitivity of the rate of return at these low rice prices. Investments required to improve the tertiary system together with improvement of the distribution system may no longer be justified unless there is a substantial increase in yields (above 1 ton per ha) and/or an increase in cropping intensity by making use of the water saved through more efficient operation. The conclusion is that in a number of cases the improvement of irrigation systems at both the tertiary and distribution level may not be economically justified for increasing rice production alone, without diversification to higher value crops. The investments required for crop diversification would have to be undertaken only when there is sufficient indication that all the other preconditions for crop diversification are met: market, marketing facilities, extension services, etc. The same conclusion may be valid for other rice surplus countries.

CROP DIVERSIFICATION IN IRRIGATED AGRICULTURE
WATER MANAGEMENT CONSTRAINTS

Rapporteur's Comments

Jessica Mott

Mr. Plusquellec summarized his paper and illustrated his main points with slides. He elaborated first on the different water requirements for rice and upland crops. He then discussed the modifications and improvements in the main distribution system, in on-farm facilities, and in land shaping required for various types of crop diversification from rice, including sequential cropping, mixed cropping, and irreversible conversion.

The first comment from an EMENA participant pertained to Mr. Plusquellec's point that rice does not require as much water control as most upland crops. The participant said that actually more water control is needed for rice because inadequate water supply is more catastrophic for rice than for other crops. Mr. Plusquellec pointed out that his statement referred to irrigation during the wet season. He agreed that rice is more sensitive to water stress but can be irrigated to excess as long as there is a suitable drainage system. Most irrigations systems in Southeast Asian countries provide semicontrolled irrigation for rice during the wet season when there is abundant water. Upland crops, in contrast, require more control over water delivery, since yields decrease rapidly with excess water. Indeed achieving efficient, equitable, timely, reliable irrigation for paddy and non-paddy crops requires strict water control during both wet and dry season.

A participant from East Africa commented that the same issues of design changes required for conversion from rice to other crops also apply to conversion from one non-rice crop to another non-rice crop. For example in the Sudan limited water supply in turn limits crop choice.

Another participant from South Asia supported Mr. Plusquellec's statement that the density of field channels required for rice irrigation depends mainly on the micro-topography. Mr. Plusquellec pointed out that in spite of expensive tertiary system for Muda II project in Malaysia there was no significant increase in yield, since the topography in this project already permits field to field irrigation. The participant also pointed out that rotation water supply is used for rice and sugarcane in Indonesia. Mr. Plusquellec responded that implementation of rotational water supply required a complete irrigation system, highly trained operators, sophisticated farmers and flexibility in distribution.

The next comment was that rice as any other plant needs oxygen and that continuous water submergence is deleterious. Mr. Plusquellec agreed and pointed out that drainage of paddy fields is also practiced to allow for weeding, for example, in northern Thailand.

A final question from an IPRI participant was raised as to what the incremental costs are for an irrigation system designed for a mixed cropping system. Mr. Plusquellec responded that the difference for tertiary systems only in Thailand varied between \$600/ha for a simple system limited to rice without land consolidation (i.e. not requiring massive land levelling) and \$1,000/ha for an intensive system, (i.e. an incremental cost of \$400/ha) provided that the existing distribution system allowed good water control. The cost of overall rehabilitation and modernization to permit water control sufficient for non-rice crops would be between US \$500/ha and \$3,000/ha depending on the degree of deterioration. Mr. Plusquellec pointed out that the Thailand Irrigation Subsector Study carried out in 1985 concluded that a .5 tons yield/ha increase was required to justify \$600/ha investment cost and that a 1 ton yield/ha increase was required for \$1,000/ha assuming a cropping intensity of 150%. With present projections of low rice prices, one needs, in addition to yield increase, an increase in cropping intensity to justify irrigation investment. He indicated that increase in cropping intensity should be a major objective for many projects and could be achieved by improving water efficiency through modernization of irrigation systems. He pointed out that water efficiency rarely, if ever, exceeds 35 to 40% in irrigation projects; appraisal estimates in the range of 50-60% are overly optimistic.

COMMODITY ANALYSIS FOR DIVERSIFICATION

Ronald Duncan*

I have interpreted the topic to imply a discussion of the outlook for primary commodity markets and of the implications of the various developments that we see in these markets for the developing countries dependent on production and exports of primary products. I will resist, therefore, talking about general economic issues relating to the topic of diversification in agriculture.

General Outlook for Primary Commodity Markets

As you know from the Commodity Studies and Projections Division's latest price forecasts, there is a similar pattern to the future path of prices in most of the commodity markets. It is believed that most prices are now in a trough from which there should be some recovery in the next several years as many of the causes of the present low prices are temporary. One should be careful, however, not to overemphasize the present depression in prices. It is easy to do so if the prices experienced in the 1970s are taken as a benchmark. But prices in real terms in the 1970s were unusually high and while the adjustment now going on to much lower prices is very painful for producers, present-day prices are much more useful signposts for future prices than are the price levels of the 1970s.

Two of the most important factors explaining the present depression of real commodity prices from the long-run trend--factors which should be temporary, at least in some respects--are the poor economic growth of recent years and the surprisingly large increases in supply in 1984 and 1985. Industrial production in the OECD countries has been growing at only about 1% p.a. over the past 12-15 months. This poor growth has adversely affected the demand for agricultural raw materials for industry. Per capita income growth in the developing countries has been very low in recent years--even negative in some instances. This recession has sharply reduced the demand for grains, particularly in the higher-income countries whose demand for grains, food, and animal feedstuffs has been so important for world trade in these commodities.

The large increases in agricultural supply in the 1984-86 period seem dependent on several factors. First, the weather has been favorable worldwide; something that will not last. Second, fertilizer prices (especially urea) have been very low, thus stimulating fertilizer application rates and boosting yields. Third, the increase in agricultural production is in part a lagged response to previous high prices--to the US Payment-in-Kind high prices of 1983-84 in grains, fats and oils, and cotton, and the much longer lagged response in perennial crops to the high prices of the 1976-80 period. Fourth, there has been the impact of agricultural policies. Production has been protected from the declining world prices in many countries. Grains and sugar are outstanding examples. Another is cotton production, which increased by 30% in 1984 under the influence of stimulative policies in China and the United States. Also, the change in farm policy in the United States led to a sharp increase in supplies of grains moving into world markets from stocks in 1986. Some of

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these policies have been changed (e.g. the incentives package previously offered to cotton producers in China has been modified), others will change (e.g., the US policy of driving down world prices will ease when stock levels move back to normal or budget pressures force an increase in loan rates). Other production-stimulating policies in both industrial and developing countries will be less easily changed.

What does this mean for future prices? Given reasonable per capita income growth and given the temporary nature of the factors responsible for the surge in supplies in recent years, it is anticipated that there will be an increase in real commodity prices in the short run. However, over the longer run it is expected that for most of the non-fuel primary commodities real prices will be on a declining trend for the remainder of this century.

Long-Term Decline in the Net Barter Terms of Trade of Non-Fuel Primary Commodity Exports

The declining trend in the net barter terms of trade for non-fuel primary commodities has received much negative attention. Generally, these negative reactions have given rise to poor policy. If the terms of trade of agricultural exports are declining, rational economic behavior would lead to producers responding to this change in relative prices by industrializing. No other incentives should be needed. But governments have responded to the "elasticity pessimism" (underlying the notion that the barter terms of trade of primary commodity exports are secularly declining, and the foreign exchange constraint which they have inferred) by restricting imports and overvaluing exchange rates. Such policies have led to the very foreign exchange constraints they feared because they penalize all export industries (whether existing or yet unborn). In the process their income terms of trade have suffered--i.e., export volume growth has been stifled. While there is not a great deal of difference in the movements of the net barter terms of trade of the various developing country regions (except for commodity-composition differences), there are very large differences in their income terms of trade. The export volumes of non-fuel primary commodities have increased much more quickly in outward-looking regions such as East Asia and Pacific than in East or West Africa.

I now turn to comments about future developments in commodity markets, some general and some specific.

Liberalization of Agriculture in Developing Countries

The thrust of much of the Bank's policy is, rightly, about freeing up markets. This will mean increased production in developing countries and increased pressures for access to export markets--both industrial and

developing. While a case can be made for levying export taxes in countries whose exports are a large share of the world market for a commodity facing inelastic demand, there are many small exporters levying very large export taxes. Hopefully, these can be reduced, in which case production will increase and exports will grow. Reductions in export taxes, reductions in overvalued exchange rates and removal of other implied taxes on agriculture in developing countries will all lead to downward pressure on world prices. But this downward pressure on prices also puts pressure on other countries to move out of production of these commodities and into other activities in which they have greater comparative advantage. A strong argument can be made that protection of agriculture in both industrial and developing countries has hindered the development of those industries in other, lower-income countries. It should be part of the Bank's role to advise developing countries to get out of primary commodity production where they no longer have a comparative advantage.

Grains Consumption Trends

An interesting trend revealed in our study of the grains market is the shift in the consumption in rice-dependent economies toward wheat and coarse grains. (A similar trend can be seen in countries where coarse grains such as corn or millet are staples.) Three factors seem to explain a large part of this trend. First, as incomes increase in these very low-income countries and the cost of time increases, rice consumption (which is a time-intensive activity in the household) loses out to consumption of wheat products which are usually prepared outside the home. Second, as incomes increase there is increased demand for coarse grains to satisfy the growing demand for meats. Third, food aid has been primarily in the form of wheat which has whetted consumers' appetites for this grain.

This trend in rice consumption was an important factor in leading us to revise our rice price projections down substantially.

Technological Advances

The downward revision in rice price forecasts would have been even greater were it not for the perception that the rates of increase in grain yields resulting from the Green Revolution are slowing down. Adoption of the higher-yielding varieties has reached levels of 70-80% of area planted in some countries and therefore the scope for continued very fast yield growth of 4-5% achieved in some countries, such as Indonesia and China, has lessened. This is not to say that future production will not benefit from advances such as genetic engineering. It will, but we do not know how to forecast it.

Reliance on Food Imports

One of the most noteworthy trends we observe from our analysis of history and our forecasts is the increasing reliance of the developing countries on food imports. This is the sort of trend that can lead policy makers into frenzied intervention aimed at generating self-sufficiency. Hopefully, it will be interpreted as a healthy, rational development. As the per capita incomes of developing countries increase, much of the increase is spent on foodstuffs, and consumption grows at much faster rates

than production--except perhaps at the height of the Green Revolution which should be thought of as an unusual event. Therefore, at certain stages of development food imports can grow quite quickly. As the marginal propensity to consume foodstuffs slows down, this phase passes.

Impact of Energy Price Fall

The decline in energy prices has implications for other primary commodities. These will be both income and price effects. The purchasing power of the oil-exporting countries will be reduced, while the purchasing power of the oil-importing developing countries will increase. Simulations with the Division's grains model indicate that in the grains market these effects will be offsetting, while grain prices will be lower than they otherwise would have been due to the lower prices of nitrogen fertilizer.

Products such as cotton and rubber compete with synthetic products manufactured from hydrocarbons. The short-run outlook for cotton consumption is for an increase because of the present very low prices. The longer-run outlook is for a return to increased competition from synthetic fibers as cotton prices increase and synthetic costs of production benefit from the fall in crude oil prices. It is likely that rubber prices will increase as a result of the fall in crude oil prices because of increased automobile use; and that this will more than offset the price-depressing effects of cheaper raw materials for production of synthetic rubber.

There are likely to be other, less easy to measure, effects in agriculture as, for example, the differential impact of cheaper energy and cheaper nitrogen fertilizer on agricultural production. Energy-intensive and fertilizer-intensive agriculture will be favored. This will mean certain products and certain countries will be favored. For example, power-operated irrigation will become cheaper. Energy-intensive transportation and processing will be favored. The extent to which any changes occur will depend greatly on the extent to which investors perceive the same kinds of energy price increases in the long run as the Bank does. If the present sharply-lower prices are seen to be a rather temporary phenomenon, as we do, then long-run investment activities may not be heavily influenced by them.

COMMODITY ANALYSIS FOR DIVERSIFICATION

RAPPORTEUR'S COMMENTS

Jane Armitage*

Mr. Duncan opened with a short exposition on the current level of prices and forecasts for the short and medium run. He pointed out that many of the reasons why commodity prices have dropped so sharply over the last few years are temporary. Demand has been weak, due to both slow growth in industrial production in the developed countries, which depresses the demand for raw materials, and to poor income growth in the high income developing countries, which has a strong influence on the demand for grains. Meanwhile, on the supply side, there has been a substantial increase in production of agricultural commodities, due partly to especially favourable weather conditions over the last few years and partly as a result of a lagged response to the high prices prevailing earlier. In the short run, there is likely to be some recovery in commodity prices as world demand picks up, the weather reverts to normal and supply is cut back in response to the present low level of prices. In the longer run, however, while prices of perennial crops, metals and minerals tend to exhibit cycles of up to thirty years due to the long investment lags associated with the production of these commodities, real prices of annual crops are likely to face a declining trend, as productivity increase boosts supply while demand is constrained by the generally low income elasticities for these types of commodities.

Mr. Duncan went on to discuss briefly some important recent developments in commodity markets. One such development is the widespread emphasis on liberalization of agriculture in developing countries today. As production and exports from developing countries rise in response to increase in producer prices, this will put increasing downward pressure on world commodity prices and on developed countries to yield access to their protected internal markets and withdraw from high cost domestic production. While getting the industrial nations to reduce their production subsidies to agriculture is certainly going to be extraordinarily difficult, the Bank, at least, should be prepared to advise some developing countries to get out of the production of those primary commodities in which they no longer have comparative advantage. Two other interesting specific developments in commodity markets mentioned by Mr. Duncan are the shift in consumption patterns away from rice and towards wheat and other coarse grains, implying a decline in rice prices relative to other food stuffs, and the impact of the recent fall in energy prices on prices of other primary commodities.

Discussion

The first speaker requested a clarification on the Bank's policy on comparative advantage. He pointed out that, in many respects, the institution is guilty of a double standard - on the one hand, preaching comparative advantage and, on the other, refusing to invest in commodities in oversupply, such as tea, coffee, cocoa and sugar, regardless of

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comparative advantage. He asked whether it might not be appropriate to take out the impact of the developed countries distortionary policies on agricultural prices when forecasting commodity prices and evaluating potential investments. Mr. Duncan observed that he also disagreed with the Bank's policy of restricted lending for commodities that are in oversupply due to world distortions, pointing out that the policy is particularly damaging to African countries that are wholly dependent on Bank finance, while richer countries such as Brazil and Malaysia, with access to other finance, continue to invest in these commodities. The result is that Africa, which could be very competitive in the production of many of these commodities, is losing its share in world markets. Mr. Duncan went on to propose that, in the specific case of tea, the restrictions on Bank lending be removed immediately, since the outlook for tea had improved substantially since the guidelines were issued in 1973, and tea prices were now rising in real terms, as supply slowed down and demand from developing countries continued to grow rapidly. It was later pointed out by several other speakers that, under existing Bank policy, the restrictions on investment in commodities in oversupply can be lifted if there are no other alternative production opportunities in the country or region, or if the investment is essentially rehabilitation, aimed at restoring previous market share.

Continuing this theme, another speaker took issue with the notion, expressed in the paper, that the Bank should encourage countries to get out of commodities in which they have lost comparative advantage, because the calculation of comparative advantage is so difficult in a world in which the developed countries subsidize their agricultural production so substantially. In addition, he felt that the appropriate time frame for such analysis was unclear. Mr. Duncan responded by outlining the way in which the Commodity Studies and Projections Division attempts to define which countries have comparative advantage. Specifically, for each country they forecast production and exports of each commodity, taking into account policy developments such as exchange rate adjustments, and build these estimates into the global demand and supply projections that underly the price forecasts.

Commenting on the projections of long run declines in prices of most agricultural commodities, a speaker asserted that, on the contrary, he believed that, in the long run, the terms of trade would shift in favour of agriculture, for several reasons. He predicted that the combination of high population growth in poor countries, and the high income elasticity of demand for food at low income levels, would lead to demand from many developing countries substantially exceeding domestic supply for many years to come. He suggested three major sources of growth in demand in the future: first, from India and China where any increase in income levels would imply a high volume of demand because of the enormous populations; second, from the New Industrialized Countries (NICs) as their economies recover from their present debt-induced depression, and, finally, from the Soviet bloc where a gradual reversal of the policy of emphasizing investment at the expense of consumption is taking place. On the supply side, he postulated first, that the seed-fertilizer-irrigation revolution had finally reached a plateau, and second, that the European and other

countries would not be able to continue their grossly inflated producer prices for much longer and that, as production subsidies were reduced, supply from the industrialized countries would fall. While he accepted that there would be some relative price shifts, his overall conclusion was that a negative shift in the terms of trade for agriculture in the long run was not inevitable. Mr. Duncan responded that, while he was in agreement with much of the above analysis, in fact, these factors were built into the projections and, despite them, the long run forecast was for a decline in real prices.

The view was expressed by another speaker that, rather than expecting agricultural subsidies to decline in the future, on the contrary, the EEC countries would be joined by the newly industrializing countries such as Korea and Taiwan, as had happened with Japan. Agricultural protectionism would rise, as increasing numbers of industrialized countries subsidized local production and even exports. He pointed out that this unwillingness of industrialized countries to exit agricultural production means that the level of prices prevailing often precludes profitable production in many developing countries. Mr. Duncan agreed, and observed that protection was part of the explanation of why world prices for some commodities, for example, palm oil, are projected to fall.

Mr. Duncan was asked to comment on how good or bad the World Bank Economic Analysis and Projections Department (EPD) had been at commodity price projections over the last fifteen years. Mr. Duncan said that the real question was how well EPD had done relative to anyone else, and that, in comparison to other consulting outfits that sell forecasts, the World Bank had substantially smaller forecast errors.

The issue of the importance of price stability rather than just the level of prices in providing a favourable environment for farmers was debated. One speaker felt that stable prices had been of considerable help to farmers in Latin America; however, another speaker felt that, in Africa at least, the level of prices represented the main constraint. Mr. Duncan asserted that, in his view, the level of prices is more important and that there exist adequate mechanisms to deal with price fluctuations. However, he felt that the World Bank could give countries more assistance in operating financial reserves to stabilize export revenues. He pointed out that, in general, producer prices are much more stable than world prices both because many governments actively fix producer prices and because exchange rates tend to adjust to compensate for world price shifts.

Mr. Duncan was asked for EPD's view on the future of energy prices. He explained that prices were expected to average about \$16/barrel for the next year. At a price of around \$15-18/barrel, demand would grow and, over the next decade, real prices were likely to increase, as OPEC gradually regains control again over oil production, following the peak in non-Opec production around 1990.

RESEARCH AND EXTENSION NEEDS FOR DIVERSIFICATION

Donald L. Plucknett*

Research and extension efforts to support diversification will, in most cases, be much greater than efforts to support specific major commodity improvements. This is because diversification depends much more on what the land resource offers and what the present dominant farming system will allow, given its use of available land, labor and capital. In most cases the present land use has become dominant because of a long, mostly-successful history of production of one, or at best, a few, major commodities.

Any effort to diversify a major farming system will require considerable research and technology development on a number of topics, including; the land resource itself, an array of possible new crops or commodities, and some integration of new enterprises into the present land use and market structure.

There are two basic strategies in agricultural research. The most familiar is the commodity strategy in which a given commodity becomes the focus for biological, physical and socioeconomic research. The bounds of the research effort are determined by the crop or livestock enterprise itself and by its attendant or subsidiary activities. Agricultural scientists are most familiar with this strategy, and have become quite good at it. The methodologies of research are well established and are generally effective. The same can be said for extension methods for such commodity-based agriculture. Extension personnel become very familiar with the major cereals, or other crops or livestock enterprises that form the base of the local farming system. Any change from the major commodities will require at least, some retraining and redirection of personnel and some reallocation of research and extension resources to support the new diversification efforts. Also, specialists in horticulture, floriculture, small animals, or cash crops, for example, may need to be introduced into both the research and extension systems.

The other basic strategy could be termed the land, or resource, capability strategy. In this approach, the land or resource endowment, good or bad, determines the direction of the research and the crops or enterprises that are possible in a given situation. We don't do this type of research or extension nearly as well as when we follow the commodity strategy. The methods used are more diffuse and belong to a number of disciplines (soil science, agroclimatology, geography, socioeconomics, etc.) that often don't integrate very well. Mapping of zones that are similar is necessary, as well as land capability classification plus determination of potential land use.

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Once the land resource situation is known, the commodity choices then follow what the available resources will allow. For first class land, this is less a problem than when the land is marginal or submarginal for crop production. Of course, often the question of marginality depends on the specific requirements of the crop involved. For example, the difficulty of finding a diversification alternative to flooded rice presents a very good illustration of the problems involved.

In Asia, where flooded rice constitutes the major land use for the fertile lowlands, countries have long sought to find alternative or subsidiary crops to complement the rice based farming system. Such efforts have been frustrated by the significant problems of soil and water management posed by puddled rice soils. Land preparation for rice which often includes puddling destroys soil structure and makes it very difficult to grow other crops. Many researchers have attempted to find ways to modify puddling to overcome problems in succeeding crops that need better soil structure for proper growth. Research has shown that some improvements can be made, but the technology required is quite precise and difficult to achieve. Real benefits in disease control can occur in soils after flooding and puddling, particularly in soil-borne diseases which can be controlled quite effectively by a period of flooding during the rice crop portion of the cropping cycle. Hence rice followed by intensive vegetable cropping can be quite an impressive cropping system, if the difficult soil and water management technology can be developed and modified to suit one or more particular vegetable crops. To do this requires intensive and ingenious research, coupled with a technology-driven extension program that must be backed up by careful training of extension personnel in the modified cropping system.

The replacement of certain cash or plantation crops has long received attention. Here again the situation requires replacement of the high value, extensively-grown cash crop which has long reigned as the dominant farming system. The first lands to be considered for diversification are those that are marginal for the cash crop, and, therefore, also marginal for many other crops.

In Hawaii, where sugarcane and pineapple have dominated agriculture on the Class A, B, and even C lands, there has been interest for some time in diversifying agriculture or in finding an alternative land use for plantations that are increasingly experiencing financial difficulties. In almost all cases, these lands lie in the northern and eastern sides of the islands where high rainfall, leached acid soils and strong tradewinds predominate. Here sunlight and crop yield potentials are lower for pineapple and sugarcane, as well as for other crops. To find substitute crops requires identifying a few crops that can be grown on a fairly large scale under marginal growing conditions, or alternatively, several crops that can be grown and marketed successfully. Both approaches require considerable research effort to develop new technology as well as a redirection of extension efforts so the new technologies can be learned and understood by extension personnel before their in-depth interactions with farmers.

Three last comments on diversification need to be emphasized; the first is that diversification research, to be successful, needs to be carried on continuously, and not be pushed just when the major commodity or land use system is in some difficulty, or when surpluses clog the marketing channels. Diversification research that begins when the major industry is in trouble and that is phased down or out when prospects for the major industry improves will be of little value. Such research takes a longer-term commitment and must be supported even in those heady days when markets and prospects are good for the dominant commodities. The same emphasis is true for extension work, although there may be some lag time between the first research efforts and the educational programs that are necessary to move new technology to the farm level.

Secondly, research and extension personnel need to work very closely in developing and testing new technology to support diversification. If possible, extension personnel should be kept abreast of the progress of the diversification research effort, and should be as fully involved in technology development and testing as is practicable. My own experience in such efforts is that technology developed without the involvement of extension personnel may pose more of a "knowledge-gap" threat to extension workers than may be realized, and they may indeed be reluctant to become involved with it or may even disparage its potential benefits. Early involvement in the technology development process ensures that extension personnel have a clear stake in the work and thereby some "pride of ownership" in the technology.

Thirdly, research and extension efforts to support diversification must be carefully planned and closely coordinated. Without this, research may well run off-track or be underutilized. Some "Task Force" approaches have been used at times, sometimes with benefit, to ensure that diversification is successful. The Task Force approach seems to work well if the area involved is defined and if the leadership of the Task Force is in the hands of senior, experienced agriculturists with some authority and control over both research and extension efforts.

RESEARCH AND EXTENSION NEEDS FOR DIVERSIFICATION

RAPPORTEUR'S COMMENTS

Hikmar G. Nasr*

The first speaker agreed that research and extension for diversification was difficult and pointed out that in some countries of the East Asia Region, particularly the Pacific Islands, there are insufficient resources, particularly manpower, to conduct simple commodity research. He asked if, in these situations, research for diversification was not a luxury. Mr. Plucknett disagreed stating that if farmers needed better incomes or if alternative enterprises were needed, then research was necessary and quoted the specific example of the uplands in Indonesia. An additional example by another speaker described the situation in Burma where rice prices were declining and diversification was becoming a necessity but, since technology was not available, research was needed. A speaker familiar with West Africa explained a similar need to diversify, and the interest of farmers in growing grain legumes, while the technology was lacking.

In further discussing the problem of the additional costs and manpower requirements for research and extension resulting from the need for diversification, a speaker pointed out that in Thailand much of this was done by the private sector at no cost to the Government. Another speaker informed the meeting that non-government organizations (NGO's) could be involved in research and extension worldwide, just as they are now in Central Africa, with the support of the Bank. At the same time, he suggested that NGO's need a statement of Bank policy on such support. Another speaker suggested that we look to traditional farming systems as a source of information on diversification and gave as a good example the situation in Paraguay where some farmers are growing up to twelve crops in a small watershed.

In concluding the discussion on whether diversification research was a luxury, a speaker pointed out that where diversified agriculture was the norm such research was a necessity and simple commodity research may be looked at as the luxury.

Several statements were made about the need for market research to be carried out alongside the technical research to ensure that any new crops that might be developed and hence promoted could actually be marketed. One speaker pointed out that, in Thailand, the commercial organization who promoted new crops takes care of the marketing. By contrast, in Brazil, another speaker explained, a plant to process cassava was built before farmers were prepared and the enterprise collapsed. It was pointed out that the cassava plant failed because of crop failure due to cassava leaf blight--and thus a lack of research.

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A speaker stated that historically agriculture started as a diversified discipline and gradually evolved towards single commodities, and asked why diversify when the market is not a problem. Mr. Plucknett responded that if there was no need to diversify, then don't diversify, but, at the same time, he pointed out that many examples exist where farmers need to move away from a single commodity, e.g. the corn belt of the U.S. This led to a discussion of what triggers the need to diversify. Is it the need for optimization? Mr. Plucknett regards it as partly a natural resources question where research agencies need to find alternatives that fit the natural resources.

A "dissident" commentator suggested that diversification itself and consequently diversification research was the current fad and the reasons would go away before the results were out. There was little support for this viewpoint and a consensus was established that there were situations where it was necessary indeed. However, it was pointed out that there had been a lot of successful crop diversification in West Africa without too much research stimulated by market opportunities. This speaker rightly pointed out the "new" crops were not completely unknown. This view was supported by advising the meeting of the necessity of looking at what had been done in similar ecological areas.

The question of the implications for the extension agent were discussed briefly following from the points made in Mr. Plucknett's paper. It was generally recognized that extension agents should be cooperating with the researchers since they should develop the new skills in order to deliver the new technology to farmers. It was agreed that most countries could not afford specialist extension agents and the generalists needed to "know their business." A speaker, using an example from Mexico, proposed that farmers learn about improved technology for new crops faster than they learn new technology for traditional crops.

The discussion turned to more radical changes in the farming system, namely: replacing annual crops with perennials, integrating livestock and fodder production, or changing to tree crops. It was agreed that these posed greater difficulties that require considerable research, and that because of the costs of making the changes and the delayed benefits more attention should be given to credit needs.

Several speakers reminded the meeting that there were reasons for diversification other than loss of market for a commodity or loss of comparative advantage. These included the control of diseases and insects, and the introduction of legumes (grain and forage) into rotations in order to increase income and to restore soil fertility. The latter approach has been introduced in some countries to reduce fertilizer subsidies. The Turkey situation was given for example where legume crops have successfully replaced fallows and at the same time increased yields and incomes. Speakers familiar with livestock presented their views on the implications for animal production research. Small animal production research is already less developed and may be more time consuming than annual crops research. There was a feeling that countries would need to depend on results from similar areas elsewhere. Two speakers felt strongly that

farmers would readily adopt new technology if it was shown to be feasible. In some Sahelian countries, livestock diversification has speeded up due to the high value farmers place on manure in the farming system.

In summarizing, Mr. Plucknett referred to some experiences in Hawaii agriculture where he had been associated with diversification research. Previously he had referred to the small numbers of scientist actually engaged relatively to the perceived needs. He referred to the activities of the sugar cane and pineapple research institute who participated in diversification research to provide alternative uses for marginal sugarcane and pineapple lands. He concluded by stressing that robust agriculture requires more options and this requires both research and extension to provide needed technology.

UPSTREAM NEEDS: Information, Inputs and Credit

Hamdy M. Eisa*

Recently agricultural diversification has been receiving renewed interest due to several reasons, particularly the decline in commodity prices e.g. sugar, rice and palm oil. This prompted agricultural planners to re-think of alternative crops which will at least sustain or improve the countries' economies and diversify sources of farmers' incomes, especially smallholders. Prior to examining the subject of upstream needs of diversification, we need to define the principal issues involved and means of addressing them.

In general diversified agriculture is practiced at the smallholder level, and in home gardens. Farmers and housewives tend to grow several perennial and annual crops and livestock mainly to satisfy their families' subsistence needs, also to generate additional income to purchase cash inputs and non-farm products. Therefore, in developing countries, diversification at the subsistence level has been traditionally practiced, to provide needed nutrition or income.

This paper will try to examine major issues in agricultural diversification for commercial crop production and the contribution of information, inputs and credit to this process. The paper will select examples of agricultural diversification to illustrate approaches taken in some developed and developing countries. Lessons learned from these examples will hopefully clarify the extent of implementing agricultural diversification policy. The paper is not meant to be an exhaustive review of literature but to provide an outline of the diversification aspects and generate discussion from the group. The final outcome of this session will hopefully lead to a better understanding of this process and how the Bank might help borrowers in this respect.

Conceptual Aspects of Agricultural Diversification

Agricultural diversification, defined as increasing the number of crops and products, has been a national policy goal for many governments in developed as well as developing countries. It usually evolves out of the growing concern that the economy is too dependent on a small number of commodities. Risk aversion, import substitution or export promotion are additional reasons often stated by agricultural planners to promote agricultural diversification. However, socio-economic and political considerations are also important.

Agricultural diversification is the outcome of an evolving process ancient as agriculture itself, yet sometimes it is introduced as an innovation or a new concept, aimed at improving the efficient use of available resources in agriculture and other sectors to maximize farmers income, benefit consumers and improve the countries' economy. Diversification is an evolutionary process. History indicates that the

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comparative advantage for a certain country to produce a certain commodity changes with time. Thus, our discussion of diversification is a dynamic situation, and is always dependent on the point in time of the history of agriculture development in a given country.

Usually governments (in both developed and developing countries) try to encourage producers, particularly smallholders, by promulgating decrees, providing incentives, making inputs available and ultimately marketing the product. Governments intentions are usually motivated by socio-economic objectives with political dimensions primarily to provide rural employment. If the diversification process is based on a true comparative advantage, and not due to government-induced intervention and distortion, it usually succeeds. Evidence points to the fact that private sector involvement from the inception in diversification is always needed to direct the process, and is ultimately implemented by producers and consumers as well.

Prior to considering the main subject assigned to this discussion group, we should try to understand at what level diversification takes place:

- (a) sector level: between agriculture and other sectors e.g., construction with resulting off-farm employment contributing to rural income, thus increasing labor wages in agriculture or blending the two as in part-time farming;
- (b) subsectoral level: between or within subsectors e.g., livestock, fisheries, tree crops, food crops, horticultural crops, industrial crops, etc.;
- (c) producer level: smallholders, large farmers, tenants, subsistence farmers, commercial farmers, government (parastatals and state farms) or private sector;
- (d) crop level: annual or perennial crops or a combination of both;
- (e) consumers level: rural, urban and speciality crops;
- (f) intensification or extensification level: double or multiple cropping or production (horizontal diversification in new areas);
- (g) agro-industrial level: direct consumption, simple preparation or integrated production-processing (vertical diversification);
- (h) market level: import substitution or export markets, rural and urban; and
- (i) marketing intermediaries: private or public sector, barter trade, free market, centrally planned economy, etc.

The above mentioned list is by no means exhaustive but it helps in trying to understand the interaction between these levels and necessary integration of factors involved in the diversification process.

Evolution of Diversification

At the producers' level (Farmers), diversified cropping is usually more prevalent at early stages of agricultural development. With the development of modern technology, particularly in machinery, irrigation, fertilizers, pesticides, agro-industries, marketing and communication, monoculture gradually dominates agricultural production activities. Increase in size of farm holdings, shortage in rural labor, improved agricultural services, e.g., contract growing, improved farmers' education, increased urbanization and government intervention may also have encouraged monoculture particularly in developed countries. The participation of governments, through parastatals, in agricultural production has led to increased specialized monoculture e.g. tree and industrial crops. Consumers' demand for a steady reliable supply of agricultural commodities through the profusion of supermarkets encouraged the development of agricultural corporations, prevalence of monoculture and specialization of certain areas in growing certain crops (US wheat belt, corn belt, cotton belt, tobacco, in southern states, feed lots). Moreover, Government support programs for particular commodities influence farmers' decisions and may contribute to increased crop specialization.

There are some indications that the picture is changing, particularly in developed countries. Organic farming is becoming more popular not only on environmental grounds but also among resource-conscious farmers for better use of available resources. As it sometimes called regenerative farming, it advocates more crop diversification and better use of leguminous and cereal crops to provide nutrients, control diseases and insects, improve soil structure and decrease cost of production per marketable unit. In some developing countries, agricultural diversification is promoted for import substitution and food security. Socio-economic aspects play an important role in propelling diversification (migration labor is particularly needed for labor intensive operations, in horticultural production in the U.S.).

Information

Prior to making a value judgment on agricultural diversification, the reason(s) for diversification (substituting crops, commodities or activities or adding new ones) should be clarified.

- (a) Why diversify?
- (b) What is (are) the area(s) of diversification?
- (c) At what level? (para. 7).

I will attempt to briefly answer some of these questions. Because of limited time, my remarks will primarily address areas where information is needed prior to making decisions pertaining to crop diversification:

- (a) natural resources: knowledge of physical and human resources in the area where diversification is intended;

- (b) research information: availability of an economically recommended technical package for the commodity(ies) under consideration (this will be addressed separately by another group);
- (c) assessing constraints and prospects from production to marketing;
- (d) demand: the need for increased production of a crop or groups of crops has to be demonstrated, especially if it is for export;
- (e) kinds of crops: annual crops are easier to diversify than perennial crops;
- (f) market opportunities: information on areas of surplus and deficit for commodities under consideration;
- (g) land tenure: government land, alienated land, customary land, relationship between landowners and tenants, size of farmholding;
- (h) credit: availability, terms, formal, informal, commercial, government, commodity specific or general, collateral (this will be dealt with in detail later on);
- (i) incentives for diversification: through the government or private sector, temporary or permanent;
- (j) kinds of inputs: through government or private sector, costs, subsidies, timely availability and quality (seeds and preparation materials);
- (k) extension service: government-private, efficiency (this will be addressed by a separate group);
- (l) infrastructure: transportation, sea, air, roads, costs;
- (m) Labor availability: skilled, unskilled, rural, urban, migrant, family, hired, costs, employment generation; and
- (n) Socio-economic: population growth rate, farmers group, cooperatives (private-Government), farmers receptivity, adoption of modern techniques, rural and urban income levels and purchasing power.

Depending on answers to the aforementioned points, a broad picture of the prospects for encouraging the production of a certain crop or agricultural activity could be assessed. Of course, additional factors of specific importance to the commodity under question would complement the points mentioned above resulting in the formulation of a more defined course of action. The needed information is usually provided through agricultural research and extension services or in the form of feasibility studies depending on the size of investment and clients.

Inputs

An essential part of the decision making process in diversification is information on inputs. First we will consider the major physical inputs needed in crop diversification and then major policy aspects to ensure their availability. Of course, the kinds of inputs differ with each agricultural activity.

Physical Inputs:

- (a) seeds and propagation material: timely availability of quality seeds of new introductions, established varieties, and healthy propagation material at reasonable prices is an essential input in any diversification process. Development of disease and pest resistant varieties is the best economic means to control pests and the safest to protect the environment. Reliability of supply is very important in gaining farmers' confidence. Lead time from identification to multiplication and distribution of seeds and propagation material is important;
- (b) suitable power source: the availability of an economic source of power, e.g., draft animal, animal drawn implements, fuel, farm machinery, pumps, harvesting and threshing equipment and transportation is essential;
- (c) water resources: reliability of effective rainfall, timing and availability of irrigation water could be the main limiting factor in the diversification process. Cost of water and its management should be taken in consideration. Availability of irrigation water, providing other factors are not limiting, promotes double and multiple cropping and diversification. For that reason, crop diversification is attractive to water resource development planners. However, the suitability of the irrigation system for the introduced crops should be considered;
- (d) agricultural materials and chemicals: timely availability of plant nutrients (organic and chemical fertilizers) is essential for intensive cultivation and multiple cropping. Pesticides, herbicides and other agricultural chemicals should be available. Use of plastic, fiberglass and glass in outdoor protected cultivation, extends crop production in greenhouses under adverse weather conditions;
- (e) capital: availability of necessary funds whether through private or government institutions should be determined. In case of agro-industries, provision of operating capital is as important as capital investment;
- (f) labor: family or hired labor, skilled and unskilled, costs are important factors in diversification particularly for labor intensive operations (e.g., horticultural crops);
- (g) infrastructure: suitable roads, vehicles, market outlets; and

- (h) suitable soils or plant media: Different crops require heavy or light soils for optimum production (e.g. rice and peanuts). Sometimes soil amendments are needed (e.g., lime, sulfur or organic matter) or soil be substituted completely as in some greenhouse operations (sand culture, soil mixes and hydroponics).

Policies Related to Provision of Inputs

Government policies play a decisive factor in the diversification process not only through provision of inputs but also in determining whether their use will be economical. Subsidies, pricing policies of inputs and outputs, taxes, production regulations, budgeting, support for research and extension, import and export regulations, wages, land tenure, irrigation management and marketing policies are examples of areas where government intervention affects the diversification process. Issues related to government(s) policies and role of the private sector in the diversification process will be discussed separately at a different session.

Credit

Availability of capital is essential to the diversification process from the production to the marketing stages. Formal and informal sources of credit play an important factor in providing capital needed to propel the rural economy. Rural credit schemes at subsidized interest rates are always promoted as the rescue of smallholders from the greed of the informal sector (money lenders), yet in many activities availability of funds is the limiting factor and not interest rate per se. Timely availability of funds, simplicity of lending procedures and closeness to the source characterize the informal sector. The formal sector always preaches that its programs are geared to smallholders, yet the cost of administering small loans is high and collateral for investment is usually a prerequisite thus making it less responsive to smallholders' needs. Some contend that with most of the subsidized programs, the majority of the beneficiaries are usually the large farmers and not the small ones. Tenants rarely benefit from formal rural credit unless it is channelled through or guaranteed by landowners.

Crop specific or commodity oriented credit schemes are always advocated whenever the diversification process is to be speeded up. This may encourage farmers to adopt new or improved technical packages, thus leading to increased production of the commodity under consideration. However, in many cases, farmers fail to repay the credit thinking that it was part of the promotion package. Rural credit portfolios are full of examples where the amounts of arrears and written off subloans could jeopardize the financial liquidity of lending institutions.

Our experience with agricultural credit schemes in the diversification process show that:

- (a) availability of funds is the limiting factor and not the interest rate per se;

- (b) crop or commodity specific credit programs, may initially succeed in promoting the commodity under question, but do not provide sustenance to the diversification process as other crops are usually neglected;
- (c) provision of rural credit to all kinds of rural activities including off-farm investments should be encouraged;
- (d) farmers convinced of the rationale behind promotion of diversification, will invest in it;
- (e) the informal sector has a role to play and the best solution is to find ways to optimize contributions of the informal and formal sectors to the process;
- (f) involvement of the private sector is essential at all stages of the diversification process from initial testing and evaluation of the technical packages to the marketing of the products;
- (g) to decrease the processing cost of loan administration to smallholders, lending should be channeled through farmers' groups, growers associations, processors and cooperatives, on the basis of efficiency and not according to political considerations;
- (h) some credit institutions get involved in the procurement of inputs--this may be justified in the early stages of the process but should be phased out gradually;
- (i) lending institutions should be innovative regarding provision of collateral and security of loans; and
- (j) mobilization of rural resources is essential to circulation of funds.

Examples of Crop Diversification

To illustrate the points mentioned above and their relationships, some examples of agricultural diversification programs in both developed and developing countries will be examined in the following paras.

New Zealand: Horticulture in New Zealand: A New Impetus (M.A. Nichols, 1986. SPAN Vol. 29. No. 2 P. 79-80). The classic example of horticultural diversification is the kiwifruit development in New Zealand. New Zealand capitalized on its natural resources and geographic location with seasonal advantages to supply distant markets in Europe and the Far East (Japan, Hong Kong and Singapore) with high quality fruits and vegetables.

New Zealand's small population of three million can only absorb part of the country's horticultural production, therefore any expansion was export oriented. Horticultural exports totalled only US\$8 million in 1970

(1.7% of agricultural exports) but by 1980 had risen to US\$65 million (3.9% of agricultural exports). In 1985, horticultural exports reached US\$255 million (8% of agricultural exports, and 5% of total exports) of the following commodities:

Commodity	US\$ million
Kiwifruit (fresh and processed)	95
Apples (fresh)	54
Peas (processed)	26
Onions (fresh)	9
Squash (fresh)	8
Asparagus (fresh and processed)	6
Strawberries (fresh and processed)	5
Sweet corn (processed)	4
Boysenberries (processed)	3
Potatoes (fresh and processed)	3
Others	42
Total	<u>255</u>

Kiwifruit offers the most exciting horticultural diversification phenomenon. Over the past decade plantings have increased over 1,000% and are projected to exceed 24,000 ha by 1990. Seed of Actinidia deliciosa was introduced into New Zealand from China in 1906 and was promoted under the name Chinese goosberry. Its commercial potential was slowly taking off and in 1953 only 31 ha were planted. Small quantities were exported in the 1950s and gradually by the 1960s exports started to pick up. This initial success is mainly attributed to renaming of the fruit as kiwifruit and the establishment of the Kiwifruit Marketing Authority which is fully controlled by producers and exporters. Aggressive international marketing campaigns paved the way for its introduction to European and North American Consumers. In the meantime, research, extension and marketing linkages were strengthened to resolve problems facing kiwifruit development. Today the US and other countries have followed New Zealand, in producing kiwifruit, which still has a great share of the market. The success of the kiwifruit paved the way for development of other New Zealand horticultural activities.

The development of horticulture in New Zealand was based on adequate flow of information from the two main government research departments, the Department of Scientific and Industrial Research (DSIR) and the Research Division of the Ministry of Agriculture and Fisheries (MAF). Extension is largely the responsibility of MAF supported by specialist diagnostic staff (Subject Matter Specialists). In addition the number of private consultants is increasing. Education and training has increased tremendously. Ten years ago only two Universities offered tertiary courses in horticulture at Diploma (non-degree), Bachelor degree and post graduate levels. Now over a dozen other institutions offer horticultural certificate courses. Timely provision of information, inputs, improved transportation (air and sea) and credit are primary factors in the success of horticultural development in New Zealand.

USA: Diversification into Fruit Production on Long Island Potato Farms, (Warner, M.E. and G.B. White, 1986. An economic study of potato farm diversification into fruit crops. XXII International Horticultural Congress, Davis, Ca., USA No. 1667). The outer fringe of the potato production area on Long Island is only about 100 km east of New York City. Suburban development pressures, rising land values, and drinking water contamination by pesticides forced traditional Long Island potato growers to alter their farming systems (crops, cultural practices and attitudes) in order to continue to earn their livelihood from farming. For generations, potatoes have been the mainstay of Long Island agriculture. With the discovery of aldicarb (pesticide) in groundwater in 1979, groundwater pollution was recognized as an environmental hazard made more acute by high population density, monoculture potato production, sandy soils, and increasing resistance of major pests to pesticides, especially the Colorado potato beetle. This latter factor had led to an ever-increasing reliance on pesticides as the means for controlling major pests. Integrated pest management practices, including crop rotations, had been identified as a means to alleviate pesticides' environmental hazards, but the crops for rotation must be chosen carefully to avoid adverse economic impacts.

A more diversified farming system is already evolving on the island. Many farmers are switching from potatoes into vegetable and fruit crops. Several economic studies have demonstrated the possibility of attaining increased net average income by expanding the production of vegetables in the traditional potato cropping system. Further studies were designed to investigate the economic feasibility of crop rotation and diversification into fruit crops. Specifically, peaches and table grapes were analyzed. These crops were chosen for their complementarity in use of machinery and cold storage, their suitability to Long Island agro-economic environment and for the availability of potential markets.

Transition from potato to fruit crops production required a multiperiod analysis over a long-time horizon in order to evaluate the effect of perennial fruit production on a farm's income, labor, capital and marketing requirements. The objectives of the studies using a multiperiod linear programming model were to determine:

- (a) the relative profitability of peaches and table grapes in the traditional annual cropping system of potatoes, wheat and cauliflowers;
- (b) the major constraints (i.e. skilled and unskilled) labor, investment capital, cashflow, and debt servicing, to diversification;
- (c) the effect of retail and wholesale marketing channels on the profitability of peaches and grapes; and
- (d) the groundwater contamination potential of pesticides and nitrates used on peaches and grapes.

Results indicate that a transition into peaches and grapes would be possible using the resources of a typical Long Island potato farm (60 ha) and would result in increased returns. Diversification into peaches and grapes would permit farmers to rotate their potato fields with grains and vegetables. The increase or loss in net income is related to management ability, especially marketing, in addition to availability and cost of skilled and unskilled labor needed for fruit production operations (e.g. pruning and harvesting). Cash flow was tighter in the first four years than continuous potatoes due to negative cash flow for perennial crops in the early years. Thereafter net returns improved dramatically as shown in the Table 1.

Table 1: COMPARISONS OF COSTS AND RETURNS PER HECTARE, LONG ISLAND

	Gross Returns	Selected Variable Costs	Skilled Labor Costs	Unskilled Labor Costs	Total Variable Cost	Net Returns
Continuous potatoes	\$3,578	\$2,271	\$279	\$126	\$2,676	\$ 902
Rotated potatoes	3,578	2,145	272	126	2,543	\$1,035
Continuous wheat	405	274		0	301	104
Rotated wheat	405	203		0	220	185
Cauliflower	6,296	2,721	591	1,067	4,379	1,917
Peaches-Year 1	0	1,740	455	35	2,229	-2,229
Year 2	0	366	311	52	729	-729
Year 3	4,354	2,943	833	642	4,418	-64
Year 4/a	8,710	1,683	1,018	1,058	3,758	4,952
Year 5	13,064	2,394	1,396	1,564	5,355	7,710
Years 6,8,10,12	13,064	2,199	1,349	1,564	5,411	7,653
Years 7,9,11,13	13,064	2,459	1,389	1,564	5,411	7,653
Table Grapes-Year 1	0	6,778	754	52	7,583	-7,583
Year 2	0	499	749	69	1,317	-1,317
Year 3	4,727	2,130	1,836	316	4,282	442
Years 4,6/a-9,11-14	9,452	2,323	2,456	529	5,308	4,144
Years 5,10	9,452	2,644	2,469	529	5,646	3,810

/a Break-even point on cash basis.

Source: Warner, M.E. 1985. "A Multiperiod Linear Programming Model of Diversification into Fruit on Long Island Potato Farms." A.E. Res. 85-13 Cornell University.

Marketing channels were important determinants of the level of peach and grape production. Without adequate direct retail markets (or improved direct wholesale prices), peaches and grapes would not be produced in large amounts and grapes might not be produced at all. Perishability of both products compared to potatoes is very high, thus management ability

becomes a critical factor. As for groundwater contamination problems, the transition into peaches and grapes showed slight beneficial effects in reducing environmental risk.

USA: Alternative Cash Crops to Tobacco in North Carolina (E.A. Estes and L.G. Wilson 1986. Personal Communication and Unpublished Information). Recently, changes in US commodity programs and tobacco policy have tended to reduce income streams and have heightened growers' searches for alternative sources of income particularly among small and medium size operators. Future reductions in target and loan rate levels for program corps included in the food security act of 1985 will accelerate the number of producers leaving farmers between now and 1990. Opportunities and alternatives, however, will continue to exist for financially solvent farmers.

Total deregulation of the tobacco program would eliminate returns associated with quota ownership (which at present can be leased), result in lower revenues, remove marketing restrictions and increase planted acreage in areas where management is efficient and production costs are low. Thus the elimination of planting restrictions may result in reduced output of other crops in favor of more tobacco. Further studies suggest that vegetable production and other alternative enterprises in these areas are not likely to become important contributions to the diversification process. However, in areas where tobacco yields are below average and costs per unit are higher, alternative enterprises appear to be more attractive including off-farm employment. Adoption of alternative enterprise production will certainly depend on changes in local and national demand (marketing prospects) and on the farmers' acquisition of new skills. Demand considerations suggest that farmers will explore alfalfa hay, nursery crop items, poultry, herbs and root crops, sheep, farm forestry, small fruit and selected vegetable crops. However, the challenge is to balance demand and supply of these alternative products without producing quantities large enough to cause price and industry disruption.

Mauritius: Agricultural Diversification Project (FAO/CP Reconnaissance Mission Report of June 1986). The economy of Mauritius is dominated by sugar production. The country has a significant comparative advantage in producing sugar which occupies 90% of the cultivated area (86,000 ha). The remaining 10% are occupied by tea (4,000 ha), food crops (4,500 ha) and tobacco (500 ha). The main constraints to agricultural development are: (i) limited cultivable land; (ii) long distance from major world markets; and (iii) frequent adverse weather conditions (cyclones). Sugar cane is the principal crop that can withstand the degree of cyclone damage encountered in the area. Forest areas cover some 56,000 ha, of which 21,000 ha are crown lands. The forest department manages 11,000 ha of pine and eucalyptus plantations which are currently leased for hunting and fishing.

Mauritius has a significant comparative advantage in producing sugar. Few commodities other than sugar can be produced at a cost less than their border price equivalents, leading to the conclusion that

agricultural diversification should only be encouraged as a complement rather than as a substitute for sugar production. Government policy regarding agricultural diversification is based on a white paper on the subject published in February 1983. The key objectives to be achieved are: (i) to reach self sufficiency in selected food crops; (ii) to reduce dependence upon imported meat and milk; (iii) to develop all lands to their maximum productivity through intensification measures; and (iv) to establish a framework of marketing facilities, institutions and price stabilization mechanism to provide improved support and security for producers.

As a result of efforts by the large sugar estates in rotating sugar with other crops, potato production exceeded consumption. The country is self sufficient in groundnuts, green vegetables, onions, and garlic. Corn production only supplies 30% of the country's requirements. A number of the larger estates have diversified into exotic cut flower production (mainly Authurium andreanum), dry beans for domestic consumption and okra and snap beans, both for export to European markets by air.

The government is trying to promote diversification through the introduction of a system of fiscal and other concessions e.g. granting of agricultural development certificates to encourage innovation and the use of modern technology. To achieve these goals, the government established a High Powered Committee (HPC) in Agricultural Diversification in 1980 and a Food and Agricultural Research Council (FARC) was created. HPC includes members of the private sector.

The reconnaissance mission recommended that the subsidies questions to producers and consumers should be assessed in relation to foreign exchange earnings. In addition the mission put forth several ideas for further investigation and concluded that: (a) the scope to increase production or introduce new large scale crops is limited by land availability and high returns for sugar, and (b) that diversification efforts remain based on interlining and rotation with sugar cane.

Cyprus: Khrysokhou Irrigation Project (Staff Appraisal Report April 18, 1983). This Bank assisted project provides an example of introducing irrigation systems in semi-arid rainfed areas with an average annual rainfall of about 600 mm. The project's objectives are (a) to expand the irrigated area; (b) intensify agricultural production; and (c) increase agricultural exports and foreign exchange earnings. The project area of 2,000 ha is located in a relatively isolated and underdeveloped part of the island. Employment opportunities in the project are rather limited and nearly half of the farming population needs to supplement farm income by engaging in employment elsewhere. The project is expected to directly benefit about 3,500 persons and generate additional benefits in the horticulture subsector. The following table illustrates the kinds of crops and cultivated areas with and without the project.

Table 2 Crops and Cultivated Area In Khrysokhou
Irrigation Project Area (ha)

	Without project	With Project
<u>Irrigated Crops /a</u>		
Citrus	162	600
Bananas	7	80
Decidious fruits	15	120
Table grapes	12	160
Vegetables	36	500
Avocados	-	160
Table olives	-	140
Almonds	-	80
Pistachios	-	40
Pecans	-	120
<u>Subtotal</u>	<u>232</u>	<u>2,000</u>
<u>Rainfed Crops</u>		
Cereals	826	-
Fodder	186	-
Legumes	158	-
Others	598	-
<u>Subtotal</u>	<u>1,768</u>	-
<u>Total</u>	<u>2,000</u>	<u>2,000</u>

a/ Tubewell irrigation schemes.

Source: Khrysokhou Irrigation Project, Staff Appraisal Report, World Bank.

The above with project cropping pattern is an indication of the wide variety of irrigated crops that can be grown in the various parts of the project area. It should be noted that the cropping pattern includes composite groups, e.g., citrus, deciduous fruits, vegetables, the latter including some 30 different categories, and hence the variety of the cropping pattern is even larger than is at first apparent. The above crop mix is considered a probable initial development, given the most important agronomic, social, economic and market constraints. With many alternative options available in the face of changing constraints and with new introductions being made available regularly by the extension service, farmers' decisions can not be predicted with any precision.

In Cyprus, previous irrigation projects were implemented successfully. The country also has a well qualified research institute, and an efficient extension service. Therefore farmers' training and adoption was not a problem as most of them work in neighboring irrigation projects with similar crops. Nurseries were established in the well irrigated area of the project to provide adequate supply of propagating material. Farmers were consulted in the cropping pattern and even surveyed for their requirements. Cyprus has its traditional markets established in Europe, particularly England, and the Middle East. However, with the formation of the European Economic Community and the recent entry of Spain and Portugal (in January 1986) as full members, Cyprus has to adjust its marketing strategies. Thus the main limiting factor for area development is irrigation which is to be provided through the project.

Other Studies: In addition to the examples mentioned before, the Bank launched several subsector studies in selected countries particularly in the East Asia to assess agricultural diversification prospects following the decline of sugar, rice and palm oil prices. These studies include:

- (a) Indonesia. Agricultural Assessment (selected issues in diversification and development potential);
- (b) Philippines. The Philippines Sugarlands Diversification Study; and
- (c) Malaysia. An Assessment of Agricultural Diversification Prospects.

Further studies were undertaken to investigate diversification potential such as:

- (a) Burma. Crop Diversification under rainfed and irrigated conditions; and
- (b) Bangladesh. Foodgrain self-sufficiency and crop diversification.

The Indonesia study highlighted the importance of alleviating the following constraints if diversification in food crops (other than rice) is to be successful: (a) lack of farmers' incentives to invest in production inputs; (b) slow adoption of technical packages developed at the provincial and regional levels; (c) emphasizing economic and financial return aspects of implementing certain packages; (d) shortage of quality seeds; (e) implementing a proven, integrated pest management approach to food crops; (f) current government practice of promoting food crops in all provinces, without determining or relating it to the agroeconomic viability of doing so (e.g. promotion of soybeans in acidic soils); (g) encourage farmers' adoption of simple efficient equipment for harvesting, threshing, drying and storage--some of which have already been developed; and (h) lack of efficient transportation and collecting and marketing mechanisms.

Conclusions

The following conclusions or lessons could be drawn from the aforementioned examples and studies on crop diversification:

(a) Information:

- assessment of marketing potential is crucial to the direction of diversification, crops etc. and should be linked with research and extension;
- review of the production to marketing chain of present proposed and alternative crops should be undertaken;
- crops with clear or potential comparative advantage should be promoted through experienced producers who can evaluate pros and cons of certain technical packages and development constraints;
- private sector participation should be ensured at all stages;
- information on competing countries, e.g., their cost of production, markets, etc. is essential to learning from mistakes done by others and forming new strategies;
- government regulations should be designed to guide and not to constrain the diversification process;
- marketing strategies should address ultimate consumers' needs whether in domestic or export markets.
- continuous flow of up-to-date information in research, extension, production and marketing is essential to sustainability of diversification;

(b) Inputs:

- availability of an initial economic technical package which can be developed through experience should be the basis for determining required inputs;
- lack of continuous supply of quality seeds and propagation material is usually a bottleneck;
- governments are always tempted to develop, multiply and distribute inputs, particularly seeds, and this may be desirable in the initial stages but gradual phasing out and involvement of the private sector is essential to its development and continuity of providing needed inputs;
- any crop diversification programs should be based on a sound farming system to optimize use of available resources;
- inputs needed for agro-processing activities should be modern, available and promoted through the private sector;
- greater attention should be devoted to the use of agricultural chemicals and its environmental effects;
- efficient management of water resources plays an important role in the diversification process;
- availability and cost of skilled and unskilled labor determines the extent of diversification; and
- with the increased level in rural education, efforts to retain needed labor should include opportunities for off-farm employment.

(c) Credit:

- availability of capital through farmers' own resources and formal and informal sources is essential to the diversification process;
- mobilization of rural savings needs increasing attention;
- provision of subsidized credit on a commodity approach may produce initial success but will cause financial and budgetary difficulties;
- availability of capital is usually the limiting factor in rural areas, not interest rates per se;
- promotion of other rural activities through general rural credit schemes should be encouraged and innovative security arrangements should be sought;

- lending to farmers' groups, growers' associations and marketing organizations based on intimate knowledge of their activities should be the basis for lending operations.

UPSTREAM NEEDS (INFORMATION, INPUTS, AND CREDIT)

RAPPORTEUR'S COMMENTS

Emmanuel H. D'Silva*

It was agreed that there need not be any conflict between diversification and specialization. A diversified agriculture consists of farmers who specialize in two or more commodities in which they have comparative advantage. Frequently, these crops are complementary (e.g., in rotation) and thereby contribute to the sustainability of agriculture. Diversification is possible within cropping systems by adding new crops for which demand exists. However, there was agreement that diversification should not be seen as a panacea for all agricultural problems. Before attempting to diversify, two questions need to be asked: Why diversify? And diversify for what?

A speaker expressed concern that emphasis on diversification might result in overproduction of certain commodities, create a glut in the market, and depress prices. Do you avoid overproduction "traps" by discouraging farmers from diversifying? In response, Mr. Eisa emphasized the importance of obtaining good information on domestic demand and the potential for exports to avoid these traps. Farmers need to be advised: "if you cannot market your crop, don't grow it."

The group recognized that in some countries, diversification into specialized crops faced a limited market. As a result, the marketing components of most diversification programs are weak and present considerable risks. Nevertheless, some countries have successfully diversified. These include Chile, Cyprus, Indonesia, Kenya, Malawi, and Turkey. They all started small with private initiative. Production increases followed market expansion--not the other way around. In retrospect, these efforts were quantum leaps in higher income and exports.

How should World Bank project officers handle diversification components? Should these be entrusted to nongovernmental organizations (NGOs) for implementation? Participants agreed that the diversification process should be tailored to particular communities and areas that enjoy comparative advantage. It must start on a small scale, and the commodity grown must be suitable for easy processing. "Area approaches" were recommended as vehicles for diversification for Bank assisted projects.

The sense of the discussion group was that information was necessary for diversification, but that it need not come from research and extension alone. Government policies on inputs and outputs are an important factor in encouraging or discouraging diversification. However, government programs should be gradually phased out and the private sector encouraged to be the main source of inputs. While credit is crucial, it is

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POST-HARVEST CONSIDERATIONS FOR DIVERSIFICATION

James G. Brown*

Most agricultural economies in which diversification has become an issue have already reached a degree of specialization and commercial market dependence which is predicated on the existence of a post-harvest sector. The technology, capital, institutional structure and policy environment of this sector is quite distinct from that of the farm sector. Furthermore, these storage, processing and marketing facilities and institutions have evolved to meet the needs of particular commodities and trade relationships, and it is highly unlikely that, without change, they could serve a new agricultural production pattern.

Development agencies such as the Bank, which provide assistance to the agricultural sector, have historically been preoccupied with on-farm production. This focus of our efforts may have resulted from the Malthusian specter of widespread food shortage, which experienced an almost universal revival among both experts and the general public alike in the late 1960's and 1970's. It may also be the result of our predisposition to search for quantifiable benefits to our efforts, and incremental production lends itself to measurement more than the commercial and institutional dimensions of agricultural development which appear to have suffered from a corresponding lack of attention. Indeed, with respect to the neglect of marketing which is characteristic of our portfolio, one is tempted to infer a disdain of this function which is not unlike the attitude towards merchants in 19th century Europe or the view of the middleman as an unproductive member of society which prevails today in many developing countries. The latter has led to public sector intervention, and other forms of erosion of the margins which are essential for intermediation services.

A few figures from the Bank's agriculture portfolio will illustrate the relative importance we attached to post harvest activities in recent years. Between 1972 and 1983, total agriculture lending by the Bank and IDA amounted to \$27.9 billion. Of this, only \$4.4 billion or 16% was committed to post-harvest systems. Processing accounted for 49% of the \$4.4 billion; storage 38%; and all forms of assistance to marketing, from market studies to selling yards, amounted to only 17%. ^{1/} Marketing assistance amounted to only 3% of Bank support to the agriculture sector during the period under review.

As clearly as we see a production focus in our historical data, we are beginning to see a shift toward post-harvest issues in our present work program. They are a recurrent theme in sector work, and special studies

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^{1/} Totals exceed 100% because some components assisted multiple functions.

have been initiated in a number of Regions (e.g. Europe, Middle East and North Africa: Fruits & Vegetables; Latin America and the Caribbean: Sugar). An increasing share of projects have components and conditionality related to processing, marketing and storage.

The Need for a Different Approach

The purpose of this session is to consider some of the issues and dimensions of downstream needs as they pertain to agricultural diversification programs. At the outset, we should recognize two distinct dimensions of diversification: the first is making different or more complete use of commodities currently being produced; the second is producing different commodities. However, there is also an ambiguity in our formulation of the issue of downstream needs of diversification that is potentially very dangerous. If we continue to start our inquiry at the farm, that is if we take alternative farm products as given, and then turn to processing and marketing to take that production off our hands we shall in very short order face the same problems that we have today, only in different commodities.

It will not suffice in planning for different production patterns simply to look more carefully at the downstream needs of the selected commodity. On the contrary, diversification of this sort will lead to the problems of surplus and depressed prices in different commodities unless, in a very real sense, we let downstream needs determine the new production patterns. We must think in terms of reversing the planning process, to work from the market back to the farm via the range processing and distribution alternatives that apply to each commodity. Of course, soils, climate, irrigation and the structure of assets in the rural community will set limits to production alternatives, but this preliminary set of production options will invariably be greater than the subset which is practical in terms of the market and post-harvest environment with which we have to contend.

Starting with the Market

What is happening in domestic markets? What are the present expenditure and consumption patterns for agricultural commodities? What effect is urbanization having on the number of market-dependent households? What is happening to incomes and, at present and projected income levels, what are the elasticities of demand for the various commodities we may wish to consider? What degree of food preparation is likely to be required outside the home? How are employment and income trends affecting the demand for non-food products? What is the direct and indirect foreign exchange content of agricultural products in their final form? What is the trend in types and quantities of industrial raw materials, particularly in terms of product substitution?

What is happening in foreign markets? Are there rising protectionist trends in the markets which realistically offer the best prospects? If so, in what form are they being enforced? Are there product, process, or package adjustments which can be made to circumvent

these restrictions? Are some commodities targetted for protection to a greater extent than others? Is there a trend away from processed to fresh products? What is happening in the exotic and ethnic segments of these markets? Do consumption trends reflect greater awareness of and demand for non-traditional products? What is the structure of these markets, in terms of number of suppliers, and the number and kind of intermediaries? What are the transportation and institutional constraints to market access? How do these affect comparative advantage?

There are several dangerous tendencies which we must guard against in market analysis:

- i) Settling for annual trade and consumption data as the basis for identifying opportunities. Seasonality is a factor in demand as well as supply, and off-season markets may be narrow.
- ii) Assuming a greater degree of product homogeneity than exists in the minds of marketers and consumers. Proprietary vs generic labelling; canned vs frozen vs fresh; institutional vs retail; water vs syrup packs; particularly in OECD countries these differences can amount to virtually different markets.
- iii) Failing to recognize the impact of market structure on access to the market. In a market that is dominated by a few large brokers, the notion of securing a small share of that market may be unrealistic.
- iv) Failing to recognize the strength of interests associated with the existing capital structure of an industry. Not simply lobbying strength, but the financial motivation to protect supply and market relationships which ensure the continued use of existing fixed assets.

Looking at Post-Harvest Needs

Having identified product possibilities from this market analysis, and, of equal importance, having eliminated products which could be produced in our target area, but not sold, we can move to the analysis of processing. It is important that we not think of processing only in terms of factory-based changes in form. Cleaning, grading and packing are also forms of processing. At this early stage of inquiry we need to address all forms of processing which are either necessary or desirable to preserve, alter or improve any raw material characteristic which the market is willing to pay for:

What type and degree of processing do we want to perform?

What alternative technologies exist?

What does each technology or process feature in terms of:

- Infrastructure requirements.
- Inherent economies of scale, and therefore raw material volume needs.
- Options in equipment and layout to offset economies of scale.
- Flexibility in terms of raw material, product and packaging.
- Rigors of raw material specifications.
- Capital costs and sophistication of technology.
- Minimum length of processing period (days per year)
- Management and skilled labour requirements.

Returning to the Farm

Thorough market analysis and an evaluation of processing needs and alternatives will permit production planning to focus on the commodities for which post harvest needs are most likely to be met under the infrastructure, capital and human resource conditions that will be encountered. While this approach will almost certainly yield a list of diversification alternatives which is much shorter than the list of agronomic possibilities, it will reduce the prospect of unmarketable produce after the changes in production pattern have been introduced. Examining post-harvest needs at an early stage in sector work and identification will also afford an opportunity to maximize the linkage effects of farm production, particularly in terms of employment, and the location of post-harvest investments. It will enable us to focus more clearly on agronomic research priorities, on on-farm and infrastructure investments, and on the contractual and trade relationships which will determine the pattern of assembly and distribution of farm products.

POST-HARVEST CONSIDERATIONS FOR DIVERSIFICATION

RAPPORTEUR'S COMMENTS

Wayne Ringlien*

Lack of markets for agroprocessed goods

Market analysis should be considered as an upstream activity because of the need to identify product groups and individual products prior to production at the farm level.

Markets for agroprocessed goods differ from those for agricultural products. The Bank staff should be careful not to bring their biases about agricultural activities to their analysis and involvement in the agroprocessing sector.

Unique market features

Due to the sophistication and seasonality of agroprocessed markets in the world, it is necessary to view data on production and trade at a disaggregated level in terms of time (weekly, monthly) and at a detailed level in terms of products e.g., carrots, squash, barley, tobacco; fresh, frozen canned; generic or proprietary; retail or institutional.

Lack of understanding of markets for agroprocessed goods

There appears to be an urgent need for the international community to establish a center for market analysis or a network of agencies dedicated to reviewing and drawing conclusions from markets for agroprocessed goods. There were different views on the best approach to meeting this need, and the types of analysis most usefully done by agencies.

This function would not be one of market promotion, but would, among others, attempt to help rationalize specific production relative to current and future demand of agroprocessed products.

Research is required to bring together knowledge about product/market relationships in order to avoid gross over-production and market instability.

There exists a need to interest individuals/agencies with commercial experience to share knowledge with the Bank and public institutions on how markets function.

Viability of regional markets

Most experiences on regional marketing are short-lived with few positive results. Recently, the countries of the Central American Common

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Market attempted to coordinate their marketing policies and investment with little success, as each country had widely divergent views on prices, taxes and subsidies, storage, handling and transportation; the same grain was traded across borders more than once due to private gain at public expense. Exchange rate differences of twenty times characterize the official and parallel markets in Nicaragua, which makes inter-country coordination of policies virtually impossible. Another case of limited results is the new defunct Eastern African Community. The Regional Development Bank located in Lome, Togo, has had some success in influencing complementary investment among its six member countries.

Diversification of output mix

Because marketable surpluses of agroprocessed goods are increasing in most countries in the face of declining prices, action is required for countries to define medium-term investment strategies relative to products/markets. One of the major difficulties of planning product/market strategies is the apparent short-term instability of many product groups. This instability on the international market requires agro-industries to have a secure domestic market developed in order for those same firms to gear up to meet export demand.

Institutional constraints on the part of international agencies have a dampening affect on efforts to induce the private sector to assume a greater role in marketing of agroprocessed products in developing countries.

World Bank has a tradition of keeping suppliers and the private sector at arms length and has difficulty in encouraging individual firms to take the lead in marketing and marketing research because of the inherent risk of appearing to favor one enterprise over others.

Cross country competition for markets creates a reluctance on the part of firms to "show their hand" to competitors; several countries produce the same product and are seeking entry into the same markets.

Final Recommendations

Mandate to increase the awareness among the staff and policy makers in international agencies, in particular, of the need for research and communication on post-harvest issues.

World Bank needs to participate more aggressively in stimulating the private sector to take a more positive role in making marketing more efficient. There is a need to develop a systematic approach to vitalized thinking on marketing issues in the Bank. Seminars for Bank staff and commercial enterprise representatives were suggested.

ECONOMIC POLICY FOR DIVERSIFICATION

Peter B.R. Hazell*

The recent decline in the real prices of many agricultural commodities on world markets has inspired many exporting and would be exporting countries to search for diversification strategies as a way of helping to maintain rural incomes and agricultural export earnings.

A related, though less articulated concern, has been an accompanying increase in the riskiness of the world prices of some major commodities. For example, between 1961 to 1971 and 1974 to 1981, the coefficient of variation (cv) of the detrended world wheat price increased from 4.0% to 20.5% (Hazell 1985). Similarly, the cv for rice increased from 17.8% to 28.2%, and the cv for maize increased from 7.4% to 12.4%. Worse still, these prices became much more positively correlated, so that exporting countries not only now face higher price risks, but prices now tend to move up and down together more, thereby diminishing the value of export (or import) diversification for stabilizing agricultural export earnings (or food import costs). Hazell (1985) reports that between 1961 to 1971 and 1974 to 1981, the correlation between detrended world cereal prices changed as follows: between maize and rice, from -0.62 to 0.79; between rice and wheat, from -0.13 to 0.82; and between maize and wheat, from 0.30 to 0.89.

These changes in world markets are largely due to rapid technological change in many countries, and the protectionist agricultural policies of the industrialized countries. Policies involving fiscal largesse towards farmers, trade barriers, and export subsidies, have led to a situation in which the industrial countries, far from being natural importers of agricultural commodities, are glutting world markets with artificially cheap food. Further, by stabilizing their domestic food prices, these countries essentially export much of the variability in their domestic production to the world market. Given that the volume of cereals traded in the world market is only about 12% of total production, these policies lead to a leverage effect whereby a relatively small degree of domestic production variability can induce a much larger increase in world price variability (Josling 1980). The problem is aggravated by increasing production variability in some developing countries, and by a loss in offsetting patterns of production variability between crops and between countries (Hazell 1985).

The consequences of these changes for developing countries can be severe. Continued emphasis on the production of major export crops in which a country has a long established comparative advantage may lead to a serious decline in the level and stability of the agricultural sector. The availability of cheap food imports also makes it more difficult to justify public investments for agricultural development, even though these may be the only way of creating sizeable increases in the incomes and employment of the poor (Johnston and Kilby 1975, Lipton 1977, Mellor 1976).

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Alternative Approaches

In principle, there seem to be four approaches that developing countries can take to confront the problem. The first is to try and compete in the world market by reducing costs. This will probably happen anyway in the absence of any other policy intervention because the market will push real wage rates down. In effect, the poor will be impoverished further to counter the subsidies received by farmers in the industrial countries. Public investments in agricultural research, extension, agroprocessing, and transport and marketing can help offset this effect if they successfully reduce unit costs. So can the removal of any export taxes, and the realignment of over-valued exchange rates. However, the extent to which cost reductions would be undermined by additional subsidies to farmers in the industrial countries remains an ominous unknown.

A second approach is to transfer resources, especially labor, out of agriculture into other more productive uses. The problem is to try and find enough alternative and productive uses, particularly when the agricultural workforce accounts for the majority of the total workforce. It is often overlooked too, that in predominantly agrarian countries, a substantial share of the nonagricultural workforce lives in rural towns, and is engaged in jobs which service agricultural and rural household demands. As agriculture shrinks, so do many of these jobs. Studies of the growth linkages emanating from agriculture suggest important income and employment multipliers as agricultural output and income grows. Unfortunately these multipliers also work in reverse when agriculture contracts. Interpreted in reverse, then work by Gibb (1974) in the Philippines suggests that each 1% reduction in agricultural output will lead to a 1% to 1.5% reduction in rural non-farm employment, most of which will occur in the local towns. Similarly, work by Bell, Hazell and Slade (1982) in Malaysia suggests non-farm rural income will decline by about \$0.8 for each \$1.0 decline in agricultural income. Clearly, the number of jobs to be found in non-rural, non-agricultural occupations is likely to be too large for most developing countries if both the direct and indirect effects of agricultural contraction are to be offset. The task is not made any easier by the restrictions imposed by industrialized countries on many labor intensive manufactured goods.

A third alternative is to seek access to higher price markets for traditional agricultural exports. Quality improvements can be an important factor in some cases, as can better storage and transport facilities. Some countries might also be able to benefit from increased inter-Third World trade, particularly if neighboring countries are paying high transport costs to acquire food imports from key world market centers. Such trade possibilities may be hindered by tariffs, over-valued exchange rates, and poorly developed transport routes. The potential benefits of reducing these barriers deserve greater attention (e.g., Koester 1986).

The fourth approach is to seek to divert some agricultural resources into the production of other agricultural commodities. If these alternatives have, or can become, more profitable than existing production patterns, then agricultural incomes will be increased. Diversification may also enhance the stability of the agricultural sector by spreading risks

over a greater number of commodities. In most cases, diversification of national agricultural output will entail more diversified cropping patterns at the farm level, but regional diversification may also be important, even when farms are specialized within regions.

Diversification

Diversification is not a new concept for farmers. There is plenty of evidence to show that they are quite skilled in adjusting the mix of products they produce to reflect changes in the relative profitability and riskiness of each activity. Recent years, however, have seen a definite trend towards more specialized farming systems, largely in response to changes in technology and the economic environment. Mixing farm enterprises rather than specializing is advantageous because:

- (a) it enables resource requirements, e.g. labor, to be spread more evenly over the agricultural season (or year);
- (b) it provides some protection against risk because low returns from one activity one year may be partly compensated by a higher return than usual from another activity; and
- (c) it enables the farmer to retain some flexibility in his capital equipment and managerial skills for exploiting improved market opportunities, should they arise. It also enables him to adjust more quickly if a market weakens or fails.

Against these benefits must be offset the loss in average profits incurred by not specializing in the most profitable enterprises.

In situations where farmers are exposed to the winds of change in world markets, it may be presumed that many farmers are already making appropriate adjustments to their cropping patterns, at least to the extent permitted by technological and market considerations. The role of government in this process is twofold. First, to do whatever it can to facilitate appropriate change at the farm level. Second, to deal with various externalities that might result from changes in the production mix at the regional and aggregate levels.

Policies to Assist Farmers Diversify

The most powerful short-run contribution that the government can make is to ensure that farmers receive the right market signals. Policy interventions which misalign exchange rates, provide input subsidies, tax exports, fix or regulate prices, and so forth, can distort both the absolute and the relative returns from different crops. They can also affect the riskiness of returns, so that farmers incorrectly perceive the true risk levels associated with each crop. Part of the social cost of such distortions arises from the inappropriate crop mixes they produce.

The issues underlying these market distortions are complex, and fundamental changes are not likely to be made on the basis of crop diversification objectives alone. However, changes that lead to more correct alignment of relative rather than absolute returns may be easier to

achieve, yet would still provide the right signals to guide crop diversification decisions at the farm level.

Many governments attempt to protect farmers from the volatility of world market prices through stabilization schemes such as buffer stocks, guaranteed minimum prices, variable trade levies, and regulated markets. The impact of these schemes on the riskiness of crop returns can be quite complex, depending amongst other things on how price fluctuations are correlated with yields, and on how stabilization changes the correlations between the returns from different crops. But the net effect will be to change the perceived riskiness of different crops, and this is known to have an important bearing on the cropping patterns that farmers choose (e.g. Hazell et al. 1982). However, such distortions need not be undesirable--it all depends on whether or not the stabilization scheme has a positive net social payoff. Some stabilization schemes, especially buffer stocks, have low social returns in relation to their costs (Newbery and Stiglitz 1981), hence their distortionary effects on cropping patterns are also costly to society. But where risks are high, farmers are risk averse, and administrative costs are low, some stabilization schemes may provide a net social gain. In this case the distortionary impact on production can be desirable, but providing that the average price level is not distorted too. In essence, the government is efficiently spreading the risk burden across taxpayers, thereby relieving farmers of part of their price risks and enabling them to use their resources more efficiently. Rather than being a market distortion, such schemes are more appropriately viewed as market enhancing--they are filling in for risk contingency markets (e.g. futures markets or capital markets) that are either inadequately developed or non-existent.

In the longer term, government can have an important influence on diversification through the development of new technologies and markets for alternative commodities. In many countries, past patterns of commodity specialization have a long history in which an initial natural advantage has been reinforced by the development of downstream agroprocessing and marketing channels, by public investments in irrigation, and by the research focused on these crops by national and international research organizations. These policies have often led to excessive specialization at the farm level as alternative and less favored commodities have been pushed out. If alternative crops are to become more competitive, then agricultural research priorities may need to be changed. At the international level, this may require a broadening of the Consultative Group on International Agriculture Research system to include additional crops (perhaps including horticultural and export crops), as well as a change in priorities amongst the crops that are currently researched. Irrigation systems may also need to be modified to permit the greater flexibility in water control and management that is required for mixed cropping systems.

In considering changes in agricultural research priorities, the choice inevitably arises between developing technologies to help divert the high cost producers of a commodity into other crops, or of focusing on areas where the potential gains from technological improvements to new

crops are greatest. With paddy, for example, the high cost producers are most likely to be found in the upland and rainfed areas, where the potential for other crops may not be much better. On the other hand, paddy farmers in irrigated areas tend to be low cost producers, and therefore better able to compete in the world market. But they may also be operating under agroecological conditions where the potential yield increases from agricultural research are high for other crops too.

If the potential yield improvements for new crops are similar across regions, then economic efficiency dictates that agricultural research be targeted in the high cost areas for existing crops. But where the potential yield improvements are different, as they surely are, then the choice is likely to be between helping the marginal farmers adapt to declining prices (a welfare concern) and the efficiency goal of utilizing agricultural resources most efficiently.

The development of agroprocessing and marketing channels is generally best left to the private sector, but government may have an important role to play in the early stages, particularly if the initial volume of trade is small. The government may need to provide initial "infant industry" subsidies to processing establishments, and establish market and storage centers, cooperatives, grading systems, quality inspections and training facilities. There may also need to be changes in the priorities of extension agents, and agricultural credit and insurance agencies. The expansion of domestic markets might be encouraged by product advertising, by changes in government procurements for school meals, and by changes in food subsidies and ration allocations.

In the case of a new export crop, the government may need to invest in additional warehouse and shipping facilities, negotiate any necessary agreements to reduce trade barriers, and help establish overseas marketing channels. The success of some Central American countries in developing floral and horticultural exports to the USA provides a good example of what needs to be done.

Externalities

Diversification in response to the glutting of world markets is essentially a defensive strategy aimed at reducing the decline in rural incomes. As such, it is almost inevitable that total rural income and wages will still decline, though hopefully by a smaller amount than without diversification. But some rural households and regions will lose more than others, and some may even gain if new markets and technologies emerge. These income distributional consequences become an important externality, and particularly during the transitional period of adjustment. Government may need to provide alternative employment opportunities, e.g. food-for-work schemes, and target relief efforts, e.g. food subsidies, to the most disadvantaged. However, such interventions should be viewed as a temporary means to assist the poor adjust, and should not become a long-term drain on the national exchequer.

Agricultural employment is particularly sensitive to changes in the aggregate product mix. Some activities are more labor using than others, e.g. horticulture and livestock activities can be very labor intensive, and total employment is likely to change according to the change in the major commodities produced. But changes in the crop mix also effect the seasonality of employment. A more diverse cropping pattern may smooth out seasonal employment and reduce seasonal bottlenecks. If so, this may be beneficial to small farmers and agricultural workers residing in a region, but detrimental to seasonal and migrant workers. With appropriate planning and foresight, diversification policies might provide a vehicle for directly increasing agricultural employment.

More diverse cropping patterns, particularly if integrated with livestock, may also have the advantage of providing more sustainable farming systems in terms of their impact on soils and the environment. Farmers may also have to use less fertilizers and pesticides as product prices fall, increasing the importance of crop rotations and livestock in maintaining yields. If the required changes in cropping patterns signaled by price movements do not match well with the diversification strategies desired for good farming practices, then appropriately focused farming systems research may be needed to bridge the gap.

One of the presumed advantages of diversification is that it should provide a greater degree of protection for the agricultural sector against the volatility of world markets. It may also help to stabilize the foreign trade balance. In a predominantly agrarian economy, this gain in stability will be beneficial to consumers, to workers and entrepreneurs in nonagriculture, as well as to farmers and rural workers. Assuming that, on average, all these groups of individuals are risk averse and that they are unable to adequately hedge their personal risks, then the increased stability may be perceived as a social benefit. If diversification entails little loss in average national income, a not unreasonable assumption when it is undertaken as a defensive strategy against declining world prices, then there may in fact be a net social gain. If so, then might there not be an argument for giving enhanced priority to public investments that help achieve the desired pattern of diversification? This would amount to correcting the present day value (PDV) of a project to reflect an externality.

In principle, there seems to be little wrong with this argument, but a computer simulation study by Anderson (1983) suggests that for most cases the correction would be so small (less than 1/100th of one percent) that it may as well be ignored. The social cost of a risky project increases with (a) the riskiness of the project relative to its mean return; (b) the degree to which fluctuations in the project's return are positively correlated with national income; (c) the size of the project's return relative to national income; and (d) the degree of social risk aversion. Given a reasonable range of assumed levels of risk aversion, a project that increased the riskiness of national income would only be significantly penalized if it were very large (say 20% or more of national income), and very risky (coefficient of variation of 0.3 or larger). In this case, the PDV might be reduced by 2% or more. Projects of this size

are rarely encountered, but it is conceivable that the PDV of program or agricultural sector loans might need to be corrected for risk when they involve policy changes that have sizeable effects on national income.

Concluding Perspective

Diversification is important because it seems to offer one of the few ways that agrarian based economies can cushion the impact of declining and less stable world prices. However, if many countries pursue this strategy, then market constraints would seem to limit the size of the economic gains attainable.

Production of additional products for the domestic market is constrained by demand. Yet the demand for commodities that have elastic demands, especially horticultural and livestock products is closely tied to the growth in national income. For many of the poorer countries the growth in national income is also tied to the performance of world agricultural markets, and so a successful drive for diversification might all too easily lead to depressed domestic prices. The prospects for successful diversification are greater in the middle-income countries where the prospects for national economic growth are greater and the income elasticities for some foods are still large.

On the other hand, successful expansion of alternative export crops is dependant on world market demand, and this demand is not much affected by production diversification strategies. If more countries end up competing to supply more commodities in existing world markets, then prices may simply be depressed across the board.

Within this generally limited market environment, there are undoubtedly little niches that some individual countries can exploit. For example, the US market for flowers and horticultural products has been successfully tapped by Mexico and some Central American countries. Also, in countries where national economic growth is not dependant on agriculture, a growing demand for income elastic commodities will encourage greater diversification into vegetable oils, livestock and horticultural crops. Sometimes there are also short-term gains to be had in world markets for the originators of new technologies or products, but which dissipate in true Schumpeterian style as competitors copy.

There may also be constraints to rapid increases in diversification from the production side. For many farmers, e.g. irrigated paddy farmers, the differences in returns from alternative crops may be sufficiently discrete that it would not be profitable to make significant changes in their crop mix, even at current world prices.

Changes in priorities for public investments and agricultural research might have a significant impact on diversification patterns, but this may take one or two decades to achieve. During that time the situation in world markets could change, with sharp increases in the real price of foodgrains. Policy makers need to balance this risk against the benefits of greater diversification when allocating scarce resources. The

difficulty of the choice is compounded by the long gestation periods for agricultural research and investment projects. Just as it will take a long time to develop alternative crops, it would also take time to increase foodgrains production again if these were unduly neglected in the meantime.

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ECONOMIC POLICY FOR DIVERSIFICATION

RAPPORTEUR'S COMMENTS

John Burrows*

After the speaker summarized the main points of his paper, a number of participants offered comments on the paper or raised questions. The discussion focused on four main subjects.

General

First, there was general agreement that the paper was timely in focusing attention on the limitations of diversification as an appropriate response to falling prices. Several speakers felt that the Bank had exaggerated the scope for diversification, particularly in the context of structural adjustment operations. For this reason, several speakers thought it would be useful to circulate the paper more widely within the Bank, one suggesting that it might help to persuade the Bank to take a position in regard to the agricultural policies of developed countries which, by subsidizing exports, had depressed world prices.

Prices

The discussion focussed particularly on the question of prices and on what advise the Bank might offer countries facing major price reduction. Given the distortion in world prices, one speaker was anxious to know how a country can get its actual or relative prices "right". How can we give the right signals to the farmer, when we have difficulty ourselves in forecasting world price changes. It was also questioned whether it is really feasible to pass on the whole burden of price falls to the poor, and with what consequences. The main speaker agreed that this was a difficult and controversial issue. It is tempting to suggest that countries might deviate from international prices in determining domestic prices, but there were budgetary considerations. Supporting domestic prices above world prices can be expensive, particularly for poor agrarian economies. While, domestic prices need not be continually adjusted to reflect changing world prices. it was important to get them in line with world prices in the long run.

Other points made were:

- Temporary support measures, i.e., import tariffs, might be justified if one believes that the currently depressed world prices are a temporary phenomenon.
- Distortions in domestic consumer prices are also an important factor. Removing distortions in consumer prices may stimulate diversification in production.

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- There is a danger that, in reacting to low prices, the Bank might persuade many different borrowers to diversify into the same alternative commodities, in which case new surpluses would arise and it would be mainly the consumer in the developed world that would gain.

Need For Different Approaches

Several speakers emphasized that there are different situations faced by different countries. At one extreme, there are some economies in Africa which face a drastic fall in the price of a monocrop commodity. In some such cases, there may be nothing else to grow in the short term. Even when there are alternatives, they may still be inferior to the existing cash crops.

Some speakers felt that even in these difficult cases, there was still scope for diversifying individual farm systems--after all, small farms are diversifying their cropping systems to some extent all the time. It is not necessary to abandon traditional cash crops facing depressed prices, but rather to reduce their relative dominance, particularly among the higher cost producers.

On the other hand, there are countries that have been successful in diversifying. One speaker referred to the experience of Malaysia in developing cocoa, but emphasized the advantage it had in treecrop experience and management.

Need For Broader Outlook

Finally, some speakers advocated a broader approach to diversification. We should consider other benefits, such as nutrition or the preservation of the legume base, which would enhance the case for a more diversified production system. We should also recognize the importance of non-agricultural sources of income in diversifying the production base, and therefore expand the analysis to a more general rural development sphere.

It was also pointed out that some countries that do not face falling prices still need to diversify because they are overly dependent on one crop and need to reduce risk. In such cases, there is an advantage in diversifying production to take greater advantage of import substitution. On the other hand, one speaker noted, diversification would not necessarily reduce risk if, for example, it involved a shift into treecrops, with a corresponding reduction in the flexibility of land use. It was concluded that the role of diversification needs to be examined on a country-by-country basis.

CLOSING SESSION

Speaker: G. Edward Schuh, Director, AGRDR

SOME THOUGHTS ON ECONOMIC DEVELOPMENT,
SUSTAINABILITY, AND THE ENVIRONMENT*

G. Edward Schuh**

To bring this Symposium to a close, I would like to provide a change of pace. In organizing this Symposium we chose the issue of sustainability because we thought it was important. And we chose it not just because the Bank has a large number of critics, from both inside and outside the Bank, who think we don't give it enough attention. We chose it because there is a great deal that can be done to deal with these problems, and because we need to face up to these issues in our lending activities.

Much of the discussion you have participated in these last two days has dealt with questions of "how to do it." We have talked about policy, about the role of institutions and institutional developments, and about the economic, social, and technical dimensions of environmental and sustainability issues.

I want to change this perspective and address a different set of issues, those having to do with economic development and its relationship to environmental and sustainability problems. This set of issues is important for a number of reasons. First, it appears to be widely perceived by many that economic development is the cause of environmental damage and a reduction in sustainability. Proponents of this view tend to have an anti-development perspective in their rhetoric, and to find the World Bank an attractive target for their political activities. It is interesting that most of these people come from the developed countries, or from the upper income classes in the developing countries.

The second reason this set of issues is important is because of its relevance to our lending program. The Bank has properly, in my judgment, given increased attention to population problems, especially in Africa. My concern is that we do not take a sufficiently broad perspective in our population work. I will argue below that we should significantly broaden our perspective from population to a greater emphasis on investments in human capital. If we do that we will give more attention to improving the quality of the population by investing more in nutrition, in health, in education and training, in the production of new knowledge - science and technology, and in the maintenance of the stock of human capital. These are the fundamental things that are needed to accelerate economic growth, to deal effectively with the problem of poverty, and in the longer run to deal with environmental problems.

** Director, Agriculture and Rural Development, The World Bank, Washington, DC. The views expressed herein are the author's alone and in no way should be construed as official views of the World Bank. I am grateful for helpful comments on an earlier version of this paper by Hans Binswanger, Claude Blanchi, John Hayward, Lee Martin, and Vijay Vyas. Remaining errors are my responsibility however.

I divide my comments this afternoon into three parts. First, I will discuss economic development and scarcity, a common motivation for environmental concerns. Second, I will discuss specific issues associated with economic development and environmental damage. And third, I will discuss some implications of the perspective I provide for the Bank and its lending program. At the end I will have some concluding comments.

Economic Development and Scarcity

Malthusian scares seem to be a cyclical phenomenon in our modern economic history. A generalized crop short-fall, or a monetary convulsion, either of which can set off a rise in primary commodity prices, tends to remind the world of Reverend Malthus' gloomy predictions, and to set off a new round of catastrophe mongering.

The most recent of these episodes occurred little more than a decade ago, with the commodity boom of the 1970's. With the benefit of hindsight we today understand that episode for what it was - an unusual monetary disturbance. That disturbance was set off in part by the country that was central banker for the world using its printing presses to finance simultaneously its part in a war in a distant land and a massive social welfare program. This was combined with the severance of the international monetary system from the last vestiges of the gold standard (with the closing of the London gold pool), and the end for all practical purposes of the old Bretton Woods fixed exchange rate system.

During the 1970's, however, the interpretation of events of that period was rather different. The commodity boom unfortunately happened to coincide with the publication of a number of studies which purported to demonstrate that the world was running out of resources and that economic development as it had been experienced in the industrialized West could not be sustained for the world as a whole. The scarcity syndrome implied by these studies and their models seemed to be confirmed by the rapid escalation in commodity prices of that period. There was a scramble to acquire control of real resources around the world, a great deal of hoarding, and the self-fulfillment of a prophecy.

The fact that food prices in dollar terms rose so much at that time appeared to be particular confirmation of a Malthusian situation. We were reminded how rapidly population was growing in the developing countries. New international food and agricultural organizations such as the IFAD and the World Food Council were created, food self-sufficiency and food security become almost everybody's goal, and resources were committed to agriculture on a massive scale in countries like the United States as farmers in that country (mistakenly) prepared to feed the world's burgeoning population that otherwise was expected to face starvation.

Today we are living with the consequences of the misguided diagnoses of that era. Mr. Volcker came into office and shortly thereafter collapsed the monetary bubble. Disinflation followed, with primary commodity prices falling faster and further than prices of manufactured products - as they almost inevitably do in such episodes. On top of that,

the European Community set prices for its agricultural commodities increasingly above efficiency prices and elicited a large supply response which eventually had to be dumped on world markets. And US commodity prices, fixed rigidly by commodity programs that were both archaic and inconsistent with a flexible exchange rate system, were translated into ever higher prices in the currencies of other countries as the dollar took off on an unprecedented rise, and a large supply response followed not only from the US but from other countries as well. The United States has been more subtle in its dumping practices than the EC, however, choosing to rely more on implicit export subsidies than on explicit subsidies. As a consequence of these developments the world is today faced with a surplus, not a shortage, at least for a while.

These two episodic events are only suggestive of the true supply-demand balance, however. For stronger evidence we need to consider a longer period. Those of you familiar with my paper on Strategic Issues in International Agriculture are familiar with the graph which plots the prices of wheat and maize for the 125 year period since 1860. That chart shows that the price of wheat, a widely traded and highly substitutable food grain, has been experiencing a long secular decline, interrupted by periodic increases, for some 125 years. By 1980 it was only approximately half in real terms what it had been in 1880, and that after a long period of unprecedented growth in population and in per capita incomes. That hardly sounds like a scarcity problem for the world as a whole. Of course, individual countries and large numbers of people are still inadequately fed. But as the World Bank Agriculture and Rural Development Department noted in its food security paper, Poverty and Hunger, that problem is in large part a problem of inadequate income, not inadequate production.

This long-term decline in price is not unique to wheat. The real price of maize has been experiencing a similar secular decline throughout the period since World War II, and the price of poultry - an ever more important meat product - has experienced a dramatic decline. Moreover, it isn't just the price of agricultural commodities that has been declining. The prices of other primary commodities have been declining in real terms also, as the data in Table 1 and Figure 1 indicate.

What one sees, then, is that economic development, rather than creating economic scarcity, in its broad general forces tends to create economic abundance. The reason for that is obvious once one thinks about it. The engine of economic growth does not lie in physical and natural resources, as many people are still prone to believe, but in science and technology - knowledge if you will. Knowledge is a form of human capital that is reproducible in all dimensions and hence not subject to diminishing returns, as Frank Knight reminded us long ago. Knowledge is used to produce new technology that eases the constraints to output expansion by developing substitutes for resources that become increasingly scarce as development proceeds. These substitutes are generally reproducible, and often available in such abundance that they contribute to a decline in the prices of the primary products in whose production they are used.

Table 1 Weighted Index of Commodity Prices/a
(Constant Dollars)
(1979-1981=100)

(WEIGHTS- \$ SHARE) /b	ANNUAL AVERAGES										
	PETROLEUM	33 COMMODITIES (EXCLUDING ENERGY) (100.0)	TOTAL (87.7)	AGRICULTURE						TIMBER (5.2)	METALS & MINERALS (27.1)
				TOTAL (93.2)	BEVERAGES (22.3)	CEREALS (9.4)	FATS & OILS (9.3)	OTHER (12.3)	NON-FOOD (14.4)		
1948	30	112	124	119	86	154	189	101	140	45	97
1949	26	115	121	119	100	163	148	100	129	50	109
1950	26	150	168	152	147	178	177	122	228	60	122
1951	23	156	172	146	141	166	182	111	271	76	132
1952	22	158	140	130	128	157	147	98	179	54	148
1953	24	132	136	134	134	161	151	100	142	51	137
1954	26	145	155	158	155	154	143	104	144	71	134
1955	25	140	142	133	152	133	130	103	173	56	154
1956	24	138	138	134	154	130	129	103	153	52	155
1957	24	128	131	128	138	121	128	114	145	49	136
1958	22	118	120	117	123	121	118	99	131	46	126
1959	20	117	120	111	110	117	128	95	152	55	124
1960	18	116	117	106	105	109	120	96	157	59	124
1961	18	110	109	103	97	115	124	89	131	60	120
1962	17	107	107	101	91	125	114	91	129	65	115
1963	17	111	113	110	92	127	122	122	121	65	114
1964	15	117	114	112	103	124	123	111	121	54	137
1965	15	119	108	107	98	120	136	91	113	62	155
1966	15	119	107	105	93	131	128	89	115	63	160
1967	15	111	105	104	89	137	120	92	108	67	134
1968	15	112	105	102	89	134	115	93	113	69	138
1969	14	113	104	101	88	127	108	98	115	63	144
1970	13	111	102	103	96	109	121	97	101	63	142
1971	16	98	93	92	79	100	115	93	96	61	116
1972	17	94	92	93	80	97	104	103	91	55	106
1973	20	124	124	124	88	170	189	107	124	83	133
1974	69	134	135	140	83	202	172	173	114	82	144
1975	61	101	100	103	71	142	104	129	89	55	113
1976	64	112	116	117	134	115	110	95	111	73	110
1977	64	123	134	143	205	96	124	78	102	75	103
1978	56	101	108	111	132	100	112	79	97	67	92
1979	71	105	106	106	121	92	114	86	102	103	103
1980	107	105	104	104	99	101	96	121	106	113	105
1981	119	91	91	90	82	107	92	92	92	84	92
1982	109	82	81	81	85	79	76	79	82	86	83
1983	102	89	80	88	88	88	92	86	95	82	89
1984	102	92	94	96	104	85	110	77	90	93	89
1985	98	81	81	83	95	74	77	75	74	81	80
1986	44	73	76	81	105	60	53	72	59	82	65
1987	50	70	71	74	90	63	50	71	61	84	64
1988	56	72	72	74	83	67	56	77	64	84	68
1989	55	74	75	76	83	70	60	82	70	84	70
1990	55	77	78	79	84	70	65	88	75	84	72
1995	64	79	79	78	85	66	69	82	83	89	76
2000	86	79	80	79	88	64	66	84	83	91	75

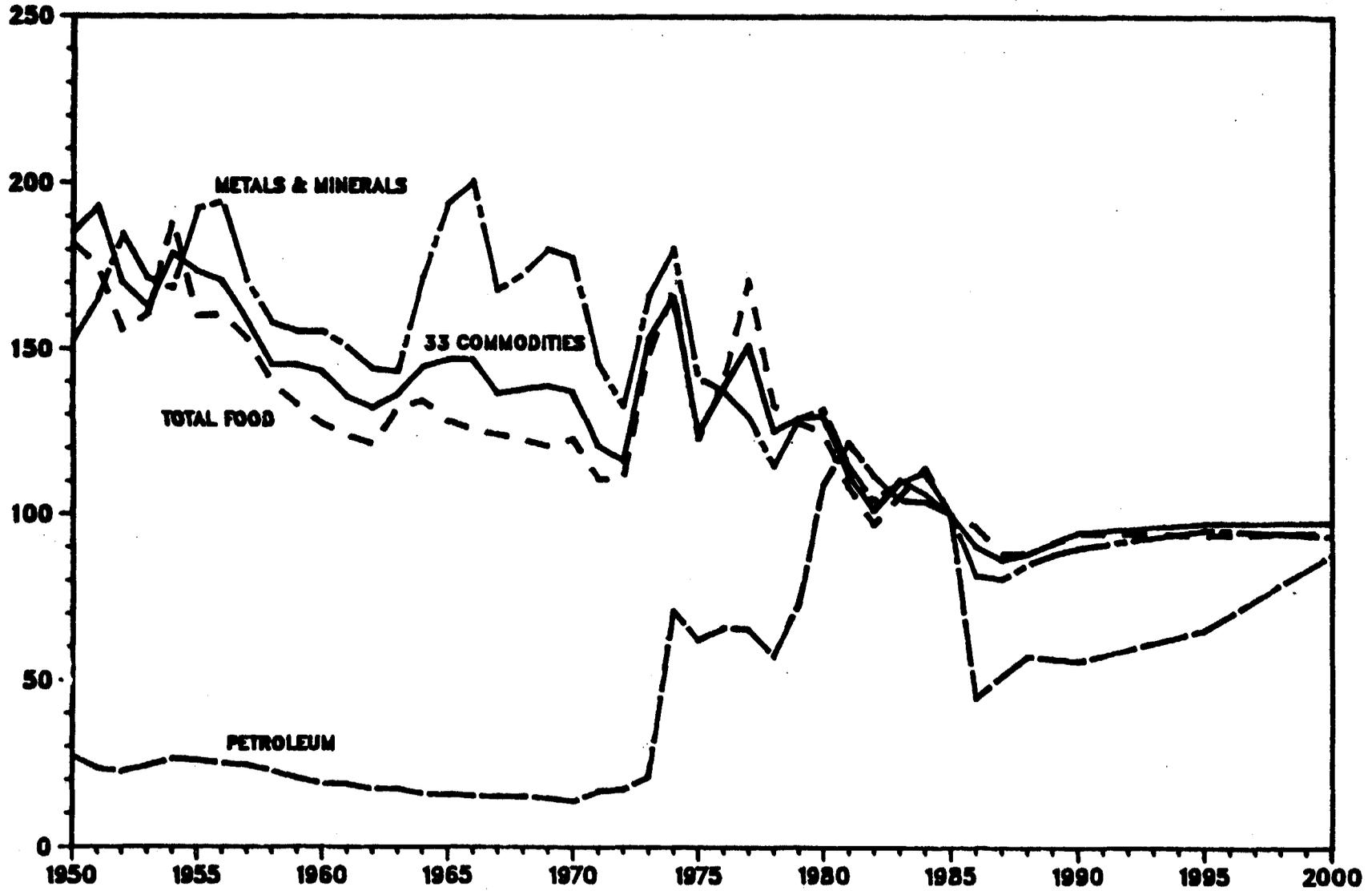
/a COMPUTED FROM UNROUNDED DATA AND DEFLATED BY MANUFACTURING UNIT VALUE (MUV) INDEX.

/b WEIGHTED BY 1979-1981 DEVELOPING COUNTRIES' EXPORT VALUES.

NOTE: THE COMMODITIES INCLUDED IN EACH GROUP ARE: BEVERAGES—COFFEE, COCOA, TEA; CEREALS—MAIZE, RICE, WHEAT, GRAIN SORGHUM; FATS AND OILS—PALM OIL, COCONUT OIL, GROUNDNUT OIL, SOYBEANS, COPRA, GROUNDNUT MEAL, SOYBEAN MEAL; OTHER FOODS—SUGAR, BEEF, BANANAS, ORANGES; NON-FOODS—COTTON, JUTE, RUBBER, TOBACCO; TIMBER—LOGS; METALS AND MINERALS—COPPER, TIN, NICKEL, BAUXITE, ALUMINUM, IRON ORE, LEAD, ZINC, PHOSPHATE ROCK.

SOURCE: WORLD BANK, ECONOMIC ANALYSIS & PROJECTIONS DEPARTMENT,
COMMODITY STUDIES & PROJECTIONS DIVISION.

Weighted Indices of Commodity Prices: 1950-2000*
(Constant US Dollars, 1985 = 100)



* 1986-2000 FORECAST BY EPDCS, WORLD BANK.

Those of us in agriculture are quite familiar with this process. Fertilizer-responsive varieties of plants developed in agricultural research stations make it possible to substitute fertilizer for land and thus to release the constraint to production implied by a limited supply of land. A technological breakthrough in the manufacture of nitrogen fertilizer lowered the prices of this substitute and gave further impetus to the process.

Interestingly enough, the resource that becomes increasingly scarce - or whose price rises - as economic development proceeds is human time. It is the one resource that is absolutely limited in supply. There are only so many days in a year and so many hours in a day. The amount available for an individual to use for work and leisure activities is thus absolutely limited, even though the productivity of that time can be raised by the proper investments. An increase in per capita incomes, which is the essence of economic growth, is inherently a rise in the value of human time.

From the perspective of a country, the amount of human time can be increased by growth in the population. But we know that the forces of economic development work against that tendency as well. As the price of time rises, the cost of children rises since they are a time-intensive commodity to produce. Families thus begin to substitute quality of child services for numbers of children by investing more in the child in the form of schooling and training. This important substitution, which is driven by the economic forces of economic growth, causes the population growth rate to decline. Hence, we witness the phenomenon of rapid population growth in low-income countries, and slow and even negative population growth rates in the developed countries.

A number of points are worth emphasizing here. First, economic development eventually leads to a deceleration of population growth rates and perhaps eventually to a stagnation or even decline in population. This in itself eventually reduces the demand on natural resources. Family planning and population programs such as those supported by the Bank are designed to short-circuit this process so that countries don't have to depend entirely on economic forces to bring their population growth into balance with their resources. These programs thus contribute to easing environmental damage as development proceeds.

Second, economic development drives the economy in an increasingly human capital-intensive configuration of the economy.^{1/} More and more of a nation's economic activities are directed to the production of knowledge and the education and training of its population. These are human time-intensive activities, not natural resource-intensive. This too reduces the pressure on the natural resource base.

^{1/} For a synthesis of the literature on this process, see Schuh, G. Edward, "Economics and International Relations: A Conceptual Framework," American Journal of Agricultural Economics 63(5): 767-778.

In concluding this section I would like to make two additional points. The first is to call attention to the phenomenal increase in life expectancy that has been associated with economic development around the world.^{2/} There has probably been no more important phenomenon associated with economic development than this. And there has been no more important contribution to improvement in human welfare. Fundamentally, it means that the supply of that ultimately limiting factor, time, has been expanded for the individual. It is puzzling that we don't give this issue more attention as a positive aspect of economic development. It is equally puzzling that we don't seem to recognize the implications of this phenomenon for development policy and the institutional developments that need to go with it. For example, it significantly increases the expected rates of return on investments in education, while at the same time increasing the need for retraining and intellectual refurbishing.

Second, the discussion of environmental issues often reaches an impasse over whether market-determined interest rates properly reflect the correct trade-off between the present and the future. The usual interpretation is that these interest rates do not give enough weight to future generations, and that in principle economic development should be slowed in the present time so that future generations can have a larger resource base to draw on when they come on the scene. This implies that observed market rates of interest are too high to use for the evaluation of environmental projects.

There are some, however, who argue that the fact that per capita incomes have risen historically casts considerable doubt on this proposition. A sustained increase in per capita incomes suggests to them that the amount of resources for future generations can be expected to be larger, rather than smaller, as a direct consequence of the very process of economic development. Hence, they believe that pleading for slower growth rates today in order to preserve resources for the future is simply misguided.

Frankly, I don't believe we can get off the hook quite so easily. In the first place, there is nothing all that "natural" about observed rates of interest. They often are the result of distortions and misguided economic policies. For example, interest rates were negative in real terms for an extended period in the 1970's. In the 1980's, on the other hand, they have been at unprecedentedly high levels - and again for an extended period of time. In this case they are high due in large part to the pursuit of contradictory monetary and fiscal policies in the United States, and to a configuration of general economic policies in that country that cause it to have a very low savings rate. Because this combination of events has caused the United States to borrow large sums from abroad, it has caused interest rates elsewhere to be high, and the value of the dollar to be strong.

^{2/} Ram, Rati, and Theodore W. Schultz, "Life Span, Health, Savings, and Productivity," Economic Development and Cultural Change 27:399-421 (1979).

Combine this situation with the mistakes in the developing countries that caused them to take on excessive amounts of debt in the heyday of petrodollar recycling. Today many of the developing countries have a large foreign debt to service at historically high real interest rates. The demand for debt service, plus the high real interest rates, and the decline in the real exchange rate which follows, causes these countries to draw hard on their natural resource base. Moreover, the demand for foreign debt servicing leaves very little investment funds for productivity-raising investments or conservation. The land and other natural resources are therefore plundered, at the expense of future growth - at least for some period of time.

Similarly, we need to recognize that the instability in real interest rates we have witnessed over the past two decades is very disturbing to longer-term investment programs, and especially to those involving human capital, such as investments in education and in the production of new knowledge.

Economic Development and Environmental Damage

In the previous section I noted that economic development over time tended to reduce the demand against natural resources by developing substitutes for scarce resources and by driving economies to a more human capital-intensive resource configuration. None of that is to deny that there are significant environmental problems associated with the process of economic development, especially in its early stages when growth is more dependent on natural resources. This is an important point. After all, one doesn't have to look very far to see environmental damage associated with agricultural modernization - environmental pollution as a consequence of widespread use of pesticides and fertilizers, the destruction of forests and germplasm as land is cleared for agricultural exploitation and wood is used for consumption, and as dams and irrigation systems create their own environmental problems. Industrial pollution of the environment is also widespread and serious. And we witness widespread soil erosion in country after country.

There are a number of points to be made on these issues. First, none of them is an inevitable consequence of economic development per se. Instead, many if not most of them reflect a combination of inadequate resources to address the environmental consequences of economic development, and serious mistakes in economic and resource management policy.

Let's consider some of the details. First, low-income countries that are pursuing forced-draft economic development policies to improve the incomes and living standards of their population, and that are servicing large external debts, not only are implicitly using very high time discount rates, but also lack the resources to address environmental problems. They choose to use their resources to improve per capita incomes or to service their debt in the short run rather than to address environmental problems that have a payoff only in the future. There may be considerable destruction of both renewable and nonrenewable resources in the process.

That is why increased attention on the part of the Bank to environmental problems in very low income countries and in those with serious debt problems is so important.

Second, the new technology associated with economic development does carry its own share of environmental problems. Nuclear energy is probably the most outstanding example. But industrial technologies carry with them chemical pollution problems, as do agricultural technologies.

Two points are pertinent on these issues. First, proper economic policies which cause those who impose such negative externalities to bear the costs of them would make them far less serious than they have been. Second, new technology itself can in some instances be the means to deal with the problem. This is being demonstrated in the case of agriculture with biological control of insects and improved placement of fertilizer to reduce the chemical applications needed. If eventually there should be more general means of nitrogen fixation by plants, pollution from use of mineral fertilizers would be reduced significantly. Moreover, one of the great promises of biotechnology is that it will reduce still further the need for chemical interventions.

None of these solutions are perfect or automatic, of course. They require significant commitments of public funds by individual countries to develop the scientific and technological and institutional base for research and development. Low income countries are not prone to make such investments - with their long gestation periods.

In addition, there is the role of economic policy as an underlying cause of environmental damage. This becomes especially important in the case of such things as soil erosion and the environmental damage associated with irrigation projects. In the case of soil erosion, economic policies which discriminate against agriculture tend to cause land to be undervalued. If it is undervalued, there is less incentive to husband it and to make investments in it which would protect and raise its productivity. In the case of irrigation projects, the failure to properly price water or to cause farmers to supply the resources for cost recovery creates an infinite demand for such projects, while at the same time providing incentives to misuse the water that is available, leading to problems of water logging and salinity.^{3/} Proper policies on these two fronts alone would significantly reduce the number of irrigation projects, and cause the water made available through those that are constructed to be used in ways less damaging to the environment.^{4/}

^{3/} For more detail on the environmental problems associated with irrigation projects, see Schuh, G. Edward, "Dealing with Environmental Problems Associated with Irrigation Projects," presented at the World Bank's Second Annual Irrigation and Drainage Seminar, Annapolis, Maryland, December 17-19, 1985.

^{4/} See Repetto, Robert, "Appropriate Incentives in Public Irrigation Systems," World Resources Institute, Washington, D.C., June 1986.

Finally, countries implementing successful economic development strategies will find that they have high rates of return on development-oriented investments. Consider the case of a low income country that has lagged behind others and wants to catch up. One of its advantages is that it can borrow a great deal of new technology for use in its development programs at a lesser cost than those countries leading the development process had to pay for it. If the institutional capacity is in place to adapt this new technology and knowledge to local conditions, and the policy environment facilitates its adoption, the productivity of capital will tend to be quite high. Unless capital markets are perfect, this means that interest rates will tend to be higher in these countries. This in turn will increase the demand against natural resources, and cause environmental problems to be deferred to a later date.

In conclusion, there is nothing inevitable about the forces of economic development that cause them to lead to greater environmental damage. To the contrary, economic growth over time provides the resources which ultimately make it possible to address environmental problems in a systematic way. Moreover, as development proceeds a country tends to have a greater base of knowledge on which to develop national policy, and a stronger research capacity which can produce solutions to problems as they rise. Hence, we see that a more well-developed economy not only has the resources to address environmental problems but a stronger base for dealing with such problems as they arise.

But for countries at low levels of development, the problem is rather different, especially in the short to intermediate run. For them, the economic forces associated with development - high rates of return to capital and heavy debt burdens - tend to create and exacerbate existing environmental problems. Thus, the soil erodes, forests are destroyed and species are lost forever. Those are the fundamental reasons why dealing with such problems should be high on the Bank's agenda.

Some Implications for the Bank's Lending Program

Developing countries have a resource endowment that tends to be more natural resource-intensive than do developed countries. Consequently, using these resources at a socially optimal rate is critical to sustainable development. Thus, lending activities that address environmental problems have a high pay-off to sustained economic development. In the case of agriculture, that should include, among other things, lending for construction of terraces and contours, and a great deal more attention to the environmental aspects of irrigation and dam projects.

Second, changing economic policies which discriminate against agriculture can probably do a great deal to reduce environmental damage in many developing countries. This will increase the value of land and cause farmers to husband it with more care.^{5/} It will also increase the rate of

^{5/} It is not necessary that there be a land market for this effect to be present. However, the institutions of resource management and control do have to transmit the incentives to the proper decision maker. Needless to say, there is much that we don't know about this issue, especially in Africa.

return to productivity-enhancing investments, while at the same time giving farmers the means to make such investments.

But such improvements in the general policy environment will not be sufficient. Thus the third implication for the Bank's lending program is that policies which seek to internalize the costs of environmental damage should be an important part of policy dialogues. In the case of agriculture, adequate cost recovery for dams and irrigation projects and proper water pricing policies should also be put much higher on our policy dialogue agenda.

Fourth, environmental issues should receive a great deal more attention in the Bank's analytical and research work. This would help us to be more sensitive to the issues, and also assist in devising more rational lending programs and policy responses. Particular attention should be paid in such work to identifying the proper time discount for environmental projects in individual countries. The identification of and design of institutional arrangements consistent with increased life expectancy and the rising value of time should also receive a great deal more attention, as should research on tenure arrangements where private property rights do not exist. We need to be more creative in devising institutional arrangements which will assure that resources are used at socially optimal rates.

Fifth, we need to articulate more effectively the point that unrestrained population growth makes it nearly impossible to invest at a socially optimal level in education and other forms of human capital which are the basis of longer-term increases in per capita income. This point needs to be given more emphasis in the rationale we provide for more effective population programs.

Finally, we should be doing a great deal more than we presently are to help the developing countries to become more human capital-intensive than they presently are. That may be the most effective way over a period of time to reduce the drain on natural resources in these countries. Moreover, it demonstrably is the surest route to more rapid economic growth. All the evidence we have is that investing in human capital has a very high social rate of return. To move in this direction means that a significantly larger share of our lending portfolio should be directed to expanded nutrition programs, to expanded lending for education at all levels, and to increased lending for science and technology generally - the production of new knowledge and new technology. Such investments are important complements to our population programs.

It is a puzzle to me that as the world's premier development institution the World Bank is not lending more for these purposes. It is especially surprising that a strong science and technology program is not a major component of the Bank's activities. Moreover, it is regrettable that prior to any attempt at reorganizing the Bank we didn't first address the issue of what the Bank ought to be doing in its lending program over the next decade. Surely, if we were developing the kind of lending program my analysis leads me to, and which empirical evidence strongly supports, we

would be making significant changes in both our staffing and in our organizational structure.

Concluding Comments

The excellent paper on the environment that Jerry Warford and his colleagues are developing establishes strong linkages among economic growth, poverty alleviation, and the environment. If we were to shift our lending program significantly to the side of human capital along the lines I have suggested above, we would be tackling all three of those components at the same time. In the case of agriculture, producing and diffusing new technology is the key to alleviating the massive poverty that characterizes agriculture in the developing countries. Increased investments in nutrition will increase significantly the productivity of labor in these countries. Higher levels of educational attainment on the part of the rural population in particular are needed to make use of that technology. It is also needed for the agricultural labor force to adjust to new labor market opportunities as development proceeds - the ultimate diversification problem, but one which many developing countries are already facing.

I could go on, but time is running out. We obviously have a long way to go in addressing the environmental and sustainability issues in a truly sustainable way. My special plea is that we address these issues in a framework sufficiently broad that we accelerate economic growth and poverty alleviation at the same time we are addressing the environmental and sustainability issues. It can be done, and that is our special challenge in the years ahead.

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