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AGRICULTURAL REVOLUTION IN SOUTHEAST ASIA

IMPACT ON GRAIN PRODUCTION AND TRADE

VOL. I

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Organized under The Asia Society in New York, SEADAG is dedicated to the solution of problems of development in Southeast Asia and to the encouragement of Southeast Asian research initiative and capacity. Toward this end, SEADAG organizes international conferences, seminars, and workshops in the United States and Southeast Asia; awards grants for research on Southeast Asia; and publishes and distributes papers on relevant topics. SEADAG renders advisory and research services under contract to the U.S. Agency for International Development. Such services are available to other institutions within the framework of SEADAG's purposes.

VOLUME One of *Agricultural Revolution in Southeast Asia* consists of nine papers—with formal discussions—read at the SEADAG Rural Development Seminar Meeting on "Implications of Technical Change for Grain Production and Trade in Southeast Asia." The Meeting was held in Honolulu, June 19-21, 1969.

VOLUME Two of *Agricultural Revolution in Southeast Asia* consists of five papers—with formal and informal discussions—read at the Second SEADAG International Conference on Development in Southeast Asia. This conference, held at Asia House in New York June 24-26, 1969, focused on "The Implications of Agricultural Innovation for Development in Southeast Asia."

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CONTRIBUTORS

MARTIN E. ABEL is currently program advisor in economics for the Ford Foundation in New Delhi, a research-cum-advisory position. He is also a faculty member of the department of agricultural economics, the Institute of Agriculture, University of Minnesota. Dr. Abel's most recent publication is entitled, "Training Foreign Graduate Students in Agricultural Economics: A Comment," in the November 1969 issue of *Journal of the American Agricultural Economics Association.*

VIRACH ARROMDEE, who received his Ph.D. in 1968 from the University of Minnesota, is head of the department of business administration at Kasetsart University, Bangkok. He has completed research on the economics of rice trade in Southeast Asian countries and on agricultural credit in Thailand.

DRAGOSLAV AVRAMOVIC, chief economist of the South America department at the International Bank for Reconstruction and Development, received his Ph.D. from Belgrade University, Yugoslavia. He has written widely on the problems of industrialization in South Asia and commodity stabilization.

RANDOLPH BARKER is visiting professor of agricultural economics at the University of the Philippines College of Agriculture, and directs a research program at the International Rice Research Institute. His work concerns all major rice producing and consuming countries.

MATTHEW DROSDOFF, professor of soil science at Cornell University, specializes in soil and agriculture of the tropics. He was consultant to the Agency for International Development in Vietnam, Thailand, and the Philippines, from 1960 to 1964.

BERNARD K. GORDON, Southeast Asia project chairman at Research Analysis Corporation, McLean, Virginia, also lectures at George Washington University and the Johns Hopkins School of Advanced International Studies. He was visiting professor at the University of Singapore from 1964 to 1965. Dr. Gordon's most recent book is *Toward Disengagement in Asia: A Strategy for American Foreign Policy*, published by Prentice-Hall.

YUJIRO HAYAMI, who received his Ph.D. from Iowa State University, is on leave from Tokyo Metropolitan University as visiting professor of agricultural economics, University of Minnesota. Dr. Hayami is co-author of "Agriculture and Forestry," in volume nine of *The Estimates of Long-Term Economic Statistics of Japan Since 1868*, published in Tokyo in 1966.

KENZO HEMMI, who received his Ph.D. in agricultural economics, is associate professor of agricultural economics in the faculty of economics, University of Tokyo. He has been with the University since 1961.

NICOLAAS G. M. LUYKX II, associate professor of agricultural economics at Michigan State University, is teaching and doing research in development planning and administration, and comparative policies for agricultural and rural development. From 1966 to 1968 he was senior advisor to the Pakistan Academy for Rural Development at Comilla; during this time he was also involved in research in Thailand on government programs in rural development.

MAHAR MANGAHAS, since 1962 an economist at the University of the Philippines, Quezon City, is engaged in research on the diffusion of new rice varieties in the Philippines, Philippines import/export technology, and the effect of new rice technology on demand for labor and on agricultural employment.

WILLIAM C. MERRILL is associate professor in the department of economics, Iowa State University. His teaching and research center on agricultural development, price theory, and industrial organization, principally in the Philippines and Indonesia. Dr. Merrill is co-author of *Introduction to Economic Statistics*, published by John Wiley & Sons.

EDWARD J. MITCHELL has been with the Council of Economic Advisors, Office of the President, since early 1969. He was formerly with the RAND Corporation in California and the Institute for Advanced Studies at Princeton. Dr. Mitchell has been involved over the years in extensive study of the Huk Rebellion in the Philippines.

THEODORE MORGAN, professor of economics at the University of Wisconsin, from 1964 to 1969 was director of a research program on economic interdependence in Southeast Asia, and from 1967 to 1969 was chairman of the Wisconsin Group at the Economic Research Center, Singapore. His most recent book, *Guide to Economic Development*, was published by Harper & Row.

MUBYARTO, an agricultural economist, heads the Bureau of Economic Research at Gadjah Madah University, Jogjakarta. He is consultant to the

Indonesian Ministry of Trade on agricultural price analysis and food policy. Beginning 1971 Dr. Mubyarto will be visiting professor at the Research School of Pacific Studies, Australian National University, Canberra.

SEIJI NAYA, associate professor of economics at the University of Hawaii, was from 1968 to 1969 a faculty research fellow at the National Bureau of Economic Research, New York. He is presently engaged in research on commercial policies and regional cooperation of Southeast Asian countries, and on the economic impact of the Vietnam conflict on Southeast Asia.

VERNON W. RUTTAN is chairman of the department of agricultural economics, University of Minnesota, and former chairman of the SEADAG Rural Development Seminar. Dr. Ruttan's research and writing have concerned the economics of technical change, including specifically the environmental, technological, and institutional factors in the growth of rice production, in the Philippines, Thailand, and Taiwan.

ERNEST W. SPRAGUE is associate director of agricultural science at The Rockefeller Foundation. From 1966 through 1969 he was agricultural project leader for the Foundation in Bangkok, developing inter-Asian programs for corn, sorghum, and rice, and coordinating Foundation assistance for research and training in grains. Beginning 1970 Dr. Sprague was appointed director of the International Maize and Wheat Improvement Center (CIMMYT), in Mexico City.

AUGUSTINE H. H. TAN, who received his Ph.D. from Stanford University in 1968, teaches in the department of economics, University of Singapore. His research includes studies in international economics, and international trade problems. Dr. Tan is joint editor of the *Malayan Economic Review*, and is presently writing a monograph on development strategies in Singapore, 1970 to 1971, for the International Bank for Reconstruction and Development.

MELVIN W. WAGNER, visiting professor of agricultural economics at Uttar Pradesh Agricultural University, Pantnagar, U.P., India, is on leave from the University of Illinois. His present work includes research in marketable and export surplus in developing countries, and regional specialization in agricultural products. From 1963 to 1968 Dr. Wagner was visiting professor at Kasetsart University, Bangkok.

DELANE E. WELSCH, an agricultural economist for The Rockefeller Foundation since 1967, is in Bangkok, Thailand, engaged in research on agro-economic studies of production and marketing of corn, sorghum, rice, and livestock. In addition, he teaches at Kasetsart and Thammasat Universities. Dr. Welsch received his Ph.D. from Michigan State University.

INTRODUCTION

During the two decades following World War II the gap in agricultural productivity between the developed and developing countries widened sharply. The developed nations which had been, on balance, net importers of food grains from the developing world prior to World War II, became net exporters of food grains to the low income countries. Much of this grain was moved to the developing countries in the form of food aid or was sold on concessional terms.

By the late 1960's a series of technical breakthroughs had created a new potential for rapid increases in grain production in the less developed countries of the tropics and subtropics. This development was not a product of the diffusion of advanced grain production technology from the high-productivity temperate grain-producing regions. Rather it was the result of the establishment, in the tropics, of research centers with the capacity to generate a new biological technology for producing far greater yields of wheat, rice, maize, and sorghum than was possible with varieties traditionally grown in the tropics.

The agricultural revolution of the late 1960's has radically altered the perspective on world food problems. It is now possible to consider directing the effort not only toward meeting world food needs but also toward the more fundamental, and more difficult, problems of utilizing the new agricultural production potential to improve the quality of food consumption, to improve the incomes of food producers, and to accelerate economic growth.

In 1968 the SEADAG Rural Development Seminar planned a series of conferences to explore a broad range of possibilities and implications of the agricultural revolution in Southeast Asia. The first of these conferences, held in Honolulu in June 1969, was devoted to an assessment of the implications of technical change for grain production and trade. Subsequent conferences were planned to focus on economic, political, social and institutional implications of the "green revolution" at the community, regional and national levels.

The choice of grain production and trade as the topic of the first conference reflects the significance of intraregional and interregional grain trade for the countries of Southeast Asia. Rice trade among these countries has traditionally accounted for over one-half of the world rice trade. Although the initial impact of the high-yield rice varieties was limited to a few countries, and to limited areas within these countries, some disruption in trade patterns occurred even in 1968; the price of rice traded in the international market receded from the high levels of 1967. Proposals for regional cooperation in stabilizing the rice trade were put forth from several sources. It seemed important, therefore, that the conference explore the implications of expanded rice production for prices and trade and for national and regional economic policy, and assess the technical and economic basis for a continued expansion in rice production in Southeast Asia. As Thailand has emerged as a major exporter of maize (corn), and wheat is competitive with rice in many markets, these two commodities were also brought into the discussion.

VERNON W. RUTTAN

TECHNICAL AND ECONOMIC CONSTRAINTS ON GRAIN PRODUCTION IN SOUTHEAST ASIA

DELANE E. WELSCH AND ERNEST W. SPRAGUE

THERE has been a recent and spectacular expansion of grain production in Asia. This expansion, which has been referred to as the "green revolution,"[1] is based on the use of Mexican-developed dwarf wheat varieties in India and Pakistan; the use in those two countries and in isolated spots in Southeast Asia of improved rice varieties developed at the International Rice Research Institute; and the use in India, Pakistan, and the Philippines of new but less publicized varieties of other cereal crops.

Much has been written about the myriad problems of agriculture in Asia, and many possible solutions have been tried. Our task in this paper is to discuss only the technological and economic aspects of these problems. We begin by recording our belief that the "green revolution" in Southeast Asia has not been a technological revolution because it has failed to lay the basis for a self-sustaining process of technological change, not only in grain production but in agriculture in general. In our opinion the dramatic production increases have only temporarily mitigated yesterday's problems, have avoided today's issues, and have not established the basic infrastructure needed to meet tomorrow's needs.

In the following pages we first review briefly some of the requirements for rapid technological change, and evaluate the recent expansion of grain production in light of these requirements. The rest of the paper deals with our ideas of what is needed to establish self-sustaining processes for the creation and adoption of new technology in agriculture.

REQUIREMENTS FOR RAPID TECHNOLOGICAL CHANGE

Professor Schultz has cautioned against careless use of terms when discussing the process of creation and adoption of new technology.[2] This process consists of developing and learning how to use a whole new set of inputs that are highly productive. New inputs may be in the form of new crop varieties that are highly responsive to increased amounts of fertilizer;

[1] Clifton R. Wharton, Jr., "The Green Revolution: Cornucopia or Pandora's Box," *Foreign Affairs*, Vol. 47, No. 3, April 1969.

[2] Theodore W. Schultz, *Transforming Traditional Agriculture* (New Haven and London: Yale University Press, 1964), p. 131.

new breeds, or strains within breeds, of livestock and poultry that are highly efficient converters of feedstuffs into food; new machines, or radical modifications of old machines, that substantially reduce the human- and animal-power component of production or permit new operations previously unachievable; or new systems of production that change the timing and sequence of new or old inputs or a combination of these.

In planning the creation or development of new inputs, one should carefully distinguish among the biological, the mechanical, and the chemical. Biological inputs, particularly crops, usually must be developed within the ecological system in which they are to be used. The new wheat varieties were developed in an irrigated environment in Mexico, and they are being adopted primarily in irrigated environments in Asia at roughly the same altitude and latitude as in their home country. One badly needed addition to knowledge of technical change in agriculture is a careful documentation of the range of ecological conditions within which successful transfer of varieties has been made. Mechanical inputs, such as tools, equipment, and machines, can sometimes be transferred from one area to another, but sometimes not. For example, within Southeast Asia the soils of Luzon present different tillage problems from those found in the Chao Phya delta, and soils in both these areas are much different from those in the United States and Europe where most of the research on tillage machines is taking place. Chemical inputs are the most readily transferable of all, although doses and techniques of application still must be determined locally.

Development of new technology does not, of course, necessarily ensure adoption. Schultz stresses three economic requirements that must be fulfilled if the economic possibilities open to Southeast Asian countries are to be realized.[3] First, there must be a system of efficient prices—more crucially of farm products and agricultural inputs, but also of consumer goods and services, particularly as incentives to production. Second, there must be a supply of high-payoff agricultural inputs; and third, there must be continual development of new sources of these inputs.

Using a slightly different classification, Harrar and Wortman have recently described the requirements for adoption as follows:

> Generally speaking, conversion of the subsistence farmer to the new technology rests on four points. First, the alternative package of practices offered must be highly productive and profitable by comparison with his present system. Second, he must be shown, by demonstration, the proper way to use the technology and become convinced that he can carry this out. Third, the

[3] Theodore W. Schultz, "Economic Opportunities in the World of Agriculture," University of Chicago Economics Paper No. 6609, 1966.

required inputs (fertilizer, seed, pesticide, credit) must be available to him when and where needed and at reasonable prices. And fourth, he must be assured of a satisfactory price and market for his harvested product at the time he plants and before he mortgages his future.[4]

EVALUATION OF RECENT EVENTS

Let us say, then, that rapid technological change in agriculture requires: (1) availability of new technology that is highly productive and profitable compared with the technology presently in use; (2) demonstration and extension of this new technology; (3) an economic, political, and social climate conducive to its adoption; and (4) a process of continuous development of even newer technology at a pace matching the rate at which the economic benefits of the most recently adopted technology are exploited.

At first glance the recent and dramatic increase in production of wheat and rice suggest that the first requirement has indeed been met. Closer examination, however, reveals that the new technology has been utilized on only a small fraction of the total grain-producing area in Asia. Granted, this degree of utilization has raised several countries close to the level of self-sufficiency in food grains; nevertheless, in most cases such a result has entailed an increase of under 10 percent in total output of any one grain. In the main, the new technology has been adopted only in localized areas where the ecological conditions are sufficiently similar to those in which the technology was developed to permit direct transfer. Thus the new varieties of wheat—a crop generally not adapted to Southeast Asia—have been concentrated in the irrigated crop lands of the Asian subcontinent, where solar energy is abundant and other factors limiting production are less rigorous. Similarly, rice has made its greatest impact in areas where water control is already reasonably adequate.

But there are millions of hectares in Southeast Asia on which the new technology is not suitable. This is due in part to lack of water control on land presently within the command area of existing irrigation projects. There is an almost complete absence of effort directed toward an understanding of water utilization and management, irrigation engineers tending to concentrate on the construction of dams for electric power, flood control, and delivery of water to main canal systems. The missing link is people who are interested in and aware of the irrigation principles needed for good water management and utilization at the farmer's level.

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[4] J. George Harrar and Sterling Wortman, "Expanding Food Production in Hungry Nations: The Promise and Problems," in Clifford M. Hardin (ed), *Overcoming World Hunger* (Englewood Cliffs, N.J.: Prentice-Hall, 1969), p. 103.

If constraints in water control had been rectified, what might have happened? In our opinion the technology which, in its limited area of adoption, has led to the agricultural revolution, would probably have been adopted over a considerably larger area—all of it ecologically suitable as well as under adequate water control—and the resulting output would have been such that markets could not have absorbed it at any reasonable price level.

Still untouched, however, would have been the vast areas outside the irrigation projects in which water control will not be available in the forseeable future. Some of these areas have water so deep during the monsoon season that only deep-water rice can be grown; yet most of the development work with rice has been on varieties very intolerant of deep water (work at the Huntra Station in central Thailand is a notable exception). Other areas either have too little water for rice or are suitable only for upland crops: if output of rice increases only a little, these areas will be forced into crops other than rice.

Thus, the expansion of the last several years has been based on new technology, but new technology suitable only for limited localized areas—not suitable for widespread use and not including alternative crops or cropping systems. But it is a start.

The second requirement for rapid change is demonstration and extension. In the present instance, the imported technology was applied with a minimum of adaptive testing, and local extension personnel were given a minimal amount of training (often abroad) in how to use it effectively. But this first dose of new technology was relatively simple for the farmer to learn to apply, and in the areas where it was suitable it was so clearly superior to the existing technology that farmers required little convincing. These comments are not intended to minimize the very important and good work carried out by demonstration-extension services in the specific areas where the new technology was adopted; but this work is still a long way from the development of effective country-wide extension services. In summary, when extension personnel had something to extend, they performed very well.

As to the third requirement, the recent expansion in grain production took place in a crisis situation in perennially food deficit areas. This crisis prompted all concerned to coordinate their activities to achieve the great breakthrough. But expediency was the mode, and basic policies and attitudes were circumvented or ignored instead of time and effort being taken for necessary revisions. Existing organizations were modified but not basically changed. In short, the expansion made only a marginal impact on the social, political, and economic climate in the countries involved. While it may have greatly increased expectations, it is still too early to tell whether institutional reforms will be forthcoming.

With respect to initiation of a continuous process of developing even newer technology, the recent advances have to be judged as only a beginning. Their very striking success in localized areas may, in fact, give rise to popular misconceptions about the creation of technological change.

It is quite possible that the leadership within individual countries has looked at the small number of visible people that were involved in the development of the new wheat and rice varieties, chiefly at the two regional institutes, and has concluded that only a very few well-trained scientists are necessary to meet their crop production needs. Some leaders may even feel that importing technology and exporting their staff for training is the best way to proceed. In reality, of course, many man-years of research went into the varietal development and crop production knowhow that made possible the great production surge in some areas. At the same time, the new varieties seem so outstanding only because the previous production level was so low that a three- or four-fold increase potential existed within the more sophisticated research programs which developed them.

It is not our intention to minimize the importance and role of regional research centers, or to suggest that each country should duplicate the facilities and staff at these regional research centers. We do strongly believe, however, that each country that wants and expects technological change in its agriculture must gear up to create it. Part of the task is comprehensive adaptive testing and research on imported technology, and part of it is research within the country to create technology for areas and enterprises in which the imported is found lacking. If this step is not taken, then yields, even in the areas where the impact has been dramatic, will level off very soon, and in a decade or more will be nearly as far below those in progressive countries as they were before the introduction of the present varieties and production technology.

WHAT IS NEEDED ON THE TECHNICAL SIDE

The Functions to be Performed

We have been critical of the "green revolution" because we do not feel that a basis has been laid in Southeast Asia for continuous technological change in agriculture. There are several ways in which this situation can be remedied. We wish to describe one that has already been successful in some countries.

A precondition of technological change is a sense of national purpose and unity on the question of agricultural improvements. At one end of the spectrum the national leadership must be aware of what is needed and be willing both to support it by budget allocations and to demand coordination and cooperation among government agencies. At the other end, farmers must be aware of the contributions that the agricultural sector can make to national progress. This point may seem elementary to the reader, but more will be said about it further on.

In our opinion, there are five distinct functions (jobs, or areas of effort) that have to be carried out to create and extend new technology in agriculture. We will call these five areas education, research, training, extension, and service. Each country must define and delineate these five functions. The definitions should be sharp, and any overlapping should occur in implementation.[5]

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[5] We offer our definitions:

Education consists of the process of exposing human beings to knowledge that is new to them, in such a way that they grasp and retain both this knowledge and the principles or processes by which it was discovered.

Research in agriculture can be defined as exploring, gaining, or adding scientific knowledge, correlating information, formulating hypotheses, testing hypotheses, trying out new ideas and materials, and testing ideas and practices that have been developed in other areas of the world. The objective of research is to discover new information, to develop fuller understanding of natural phenomena and their relationships, to learn how these can be utilized toward beneficial ends, and to prove the reliability of new technology that will be of economic advantage to farmers. There is some overlap between research and education because educators should be involved in research. Research can and should be used as an educational tool for teaching extension workers and students. Graduate students, of course, in addition to their academic work, must be involved in research.

Training is differentiated from education in that it is the process of learning and practicing the application of techniques until they can be performed skillfully. There are arguments pro and con over whether education should precede or accompany training. Training is probably more effective when some principles behind certain techniques are understood.

The function of extension in agriculture is to demonstrate the new technology coming from research and to relay this information to the farmers. There is an absolute need for very close liaison between research and extension. In some areas the two overlap, although their objectives are different. Thus, researchers should do some of their advanced testing on farmer-operated land, but this is not extension as defined; on the other hand, comparative demonstrations conducted on cooperating farmers' land by extension personnel are not research. Extension and education also overlap in that extension workers provide an educational service if they discharge their duties of conducting comparative demonstrations, holding farmers' field days and farm meetings, etc.

By service we mean such activities as production of foundation seed or breeding stock, seed testing, soil testing, animal health protection, crop and livestock reporting, weather reporting, provision of credit, and marketing services. All regulatory functions constitute service. Service is an important area where the public and private sectors can each contribute, depending upon whether or not the benefits of the service are capturable and thereby reimbursable.

The Education-Research-Training Nexus

Experience indicates that tooling up to achieve the capacity for creation and extension of new technology in agriculture must come in phases. Research depends upon competent and qualified researchers, not just a few but many, and they must be educated. Education precedes research, yet at the same time the two go hand in hand, for it is quite clear in agriculture that educators are better prepared, more aware of problems confronting rural people, and more up to date on solutions and recent findings (and therefore better teachers) if they are involved in research as well as teaching. But qualified researchers are most productive if they are adequately supported by skilled technicians, who must be trained by the researcher. Thus we have an education-research-training nexus in the first phase of developing new technology.

The Training-Extension-Service Phase

Extension and service belong to the second phase for a very important reason. The most highly trained, qualified, and competent extension worker in the world is useless unless he has something to extend. Granted, there is at present a considerable backlog of new technology in grain production available to developing Asian countries—quite enough to double yields per unit area in some regions—but it is not being adopted. Non-adoption is probably due to the absence of one or more of the crucial factors listed by Schultz and Harrar and Wortman. Frequently, adaptive research and testing is the missing link.

When the flow of new technology starts from the education-research-training pipeline, then the extension and service functions are faced with a new set of tools. If these tools are to be handled adequately, a tremendous effort is required in training and preparing people working in these areas to extend the technology and service to the rural community. Also required is a more objectively organized system of input distribution, marketing, and credit at the immediate disposal of the farmers. A crucial element in continued effective extension and service is very close liaison between education-research and extension-service. This can be achieved in part by having researchers train extension personnel, or at least extension instructors.

The preceding general discussion implies that the capacity to create technological change must be organized to obtain maximum results within the constraints of limited available resources, both financial and human. This capacity should include the ability to increase the supply of educated and trained manpower within the country. The general pattern of a coordinated crop-oriented approach has been successful in some countries, and might fruitfully be followed by others. We turn now to a specific example.

THE COORDINATED CROP-ORIENTED RESEARCH APPROACH

Establishing the Team

An approach, through coordinated crop-oriented research, to the establishment of a self-generating system for continuous development of new agricultural technology requires clear definition of objectives, with a sharp focus on problems. In addition, this approach implies the existence of a team of individual specialists who devote their full research time to the program. Usually this group will be more effective and efficient if it is working on one major crop (or at the most, two), with cropping systems and alternative cropping patterns included in the total research effort.

The first step in establishing such a team is a decision at the national policy-making level to specify the crops (or problems) which are to be the focus of a coordinated program. The next step is to define the overall goals of each crop-oriented project. Next it is necessary to define the five activities of education, research, training, extension, and service. The relevant disciplines which can contribute, and their responsibilities in each activity, should be delineated. For each discipline the overall goal should be broken down into the specific objectives that need to be accomplished. At this point, an inventory should be made of the human resources upon which the program can draw, and responsibilities for each objective should be assigned. These specialists should then draw up the specific tasks or jobs that need to be done to meet the objectives.

The size of the research staff necessary to handle a crop research program depends, of course, on a number of factors, including budget, importance of the crop, etc. Each crop project should have a coordinator—himself an active researcher on the team—who takes the leadership in assuring that efforts are properly focused on priority problems for each crop season. The team membership should include well-qualified researchers from the disciplines of plant breeding, plant pathology, entomology, production agronomy, and soil science, and also a production-oriented agricultural economist responsible for establishing economic feasibility criteria for the inputs under study and evaluating the impact of increased production. (Experiences in several countries during the past few years have shown that chaotic situations can quickly arise if production research is emphasized while marketing and consumption or utilization research is neglected.)

As the researchers develop new technologies, a procedure should be established to test and evaluate these under a range of representative conditions—probably first at regional stations and ultimately on selected farms.

To provide the necessary assistance to the researchers in each discipline, there should be technicians with a B.S. degree or similar qualifications. These positions can then be used as a vehicle for training and for identifying those young graduates who, with further education, may be expected to form the next generation of independent researchers in a self-sustaining system of scientific growth. Backstopping on special problems, for example in crop physiology, may be provided by a plant physiology laboratory that deals in general with more fundamental problems. As more qualified people and more funds become available, the disciplinary components of the team should be expanded to the extent practical.

Besides the standard research tools, such as power farming equipment and plot equipment, the team should have a well-trained permanent labor force, adequately distributed among the different disciplines, and the means to employ casual labor for peak periods.

With this approach, the technicians and laborers on the team, as well as the researchers, become genuine specialists in terms of their individual assignments. And as experience renders each of them better qualified, they become committed to the program and hence devote more effort to it, take more pride in their work, and accomplish much more than they would operating out of a pool.

In the overall planning and conduct of the program, representatives of the various disciplines and projects involved may usefully serve as a committee to assist the coordinator in establishing priorities, courses of action, and budget proposals, and to assure cooperation at all levels.

Coordination of Responsibilities

The purpose of this approach is not to create new departments or ministries but to achieve coordination—organized cooperation—among existing individuals and the institutions to which they belong. The intent is to reduce duplication of effort and, through specialization and coordination, to maximize the contributions of valuable people and institutions. Each member of the team works in his technical area of specialization while remaining sensitive and responsive to the needs of other members and to the goals of the program. This approach thus brings about an interaction among disciplines and exposes problems that otherwise would not be clearly delineated. We strongly feel that a sharply focused team approach stimulates problem-oriented research.

Performance of the five functions of education, research, training, extension, and service obviously raises questions as to the division of responsibilities between universities and national ministries. Undergraduate and graduate education must, of course, be handled by the universities. Research could be done by the universities or a ministry; as mentioned previously, however, research is not only essential in the development of high-quality professors, but is also a valuable tool for teaching and an absolute requirement for graduate programs. Universities must therefore become heavily committed to research if they are to fulfill their educational responsibility to the nation. Training, because it is inextricably linked with education and research, must be performed by educator-researchers.

Extension could very well be performed by either the universities or a ministry, or both. Universities do need to be involved in extension to some degree, because it is a tool for teaching and also a source of feedback on rural problems. There seems very little justification, however, for universities to become directly responsible for service, as defined above.

Research, extension and service are thus three areas where universities and ministries are in danger of duplicating effort and expense. In principle, it should be easy to coordinate their activities so that they complement one another. In developing nations, however, the limited number of qualified people available often means that no one agency has enough men to form a team; furthermore, the existing degree of coordination is frequently not adequate for the information of a team across agencies.

The objective should be to direct staff toward areas of specialization, since substantial contributions are not made by "jacks-of-all trades." Thus, people who are trained to provide services should not be expected to do research as well; similarly, people in universities who are responsible for teaching and research should not be expected to provide service. Unfortunately there are many instances in which one person is expected to function not only in the categories of teaching, research, and service, but also in those of extension and training—with the general result that he is inefficient in all five. Administrators usually plead that shortage of personnel makes such broad assignments necessary. We submit that if administrators would define these categories and then assign staff to narrower areas of responsibility according to qualification, interest, and aptitude, the shortage of staff would not be more acute but less so.

Development of Staff and Leadership

Every country obviously needs to give careful consideration to its immediate and long-range requirements for education and research manpower.

This consideration includes less unbiased evaluation of the cost and the products of present education and research systems. Crucial questions are whether the universities are adequately educating and training agricultural scientists, and if not, what can be done. The training aspect of universities should not be overlooked, for students with high-quality education still need training or internship in research before their potential as researchers can be realized.

If the countries of Southeast Asia are to compete in the agricultural world, they must face the fact that soon only scientists with the best of education and training will be involved in research, and only rural extension workers with at least a B.S. degree and training will be capable of extending the technology coming from research. But it will take them many years to develop the manpower to meet these needs, even if the process is started right now. Already the progressive sector of the rural society is in many ways ahead of extension, and in some cases ahead of research. The agricultural revolution has already outpaced needed educational and training upgrading. Localized overproduction, industrialization based on agricultural commodities, mechanization, etc., will continue to complicate the total agricultural position, which in turn will put more and more demands on agricultural research and extension.

There are relatively few outstanding agricultural scientists in the region, and they are for the most part overburdened with administration, so that at best they can provide only inadequate supervision of research. Furthermore, many are over halfway through their professional careers and will become less involved with research and more involved in planning and administration as time goes on. The educational background of the younger research workers in the region does not equip them to assume research leadership, but most are capable of acquiring the education and developing leadership ability, if given the opportunity. While the "in-service training" that some have received in Mexico and the Philippines is undoubtedly helpful, effective research leaders in the field need an educational as well as training background. A person without an advanced degree can be trained to be an excellent rice or wheat breeder, but his influence will be greatly overshadowed by that of people who do hold advanced degrees, even though they may be less productive.

Agricultural education, research, training, extension, and service need to be critically examined to determine where and how limited resources of money and trained personnel can be used most effectively. In many countries there is a trend toward quantity rather than quality. It is certainly desirable to have as large a volume of these functions as possible, but not at the expense of quality. The same is true for staff. Too often a kind of "numbers game" is practiced. This game goes as follows: A job is not being adequately done, so more staff members are added; but the new members are inexperienced, and the already overextended cadre of qualified people becomes even more overextended in training and supervising them, with the result that the job is done even less adequately than before; so still more new staff members are added, etc. We maintain that poor organization, inadequate budget, or lack of qualified leadership is the cause, not the numbers of people involved. Often a critical assessment will show that actually there is no shortage in the numbers of people but instead a real shortage in their capabilities and in the organizational pattern.

The next step is to outline programs that can be properly handled with the staff and funds available; then a systematic and dynamic effort can be exerted to make up the deficiencies in budgets, staff numbers, and staff development so that each staff member is or becomes a specialist in his own right. All of this can be organized in terms of the crop approach to research.

Financing-Budgeting

The way in which the research budget is prepared is extremely important in making the crop-oriented research approach workable. Each crop team should prepare what it considers to be an adequate budget, based on actual experiences and needs. The research budget which the university or department of the ministry then submits is the sum of the individual team's requests. Budget approval should include identification of the funds with the purpose for which they were requested, so that each member of the team knows how much he has for the research program for the year. There should be adequate flexibility in the budget to allow the team to utilize funds where they are most needed.

When the budget is approved and the funds released, these funds go to the respective heads (within the university or the ministry, as the case may be) of the administrative units to which the individual researchers on the team are attached. This procedure allows for the preparation of a national crop improvement budget but still maintains the technical and administrative control and identity of the individuals and the departments involved.

The Regional Station Question

A very close look should also be taken at the number of research stations and the functions which they are to perform. Generally speaking, in most countries of the region there are too many stations in relation to the number of research workers, and their functions are not well defined. These stations usually have been established for the worthwhile purpose of solving local problems; in practice, however, because of the limited number of qualified people, their existence may dissipate resources and reduce overall performance. In some cases stations may actually be a tool or lever to obtain a larger budget, even though the stations do not effectively add to accomplishments. The "numbers game" described with regard to number of staff is also often practiced with regard to number of research stations.

A budgeting procedure of allocating research funds directly to stations lacking resident research staff usually is wasteful. Each station should provide facilities and service to the research team, but the station superintendent should not have control of the experimental work. His responsibility should only be to provide service to the research program. His budget should cover certain fixed items, such as the wages of a few permanent laborers and maintenance costs for buildings and farm roads. The costs of conducting research on the station should be met by the various research teams from their budgets.

FURTHER ECONOMIC CONSIDERATIONS

Thus far we have concentrated on how to create the technical basis for a self-generating system for increased grain production in Southeast Asia. We now turn to what must be done to create the economic basis, realizing that the technical and the economic are interconnected.

In general, traditional, subsistence-oriented agriculture has been neither conducive to change nor aggressive in seeking alternatives. Whether this resistance is magnified when additional risk is involved in adoption of new technology, particularly when the crop is a staple food, is not clear. Institutional reforms, notably in land and credit, are frequently not forthcoming. None of these limitations is overwhelming if national price and income policies stimulate rather than stifle change, as recent experiences in the Philippines illustrate.

Product price policies are crucial. They must be high enough to provide production incentives to producers. If domestic prices are held at artificially high levels, however, agricultural change is likely to be built on an inefficient basis that would be very difficult to overcome, as experience in some high-income countries has shown.

Input price policies are also very important. The manufacture and distribution of the host of new inputs required by modern agriculture presents a real challenge to the agribusiness community. Yet in the initial stages of adoption of new technology, the demand is small and distribution costs are high. Should the government subsidize inputs, and if so, for how long before there is incipient danger of inefficiencies in the structure of production becoming built-in? The temptation is strong to protect the local industry from cheaper imports until the industry is established; yet, in the case of fertilizer, for example, the potential market will not be large enough in the near future for each country to build a fertilizer plant of the size permitting manufacture at the lowest possible cost per unit. Some sort of regional cooperation and specialization, such as is currently being proposed for steel, is necessary if Southeast Asian farmers are not to end up paying the bill for protectionism.

The danger of protectionism and isolationism becomes even more pressing when the markets for the increased production of farm products are considered. Within the region, as more of the countries become self-sufficient, the exporting countries will run into increasing difficulties in disposing of production at prices favorable to modernization of agriculture. We are speaking of disposing of raw products in the form in which they currently are being exported or utilized domestically. There will be tremendous payoffs from research on increasing utilization. These will take the form of new processed products for both domestic use and export, and rapid transition to feed-grain-livestock economies, with further processing of these products for both domestic use and export.

A very important economic consideration is the building of effective demand. This means that urban incomes must grow fast enough for this sector to buy more farm produce, and that rural incomes must grow fast enough for the rural sector to buy more industrial products. This in turn means that the old distinction between the farm and non-farm sectors and arguments over which should be stimulated are sterile and obsolete, for the interdependence among sectors is great if and when growth occurs. One of these sectors is the government sector. It is "conventional wisdom" that agriculture must be taxed to provide the money for incentives such as roads, marketing and irrigation facilities, and rural education. How to provide incentives without at the same time destroying incentives is a problem that monetary and fiscal authorities have yet to face realistically. When real advances are made in creating new technologies within countries and these countries follow incentive price policies, then agriculture can fully compete with other sectors for short- and long-term capital and credit because the payoff will be that great. If both the technology and the incentives are not there, no amount of interest-free capital will transform agriculture. History is replete with examples of this.

One final and pressing point. Countries have a productivity problem and they have a poverty problem. Sometimes the first is the cause of the second and sometimes not. Creating technology and incentives can help the productivity problem, and may also, although not invariably, help the poverty problem as well. But devoting considerable resources to the poverty problem while neglecting the technical and economic bases for increasing productivity, as some countries are doing, can only perpetuate poverty.

SUMMARY

Although the "green revolution" has been dramatic in localized areas and has raised several countries to the level of self-sufficiency in food grains, the new technology involved has been adopted on only a small fraction of the total grain-producing areas of Southeast Asia. After this initial impact, yields will increase slowly if continued effort in research and extension is exerted, but will then level off, and in another decade the production level may be nearly as far behind that of advanced countries as it was before the "green revolution" reached Southeast Asia. It is absolutely essential, therefore, that the countries of this region develop their own education and research programs for the creation of the new technology required for steady and significant technical change in their agriculture.

Research must be organized to obtain maximum accomplishment with the limited resources available in most of these countries. Although there are various patterns for organization of research that could be followed, it is suggested that the coordinated crop-oriented approach is likely to be the most productive in Southeast Asia. This pattern entails a teamwork approach, with well-defined objectives and a sharp focus on problems. Specialists are more productive than generalists, and this approach permits them to concentrate on their area of specialty while remaining responsive to the needs of the other disciplines and the goals of the program. Coordination and clear definitions of the functions of education, research, training, extension, and service are crucial to the purposes of this approach.

Creating the technical basis is not enough, however, for if the economic basis is not forthcoming, the new technology will not be adopted. Efficient product and input prices are also essential to the adoption process.

APPENDIX

We are aware of the considerable body of published material in the field of "Research and Development," but have had time to review only a minute part of it. A reviewer has suggested that the research approach we have outlined in this paper is analogous to industrial "development" rather than to "research," as the terms are used in the "Research and Development" field, and that one could make a good case for organizing industrial development projects along the lines we have suggested for agricultural development.

We do not agree with the analogy, and believe that research of the type needed in Southeast Asia to create technological change in agriculture is so vastly different from that which occurs in the industrial sector of highly industrialized countries that meaningful parallels cannot be drawn. One reason is the contrast between the basically biological nature of agriculture and the mechanical or chemical nature of industry. A second may be definitional, for in agriculture we tend to be overly concerned with the basic-applied dichotomy. Certainly, science in a world context means creative individuals pursuing uncoordinated and unfettered efforts on the frontiers of research in biology, botany, genetics, and economics. The new knowledge coming from such investigation provides some of the tools that are used in agricultural education and research the world over. The point is that the countries in the region under discussion must be careful not to overextend themselves in such independent investigation, particularly when they have not yet applied existing knowledge in solving the technical and economic problems in their agriculture. Even if they could afford such independent investigation financially, most of these countries have not yet laid the necessary foundations in education and research to be able to support it professionally.

There may be one similarity to "Research and Development," however, and it is worth mentioning. One of the most basic and difficult problems in industrial research management is achieving cooperative attitudes—identification with the overall goals of the project, high morale, emotional involvement, personal concern, etc.—all of which require an exceptionally able project director or coordinator under any form of organization. We do not deny the crucial role of leadership. Maybe we are agricultural fundamentalists, and maybe we are naive, but we believe that the approach we have outlined offers one of the best vehicles for mobilizing the leadership ability presently available in the region, and even more important, will lead to rapid growth of leadership ability in the next generation of Southeast Asian scientists.

ECONOMIC ASPECTS OF NEW HIGH-YIELDING VARIETIES OF RICE: IRRI REPORT[1]

RANDOLPH BARKER

THE rapid dissemination of new-high-yielding varieties of rice throughout tropical Asia is creating a whole range of second-generation problems, not only at the farm level but in marketing and policy as well. Because of the dominance of rice in both production and consumption in most Asian countries, it is of critical importance that current national policies and priorities in rice production and rice price be reexamined in the light of these developments.

This paper attempts to point out general policy directions for South and Southeast Asia. Initial discussion describes the historical development of the new varieties, examines the experience with new varieties among groups of Filipino farmers, and documents the dessimination of the new varieties throughout the tropics based on the limited available evidence. The last section deals principally with the implications of new rice varieties for national price policy, including the pricing of inputs used in rice production.

HISTORICAL DEVELOPMENT OF HIGH-YIELDING VARIETIES

The origin of the new varieties can be traced through a long history of breeding for high yield in rice. In the late 19th century the Japanese undertook research to identify the morphological characteristics of the rice plant associated with high yield.[2] They succeeded in transferring and adapting the native high-yielding japonica varieties to other temperate zone countries. Japonica varieties also were grown in California. Shortly after the turn of the century a breeding program, initiated in subtropical Taiwan, resulted in the development of the ponlai varieties in the early 1920's. At this time an American farmer-breeder produced a series of varieties which combined the high-yielding characteristics of the japonicas with the grain type of the indicas. These varieties became popular in the United States.

What distinguishes the varietal improvement work in the tropics from

[1] This is a revision of a paper entitled, "Economic Aspects of High-Yielding Varieties of Rice with Special Reference to National Price Policies: IRRI Report," presented at the Thirteenth Session of the FAO Study Group on Rice. Manila, March 20-27, 1969.

[2] Isamu Baba, "Breeding of Rice Variety Suitable for Heavy Manuring," report presented to the Fifth Meeting of the International Rice Commission on Rice Breeding, Tokyo, October 1954, pp. 167-184.

that in the temperate zones prior to the 1950's is the failure to identify and breed the plant type characteristics in the indica varieties specifically for high-yield potential. Experience in Japan and elsewhere has shown that fertilizer responsiveness and high-yield potential are associated with short stature, stiff straw, and erect leaves. Traditional indica varieties in the tropics are tall, weak-stemmed, leafy, heavy-tillering, and photoperiod sensitive. Although these characteristics are desirable for plant survival in a tropical environment when weed and water control are poor and cultivation practices are often primitive,[3] application of even small amounts of fertilizer encourages lodging and reduces yield.

Varietal improvement programs were, in fact, carried out in several tropical countries, and outstanding varieties incorporated some of the desirable plant characteristics. Examples are H-4 from Ceylon, ADT-27 from India, BPI-76 from the Philippines, Mos, Peta, and Bengawan from Indonesia, Tangkai Rotan and Seraup 50 from Malaysia, and Dima from Surinam.[4] Notwithstanding these achievements, it was the semi-dwarf indica variety developed in Taiwan in the late fifties that had the deciding influence on subsequent rice breeding for high yield in the tropics.

Although the origin of the dwarfs is unknown, the first examples are assumed to have come to Taiwan from Mainland China before the Japanese occupation. Dwarf mutants selected by farmers perhaps decades ago eventually entered the collection of rice breeders in Taiwan. But it was not until after the return of Taiwan to the Republic of China in 1945 that attention shifted from the improvement of the ponlai or japonica to the indicas. A program to upgrade the indica varieties[5] was inaugurated in 1945 at the Taichung District Agricultural Improvement Station. In 1957 the new semi-dwarf indica, Taichung (Native) 1, was developed from a cross using the semi-dwarf Dee-geo-woo-gen. Chandler[6] states that the Taiwan semi-dwarf varieties can be compared in importance to the Japanese dwarf wheat Norin No. 10, introduced into the United States after World War II.

The successive improvements in rice plant type brought the tropics closer to a major yield breakthrough in rice production. The International Rice

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[3] E. A. Jackson, "Tropical Rice: The Quest for High Yield," *Agricultural Science Review,* Vol. 4, No. 4, Fourth Quarter, 1966, pp. 21-26; and P. R. Jennings and L. Johnson, "Breeding for Improved Rice Production," conference report on Mechanization and the World's Rice, Coventry, England, September 1966, pp. 58-63.

[4] P. R. Jennings, "Plant Type as a Rice Breeding Objective," *Crop Science.* Vol. IV, No. 1, January-February 1964, pp. 13-15.

[5] Chinese-American Joint Commission on Rural Reconstruction: "Rice Improvement in Taiwan," Plant Industry, Series No. 15, Taipei, May 1959; and "Crop and Seed Improvement in Taiwan, Republic of China, May 1959-January 1961," Taipei, July 1961.

[6] Robert F. Chandler, Jr., "Dwarf Rice Variety—A Giant in Tropical Asia," U.S. Department of Agriculture *Yearbook of Agriculture 1968.* pp. 253ff.

Research Institute in Los Baños, the Philippines, began operations in 1962 on the threshold of this breakthrough. Many of the Institute's personnel had been previously involved in rice improvement work in Japan, the United States, India, and Taiwan. In the words of M. S. Swaminathan, Director of the Indian Agricultural Research Institute, these scientists "spread all over the world the gospel of plant type in relation to yielding ability."[7]

The initial breeding program of the Institute gave equal emphasis to two possible alternatives for creating the desired plant type: (1) the crossing of japonica and indica varieties and (2) the crossing of semi-dwarf indicas developed in Taiwan and the United States with the tall indicas from the tropics. During 1962 thirty-eight crosses were made, eleven of which involved the Taiwan semi-dwarfs, Dee-geo-woo-gen and I-geo-tze. The majority of other crosses were made between the ponlai or Taiwan japonicas and the tall indicas.

Sterility due to the lack of genetic affinity in plant materials and susceptibility to disease were problems encountered in the ponlai-indica crosses. The discovery that short stature in the Taiwan semi-dwarfs is controlled by a single recessive gene moved these varieties into a position of prominence in the breeding program.[8]

The yield potential of a selection from one of these early indica crosses, IR8-288-3 (Dee-geo-woo-gen x Peta, now known as IR8), was first recognized in tests made during the 1965 wet season. In the following year this selection underwent intensive examination and testing by several departments at the Institute. The fertilizer trial data from the agronomy department, shown in Fig. 1, compares the yield of six varieties using five levels of fertilizer grown at the Institute farm during the dry season of 1966. The results show two important relationships. First, with fertilizer added IR8 achieved a maximum yield of approximately 1 to 2 tons above the improved indicas and 3 to 4 tons above the native indicas. Second, at zero fertilizer IR8 did as well as and somewhat better than most other varieties.

During the next few crop seasons IR8 was tested in a variety of yield trials throughout the tropical rice growing regions of the world. The gap in the performance of IR8 and local varieties varied from country to country depending on the degree of success already achieved in the local breeding program. Nevertheless, the consistent ability of IR8 to perform at or near the top in these yield trials under a wide range of climatic conditions clearly

[7] M. S. Swaminathan, "Rice Production: Phenomenal Increase Possible," *Indian Farming,* Vol. XVII, No. 3, June 1967, p. 3.

[8] T. T. Chang, "Analysis of Short Stature Genes," proceedings of the Rice Technical Working Group, Little Rock, Arkansas, June 1966, pp. 18-19.

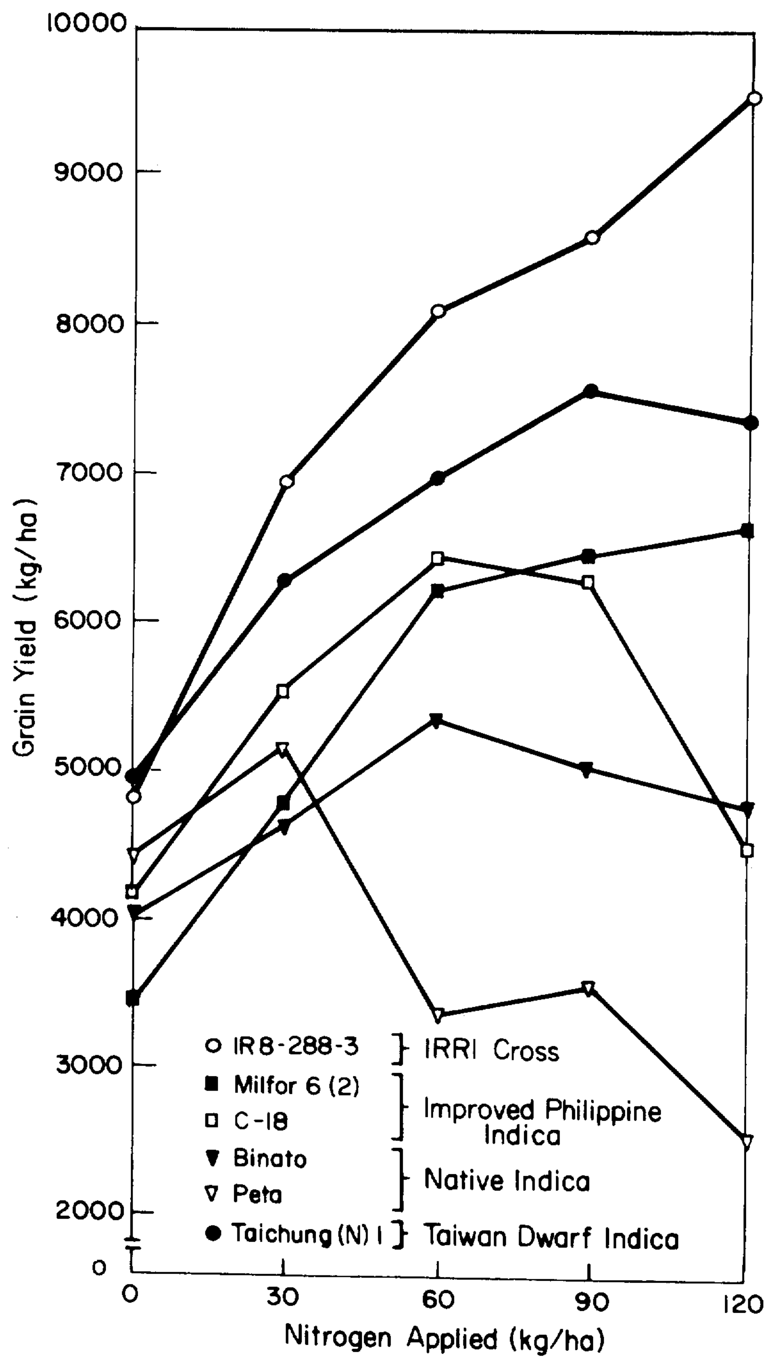

FIG. 1. Grain Yield Response of Six Nitrogen Varieties, 1966 Dry Season, IRRI.

vindicated the early decision to breed for plant type. This selection was officially recognized as a new variety on November 28, 1966, the first to be released by the Institute.

In the initial effort to establish a plant type with high-yielding ability, cooking and eating quality were deemphasized but not ignored. Earlier experience suggested that once the physiologically efficient plant type was developed, grain quality could be changed through further breeding to suit the various taste preferences without sacrificing yielding ability. Following the achievement of a high-yielding plant type, the research at the Institute began to focus on the improvement of grain quality and disease and insect resistence. Current progress in this direction suggests that varieties such as IR8 and IR5 will soon be replaced by others of superior grain quality.

Regardless of which of the high-yielding varieties becomes popular in the future, the new plant types will continue to be grown throughout the tropics. An analysis of not only the biological response but also the economic performance of these varieties will explain why.

FARMER EXPERIENCE WITH NEW RICE VARIETIES (THE PHILIPPINES)

Recent surveys conducted in the Philippines have compared farm level experience with new and local varieties in relation to (1) the adoption pattern, (2) the level of resource use, and (3) returns and costs. These surveys have been conducted in what must be regarded as the more progressive rice growing areas. Although they are by no means representative of the Philippines, they do bring to light information of interest to both producers and policy-makers.

Our survey has been conducted annually during the past three years on 155 farms in Laguna Province to record the changes introduced with the new high-yielding rice varieties. Laguna Province has relatively good irrigation facilities, and provincial yields are normally well above the national average. Although 90 percent of the farm operators are tenants, the level of management and resource input is higher than would be found in many regions.

The adoption pattern of new varieties is presented in Table 1. Yields are presented only for those farms planting 100 percent of their land to new varieties; the yields of farms planting only local varieties are shown for comparison. New varieties include here IR8, IR5, C4-63, and BPI-76. The most commonly planted new variety was IR8. During the wet season of 1968, for example, only 12 out of 127 adopters planted new varieties other than IR8.

TABLE 1. Adoption Pattern for New Varieties on 155 Farms, Laguna, Philippines, 1966 to 1969.

	1966	1967		1968		1969
	Wet	Dry	Wet	Dry	Wet	Dry
Percent of Area Planting New Varieties	1	8	55	53	75	67
Total Farms Planting New Varieties						
Number of farms planted	4	14	70	62	87	69
Percent of farms irrigated	100	95	83	88	90	93
Number of full adopters	1	9	60	62	83	63
Yield/hectare of full adopters	4360	4710	4220	3480	3340	—
Farms Planting No New Varities						
Number of farms planted	96	86	30	38	13	31
Percent of farms irrigated	79	78	68	66	84	79
Number of non-adopters	149	134	47	56	19	43
Yield/hectare (wet season)	2376	2420	2110	2990	2770	—
Total Number of Farms Planting Rice[a]	155	155	155	147	146	138

[a] Some non-irrigated farms have shifted out of production in certain seasons and nine farms were converted into housing subdivisions in 1968.

The major shift to IR8 occurred in the wet season of 1967, when the seed first became available in large quantity. Official government statistics show that over 428 thousand hectares or 13 percent of the riceland in the Philippines were planted to this variety during the 1967-68 crop year. Of the 155 survey farms in question, 146 had planted new varieties in at least one season by the end of 1968.

From this table a number of interesting observations can be made. First, a new seasonal pattern has begun to emerge. A growing number of farmers are planting new varieties in the wet season and local varieties in the dry season. This strategy seems particularly appropriate on those farms which have uncertain or limited dry-season water resources. The explanation is related to price differentials. IR8 requires high levels of fertilizer input during the dry season in order to maximize profits, whereas local varieties will respond to medium input levels of nitrogen during the dry season without lodging. Many farmers can ill-afford the risks associated with planting new varieties during the dry season. The 1968 survey of Laguna farmers showed that 53 percent of the riceland was planted to new varieties during the dry season and 75 percent during the wet season.

Second, as the number of farmers adopting new varieties has increased, actual yields have decreased. The reason is that later adopters have not had the farm resources and the level of inputs of the early adopters. Lack of irrigation made the most critical difference. Nearly 100 percent of the farms of early adopters (those planting new varieties for the first time in the wet season of 1966 or dry season of 1967) were fully irrigated. This figure dropped to about 50 percent for the late adopters. Because of the uncertainties involved, poor irrigation facilities are associated with lower input levels, lower yields, and lower farm profits.

A third observation is that the yield of new varieties shows a downward trend, while the yield of local varieties has increased. To understand why, it is necessary to see in more detail the changes in varieties grown and resource use.

During 1966 and 1967 farmers were planting two new and nine local varieties. The most popular of the local varieties, Malagkit, a glutinous rice not consumed regularly in the household but used in specialty items, received a price approximately double that of IR8. By the wet season of 1968 the new varieties grown had increased to four while local varieties had declined to only two. However, of the 146 farms interviewed (nine of the original 155 farms sampled had been transferred into housing subdivisions), 142 were growing either IR8 exclusively, or Malagkit. The price of Malagkit, although lower than in 1967, was still high enough to be grown alongside IR8, benefiting in the process from the higher level of management and care than had been customary with other local varieties.

Many farm operators switching to new varieties for the first time have adopted not just a new variety but a whole new package of inputs. The explanation is that the inputs and credit were available, and farmers found it profitable. Beginning in 1966 a fertilizer distribution system developed by private industry gave farmers easy access to fertilizer in all of the major rice growing areas of the Philippines. Between 1965 and 1969 the supply of credit extended by Laguna landowners to their tenants increased approximately five times—from ₱30 to ₱150 per hectare. This credit was used not only for fertilizer, but for additional hired labor in weeding, land preparation, and transplanting, and for fuel for irrigation pumps.

How profitable is it to grow new varieties? The best way to measure this is to make the comparison between returns and variable costs. Fixed costs such as irrigation fees, land taxes, and depreciation on equipment will be the same regardless of the variety grown. Variable costs, involving seed, fertilizer, chemicals, hired labor, and the harvester's share of crop yield, depend on the level of inputs used and the level of output attained.

Table 2 compares the returns and costs for high-yielding and local varieties grown during 1966-67, based on three studies of early adopters conducted in Laguna and Central Luzon. Yields of new varieties (principally IR8) were 73 percent above those of local varieties. Gross returns

TABLE 2. Summary of Farm Surveys of Returns and Costs Per Hectare for Local and High-Yielding Varieties, Early Adopters, Laguna and Central Luzon, Philippines, 1966–1967.

	Local	HYV[a]	Increase HYV (percent)
Yield in Kg./ha.	2464	4268	73
Gross Return (₱)	1000	1433	43
Net Return (₱)[b]	704	917	30
Cash Costs (₱)	296	516	74
Total Costs Per Cavan[c]	32	24	—

Source: Randolph Barker and E. U. Quintana, "Returns and Costs for Local and High-Yielding Rice Varieties," *Philippine Economic Journal,* forthcoming.

[a] Predominantly IR8.

[b] Net return to fixed resources: land, operator and family labor, and farm capital, ₱3.90 = $1.00.

[c] Includes cash or in kind payments for fertilizer chemicals, seed, hired labor, and for harvesting and threshing. Add ₱500 to costs as charge for fixed resources.

were only 43 percent higher owing to the lower price received for IR8 (approximately 20 percent below many local varieties). Net return above variable costs was only 30 percent higher because of the greater cash outlay required for new varieties. The adoption of the new technology, however, reduced the total cost per 100 kilograms of rough rice from ₱32 to ₱24. Thus, in spite of lower prices received, the net return for the new varieties was high enough to encourage their expansion.

Judging from the reports received from other countries, the experience of these Philippine farmers is not an isolated case.[9] The early adopters—those farmers with better resources and management capabilities—have been in the best position to realize the yield and profit potential of these varieties. Later adopters with generally poorer water resources and lower level cash inputs have experienced lower yield increases.

Under the widely varying climatic conditions of tropical Asia, farm level success has not been uniform. The yield of crops grown under irrigated conditions with high sunlight in many cases has more than doubled. Other farms, on the other hand, have found the new varieties unsuited to this particular climatic or cropping pattern, or not resistant to local diseases and insect attack.

[9] W. David Hopper and Wayne H. Freeman, "India's Rice Development Moves From Unsteady Infancy to Vigorous Adolescence," unpublished mimeo, Rockefeller Foundation, New Delhi, March 1969.

An even more important threat to the initial enthusiasm with which the varieties were received is the prospect of lower rice prices. Prices have fallen in part because the abundance of supply in some regions has exceeded the capacities of drying, milling, and storage facilities. Of more direct concern to those planting new varieties has been the lower price received for certain of these varieties. The most widespread, IR8, typically sells at a price 20 percent or more below local varieties in a number of Asian markets.

Farmers reflect their sensitivity to this price difference by switching back and forth between varieties to find the combination of price and yield potential that will give the highest profits. As a consequence, progressive producers still consider it profitable in many situations to plant local varieties. Continued efforts to improve grain quality and disease and insect resistance will make it possible in the near future to select from a wide range of high-yielding varieties the one that best suits the particular farm situation.

DISSEMINATION OF NEW RICE VARIETIES THROUGHOUT THE TROPICS

The amount of land planted to the new varieties during the crop year 1968-69 exceeded five million hectares or 6 percent of the total riceland in South and Southeast Asia. That the spread has been more rapid than initially anticipated by many observers seems to highlight the advantage of the new plant type over existing indica varieties throughout a broad geographical area in the tropics. Related to the initial acceptance have been the apparently successful promotional efforts of a number of governments which heretofore had shown relatively little interest in agriculture. The spread has not been uniform, however: the rate of diffusion differs among countries, among regions within a country, and among farms within a region.

The crop season 1965-66 marks the starting point for the spread of new varieties[10] and coincides with the introduction into India of the semi-dwarf Taichung (Native) 1. To date, the principal new varieties in terms of planted area are IR8 and IR5. Other varieties recently developed through various country research programs are C4-63 and BPI-76 in the Philippines. ADT-27, developed several years ago, has been spreading rapidly in the Tanjore District of India. H-4 and H-8, which account for more than 50 percent of the rice grown in Ceylon, are omitted since their dissemination occurred well before 1965-66.

Until now the Philippines has been the major source of seed for the

[10] "New" or high-yielding rice varieties are here defined as plant types of medium-to short stature with high-yield potential introduced into the tropics after crop year 1965-66.

new varieties. Some of the seed was multiplied and distributed by IRRI. Most of the estimated 6500 tons of exported seed was produced by private growers and shipped through private or government channels. Table 3 shows the quantity of seed exported from the Philippines by year and by country of destination.

TABLE 3. Seed of New Varieties Exported From the Philippines by Country of Destination, to January 1969.

Country	1967	1968				
	IR8	IR8	IR5	IR253[a]	C4-63[a]	C4-113[a]
			(metric tons)			
Burma	200	—	—	—	—	—
Ceylon	—	210	—	—	—	—
Ecuador	—	—	[b]	—	—	—
Germany (Fed. Rep.)	—	[b]	—	—	—	—
Ghana	—	—	—	—	2	—
Indonesia	—	—	—	—	1	—
Iran	—	[b]	—	—	—	—
Israel	100	198	—	—	—	—
Laos	—	—	2	2	—	—
Liberia	—	1	1	—	1	—
Pakistan	3600	—	—	—	—	—
Panama	10	—	[b]	—	—	[b]
South Vietnam	—	1807	205	—	—	—
Spain	—	12	—	—	—	—
United Arab Rep.	100	—	—	—	—	—
Venezuela	—	10	—	—	—	—
Total	4010	2238	208	2	4	—

Source: Rice and Corn Administration, Philippine government.

[a] IR253 is not an official IRRI variety, but a selection. It is a glutinous rice bred specifically to suit taste preference in the Upper Mekong River Basin. C4-63 and C4-113 are varieties developed at the University of the Philippines College of Agriculture.

[b] Less than 1.0 metric tons.

Seed exports give a rough indication of where the new varieties are being grown and where the expansion is likely to take place in the immediate future. One ton of seed will plant 20 to 25 hectares. Assuming a 50 percent loss in the production and distribution channels, the expansion per crop season would be approximately fiftyfold—1,000 hectares at the end of the first season, 50,000 hectares at the end of the second season. Thus in two crop seasons a relatively modest amount of seed can be multiplied into a quantity sufficient to meet local demand.

Table 4 shows the estimates of area planted to new varieties by country and by crop year beginning 1965-66.[11] Most of these figures are either projections of government plans or predictions as yet unsupported by official government surveys. Allowing even for gross inaccuracies the estimates are revealing. The most rapid dissemination has occurred in India, West Pakistan, and the Philippines. One of the major rice exporting countries, Thailand, does not appear in the table at all.

The extent to which a technological change at the experiment station is transmitted to the farm is determined by a multitude of complementary factors. These represent possible obstacles, a certain number of which must be overcome at one time if the diffusion of technology is to occur. Factors influencing the rate and extent of acceptance of new varieties include (1) water control, (2) degree of plant protection or resistance to insects, rodents, and disease, (3) availability of complementary inputs such as seeds, fertilizer, chemicals, and credit, (4) relative advantage of new over existing varieties, particularly in economic terms, (5) acceptability of the quality of the new grain, (6) the quality of farm management, (7) the farm institutional structure, (8) the availability of adequate market resources including drying facilities, storage warehouses, and milling equipment, and (9) government institutional structure, incentive, and initiative. No one of these conditions can be singled out as most essential or critical.

It is too early to determine the extent of adoption that will occur in a given country, since the dissemination process has just begun. It is possible, however, to subjectively determine which countries appear to have more favorable, average, and less favorable conditions for adoption. This analysis is presented in Table 5 using five of the nine factors listed. For a given country, each of the factors is identified in one of three categories from favorable to unfavorable. Those which appear to have particular influence in the initial acceptance in a given country are underlined. Among the five, disease resistance and acceptability of grain quality can be overcome in a comparatively short time by further work in varietal improvement. These are understood to be more temporary obstacles to expansion than, for example, poor water control which must be considered the most important deterrent to the spread of new varieties.

[11] This table was compiled in cooperation with Dr. Dana G. Dalrymple, International Agricultural Development Service, U.S. Department of Agriculture.

TABLE 4. Estimates and Projections of Areas of New Rice Varieties in Southeast and South Asia by Country and Year, December 1968.[a]

Country and Crop Year	Total Rice Hectarage 1965–66 (1000)	Hectares New Varieties (1000)	Percent Riceland 1965–66
SOUTHEAST ASIA			
Burma	4856	—	—
1968–69	—	324	6.7
Indonesia	7348	—	—
1968–69	—	271	3.7
1969–70	—	809	11.0
Laos	648	—	—
1967–68	—	1	[b]
Malaysia	480	—	—
1966–67	—	4.5	[b]
1967–68	—	30	6.3
Philippines	3109	—	—
1966–67	—	75	2.4
1967–68	—	701[c]	22.5
South Vietnam	2450	—	—
1967–68	—	0.9	[b]
1968–69	—	44	1.8
1969–70	—	200	8.7
SOUTH ASIA			
Ceylon	492	—	—
1968–69	—	10	2.0
India	35,274	—	—
1965–66	—	6	[b]
1966–67	—	887[c]	2.5
1967–68	—	1784[c]	5.1
1968–69	—	3440	9.8
East Pakistan	8900	—	—
1966–67	—	0.2	[b]
1967–68	—	81	[b]
1968–69	—	242	2.7
West Pakistan	1393	—	—
1967–68	—	4	[b]
1968–69	—	344	24.7
1969–70	—	405	29.1
TOTAL	80,678[d]	—	—
1966–67	—	967	1.2
1967–68	—	2602	3.2
1968–69[e]	—	5397	6.7

[a] Detailed description of data sources may be obtained through IRRI or through Dr. Dana Dalrymple, International Agricultural Development Service, U.S. Department of Agriculture. The definition of *new* in this table refers principally to varieties disseminated since 1965–66 and excludes H-4 and H-8 in Ceylon although hectarage of both varieties has been increasing.

[b] Less than 1 percent.

[c] Based on official government survey.

[d] Includes all non-Communist countries in South and Southeast Asia.

[e] Where data is not available, 1967–68 estimates are repeated.

TABLE 5. Countries Which Appear to be in a More Favorable or Less Favorable Situation with Respect to Five Factors Influencing Dissemination of New Indica Varieties in South and Southeast Asia, 1968.[a]

	FACTORS				
	Water Control	Availability of Inputs	Yield Advantage Over Existing Varieties	Disease Resistance	Quality Acceptability of New Rice Grain
More Favorable					
India	Average	Good	*High*	Average	Average
Malaysia	*Good*	Good	High	High	Poor
Philippines	Average	Good	*High*	Average	Average
West Pakistan	Good	Good	*High*	High	Average
Vietnam	Average	Average	*High*	Average	Average
Average					
Ceylon	Good	Good	Low	Average	Average
Indonesia	Average	Poor	Medium	Average	Average
Less Favorable					
Burma	Poor	Poor	High	Average	Poor
East Pakistan	*Poor*	Average	High	*Low*	Average
Thailand	*Poor*	Average	Medium	Average	*Poor*

[a] Those factors thought to be particularly important in influencing the initial rapid or slow rate of adoption are *italicized*.

The contrast between the more and less favorable situations can be seen in West and East Pakistan. The very conditions that favor West Pakistan—high-yield response due to the dry climate, water control, and a minimum of disease and insect problems—are major handicaps in East Pakistan. Much of East Pakistan's rice growing area is flooded during the annual monsoons. Disease and insect problems have made it virtually impossible to grow IR8 during the main crop season.

In Malaysia and Indonesia, too, IR8 is a prey to local diseases. In some areas IR5 is more resistant; but in other areas the search for new varieties which combine high-yield potential with local disease resistance is still continuing. Thailand, a major world exporter of rice, has chosen to delay acceptance of the new plant type until a high-yielding variety with export quality can be developed. In Burma and Indonesia low rice prices and wage rates inhibit the use of fertilizer and chemicals needed to achieve the potential of high-yielding varieties unless farmers are subsidized by the government.

In sum, the introduction of new varieties will shift the absolute advantage in rice production throughout Asia. Water control will be a major consideration in the rate and extent of adoption. The producing areas with the lowest cost are likely to be those which combine a relatively dry climate with adequate irrigation, such as West Pakistan. If marketing facilities are adequate, these regions could become net exporters of rice. In view of this, the traditional Asian exporting countries, Burma and Thailand, may find increasing competition in the world rice market.

IMPLICATIONS OF NEW VARIETIES FOR NATIONAL PRICE POLICY

Traveling through Asia today, one is struck by the contrasting problems presented by technological advance. In some regions, especially the rainfed areas, the so-called "green revolution" is making slow progress, and the concern is still over how to encourage farm production. In other areas, increased food-grain production has uncovered a host of what are now referred to as second-generation problems. These relate principally to marketing functions —drying, storage, milling, and export of rice—but include other political and social issues as well.[12]

Against this background a wide range of national policies are being dabated, many of which deal with subsidization and/or taxation of rice and inputs used in rice production. Indian policy-makers are considering proposals that would provide for a 10 percent tax of fertilizer, a duty on electric pumps for irrigation, and a higher tax on agricultural wealth or property.[13] West Pakistan is currently debating the merits of a government-supported, large-scale mechanization program for agriculture.[14] The Philippines maintains a high support price on rice, a policy that draws criticism because of insufficient funds to purchase more than a token amount of rice at the support level.[15]

Of all agricultural commodities produced in Asia, none has more far-reaching impact on the functioning of the national economy than rice. It would seem appropriate, therefore, to review the effects of a change in rice price and rice policies.

This section will not discuss specific policies (the merits of which can only be judged within the context of the overall policy of a given country), but rather the general principles and factors to be considered in the pricing

[12] J. Norman Efferson, "Observations on the Current Developments in Rice Marketing in West Pakistan," discussion draft, Planning Cell, Agricultural Department, Government of West Pakistan, Lahore, January 1969.

[13] Vishnu Dutt, "Mr. Desai Against the Rest, a Fertile Controversy," Editorial Page, *The Times of India,* New Delhi, March 5, 1969.

[14] Hiromitsu Kaneda, "Economic Implications of the 'Green Revolution' and the Strategy of Agricultural Development in West Pakistan," Research Report No. 78, Pakistan Institute of Development Economics, January 1969.

[15] Amado M. Dalisay, "Economic Incentives for Increased Productivity," editorial, *Economic Research Journal,* Vol. XV, No. 1, June 1968.

of rice and also of inputs to be used in rice production. We will examine (1) the function of rice price in the economy, (2) the objectives of pricing policy, and (3) pricing policy and the new high-yielding varieties.

Function of Rice Price

In an open economy the price of rice influences the income levels of both producers and consumers and serves to allocate resources in production. Any change in the price of rice will stand to benefit some segments of the economy at the expense of others. A higher price will provide more income to the producer and hence a greater incentive to grow rice. The producer may choose either to increase production per hectare—a decision that will depend very much on the input-responsiveness of a rice variety—or he may increase hectarage of rice. If he decides to shift area and/or inputs to rice production, or if lending institutions shift financial resources to the rice sector, the effect will be a decline in production and income of competing crops.

A higher rice price for consumers will mean a higher cost of living and thus a lower standard of living. Consumers will spend more of their income for rice, in which case there will be less money available for other goods, or many will decide to eat less rice and more of other goods instead.

A higher price may force labor to demand higher wages, which will lead to a higher cost of production. A higher cost of production will negatively influence the competitive position of rice in the world market.

As to the economy as a whole, higher production of rice may mean a saving in foreign exchange for rice imports. However, if the higher rice price leads to higher wages and higher prices for goods other than rice, it could mean a loss in export markets and foreign exchange from other sources. The sequence of events would place inflationary pressure on the economy.

In short, there is the constant danger that a rice price policy may lead to serious misallocation of resources. The politician must balance the pros and cons in arriving at a policy that is equitable and in line with national objectives. A first step is to understand clearly the objectives sought by the price policy.

Objectives of Pricing Policy

Five broad objectives of rice price policy are (a) to increase production, (b) to stabilize prices, (c) to transfer profits or capital to support the development of a sector, (d) to transfer income to raise the living standard, and (e) to lower the food cost to the consumer. These policies are not all complementary, and some decision must be made as to which sector will benefit and which will pay the cost of any particular program.

Increasing production. To overcome current deficits in production and to meet the demands of a growing population, most Asian countries have set as a major policy objective the achievement of self-sufficiency in rice and certain other food grains. Self-sufficiency can be achieved by prohibiting food imports, by transferring hectarage from other crops to rice, or by increasing rice yield per hectare. Some countries may open up new lands, but this alternative is very limited in Southeast Asia. Since prohibiting food imports would normally result in a very high and politically unacceptable rice price, and because transferring hectarage from competing crops to rice could lead to reduced foreign exchange earnings or increased spending for agricultural imports, it is implicitly assumed by most people that the third alternative of increasing rice yield per hectare should be the way to achieve self-sufficiency. The principal means of stimulating and sustaining production per hectare is through rice price support or input subsidization. In the past, however, price incentive programs have failed to attain the intended production increases because input-responsive varieties were unavailable.

Stabilizing prices. The purpose of a stabilization policy is to reduce income fluctuations of both producers and consumers. For the producer this will serve as a further incentive to production since it lessens uncertainty. Stabilization schemes involve the procurement and sale of stocks by the government in order to minimize price fluctuations at farm and retail levels. The problem of determining an average size of stabilization stock, and of developing the decision criteria for government procurement and sales that will maintain this average, is more complicated than normally visualized. Deciding on the average stock level involves a tradeoff of costs. First, there is the tradeoff between the cost of maintaining stocks and the cost of price fluctuation. Second, there is the tradeoff between the cost of maintaining stocks and the cost of obtaining improved forecasting data for both crop production and consumption. It seems certain that in many countries improved estimates in crop production and consumption are a necessary first requirement for a workable stabilization scheme.

Transferring capital. There is general agreement among economists that once a sustained growth rate is established in agriculture, farm profits must be taxed, not only for further investment in agriculture (research, infrastructure development, etc.), but also to promote industrial development. However, as already pointed out, price incentives may be necessary to sustain the agricultural growth rate. The potential conflict between these objectives can be minimized by skillful pricing and taxation policy. For the majority of Asian countries, every effort should be made to encourage the adoption of fertilizer-responsive varieties and the use of inputs. At the same time it is equally important to find a way to tax the rather substantial profits of some farmers. An income tax could be desirable but very difficult to administer. Cochrane[16] has suggested in lieu of an income tax a graduated land tax with tax rates per hectare increased according to the number of hectares operated. Such a tax would not discourage the use of inputs and would tend to promote production efficiency. This tax would of course encounter strong opposition from politically powerful landowners in many countries.

Transferring income. Many developed countries have used price supports as a means of transferring income to the agricultural sector. This is a welfare or equity measure designed to compensate the farm population for its generally lower level of income. Developing countries cannot afford these costly parity programs. Neither can they afford to overlook the equity issue. A number of policies currently being executed tend to broaden income distribution but leave the well-to-do population relatively better off under the new program.

The introduction of new technology historically has operated to the advantage of those with better resources. The most critical equity issue in Asia today concerns not the widening gap between the rich farmer and the poor farmer, but rather the gap between the employed and the growing ranks of the unemployed. Rice price policy can have an important effect on employment as illustrated below.

Lower food cost for the consumer. The ultimate objective of a national rice program should be to provide cheaper food to the consumer. Maintaining a low rice price will make it possible to hold down the wage rates and hence increase employment without reducing the real level of income. At the same time, farm price must not fall so low as to discourage the rice producer. High farm profits can be maintained by lowering the cost of producing rice. Lowering the cost of production should be a primary goal of agricultural research and government policy.

Farm and retail price levels in several Asian countries are an indication of radical differences in the policy objectives of governments. Fig. 2 and Table 6 provide information on rice price at farm and retail levels for eight Asian countries during 1964-65. India and Indonesia have been omitted because their prices vary according to region. Pakistan has been omitted because of the different situations of East and West Pakistan.

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[16] Willard W. Cochrane, "Food and Agricultural Policy for India," unpublished mimeo, The Ford Foundation, New Delhi, April 1968, p. 39.

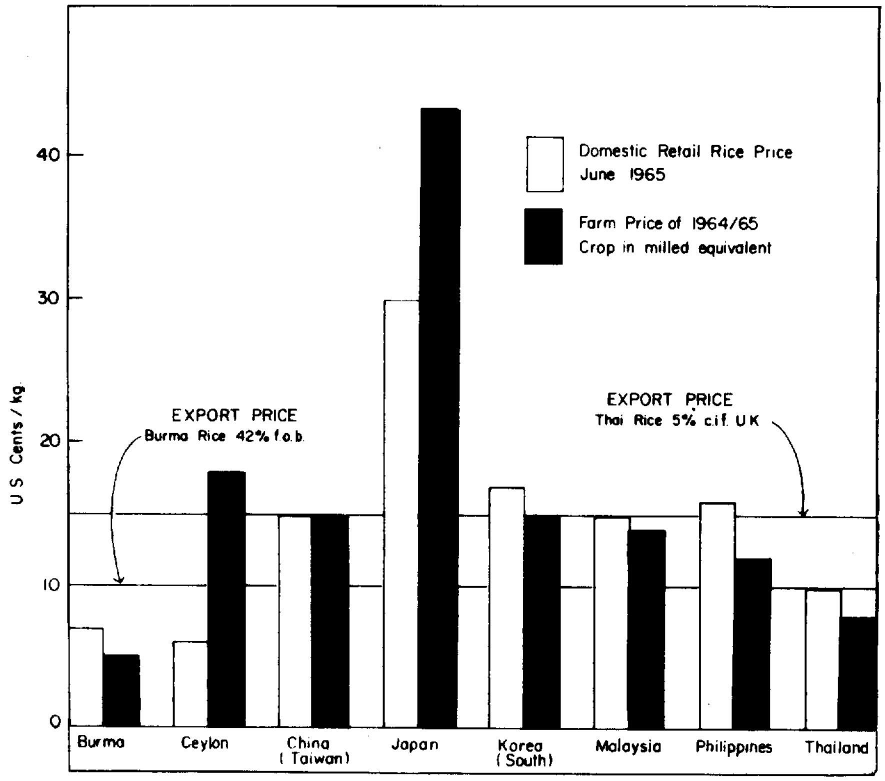

FIG. 2. Comparison of Domestic Retail and Farm Price of Rice in Eight Asian Countries, 1964-1965.

Burma and Thailand, traditional exporting countries, have held farm prices below the world export prices and are using the proceeds from the export of rice to finance government operations. Ceylon and Japan, both major importers, support a farm price well above the retail price. High farm prices have stimulated production, but the cost of such operations has created a serious financial problem in both countries. The government of Ceylon has recently shifted to a somewhat less costly policy of distributing free to the consumers the 50 percent of the requirement normally imported and allowing domestic production to be sold on the free market. Japan, the more highly developed country, can rationally view its policy as an equity measure: the purpose is not only to stimulate production but to transfer income to farm workers.

TABLE 6. Comparison of Farm and Retail Rice Prices and Fertilizer Price for Eight Asian Countries, 1964–65.

Country	Retail Rice	FARM RICE: Paddy	FARM RICE: Milled Equivalent[a]	Nitrogen[b]	Farm as Percent of Retail	N/Paddy
	(US ¢/kg)	(US ¢/kg)	(US ¢/kg)	(US ¢/kg)	(Col. 4 ÷ 2)	(Col. 5 ÷ 3)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Burma	7	3	5	29	71	9.7
Ceylon[c]	6	12	18	25	300	2.1
China (Taiwan)	15	10	15	44	100	4.4
Japan	30	28	43	26	143	0.9
Korea (South)	17	10	15	27	88	2.7
Malaysia	15	9	14	29	93	3.2
Philippines	16	8	12	36	75	4.5
Thailand	10	5	8	28	80	5.6

Sources: Column (2), *State of Food and Agriculture*, FAO, 1966. Column (3) *Production Yearbook*, FAO, 1965, and *National Rice Policies*, FAO, 1966. Column (4) *An Annual Review of World Production, Consumption, and Trade*, Table XVIII, Fertilizer, FAO, 1965. Data for crop year 1964–65 except Burma, 1960–61.

[a] Column (3) divided by 0.65 assuming as 65 percent milling recovery.

[b] Price of elemental nitrogen in the form of ammonium sulfate.

[c] The Ceylonese government has recently revised its program. It has stopped purchasing domestic rice but continues to import approximately 50 percent of total requirements which are given free to customers.

Three of the four remaining countries—the Republic of Korea, Malaysia, and the Philippines—as of 1965 do not appear to have adopted policies that are either strongly beneficial or detrimental to farmers, producers, or governments. Domestic retail price in these countries is generally in line with the world price, and exceeds the farm price by the approximate cost of moving the rice from the farm through the markets to the consumer.

The unique situation of China (Taiwan) is best discussed in connection with the rice-fertilizer price ratio shown in Table 6. The government of Taiwan maintains a monopoly on fertilizer and employs a fertilizer-rice barter ratio which places the price of fertilizer to the farmer approximately 50 percent above the world market. In this manner the government has been able to transfer income from the farm sector. This policy is effective for Taiwan but would greatly discourage fertilizer use in other less advanced countries.

Pricing Policy and New High-Yielding Varieties

Many countries will be finding it necessary to reexamine their rice price policy in the light of production gains and shifts in comparative advantage brought about by the new varieties. Price policy will be influenced by the rate of growth in food-grain output which may be either consonant with, below, or in excess of, the growth in demand for food grain. The first situation, although ultimately less satisfactory from the point of view of potential growth in the economy, presents fewer problems for the policy-maker. There is no danger of low food-grain price or unmanageable surpluses in government stores. The monolithic character of production—rice followed by rice—is not a major concern.

The second situation presents at once a hope and a fear. The hope rests on the expectation that the pace of growth in food-grain production will allow resources to be shifted to non-food-grain crops. The fear is over the prospect that (1) rapid increase in food-grain production in the face of an inelastic demand will drive prices down, (2) the lack of flexibility will not allow a rapid shift to other cropping alternatives, and (3) the expanding population will experience growing underemployment or unemployment. In other words, there will be not only an absence of industrial alternatives to absorb the rural labor force, but a lack of non-food-grain alternatives to absorb the rural labor force. This is a grim prospect. It is not one that faces most countries or regions in the immediate future, but the possibility is real enough for some regions of Asia to suggest a bold new direction in agricultural research.

The "beachhead" in varietal improvement for rice and other food grains has been established. The strength of the production response, as evidenced by the initial enthusiasm of Asian farmers, allays any fears that there will be a return to old varieties and old methods. As the new varieties spread, efforts will continue in almost every country to improve the grain quality and disease and insect resistance of these varieties without loss of yield potential.

The time has come to examine the requirements of a flexible agriculture —one that possesses alternatives to food-grain production and directs research to this end and one that will respond to price changes and will continue to absorb the growing labor force. This cannot be achieved by varietal improvement alone. The new research effort must include three other areas: (a) irrigation, (b) multiple cropping, and (c) marketing.

Irrigation. More has been written about the need for improved irrigation than on almost any subject. None the less, one has the feeling that serious efforts to move irrigation development in the right direction have not been undertaken. The main emphasis now is on raising the capital to finance the construction of dams and the purchase of irrigation pumps. Yet, if this new investment in irrigation is to become truly productive, much research must be carried out first. For example, farmers in southern Taiwan responded to an increase in the Japanese price of bananas in the mid-1960's by planting bananas instead of rice in paddy fields. But bananas cannot be grown on most irrigated farms in southern India because these farms lack drainage facilities. Irrigation problems encompass a broad spectrum from technical and engineering questions to social issues. The most pressing problems at the moment undoubtedly relate to social matters dealing with organization requirements for efficient operation of an irrigation system.

Multiple cropping. Adequate irrigation is a prerequisite for multiple cropping. It is the capacity for multiple cropping throughout the year that should ultimately give the tropics an advantage over the temperate zones in the production of food. The importance of research in multiple cropping is becoming more apparant with the decline of rice prices in many areas. However, farmers will continue to produce rice even at very low prices unless the risks and uncertainties can be reduced for other alternative cropping.

Marketing. The expansion in production of rice has created a number of marketing problems. It should be pointed out, however, that the rice market is one of the most highly developed in Asia. Unfortunately, in almost every crop, with the exception of food grains, efforts to improve crop productivity alone are not likely to result in major production gains at the farm level. In the case of soybeans, production acreage must be matched to processing plant capacity.

The resources required to carry on research and to fully develop the rural infrastructure and marketing sector to a great extent must come from the rural sector itself. As previously noted, this would require a selective policy of incentives and taxation. The introduction of new rice varieties creates the appropriate environment for both measures. Timing is crucial, particularly in the case of incentives. These should be largely looked upon as temporary measures designed to encourage initial acceptance of the new technology.

This deserves further scrutiny since it relates both to productivity and equity. Fig. 3a and 3b shows yield response curves in the wet and dry seasons, respectively, for an average of three years at the Philippine government's main experiment station in Central Luzon. The two varieties shown are the tall indica Peta and the new semi-dwarf indica IR8. Allowing for a price discount due to uncertainty, the optimum levels of fertilizer input have been calculated for each variety under a broad spectrum of rice price relationships. With traditional varieties of rice such as Peta, only small amounts of nitrogen application are profitable. For IR8, it is profitable to use a relatively high level of nitrogen input (higher of course in the dry than in the wet season when adequate irrigation is present). If the price of paddy drops from ₱0.40 per kilo ($100 per metric ton) to ₱0.24 per kilo ($60 per metric ton), the optimum level of fertilizer input changes relatively little. (The upper limit is the Philippine support price level, while the lower limit is the price received by many Philippine farmers on the open market during the 1968 wet season main crop harvest). This implies that a farmer with adequate resources will continue to find it profitable to use substantial amounts of fertilizer with new varieties.

Most Asian farmers, on the other hand, have a very limited amount of capital or credit with which to buy fertilizer and other cash inputs. They cannot afford initially to apply even close to the recommended levels, and in many cases they are not familiar with the use of these inputs. When the fertilizer price rises or the rice price falls, small farmers with few resources will have less income and hence less money available for the purchase of fertilizer. A lower rice price or a higher fertilizer price works particularly to the disadvantage of the small producer and will tend to widen the disparity in income distribution within agriculture.

Fig. 3 also indicates that the subsidy or price support to stimulate production should be temporary in nature. Once farmers have become accustomed to using fertilizer on highly responsive new varieties, they will continue to find it profitable to apply it. The response functions for IR8 are comparable in magnitude to those for Taiwan rice varieties which were initially developed in the mid-1920's. Taiwan farmers have been accustomed to using a high level of fertilizer on rice for decades. As a consequence, the extremely unfavorable fertilizer-rice price ratio established by the government to tax the farm sector has not significantly reduced the level of fertilizer input.

The spread of new varieties has increased interest not only in the use of cash inputs, but in irrigation and mechanization. Here again, timing and selectivity are important. Adequately financed and well-organized government irrigation schemes have been successful in Japan and Taiwan. But in the majority of Asian countries the unreliability of large government irrigation schemes has raised the question of whether or not the emphasis should be placed upon the development of private tubewell systems. This expansion should undoubtedly be encouraged where possible since it raises the productivity of the labor as well as of the land. Other forms of mechani-

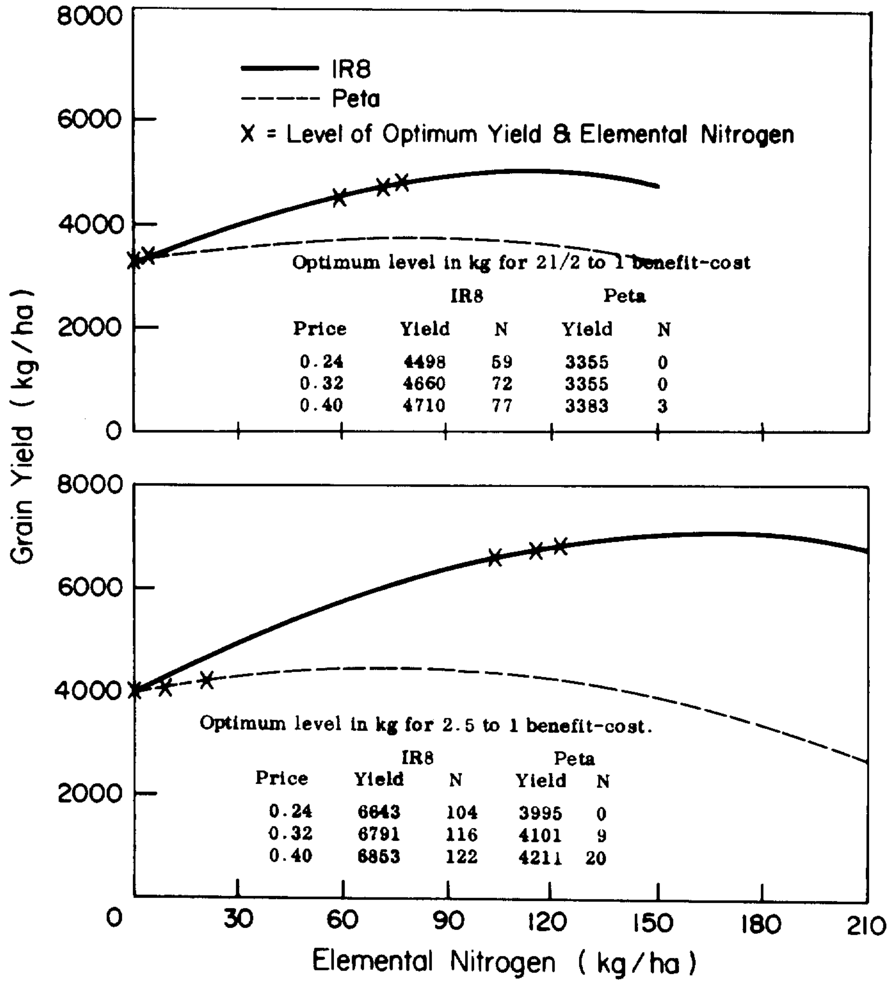

FIG. 3 a. Variability in Optimum Level of Nitrogen and Yield Output Level Due to Price Effect, 1966, 1967, and 1968 Wet Seasons, Maligaya. Observations Combined.

b. Variability in Optimum Level of Nitrogen and Yield Output Level Due to Price Effect, 1966, 1967, and 1968 Dry Seasons. Observations Combined.

zation which tend to be labor-saving have been questioned. There are peak periods of work during the cropping season, however, when labor is frequently in short supply. It may be desirable to mechanize certain operations to reduce the peak demand and to improve the timeliness of operations, particularly where more than one crop is grown.

The introduction of new varieties has brought attention to two other areas related to pricing policy—production estimates and grade standards. The production forecast and estimation procedures worked reasonably well in a period when there was little change in the trend of rice output and year-to-year changes were due principally to weather. These procedures must now be revised to take into account the increase in acreage planted to new varieties.

In rural areas of Asia rice is not traded on any reliable set of quality or grade standards. The relatively poor quality of early high-yielding varieties [IR8, IR5, T (N) 1] has led to an increased awareness of quality. Grade standards must be developed that can be applied not only at the export level, but throughout the marketing channel. Farmers as well as merchants should receive a higher unit price for a higher quality product.

SUMMARY

The introduction of the new high-yielding varieties has ushered in an era of change in rice production. Regardless of which of these varieties becomes popular in the future, the new plant type which they represent will continue to be grown throughout the tropics. The responsiveness of this plant type to fertilizer has given it an economic advantage over tall native indicas in many areas. This advantage will increase with further improvement in grain quality and in pest and disease resistance.

The new varieties are spreading rapidly but unevenly throughout tropical Asia. There are many regions, especially the rainfed areas, that have not benefited greatly from the new technology. In other areas, increased production has been so rapid as to result in a number of problems related particularly to the drying, storage, and marketing of rice. These events suggest the necessity of a change in research emphasis, not only to improve rice marketing, but also to create the environment for a more flexible agriculture, i.e., one in which there are profitable alternatives to rice production. The new areas of research emphasis should include irrigation, multiple cropping, and marketing.

The variable pattern of change in rice production requires a careful reevaluation of national pricing policy. On the one hand, there is the need to encourage a sustained growth in production. On the other, there is the need to capture profits for the development of other sectors. Pricing policy must consider equity as well as productivity. Timing and selectivity are important in the choice of incentive or tax programs. A price support on rice or a subsidy on inputs such as fertilizer may encourage the adoption of the new technology, but should not be viewed as a long-term program. Conversely, a tax on rice or cash inputs will discourage the use of new technology particularly among the smaller farmers, further widening the income disparity in agriculture. A more equitable arrangement would involve a tax on land rather than on the product or the cash inputs. Taxes or subsidies for irrigation and mechanization should be considered with a view to increasing the utilization of labor productivity in the rural area.

Finally, the introduction of new varieties has called attention to the need for improved production estimates and grading standards. Without better production estimates, it would be difficult in many countries to effectively implement price and price stabilization programs.

DISCUSSION I

NICOLAAS LUYKX

IN their presentation, Delane Welsch and Ernest Sprague made important observations concerning governmental policy-making in the organization and implementation of technical agricultural research in Asian countries. They emphasize the need for innovations in the internal structure, outlook, and support of educational, research and service institutions which are "needed to establish self-sustaining processes for creation and adoption of new technology in agriculture."

Although the métier of the authors is technology, not policy-making and execution, their experience has sensitized them to the planning and administrative needs on which the relevance and success of their technology depends.

Welsch and Sprague dissect the so-called "green revolution" to demonstrate that the impact of the new wheat and rice varieties has indeed been limited. As reported elsewhere,[1] the areas in Asia planted to these new varieties grew from 200 acres in 1964-65 to 20,000,000 acres in 1967-68. However, the authors show that fundamental problems in the achievement of productive and welfare potentials have not yet been faced up to by Asian policy-makers.

It was with unusual ecological luck that wheats developed in Mexico and rices developed at the International Rice Research Institute could be transferred directly to large but restricted land areas in Asia. The environmental conditions under which these varieties were selected after years of painstaking research in Mexico and the Philippines are matched by similarities in climate, soil, sunlight, and water control in particular regions of Asia. Thus, it was possible to achieve initially large growth in acreages under the new varieties—and the consequent growth in output—without extensive indigenous research or revisions in governmental procedures or policies.

The authors suggest that Asian policy-makers may be relying on the same providence that granted their initial achievements in food-grain production to bless them indefinitely. It is a thesis of Welsch and Sprague that these policy-makers have not yet committed themselves to the basic task of developing a domestic corps of agricultural scientists, nor to organizing

[1] Clifton R. Wharton, Jr., "The Green Revolution: Cornucopia or Pandora's Box?" *Foreign Affairs*, Vol. 47, No. 3, April 1969, p. 465.

ancillary and supportive services that would maintain a relatively steady flow of new technologies adapted to the national environment and needs.

The work in which the authors and their associates have been engaged has given them experience in several countries with an intensive program they identify as "The Coordinated Crop-Oriented Research Approach." Its functional components are identified as education, research, training, extension, and service for whose particular meaning, interrelationships, and implementation they propose special definitions, organizational patterns, and procedural steps.[2] Although the printed statement lacks the vividness of the conference presentation, it is the authors' hope and intent that these guidelines will convince Asian policy-makers to see the value of such an approach and take measures to implement it.

This leads directly into an overlooked aspect of the planning and implementation of governmental policies and programs which might be called "the political economy of external intervention." The same set of factors that works internally, as government programs for modernization and technological change seek to elicit local involvement in program development and field implementation, also affects the international transfer of technology from a donor to a recipient nation.

Although nothing can be said specifically about *the* appropriate or optimal rate of technological change, it has something to do with "absorptive capacity" in the society experiencing these changes. Absorptive capacity, nonetheless, has something to do with the relevant organization of society and its structures, with the state of health and education in the population, with the clarity of national goals and the breadth of commitment to them, and with the effective availability of supplementary components in the "technological package."

In a recent article, Don Paarlberg notes conflicting interpretations of the appropriate rate of technological change:

> The relationship between the rate of technological change in a society and the general good that accrues to the society is in the form of a curve, with a low reading for a semi-stagnant economy, reaching a maximum at some intermediate rate of technological change, and taking on a negative slope when the rate of change exceeds some optimum point. This is contrary to the conventional view, held by almost all physical scientists, that the rela-

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[2] Further discussions of the technological and economic requisites of agricultural change may be found in the writings of a number of authors including John W. Mellor, *The Economics of Agricultural Development* (Ithaca, New York: Cornell University Press, 1966); Max F. Millikan and David Hapgood, *No Easy Harvest* (Boston: Little, Brown and Co., 1967); and Arthur T. Mosher, *Getting Agriculture Moving* (New York: Frederick A. Praeger, 1966).

tionship of rate of technical change in a society and the general good resulting therefrom is positive, linear, and steep.[3]

It is not difficult to see how this conflict comes about in many fields, including the international transfer of agricultural technology and the development of foreign scientific capacities. Agricultural scientists—including our foreign advisers as we know them in the United States—have certain distinctive general characteristics. Those who are professionally well-regarded are highly skilled in scientific method to which they are professionally committed with uncompromising standards. They are expert in experimentation and its rigorous rules of evidence, including systematic design and scrupulous adherence to procedures. Their results are evaluated with powerful objective systems of analysis. Their technical conclusions are formally testable. In a broader perspective they are constructively aggressive in seeking means of achieving productive potential, to which they are morally committed. Indeed, objective science comprises an ethical system, whose acceptance is seen by many as implied in the acceptance of the technologies themselves.

All those working toward the betterment of others have a utopian bias in varying degrees. Where convictions and drive are strong, this bias may become militant and even messianic.

The relationships between a donor and a recipient are colored by many factors and may lead to many unintended outcomes. Among the fears of recipients in Asia are the loss of identity, of status, and of control over domestic resources. The problems of human interaction under stress—and change is a stressful situation—is the realm of the social sciences. Social scientists, including political scientists, psychologists, sociologists, and economists, have largely been insensitive to the problems perceived by agricultural technologists—just as agricultural technologists have largely been blind to the relevance of the social sciences.

It is no easy task for those who know the technological answers to realize that planning is fundamentally a political process. The achievement of technically feasible potentials in productivity represents only one among many aspirations of national leaders and the diverse individuals and groups in a nation. What is the full range of aspiration? What are the political arenas and their ground rules? How are issues managed and what are the "tradeoffs" that will win concessions? How is it possible to accommodate indigenous political realities and the standards of objective technology? What is

[3] As quoted in James D. Shaffer, "On Institutional Obsolescence and Innovation—Background for Professional Dialogue on Public Policy," *American Journal of Agricultural Economics*, Vol. 51, No. 2, May 1969, p. 251.

the appropriate rate of technological change? These and other questions need early answers.

Since one of SEADAG's objectives is the generation of relevant research, it seems pertinent to make suggestions toward an "agenda for research," so that policies may be based on evidence more than on convictions alone, and so that knowledge and sensitivities may be broadened. In view of the breadth of the topic of the paper by Welsch and Sprague, the categories for research appear to cover technical, economic, and policy subjects with considerable interaction and overlap among them.

TOWARD AN AGENDA FOR RESEARCH

Technology

1. Technical performance of alternative crops such as oil seeds, fibers, vegetables, and so forth; either singly, in rotations, or concurrently; in specific local environments.
2. Production potentials for seed, fertilizer, vaccines, pesticides, machinery and other ancillary agricultural inputs within particular countries or regions.
3. Technical performance and management requirements of large- and small-scale irrigation systems.
4. Technological requirements for investments in areas not intrinsically adapted to new wheat, rice, and corn varieties, so that relevant economic opportunities may increase in these areas as well.
5. The alternative adaptations of domestic research organizations so as to maintain a sustained output of adapted new technologies.

Economics

1. Relevant price policies for a modernizing agriculture (most current price policies being derived from the food deficit era).
2. Promoting the growth of effective demand.
3. Indicative planning and private sector participation.
4. The economic consequences of rural-urban migration.
5. Marketing (including storage, processing, and transportation), as the marketable surplus of traditional types of crops increases more than proportionately to the growth in their total output, and as "new" crops enter market channels.
6. The effective utilization of credit.

Policy

1. Alternative crops—which crops should be fostered and for which markets?
2. What are the impacts of the drive toward self-sufficiency on the patterns of specialization and trade?
3. The political economy of external intervention (international and intranational).
4. The organization of agriculture—bureaucratic coordination of government services to agriculture, organization of farmers for effective individual and joint action.
5. Policies for educational reform of primary and secondary schools, for the development of scientists and officials sensitive to technology, and for effective extension.
6. Policies for "by-pass" areas unresponsive to new wheat, rice, and corn technologies.
7. The changing power base of agriculture as new levels of productivity and income are possible with new technology. Challenges to traditional "urban" seats of power on questions of "equity" in national investment and the distribution of services.

DISCUSSION II

Matthew Drosdoff

I fully agree with Welsch and Sprague that a massive research and educational effort is necessary in order to sustain continued development of new technology in Southeast Asia. The strong implication is that government policies can provide the most important impetus—and hindrance—to self-sustaining technological change.

Although one may point out what governments must do to close the gaps in technology and advanced education and research, the big question remains as to how national leaderships can be motivated to remedy present deficiencies. How can they be persuaded to provide more resources for training agricultural scientists and developing the technology required?

With the very limited financial resources of poor countries, there is little inclination for them to provide the necessary support for research and the training of agricultural scientists. These activities are not as highly visible or as glamorous as building atomic reactors or steel plants, but they may be more essential to the needs of the country. Of course, national pride and prestige are important elements in determining resource allocations of any country, and these considerations are given much weight by the political leadership. Consequently, many of the countries in Southeast Asia are dependent on outside financing to help in the development of their agricultural research and training capabilities.

National and international technical assistance agencies do not give a very high priority to agricultural research and advanced training that are long-term programs. The emphasis is on short-run, quick impact projects that produce easily visible and dramatic results. The kind of program which Welsch and Sprague propose is relatively long-range, requires continuity, and seldom produces highly visible, dramatic results in a short period of time. Consequently, the financing for this kind of program is rather limited in comparison with other types of technical assistance which in the long run may be of much less importance to the recipient nation.

Bilateral and multilateral technical assistance agencies could help stimulate Southeast Asian countries to give more emphasis to agricultural research and the training of agricultural scientists by making longer-range commitments to this kind of program. It should be recognized that the recipient country will require support for a good many years and progress will be slow. And if a country is to receive this kind of help, it must be prepared to make adequate long-term commitments of its own to the training of agricultural scientists and the development of agricultural research. This would include the provision of opportunities for the people trained to utilize their research capabilities and training for the development of the needed technology.

Although the crop-oriented approach suggested by the authors has been successful in some countries, it might be that a more flexible approach would be advisable, to allow the cultivator to have a few options. Concentrating on one or two crops in a team effort has led to dramatic breakthroughs in such crops as maize, wheat, and rice, but at the same time it has created some difficult problems in storage, marketing, and other so-called "second generation problems." Research on cropping systems involving crop sequences or crop rotations would provide alternatives to the cultivator and encourage diversification. This would minimize dependence on one or two crops which in many localities would have distinct advantages.

One of the dangers of rapid technological development in the production of certain crops is that it may widen the economic gap between the great majority of the small farmers at the near subsistence or subsistence level and the smaller number of commercial farmers who are in the best position to take advantage of the benefits of the new technology. The latter have better managerial skills, greater access to the necessary inputs, and other advantages. Thus the problem of how to reach the millions of small farmers with the new technology is a difficult one and has serious social and political implications.

This raises the question of technical constraints that have limited the impact of the new technology in Southeast Asia. The thrust of the Welsch and Sprague paper is that the limited impact of the new technology stems largely from deficiencies in research and trained manpower. No doubt these are vital factors; but it must be pointed out that social and political constraints are just as crucial and probably in many instances overriding.

The need for coordination among institutions is central to the research and education program suggested by Welsch and Sprague. Rather than encourage the creation of new ministries or departments, they would maximize the contribution of available people and institutions by specialization and coordination. This is a desirable goal, but it may not be realistic for political reasons. Teaching and research functions are usually in different ministries or offices, and well-organized cooperation is seldom achieved, especially at the highest levels. Those at the working level often cooperate informally, but for the kind of team effort required, the heads of the different agencies must provide encouragement, direction, and leadership. Because of interagency rivalry and the political orientation of the leadership, it is almost impossible to achieve the kind of organized cooperation required for a successful coordinated program.

It is for this reason that the creation of new agencies or departments is often the most practical and workable organizational mechanism to bring together the various areas of specialization to focus on a high priority problem. Although perhaps not the best or most efficient procedure, this may be the only way to get on with the job.

DISCUSSION III

YUJIRO HAYAMI

THE main contention that an educational-research revolution is needed in Southeast Asia in order to evolve new technology (supported by relatively minor efforts in adaptive research) into a self-generating and self-sustaining process is one I support. I also agree that the "coordinated problem-oriented approach" is likely the most productive pattern of research organization. (I use the term *problem*-oriented approach instead of *crop*-oriented approach because certain problems capable of solution by this method are not limited to crops). Henceforth, my discussion is not a critique but a supplement to the Welsch and Sprague thesis.

I would like to point out that the education-research infrastructure as described by the authors, although a necessary condition, may not be sufficient to sustain progress. A basic structural transformation of the economy will be required. Modern agriculture is characterized by the use of the inputs supplied from the non-agricultural, industrial sector. Such inputs are highly complementary to the new technology generated from agricultural research (e.g., fertilizer and high-yielding rice varieties). Unless industrial inputs are supplied at adequate prices, the productivity potential of the new technology may not be exploited. The prices of modern industrial inputs going to farmers depend essentially on the share of resources allocated to the sectors which produce and distribute those inputs.

A large share of resources of the nation must be allocated to the marketing sector (trade, transport, storage, processing, etc.) so that industrial inputs can reach farmers at adequate prices in adequate forms and timing. The efficiency of the marketing sector is essentially based on the progress of the intersectoral division of labor accompanying industrialization. No country in the world has attained high agricultural productivity without allocating a large share of its resources to the non-agricultural sector. High ratios of labor population in non-agricultural occupations to total labor population in such agriculture-based countries as Australia and New Zealand (0.81 and 0.86 respectively in 1960) may be cited as evidence.

Table 1 shows that the progress of mechanical technology (measured by power per farm worker) in U.S. agriculture has been associated with a dramatic decline in the price of farm machinery relative to the farm wage rate, and that the progress of bio-chemical technology (measured by fertilizer

TABLE 1. Changes in the Factor Combinations and Factor Price Ratios in Agriculture and the Structural Transformation of the Economy: the United States and Japan, 1880–1960.

	UNITED STATES			JAPAN		
Year	Power Per Male Farm Worker (HP's)	Machinery Price Relative to Farm Wage Rate (1800 = 100)	Male Workers in Non-Agricultural Occupations (%)	Fertilizer Input Per Hectare of Arable Land (Kg. of $N+P_2O_5+K_2O$)	Fertilizer Price Relative to Farm Product Price (1880 = 100)	Male Workers in Non-Agricultural Occupations (%)
1880	1.8	100	46	13	100	21
1890	2.1	72	53	12	93	28
1900	2.2	57	58	17	70	35
1910	2.4	47	65	40	52	43
1920	3.0	31	70	63	47	52
1930	4.3	28	75	97	33	57
1940	6.7	36	78	115	26	64
1950	15.6	16	85	—	—	—
1960	40.9	17	91	260	14	74

Source: Yujiro Hayami and Vernon W. Ruttan, "Patterns of Agricultural Growth: United States and Japan, 1880-1960," mimeo, March 1969.

Note: Power, labor, and land are measured in years shown. Prices are five years averages ending years shown. Fertilizer (commercial fertilizer only) inputs are five years averages centering years shown.

input per hectare of arable land) has been associated with the decline in the price of fertilizer relative to the price of farm products.

Such price declines imply a structural transformation which can be measured by the increase in the percentage of workers in non-agricultural occupations relative to total labor population. It is hard to imagine that the self-sustaining growth in agricultural productivity in the United States and Japan during the past eighty years could have been attained without progress in the intersectoral division of labor accompanying industrialization and the resulting decline in the prices of industrial outputs.

The high rate of return to adaptive research on major grains in Southeast Asia, as dramatized by the agricultural revolution, is based on the existence of an enormous technology gap between the developed and less developed countries. It is also based on the present relatively favorable price ratios of fertilizer and other industrial inputs to farm products. The exploitation of the technology gap by coordinated adaptive research under a relatively favorable price situation has brought the dramatic outcome. This gap, however, is bound to be closed as it is exploited.

Both the establishment of an education-research infrastructure and a major structural transformation of the economy will be required to lead the agricultural revolution in Southeast Asia. The existing technology gap presents a real opportunity for the nations in Southeast Asia to finance, out of the agricultural revolution, the establishment of an education-research infrastructure and the transformation of the economy before this opportunity is gone. These nations need to discuss which kinds of institutions must be created in order to accomplish this task.

RICE PRODUCTION AND TRADE PATTERNS: THE HISTORICAL RECORD

VIRACH ARROMDEE

THIS paper analyzes the rice production and trade patterns and relationships of six major rice trading countries: Thailand, Burma, West Malaysia-Singapore, Japan, Mainland China, and the United States. The statistics are drawn primarily from the analysis period 1951-65, and are based on research carried out for a thesis project on the *Economics of Rice Trade Among Countries of Southeast Asia.*[1]

WORLD RICE PRODUCTION AND TRADE

Rice, the staple food of one-third of the world's population, plays a vital role in the economies of many Southeast Asian nations. In addition to providing employment to a large share of the population, production of milled rice is a major source of earnings for foreign exchange. The ratio of rice exports to total exports in recent years has averaged approximately 75 percent for Burma, 35 percent for Thailand, 30 percent for the Republic of Vietnam, and 30 percent for Cambodia.[2]

Despite the importance of rice to export earnings in these countries, only about 4 percent of all rice produced reaches the world markets; the greater share is consumed domestically. A small ratio of exports to total production or consumption can have far-reaching effects on the volume of trade and the price of rice in the international market. During 1966-67, for example, rice production in Burma declined by one-fifth, and Burma's annual exports fell from approximately 1.4 million tons[3] to only 500 thousand tons in 1967. South Vietnam, which in the early 1960's exported from 300 to 400 thousand tons per year, imported nearly 700 thousand tons annually during the late 1960's. The combined export reductions of these two countries alone totaled about 2 million tons, precipitating a sharp rise in world rice prices. The f.o.b. Bangkok price per metric ton of 100 percent rice

[1] Virach Arromdee, *Economics of Rice Trade Among Countries of Southeast Asia,* thesis submitted to the Graduate Faculty of the University of Minnesota in partial fulfillment of the degree of Doctor of Philosophy, July 1968.

[2] *Agriculture in Southeast Asia, Asian Rice Bowl and its Relation to U.S. Farm Exports,* FAER No. 26, U.S. Department of Agriculture, Economic Research Service, June 1965, p. 30.

[3] Rice quantities refer to metric tons.

rose from £55-16 in April 1966, to £66-8 in April 1967, to £92-0 in April 1968.[4]

The reduction in exports from the major rice suppliers encouraged an expansion in rice production in other Asian and non-Asian countries. The Philippines, normally a rice importer, has become a rice exporter; and many other importing countries have begun to move toward self-sufficiency in rice. The world food situation thus began to change from a buyer's to a seller's market, and export prices showed a declining trend. In 1968 the price per metric ton of 100 percent rice fell from £96-0 f.o.b. Bangkok in January, to £92-0 in April, to £77-0 in June.[5]

World milled rice production and trade patterns have changed substantially over time (Table 1). Between 1951-53 and 1963-65 production increased from an average of 119,658,000 to 169,390,000 tons (by 42

TABLE 1. World Milled Rice Production and Trade, 1951–66.

Year	Rice Production	Rice Trade
	(1000 metric tons) (conversion rate 66 percent)	
1951	110,484	4,978
1952	119,064	5,253
1953	129,426	4,805
1954	126,720	4,966
1955	136,950	5,668
1956	144,210	6,874
1957	140,976	6,666
1958	151,140	6,596
1959	151,140	7,073
1960	159,456	7,374
1961	161,898	6,209
1962	163,944	6,210
1963	167,025	6,559
1964	173,376	7,388
1965	167,769	7,390
1966		7,540

[4] *Report of Rice Exports,* No. 4/2511, Thailand Ministry of Economic Affairs, January 1968, p. 5. The U.S. devaluation of the pound on November 18, 1967, was 14.28 percent (U.S. $2.80 to $2.40 per pound sterling).

[5] *Monthly Review,* Bangkok, Ltd, Bangkok, January 1968, p. 10.

percent). The total volume of world trade during the same periods increased from an average of 5,012,000 to 7,112,000 tons (also by 42 percent). Total world trade, however, declined from 7,540,000 tons in 1966 to 6,640,000 tons in 1967.

The relative importance of exporting nations and regions also shifted between 1951 and 1965 (Table 2 and Fig. 1). Exports from all of Southeast Asia declined from 63.5 to 49.8 percent of world trade. Combined exports from Burma and Thailand, until 1966 the world's leading exporters of rice, declined from 58.2 to 45 percent. At the same time, exports from Communist Asia rose from 2.85 to 12.4 percent, and exports from the United States rose from 9.78 to 20.6 percent. While exports from Mainland China fluctuated from year to year, U.S. exports were stable and showed a steadily upward trend. In 1965 the United States was runner-up in world rice exports with 1,523,000 metric tons. In 1967 this figure accelerated to

TABLE 2. Milled Rice Exports From All Regions and Individual Southeast Asian Countries to Total Six Asian Regions and the World, 1951–65.

	Total of Exports to Six Asian Regions		Percent of Exports to Six Asian Regions		Total of Exports to All Regions of World		Percent of Total World Trade	
	1951	1965	1951	1965	1951	1965	1951	1965
	(in 1000 metric tons)							
South Asia	186	48	5.20	1.03	215	146	4.32	1.98
Southeast Asia	2774	2843	77.59	60.71	3159	3681	63.46	49.81
Other East Asia	73	280	2.04	5.97	74	281	1.49	3.80
Far East & Oceania	—	9	—	0.19	16	21	0.32	0.28
Japan	—	—	—	—	—	—	—	—
Communist Asia	127	634	3.55	13.54	142	917	2.85	12.41
United States	163	832	4.56	17.77	487	1523	9.78	20.61
Rest of World	252	37	7.06	0.79	885	821	17.78	11.11
Total	3575	4683	100	100	4978	7390	100	100
Burma	1137	1081	31.80	23.08	1269	1362	25.49	18.43
Cambodia	56	220	1.57	4.70	56	359	1.13	4.86
Laos	—	—	—	—	—	—	—	—
South Vietnam	13	2	0.36	0.04	208	2	4.18	0.03
Thailand	1568	1540	43.86	32.89	1626	1958	32.66	26.49
Total	2774	2843	77.59	60.71	3159	3681	63.46	49.81

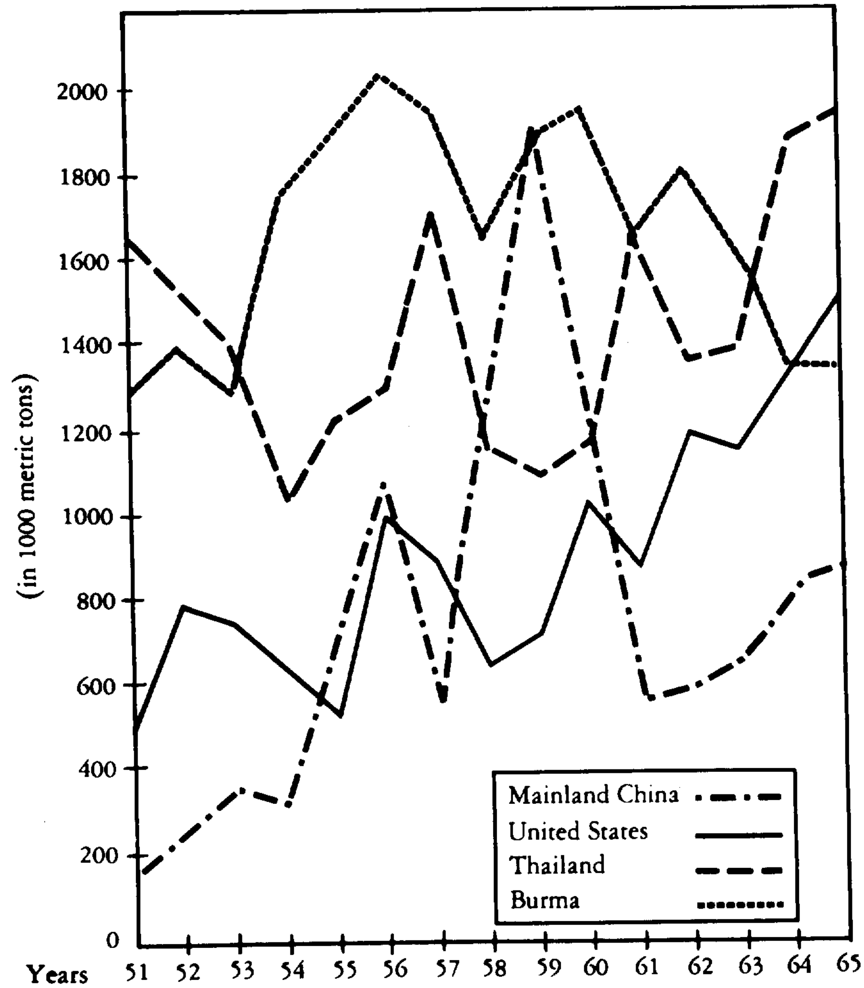

FIG. 1. Milled Rice Exports from Leading Rice Exporting Countries, 1951-1965.

1,750,000 metric tons. Thus, by 1967, the United States became the world's largest exporter of rice, while Thailand ranked second, Mainland China third, and Burma fourth.

Two major exporting countries causing instability in world rice trade are the United States and Mainland China. The United States has a high capacity to export because of low domestic consumption and the large volume of storage built up. It can therefore play the role of residual supplier to meet the gap in the world rice shortage. Mainland China, the largest producer, accounts for approximately one-third of the world's total rice production. Consequently, any change in its production, domestic consumption, or export policy could have a great impact on the world's total rice trade.

The introduction of new high-yielding varieties of rice developed in the Philippines will initiate a whole new era of change in rice production and trade. It will shift the comparative advantage in rice production in many countries. Burma and Thailand and other Asian exporters will face even stiffer competition in the world rice market.

As we have seen, Table 2 compares the trade patterns of six Asian regions, the United States, and the rest of the world. Before proceeding to a discussion of individual countries, we will first review the trade relationships of these regions as follows:

1. *Southeast Asia* includes Thailand, Burma, Cambodia, Laos, and the Republic of Vietnam. These countries provide the main sources of rice exports to the six Asian regions and the rest of the world. They possess the common characteristic of low population density which, in Asia, is an important factor affecting potential increases in rice production and consumption. Their economies, except for Laos, are competitive with one another in rice exports.

2. *South Asia* includes Ceylon, India, Pakistan, Bhutan, Nepal, and Afghanistan. These countries are important markets for Southeast Asia. They are situated close together, have similar ethnic composition, are primarily rice deficit countries (except for some years in Pakistan), and their trade patterns have both a commercial and non-commercial basis. Their commercial rice imports are directly as well as indirectly affected by concessional rice imports.[6]

3. *Other East Asia* includes Hong Kong, the Republic of Korea (South), the Philippines, Taiwan, Macao, Ryukyu Isles, and Port Asia. Most of these countries trade on a commercial basis and are important markets for Southeast Asian exporters, especially for Thailand. They comprise largely a food deficit region: Hong Kong is a regular commercial rice importer, and South Korea and the Philippines are occasional but not regular importers. Taiwan is the only country with a net rice export.

4. *The Far East and Oceania* includes Indonesia, West Malaysia, Singapore, New Guinea, Papua, Sarawak, Brunei, Guam, Sabah, Fiji, Australian

[6] Concessional trade is that which does not have a purely commercial basis, but rather is a privilege agreement such as trade under Public Law 480.

New Guinea, West Samoa, New Caledonia, Polynesia, and Oceania not elsewhere specified. This region also provides a large market for Southeast Asia, especially for Thailand and Burma.

5. *Japan,* which has provided a large export market for rice from Thailand over the years, is treated separately mainly because of its more advanced economy and technological development in contrast to other countries in Asia. Japan imports rice not because of its inability to produce enough to meet domestic demands, but because it has more productive alternatives for the employment of its resources.

6. *Communist Asia* is composed of Mainland China, Mongolia, North Korea, and North Vietnam. These countries are treated separately because their economies are administered by central authorities. Therefore, the behavior of the rice trade pattern between Communist Asia and the rest of the regions is, to a certain degree, responsive to both economic and non-economic considerations that are reflected in government policy. Mainland China is particularly competitive with Thailand in the Hong Kong market.

7. *The United States* is also treated separately from the rest of the world because it is one of the most important suppliers to the six Asian regions. Most of this trade has been on a concessional basis.

8. *The Rest of the World* is considered in order to obtain a complete picture of the rice trade of the six Asian regions in relation to total world trade.

PRODUCTION AND TRADE PATTERNS OF SIX MAJOR RICE TRADING COUNTRIES

Thailand

Thailand has concentrated its trade on Other East Asia and the Far East and Oceania region rather than on South Asia. It is noteworthy that the trade of these regions has usually been carried out on a commercial basis (except for Indonesia), while the trade of South Asian regions has had important concessional components. Fig. 2 shows the pattern of total milled rice exports and some dominant importers during 1951-65. Table 3 shows the volume and percent of exports to various countries.

The overall trend of Thailand's exports in the period 1951-65 was slightly upward. In the first three years of the 1950's, Thai exports were in a declining phase, although they still exceeded those of Burma. Exports fell from a peak of 1,626,000 tons in 1951, to 1,556,000 tons in 1952, to 1,389,000 tons in 1953, and finally to 1,039,000 tons in 1954, the lowest level of the study period.

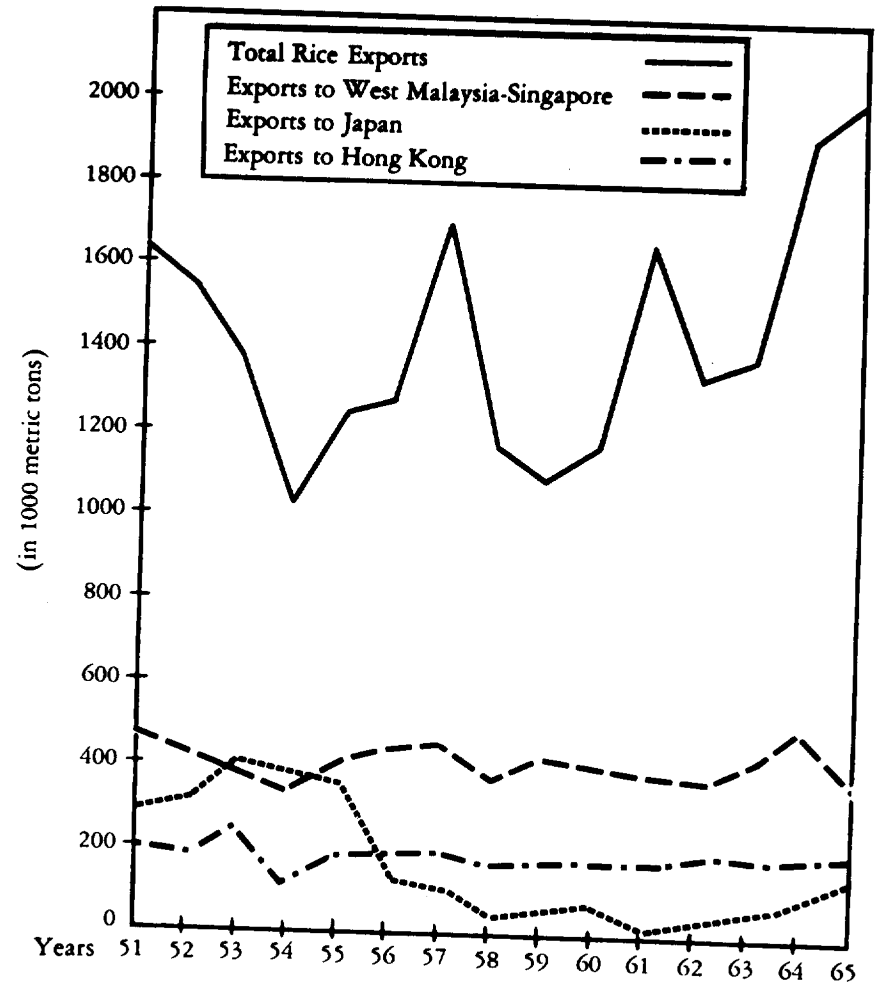

FIG. 2. Milled Rice Exports from Thailand, 1951-1965.

After 1954 Thai exports steadily increased from 1,223,000 tons in 1955, to 1,288,000 tons in 1956, to 1,724,000 tons in 1957. Exports again slackened during 1958, 1959, and 1960, falling to another low of 1,089,000 tons in 1959.

In 1961 Thai exports increased to 1,660,000 tons, surpassing those of Burma which was at this time the world's largest exporter. Another decline to 1,345,000 tons occurred in the year 1962 followed by a slight recovery

TABLE 3. Milled Rice Exports from Thailand, 1951–1965.

YEAR	CEYLON		INDIA		HONG KONG		SOUTH KOREA		PHILIPPINES		INDONESIA	
	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)
					(in 1000 metric tons)							
1951	45	2.77	217	13.34	197	12.12	26	1.60	104	6.40	180	11.07
1952	17	1.09	187	12.02	184	11.83	31	1.99	30	1.93	226	14.52
1953	—	—	4	0.29	250	18.00	152	10.94	—	—	55	3.96
1954	—	—	3	0.29	116	11.17	—	—	17	1.64	78	7.50
1955	12	0.98	2	0.16	181	14.80	—	—	56	4.58	66	5.40
1956	—	—	6	0.46	186	14.44	39	3.03	31	2.41	167	12.97
1957	50	2.90	5	0.29	197	11.42	43	2.49	105	6.09	179	10.38
1958	7	0.60	31	2.65	171	14.61	3	0.27	47	4.02	132	11.28
1959	—	—	—	—	173	15.89	—	—	—	—	75	6.89
1960	26	2.19	—	—	178	15.02	—	—	—	—	187	15.78
1961	62	3.73	—	—	195	11.75	1	0.06	141	8.49	376	22.65
1962	35	2.60	—	—	218	16.21	—	—	—	—	271	20.15
1963	19	1.37	—	—	196	14.10	10	0.72	71	5.11	340	24.46
1964	30	1.60	35	1.86	205	10.91	—	—	115	6.12	463	24.64
1965	166	8.48	215	10.98	201	10.26	—	—	130	6.64	108	5.52

TABLE 3.—*(Continued)*

YEAR	WEST MALAYSIA-SINGAPORE (Vol.)	(%)	JAPAN (Vol.)	(%)	OTHERS IN SIX ASIAN REGIONS (Vol.)	(%)	UNITED STATES AND REST OF WORLD (Vol.)	(%)	TOTAL (Vol.)	(%)
					(in 1000 metric tons)					
1951	463	28.47	316	19.43	20	1.23	58	3.57	1626	100
1952	444	28.54	317	20.37	56	3.60	64	4.11	1556	100
1953	396	28.51	424	30.52	43	3.10	65	4.68	1389	100
1954	333	32.05	380	36.57	16	1.54	96	9.24	1039	100
1955	401	32.79	341	27.88	69	5.64	95	7.77	1223	100
1956	451	35.02	130	10.09	143	11.10	135	10.48	1288	100
1957	462	26.80	116	6.73	281	16.30	286	16.60	1724	100
1958	375	32.05	45	3.84	103	8.80	256	21.88	1170	100
1959	428	39.30	71	6.52	89	8.17	253	23.23	1089	100
1960	402	33.92	65	5.49	129	10.89	198	16.71	1185	100
1961	387	23.31	34	2.05	148	8.92	316	19.04	1660	100
1962	377	28.03	63	4.68	132	9.81	249	18.52	1345	100
1963	407	29.28	94	6.76	98	7.05	155	11.15	1390	100
1964	501	26.66	117	6.23	150	7.98	263	14.00	1879	100
1965	397	20.28	145	7.40	178	9.09	418	21.35	1958	100

of 1,390,000 tons in 1963. After 1963 Thailand's exports rose sharply, exceeding those of Burma by more than 500,000 tons each year. Exports rose to 1,879,000 tons in 1964 and to 1,958,000 tons in 1965. Thailand's peak share of exports to the world market was equivalent to 32.7 percent in 1951, 25.6 percent in 1957, 26.7 percent in 1961, and 26.5 percent in 1965. Exports to the six Asian regions for the corresponding periods were 43.9 percent in 1951, 33.6 percent in 1957, 34.4 percent in 1961, and 32.9 percent in 1965.

Burma

Burma's most important rice markets were Ceylon, India, Pakistan, West Malaysia-Singapore, and Indonesia. Fig. 3 shows the pattern of total milled rice exports and some dominant importers during 1951-65.

During the first three years of the analysis, rice exports from Burma were low relative to the following years. In 1951-52 exports rose from 1,269,000 to 1,394,000 tons, then declined to 1,303,000 tons in 1953. After 1953 Burma's rice exports stayed at a very high level and at no time during the 1953-63 period did they fall below 1,600,000 tons. The peak was reached in 1956 when Burma exported a total of 2,036,000 tons. Beginning in 1962, however, the volume of exports steadily declined as follows:

1962—1,823,000 tons
1963—1,625,000 tons
1964—1,378,000 tons
1965—1,362,000 tons
1966—1,100,000 tons

A further decrease to 600,000 tons in 1967[7] may have been the result of the government's policy of stepping up centralization in rice production and trade.

West Malaysia-Singapore

Thailand and Burma were the major suppliers of rice to this rice deficit region. Other suppliers were Cambodia, Mainland China, South Vietnam, and to a slight extent, the United States and other countries. Fig. 4 shows the pattern of total rice exports and dominant exporters to West Malaysia-Singapore. Table 4 shows the volume and percent of imports by West Malaysia-Singapore from the various countries.

[7] *The Far East and Oceania Agricultural Situation,* ERS-Foreign 197, U.S. Department of Agriculture, Economic Research Service, September 1967, p. 4.

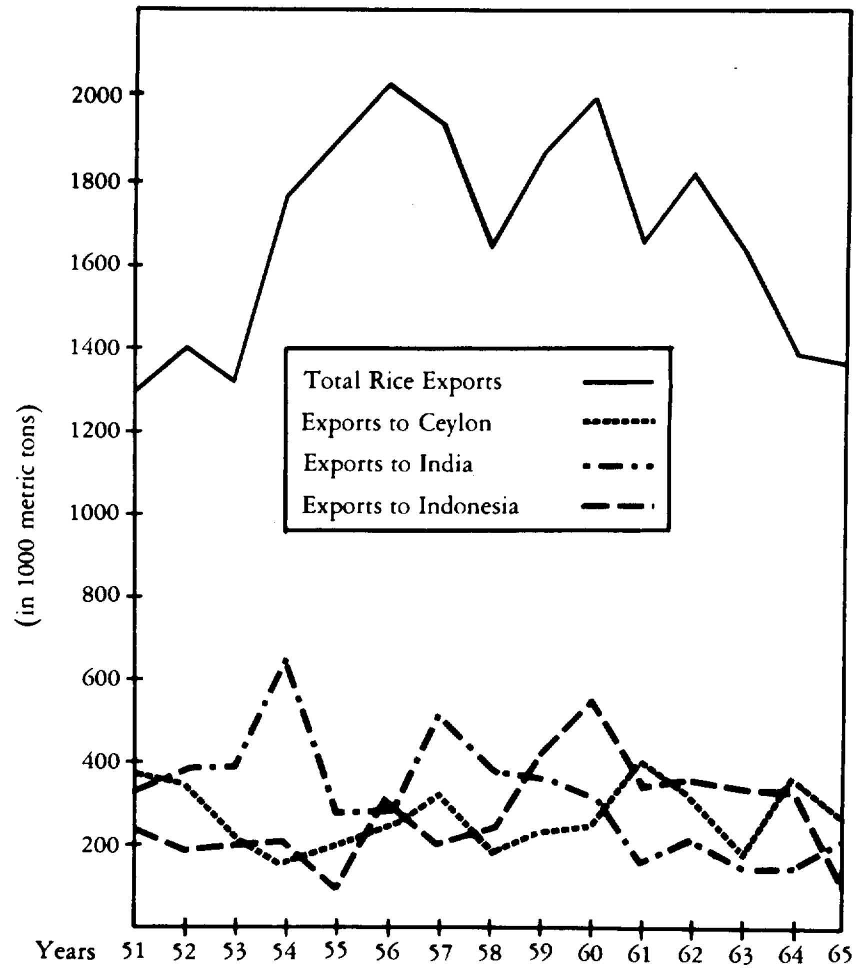

FIG. 3. Milled Rice Exports from Burma, 1951-1965.

During the analysis period annual average imports of this area totaled 644,000 tons (10.4 percent of the total rice trade). Of this annual average amount, 415,000 tons were received from Thailand—about 65.4 percent. Annual average exports from Burma, the second largest regular supplier to West Malaysia-Singapore, were 128,000 tons—about 19.6 percent.

The annual pattern of imports did not vary greatly from year to year, ranging between 528,000 and 836,000 tons. There were two high importa-

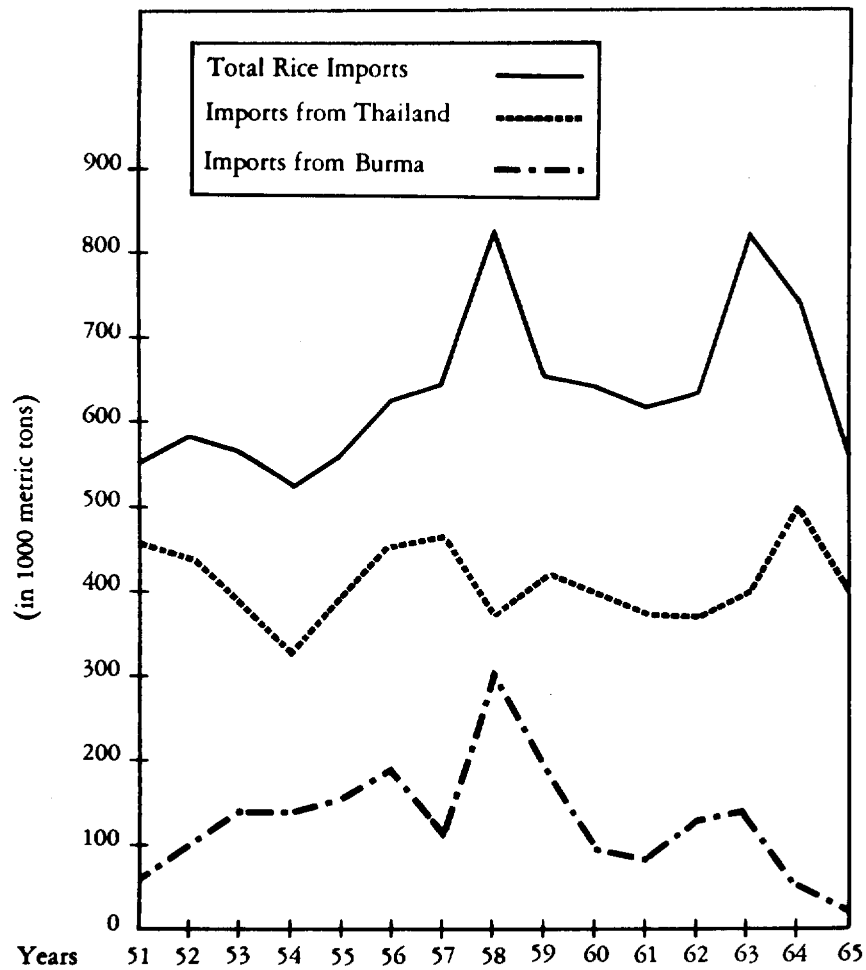

FIG. 4. Milled Rice Imports of West Malaysia-Singapore, 1961-1965.

tion peaks—811,000 tons in 1958 and 836,000 tons in 1963. Of the 1958 imports, 375,000 tons were from Thailand and 304,000 tons were from Burma, totaling 679,000 tons. Of the 1963 imports, 407,000 tons were from Thailand and 147,000 tons were from Burma. Imports from Thailand ranged between 333,000 and 501,000 tons during the analysis period, and the pattern was rather stable. Imports from Burma ranged from 30,000 to 304,000 tons and, when illustrated graphically, looked "bell-shaped"—high in the middle of the analysis and low at both ends.

TABLE 4. Milled Rice Imports of West Malaysia-Singapore, 1951–1965.

YEAR	PAKISTAN		BURMA		CAMBODIA		SOUTH VIETNAM		THAILAND		TAIWAN	
	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)
						(in 1000 metric tons)						
1951	—	—	62	11.05	36	6.42	—	—	463	82.53	—	—
1952	—	—	104	17.81	31	5.31	5	0.86	444	76.02	—	—
1953	1	0.17	137	23.66	43	7.43	—	—	396	68.39	—	—
1954	—	—	137	25.94	36	6.82	21	3.98	333	63.07	—	—
1955	—	—	155	27.43	2	0.36	6	1.06	401	70.97	—	—
1956	—	—	179	27.92	—	—	—	—	451	70.36	—	—
1957	—	—	111	17.08	50	7.69	—	—	462	71.08	—	—
1958	—	—	304	37.49	59	7.27	—	—	375	46.24	—	—
1959	—	—	189	28.29	20	2.99	—	—	428	64.07	—	—
1960	—	—	96	14.70	74	11.33	—	—	402	61.56	—	—
1961	—	—	84	13.19	31	4.87	—	—	387	60.75	—	—
1962	10	1.56	129	20.09	24	3.74	14	2.18	377	58.72	—	—
1963	17	2.03	147	17.58	26	3.11	73	8.73	407	48.69	—	—
1964	13	1.74	52	6.93	56	7.47	22	2.93	501	66.80	—	—
1965	—	—	30	5.36	21	3.76	1	0.18	397	71.02	—	—

TABLE 4.—*(Continued)*

YEAR	MAINLAND CHINA		UNITED STATES		OTHERS		TOTAL		TOTAL WORLD TRADE	
	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)
					(in 1000 metric tons)					
1951	—	—	—	—	—	—	561	100	4978	11.27
1952	—	—	—	—	—	—	584	100	5253	11.12
1953	—	—	—	—	2	0.35	579	100	4805	12.05
1954	—	—	—	—	1	0.19	528	100	4966	10.63
1955	1	0.18	—	—	—	—	565	100	5668	9.97
1956	11	1.72	—	—	—	—	641	100	6874	9.33
1957	26	4.00	—	—	1	0.15	650	100	6666	9.75
1958	25	3.08	—	—	48	5.92	811	100	6596	12.30
1959	15	2.25	—	—	16	2.40	668	100	7073	9.44
1960	45	6.89	8	1.23	28	4.29	653	100	7374	8.86
1961	76	11.93	5	0.79	54	8.47	637	100	6209	10.26
1962	75	11.68	13	2.03	—	—	642	100	6210	10.34
1963	160	19.14	6	0.72	—	—	836	100	6559	12.75
1964	106	14.13	—	—	—	—	750	100	7388	10.15
1965	108	19.32	1	0.18	1	0.18	559	100	7390	7.56

Japan

Japan, a highly developed nation, can manipulate policy in such a way as to affect the volume of rice imports. A rice deficit nation in the past, Japan became much less dependent on rice imports later in the analysis period. Fig. 5 shows the pattern of total rice imports and the two exporting countries during the years 1951-65. Table 5 shows the volume and percent of rice imported by Japan from the different countries.

Japan's pattern of imports changed drastically between 1951 and 1965. The annual rate of rice imports compared to the annual world rice trade varied from 2.0 to 28.9 percent. During the period 1951-54 the volume of rice imported was quite high, increasing from 799,000 tons to a peak of 1,433,000 tons. From 1954 to 1957, imports fell sharply to only 347,000 tons. There was a slight increase to 506,000 in 1958, followed by another decline. A trough was noted in 1961 when imports dropped to 126,000 tons—only 2 percent of the total world rice trade. After 1961 imports rose and continued on the upswing to 416,000 tons in 1964 and 969,000 in 1969.

A review of the various nations contributing to Japan's imports presents an interesting lineup. During Japan's high import period between 1951 and 1956, Burma contributed an annual average of 21.4 percent of Japan's total rice imports, Thailand contributed 30.4 percent, Taiwan 8.3 percent, Mainland China 7.2 percent, the United States 17 percent, and other countries 37.1 percent. In the period following 1956, when Japan's imports were low, shipments from Burma declined: there were no rice imports at all from Mainland China and the United States in 1957, 1959, and 1963. Thailand's contribution remained fairly constant; but imports from Taiwan rose significantly, both in absolute and percentage terms. In 1956 Taiwan's share of exports to Japan was 89,000 tons, only 11.7 percent of the total. This figure rose to 153,000 tons in 1959.

In 1965 the ratio of Burma's and Thailand's exports to total Japanese imports dropped drastically to 4.8 percent and 15 percent respectively, while the share from Taiwan increased from 24.5 percent of the previous year to 28.3 percent. Imports from Mainland China again resumed, reaching 17.3 percent in 1965. The largest share of Japan's imports came from the United States, amounting to fully 30 percent of total imports.

Mainland China

During the period of study Mainland China was a rice exporting country. Major customers in the six Asian regions were Ceylon, Hong Kong,

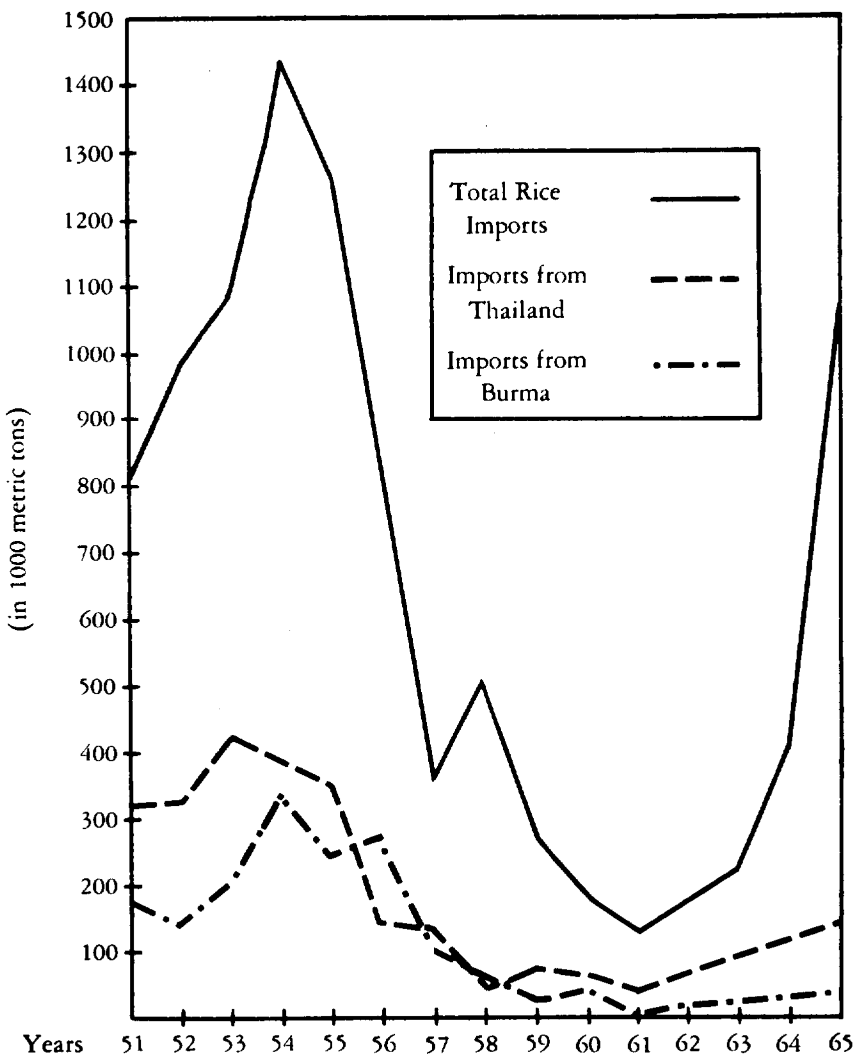

FIG. 5. Milled Rice Imports of Japan, 1951-1965.

Indonesia, Malaya-Singapore, and Japan. Fig. 6 shows the pattern of milled rice exports and some dominant importers during 1951-65. Table 6 shows Mainland China's exports and imports of rice during the same analysis period.

Between 1951 and 1958 Mainland China's exports were on a generally

TABLE 5. Milled Rice Imports of Japan, 1951–1965.

YEAR	PAKISTAN		BURMA		CAMBODIA		SOUTH VIETNAM		THAILAND		TAIWAN	
	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)
					(in 1000 metric tons)							
1951	—	—	162	20.28	—	—	—	—	316	39.55	73	9.13
1952	—	—	126	12.87	—	—	—	—	317	32.38	61	6.23
1953	—	—	200	18.53	—	—	—	—	424	39.30	54	5.00
1954	24	1.67	327	22.82	—	—	46	3.21	380	26.52	43	3.00
1955	—	—	236	18.93	—	—	—	—	341	27.35	183	14.67
1956	—	—	267	35.13	—	—	—	—	130	17.11	89	11.71
1957	—	—	106	30.55	—	—	6	1.73	116	33.43	115	33.14
1958	—	—	51	10.08	4	0.79	—	—	45	8.89	191	37.75
1959	—	—	27	9.64	3	1.07	5	1.79	71	25.36	153	54.64
1960	—	—	47	26.40	4	2.25	6	3.37	65	36.52	34	19.10
1961	—	—	6	4.76	—	—	—	—	34	26.98	70	55.56
1962	—	—	21	11.80	—	—	—	—	63	35.39	52	29.21
1963	—	—	29	13.00	5	2.24	10	4.49	94	42.15	85	38.12
1964	—	—	36	8.65	5	1.20	5	1.20	117	28.13	102	24.52
1965	—	—	46	4.75	10	1.03	—	—	145	14.96	274	28.28

TABLE 5.—*(Continued)*

YEAR	MAINLAND CHINA		UNITED STATES		OTHERS		TOTAL		TOTAL WORLD TRADE	
	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)	(Vol.)	(%)
					(in 1000 metric tons)					
1951	7	0.88	41	5.13	200	25.03	799	100	4978	16.05
1952	44	4.50	276	28.19	155	15.83	979	100	5253	18.64
1953	78	7.23	239	22.15	84	7.79	1079	100	4805	22.46
1954	75	5.23	346	24.15	192	13.40	1433	100	4966	28.86
1955	133	10.66	243	19.49	111	8.90	1247	100	5668	22.00
1956	113	14.87	20	2.63	141	18.55	760	100	6874	11.06
1957	—	—	—	—	4	1.15	347	100	6666	5.21
1958	86	17.00	1	0.20	128	25.29	506	100	6596	7.67
1959	—	—	—	—	21	7.50	280	100	7073	3.96
1960	—	—	—	—	22	12.36	178	100	7374	2.41
1961	—	—	—	—	16	12.70	126	100	6209	2.03
1962	—	—	—	—	42	23.60	178	100	6210	2.87
1963	—	—	—	—	—	—	223	100	6559	3.40
1964	—	—	107	25.72	44	10.58	416	100	7388	5.63
1965	168	17.34	290	29.93	36	3.71	969	100	7390	13.11

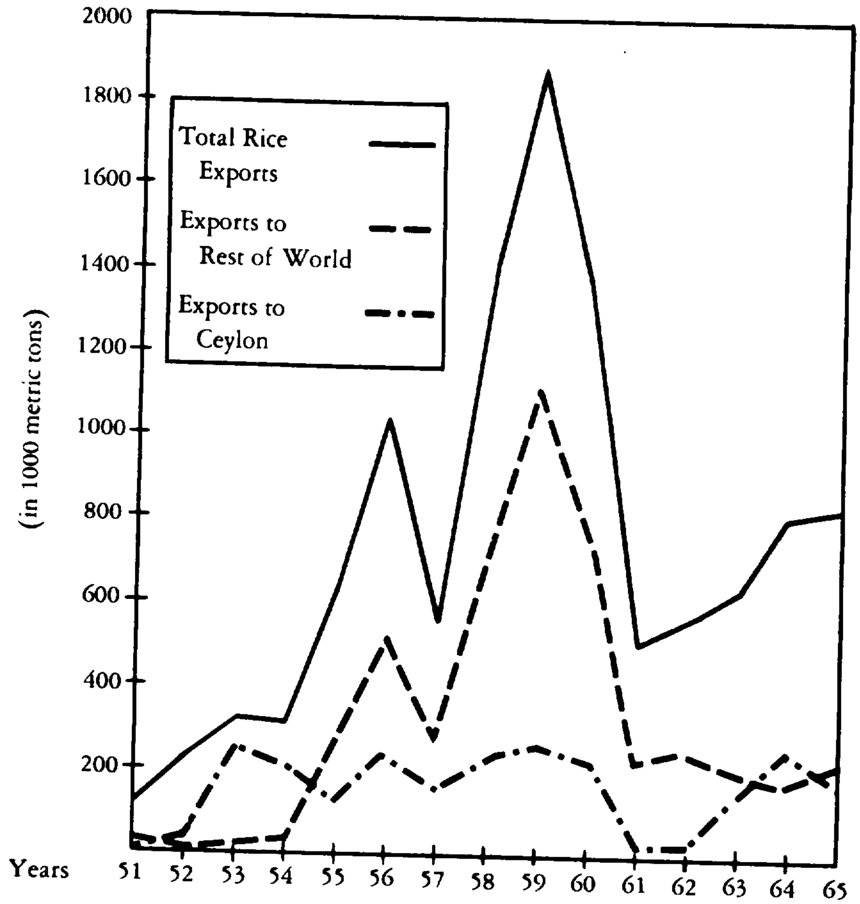

FIG. 6. Milled Rice Exports from Mainland China, 1951-1965.

upward trend. Exports ranged from 122,000 to 1,824,000 tons, fluctuating widely, however, between as much as 2 million to as little as one-half million tons. The annual average percent of exports compared to total world rice exports during 1951-65 was 11.6. Exports to the six Asian regions amounted to 428,000 tons or 10.6 percent of the total. Almost half of Mainland China's total exports—333,000 tons—went to areas outside the six Asian regions.

Ceylon, a regular customer, received an average of 168,000 tons a year from Mainland China. Hong Kong's imports were irregular until 1955, but thereafter maintained a consistent high average of over 100,000 tons

TABLE 6. Milled Rice Exports and Imports of Mainland China, 1951–1965.

YEAR	EXPORTS								
	CEYLON	INDIA	PAKISTAN	HONG KONG	INDONESIA	MALAYA-SINGAPORE	JAPAN	OTHER SIX ASIAN REGIONS	TOTAL
	(in 1000 metric tons)								
1951	—	120	—	—	—	—	7	—	127
1952	36	150	—	6	—	—	44	—	236
1953	265	—	—	3	—	—	78	—	346
1954	218	—	—	—	—	—	75	—	293
1955	122	—	—	37	—	1	133	8	301
1956	246	47	64	52	—	11	113	—	533
1957	163	14	—	65	2	26	—	14	284
1958	249	—	68	143	89	25	86	24	684
1959	280	—	49	63	318	15	—	24	749
1960	246	—	4	76	104	45	—	27	502
1961	28	—	—	126	6	76	—	55	291
1962	29	—	—	144	40	75	—	46	334
1963	165	—	—	111	—	160	—	16	452
1964	265	—	—	141	100	106	—	46	658
1965	200	—	—	111	—	108	168	44	631

TABLE 6.—*(Continued)*

YEAR	EXPORTS: REST OF WORLD	EXPORTS: EXPORT TOTAL	EXPORTS: PERCENT OF WORLD TRADE	EXPORTS: PERCENT OF SIX ASIAN REGIONS	IMPORTS: BURMA	IMPORTS: THAILAND	IMPORTS: CAMBODIA	IMPORTS: OTHERS	IMPORTS: TOTAL	NET EXPORT
	(in 1000 metric tons)									
1951	15	142	2.85	3.55	—	20	—	—	20	122
1952	8	244	4.65	5.74	—	16	—	—	16	228
1953	13	359	7.47	9.68	—	5	—	—	5	354
1954	40	333	6.70	7.97	—	—	—	1	1	332
1955	352	653	11.52	8.98	157	—	—	—	157	496
1956	547	1,080	15.71	11.82	86	—	—	6	92	988
1957	295	579	8.68	6.63	106	—	—	—	106	491
1958	646	1,330	20.16	16.22	12	—	—	—	12	1,318
1959	1,136	1,885	26.65	19.16	10	—	51	—	61	1,824
1960	822	1,324	17.96	11.26	18	—	10	1	29	1,295
1961	237	528	8.50	7.45	55	—	—	12	67	461
1962	250	584	9.40	9.03	5	—	—	—	5	579
1963	200	652	9.94	10.44	35	—	—	62	97	555
1964	187	845	11.44	14.03	—	—	46	—	46	799
1965	239	870	11.77	13.48	61	—	38	3	102	768

per year. The range of imports was from zero in 1951 and 1954 to 144,000 tons in 1962. Indonesia, not a regular customer of Mainland China, received no imports at all in 1951-56, or in 1963 and 1965. Peak imports reached 318,000 tons in 1959. There were no exports to Malaya-Singapore from Mainland China in 1951-54, and only 1,000 tons were exported in 1955. From 1955 on, however, exports showed an upward trend, reaching 108,000 tons a decade later.

During Japan's high volume of imports in the early 1950's, Mainland China exported an annual average of 75,000 tons to Japan. This increased to 133,000 in 1955. From 1956 to 1964 no exports were made to Japan with the exception of 1958 when 86,000 tons were shipped. Then, in 1965, exports to Japan jumped to 168,000 tons.

The United States

The largest customers of the United States among the six Asian regions were India, Pakistan, Indonesia, and Japan. Table 7 shows the volume of U. S. rice exported to the various countries.

Rice exports from the United States steadily increased during the analysis period, averaging an annual 14.3 percent of total world rice exports of which 11.7 percent went to the six Asian nations.

Exports to India were irregular from 1951 to 1959, but between 1961 and 1962 ranged from a high level of 194,000 to 368,000 tons. Shipments to Pakistan rose from a substantial 57,000 to 251,000 tons during 1956-61. Significant amounts were also shipped to Indonesia in 1956-64. Graphically, exports to Indonesia took on a "U-shaped" appearance—as high as 239,000 tons in 1956, down to 122,000 tons in 1957, and descending to a trough of 91,000 in 1959. Exports then increased to 223,000 tons and 220,000 tons in 1962 and 1963 respectively.

In the early 1950's the United States contributed a significant share of Japan's total rice imports. These imports were sharply reduced between 1955 and 1963. In 1964-65, however, Japan resumed heavy imports of rice from the United States of from 107,000 to 290,000 tons.

TABLE 7. Milled Rice Exports from the United States, 1951–1965.

YEAR	CEYLON	INDIA	PAKISTAN	SOUTH VIETNAM	HONG KONG	SOUTH KOREA	PHILIPPINES	INDONESIA
				(in 1000 metric tons)				
1951	—	—	—	—	—	64	—	58
1952	63	—	—	—	8	104	3	40
1953	2	—	—	—	—	111	7	51
1954	—	—	—	—	—	—	—	—
1955	—	9	—	—	—	—	2	—
1956	—	48	251	—	—	—	1	239
1957	—	197	127	—	—	135	18	122
1958	23	—	98	5	1	2	60	68
1959	55	1	57	3	2	2	1	91
1960	19	336	83	13	14	—	6	104
1961	10	194	64	2	—	11	—	121
1962	—	368	—	42	—	—	—	223
1963	—	334	1	—	—	1	—	220
1964	—	276	—	1	—	—	75	38
1965	—	220	—	186	—	—	67	—

TABLE 7.—*(Continued)*

YEAR	MALAYA-SINGAPORE	JAPAN	OTHERS	TOTAL	REST OF WORLD	GRAND TOTAL	PERCENT OF WORLD TRADE	PERCENT OF SIX ASIAN REGIONS
				(in 1000 metric tons)				
1951	—	41	—	163	324	487	9.78	4.56
1952	—	276	—	494	294	788	15.00	12.02
1953	—	239	—	410	342	752	15.65	11.47
1954	—	346	—	346	291	637	12.83	9.41
1955	—	243	26	280	256	536	9.46	8.35
1956	—	20	103	662	334	996	14.49	14.68
1957	—	—	3	602	296	898	13.47	14.06
1958	—	1	25	299	358	657	9.96	7.09
1959	—	—	2	215	501	716	10.12	5.50
1960	8	—	26	643	419	1,062	14.40	14.42
1961	5	—	32	439	427	866	13.95	11.24
1962	13	—	30	676	517	1,193	19.21	18.29
1963	6	—	92	654	509	1,163	17.73	15.10
1964	—	107	69	566	767	1,333	18.04	12.07
1965	1	290	68	832	691	1,523	20.61	17.77

CORN PRODUCTION AND TRADE PATTERNS: THE HISTORICAL RECORD

MELVIN M. WAGNER

IT seems to have become fashionable in recent years among the physical and biological branches of agriculture to view agricultural economics as the science of looking over one's shoulder. While one would hope that economics involves more than the study of the past and the analysis of trends, the usefulness of such exercises cannot be argued. To look at the record is sobering: it tends to curb our excesses of despair or enthusiasm by reminding us of the complexity of the phenomena with which we deal. A few years ago in Asia the hue and cry was famine, and persons who dared to express guarded optimism were regarded as out of touch. Now the cry is "green revolution," and although there is no doubt of the importance of recent technological breakthroughs in production, it is possible that guarded optimism still may be in order; for most of the same forces of demand and supply which helped to shape past production trends in ways sometimes not to our liking are, alas, still in operation. The purpose of this paper is to summarize the patterns in corn production and trade in Southeast Asia during the past two decades, and to consider how some of the forces which shaped these patterns may operate to affect the course of the revolution now in progress.

TRENDS IN CORN AND TOTAL GRAINS

In late 1963 a comprehensive study of broad trends in grain production and trade was published by the U.S. Department of Agriculture.[1] This study considered production and trade trends among seven regions of the world. More recently, in June 1968, the Department of Agriculture published a study consisting primarily of historical data on trade in the major food and feed grains among nineteen regions of the world for the period

[1] Lester R. Brown, *Man, Land, and Food: Looking Ahead at World Food Needs,* U.S. Department of Agriculture, Economic Research Service, Regional Analysis Division, November 1963.

1951-65.[2] Although the separate studies present a different view of world trade patterns in grain, they nevertheless provide a reasonably complete picture of broad trends.

Fig. 1 summarizes the volume of total world grain trade during the fourteen-year period 1951-65 and shows the extent to which corn and wheat dominate this trade. As shown, total trade has more than doubled during this period, and corn and wheat have accounted for most of the gain. Total world grain trade was 117.7 percent higher in 1965 than in 1951; corn and wheat trade increased 162 percent during the same period, while trade in all other grains increased only 48 percent.[3] Thus the proportion of total world grain trade in wheat and corn increased from 60.5 percent in 1951 to 72.7 percent in 1965. Trade in corn alone increased from less than 10 percent of the total in 1951 to about 23 percent in 1965.

Table 1 and Fig. 2 show net trade among the nineteen regions for total grains. Only four regions—the United States, Canada, Australia-New Zealand-South African Republic, and Southeast Asia—have been net exporters throughout. In the latter part of the period these four regions accounted for over 90 percent of net exports. Ten regions were consistently net importers, of which the four major ones were subregions of Europe (EFTA, EEC, Other West Europe, Eastern Europe). Five regions were neither consistently net exporters nor net importers. Among these, four—the USSR, Communist Asia, West Asia, and North Africa—had become major importers by the end of the period. The fifth, Latin America, was an importer in 1951 and 1952 and again during the years 1961-63, but otherwise has been an exporter.

By the end of the period, therefore, all of Europe including the USSR,

[2] Arthur B. Mackie, A. Nicholas Filippello, John E. Hutchinson, and James F. Keefer, *World Trade in Selected Agricultural Commodities, 1951-65,* Vol. II: *Food and Feed Grains,* U.S. Department of Agriculture, Economic Research Service, June 1968. Two tables in this paper have been calculated from data in the USDA report. Although the report summarizes trade according to nineteen regions, the summaries include all grain which crosses international boundaries; thus if France exported 100 tons of wheat to West Germany, and West Germany exported 50 tons of barley to France, 150 tons would be added to total world trade even though both countries are in the European Economic Community—one of the nineteen regions used in this report. In order to present a clearer picture of which regions have been, on balance, net exporters and which have been net importers, the data in the tables have been calculated to reflect only *net* trade among regions; the trade of the kind just mentioned would not be counted at all. Care should be exercised in interpreting the tables since net trade in all grains would be less than the sum of the net trade of individual grains. The nineteen regions delineated in the report, and their composition, are shown in the appendix to the present paper.

[3] These figures tend to underestimate the actual rate of gain, as there was an absolute decline in the substantial imports required by Europe in the years immediately following World War II. These data also do not reflect the substantial imports required by India during the drought years of 1965-66 and 1966-67. World trade in all grain in 1965 was 2.3 times that of 1954; trade in corn and wheat more than tripled; and trade in all other grains increased 41 percent.

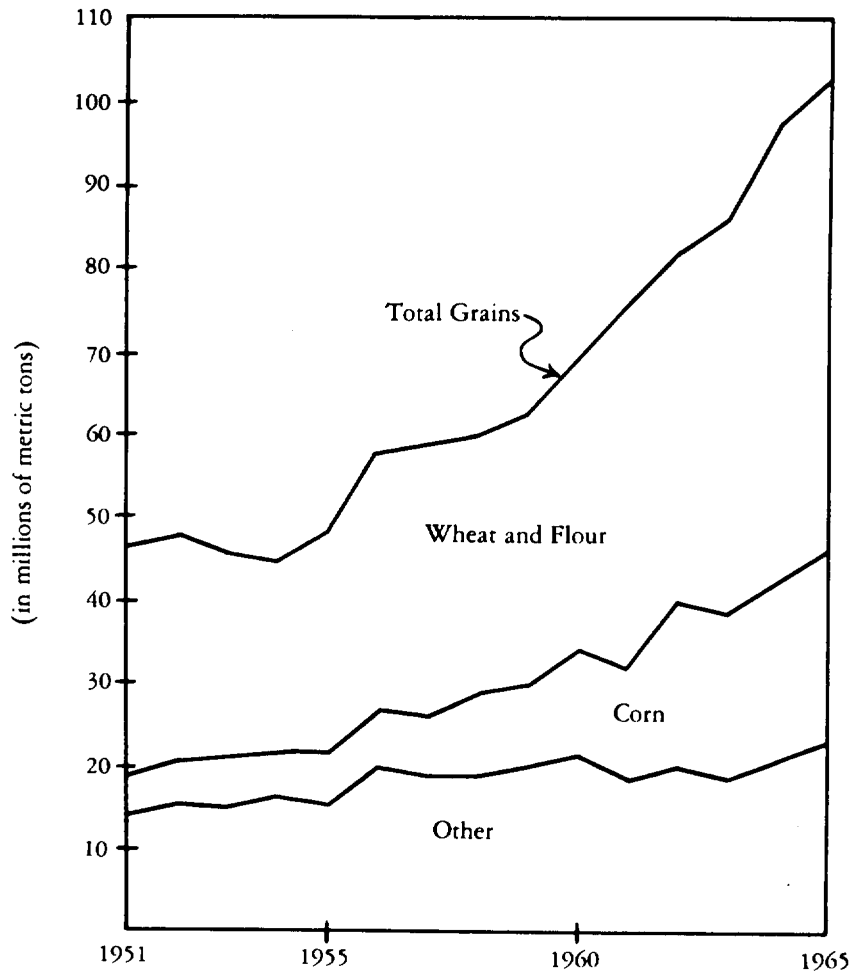

FIG. 1. World Trade in All Grains, 1951-65.

Source: Calculated from Mackie *et al.*, *World Trade in Selected Agricultural Commodities*, 1951-1965, Vol. II, Tables 9-23, 54-68, and 114-128.

all of Asia except Southeast Asia, and all of Africa except the South African Republic, had become importers, leaving North and South America, Australia-New Zealand-South African Republic, and Southeast Asia as the only net exporters. These trends can be and have been interpreted as alarming. However, as total world production of grains in 1960 was on the order of 900 million tons, the net trade of 52 million tons among these nineteen

TABLE 1. Net World Trade in Total Grains, 1951–1965.

Regions	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
	(1000 metric tons)														
U.S.	17,985	14,204	9,951	7,829	13,074	18,761	17,648	19,589	22,433	25,781	28,640	32,545	35,312	38,774	39,107
Canada	8,898	13,215	13,464	8,924	7,915	10,740	9,434	10,023	9,752	8,531	11,422	8,911	11,741	16,123	14,746
Japan	−3,291	−3,521	−3,561	−4,594	−4,576	−4,388	−4,023	−4,227	−4,192	−4,328	−4,906	−5,480	−6,976	−8,743	−10,209
E.E.C.	−10,578	−10,362	−8,652	−9,195	−6,604	−11,753	−7,911	−8,267	−10,284	−10,346	−10,611	−13,958	−10,560	−8,686	−9,826
E.F.T.A.	−10,237	−10,038	−9,674	−8,625	−11,142	−11,162	−10,233	−12,208	−13,393	−12,724	−11,479	−13,211	−10,995	−11,247	−11,789
Other West Europe	−1,932	−1,480	−1,506	−1,594	−1,456	−1,313	−1,456	−1,067	−741	−1,008	−2,046	−1,907	−2,394	−2,742	−3,521
A-N.Z. & S. Afr. Rep.	3,374	2,289	2,837	2,658	3,046	4,743	3,964	2,644	3,874	4,223	8,304	8,264	7,844	8,125	7,946
East Europe	−24	−149	−987	−2,079	−4,437	−4,381	−8,079	−4,515	−4,509	−5,688	−5,234	−6,643	−7,852	−8,351	−8,442
U.S.S.R.	1,347	2,340	1,355	1,550	2,375	2,120	6,835	3,571	3,597	5,856	4,984	6,935	3,743	−5,184	−2,346
Com. Asia	773	345	425	321	502	967	534	1,311	2,033	1,584	−4,983	−5,148	−4,330	−4,562	−5,002
Latin Amer.	−50	−2,197	98	3,714	1,989	918	370	884	1,214	2,114	−1,186	−1,496	−472	1,196	6,309
N. Africa	148	−366	425	959	1,006	5	−423	−191	−1,560	−1,815	−3,158	−3,210	−2,444	−2,565	−3,015
W. Africa	−196	−199	−251	−321	−500	−487	−684	−442	−659	−661	−819	−855	−804	−873	−871
E. Africa	−289	−89	−270	−134	−91	−79	−44	−111	−206	−248	−212	−79	−162	−330	−785
W. Asia	−206	623	764	1,326	−1,059	−677	−1,277	−837	−1,560	−2,733	−3,324	−2,020	−2,648	−1,634	−2,638
S. Asia	−5,406	−4,685	−4,143	−1,662	−1,219	−3,377	−4,996	−5,434	−5,796	−8,315	−4,821	−5,209	−7,246	−9,513	−9,785
S. E. Asia	3,099	3,156	2,844	3,102	3,345	3,430	4,118	3,287	3,468	4,085	4,042	3,712	4,059	4,907	4,212
Other E. Asia	−814	−1,323	−1,739	−948	−923	−1,774	−1,963	−2,141	−1,131	−1,742	−2,227	−1,868	−3,014	−2,248	−2,628
Far E. Asia & Oceania	−2,601	−1,763	−1,380	−1,231	−1,235	−2,293	−1,814	−1,869	−2,341	−2,566	−2,386	−2,275	−2,802	−2,447	−1,463
Net Grain Traded	35,624	36,172	32,163	30,383	33,252	41,684	42,903	48,945	46,372	52,174	57,392	61,863	62,699	69,125	72,320

Source: Calculated from Mackie *et al.*, *World Trade in Selected Agricultural Commodities, 1951–1965*, Vol. II: *Food and Feed Grains*, Economic Research Service, U.S. Department of Agriculture, June 1968, Tables 9–23, pp. 20–34.

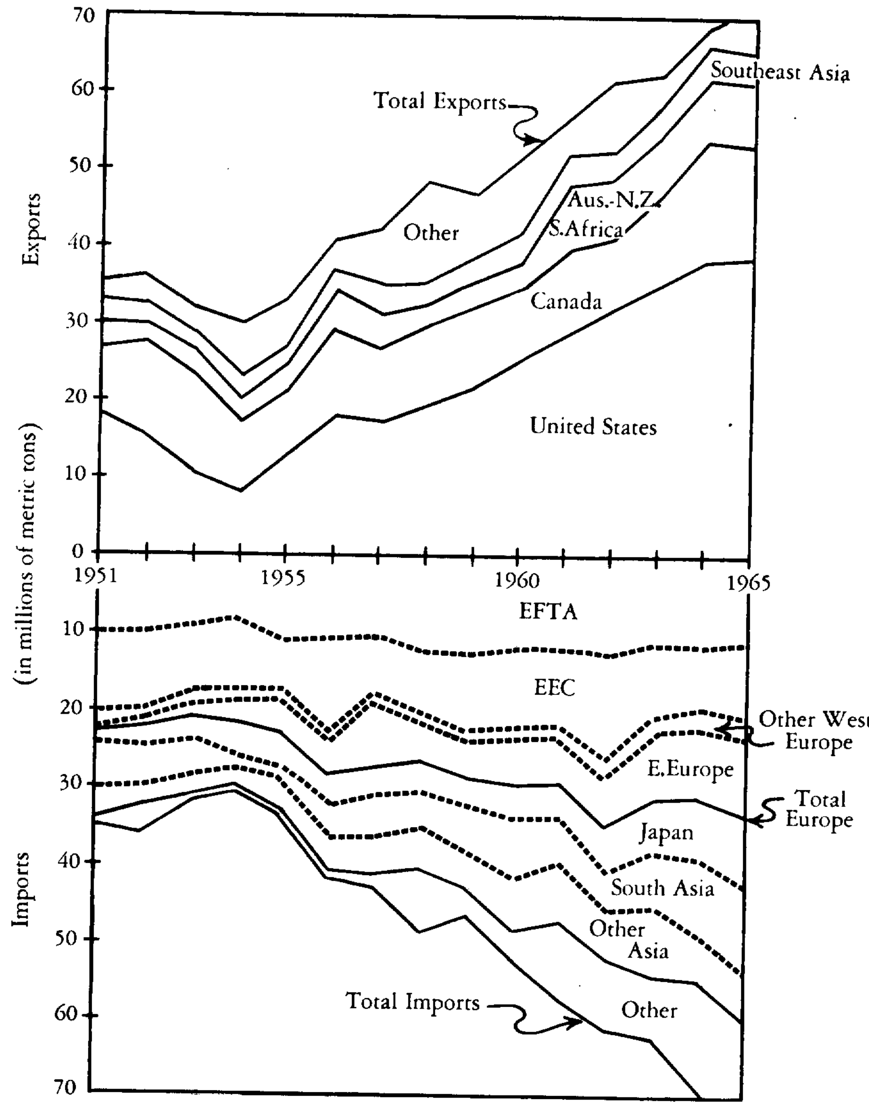

FIG. 2. Net World Trade in Total Grains, by Regions, 1951-1965.

Source: Table 1.

regions in that year represents a shift of grains among regions of only about 6 percent of the total. Moreover, as about two-thirds of these exports go to relatively developed countries, only a small proportion of the trade can be construed as arising from regional deficits in production for human consumption.

Table 2 and Fig. 3 summarize net corn trade among the nineteen regions of the world. With the exception of 1954, the United States supplied two-thirds or more of total corn exports throughout 1951-65. Since 1953, exports of the four major regions—the United States, South Africa, Latin America (primarily Argentina), and Southeast Asia (primarily Thailand)—have never dropped to less than 85 percent of total exports. During 1959-65, the proportion of world corn exports supplied by these countries ranged from 89 to 95.4 percent. Imports of the four major importing regions—the EEC, EFTA, Other West Europe, and Japan—were seldom below 90 percent of total imports during the entire period. None of the remaining regions has been either a consistent importer or exporter, and the quantity traded by each of these regions obviously has been quite small relative to the total.

Turning to Asia, Japan moved from a very small net import in 1951 to one of the world's largest imports in 1965 with 3.4 million tons. Southeast Asia (primarily Thailand) shifted from the position of a very small exporter to one of the four major exporting regions of the world. The rest of Asia, excluding Communist Asia, became a net importer. Each of the subregions—West Asia, South Asia, Other East Asia, the Far East and Oceania—were consistent net importers during 1960-65. Their total imports nearly equaled the total exports of Southeast Asia in 1965.

Table 3 and Fig. 4 show corn production in various Southeast Asian countries. Corn is produced in significant quantities in three Southeast Asian countries: Indonesia, the Philippines, and Thailand. These countries together in 1966 produced over 90 percent of the total. Indonesia's production had been large, subject to considerable fluctuation, and almost entirely consumed at home. Production in the Philippines has been smaller, stable, and again almost entirely consumed locally. Only in Thailand, where corn production advanced steadily from miniscule beginnings, has export been the object of production. In 1966, Thailand was the only country in Southeast Asia of importance in world corn trade.

FACTORS INFLUENCING PATTERNS IN CORN PRODUCTION AND TRADE

The principal market for Thailand's corn exports is Japan. Japan's import requirements have advanced even more rapidly than Thailand's production rate. Japan, which consumes little corn directly, began to require corn on

TABLE 2. Net World Trade in Corn, 1951–1965.

Regions	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
						(1000 metric tons)									
U.S.	2,758	2,201	3,580	1,671	2,693	2,858	4,210	4,361	5,260	5,117	6,790	10,152	10,144	11,286	13,177
Canada	−181	−156	−28	−120	−76	−170	−246	−258	−174	−283	−490	−640	−225	−141	375
Japan	−56	−67	−187	−195	−341	−343	−517	−666	−916	−1,353	−1,831	−2,316	−2,646	−3,229	−3,420
E.E.C.	−1,683	−1,585	−1,795	−1,988	−1,863	−2,543	−2,288	−3,024	−3,598	−4,243	−4,059	−6,146	−7,568	−7,139	−8,708
E.F.T.A.	−1,615	−2,006	−1,956	−1,874	−2,143	−2,052	−2,136	−2,904	−3,644	−3,896	−3,878	−5,367	−4,276	−4,264	−4,288
Other W. Europe	−227	−146	−231	−252	−334	−262	−151	−200	−253	−299	−466	−579	−1,221	−1,449	−1,930
Aus.-New Zea.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
S. African Rep.	136	−8	−94	472	626	940	961	1,128	509	556	1,034	2,154	2,278	1,582	343
E. Europe	−105	446	−109	91	292	233	60	632	103	634	702	−374	334	−108	−345
U.S.S.R.	381	330	95	60	−24	214	60	−49	159	28	400	1,214	841	619	471
Communist Asia	257	27	69	0	0	29	9	−7	103	74	−40	−478	−13	172	133
Latin Amer.	315	776	561	1,871	782	670	−167	585	2,211	3,267	1,654	2,367	2,180	2,610	4,218
N. Africa	11	9	74	57	85	63	−19	30	−7	14	−117	−272	−86	−385	−125
W. Africa	95	72	65	50	29	98	35	148	118	80	−15	66	−6	−22	65
E. Africa	−97	60	−44	75	159	170	237	222	142	108	156	327	204	−43	−147
W. Asia	−2	−5	−4	3	2	−39	−98	−74	−108	−35	−175	−236	−267	−238	−196
S. Asia	−23	0	−44	−5	0	−1	−43	−71	−126	−179	−146	−98	−76	−121	−177
Southeast Asia	46	70	65	82	158	192	196	257	273	565	725	600	764	1,048	974
Thailand	—	—	—	—	—	—	64	163	238	515	573	484	767	1,115	831
Other East Asia	1	0	21	−2	−19	3	−34	−30	37	−45	−89	−147	−136	−103	−244
Far East Asia	−11	−18	−38	4	−26	−60	−69	−80	−89	−110	−155	−227	−226	−75	−176
Net Corn Traded	4,000	3,991	4,530	4,436	4,826	5,470	5,768	7,363	8,915	10,443	11,461	16,880	16,745	17,317	19,756

Source: Calculated from Mackie *et al.*, *World Trade in Selected Agricultural Commodities, 1951–1965*, Vol. II: *Food and Feed Grains*, Economic Research Service, U.S. Department of Agriculture, June 1968, Tables 114–128, pp. 125–139. *Annual Statement of Foreign Trade of Thailand*, Data for Thailand from Royal Thai Government Department of Customs, 1957–1965.

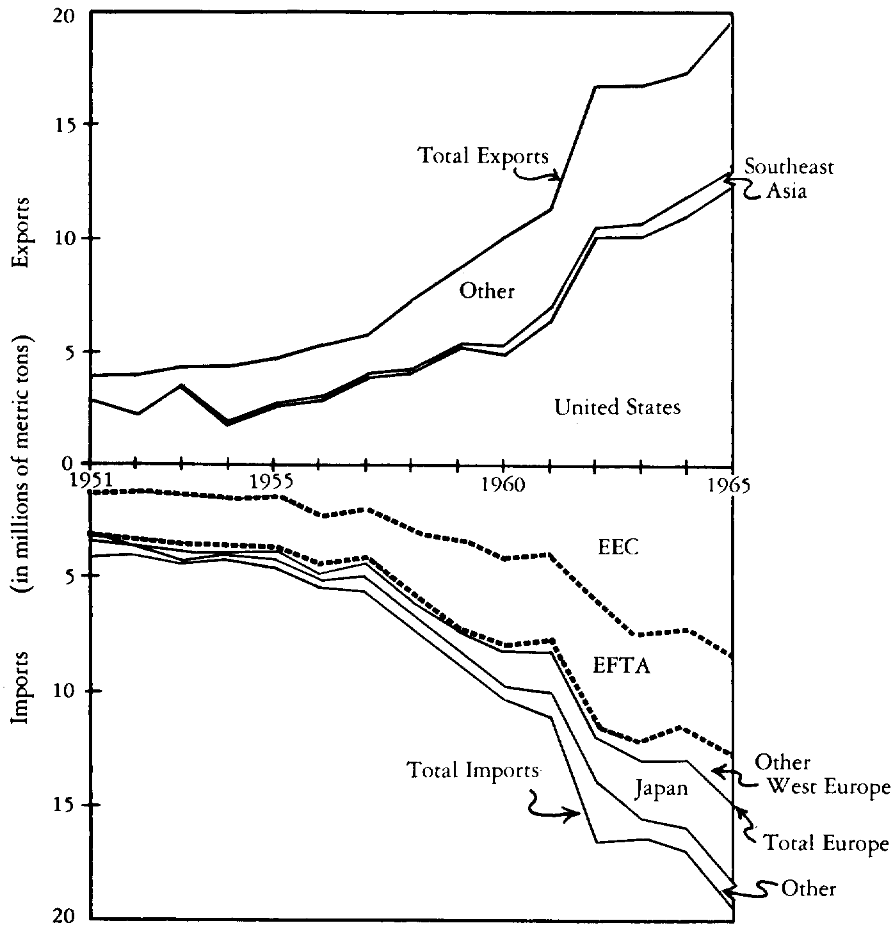

FIG. 3. Net World Trade in Corn, 1951-1965.

Source: Table 2.

reaching the level of affluence where the more costly foods supplied by corn-fed animals—meats, dairy products, eggs—could be afforded.

One factor enhancing the profitability of corn production has been Thailand's rice price policy. The Thai government levies a substantial tax on rice exports, and this premium has reduced the price for rice received by farmers to such low levels that almost any alternative crop is profitable by comparison. This is particularly true for crops whose price is determined by market forces outside of Thailand, as is the case with corn.

A second thesis involves the land factor. The most adaptable type of

TABLE 3. Corn Production in Southeast Asian Countries, 1957–1966.

Country	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
					(1000 metric tons)					
Burma	23	26	26	42	56	66	73	54	48	61
Cambodia	100	69	122	118	147	152	183	204	139	136
Indonesia	1860	2634	2101	2460	2283	3242	2358	3769	2283	2874
Laos	14	12	15	12	17	18	15[a]	19	23[a]	20[a]
Malaysia										
Sabah	—	—	—	2	2	2	3	3	2	2
West Malaysia	—	—	—	—	—	6[a]	7[a]	7[a]	7[a]	7[a]
North Vietnam	197	N.a.	N.a.	198[b]	N.a.	276[b]	217[b]	274[b]	265[a]	250[a]
Philippines	826	1016	989	1210	1266	1273	1293	1313	1380	1435
South Vietnam	18	29	26	27	32	38	37	46	44	35
Taiwan	9	12	17	21	27	36	35	42	41	52
Thailand	137	186	317	544	598	665	858	935	1021	1277[b]
Total	3184	3984	3613	4634	4428	5774	5079	6666	5253	6149

Source: FAO Production Yearbook, Vols. 14, 17, and 21, 1960, 1963, and 1967. Data for 1957–58, Vol. 14, Table 16, p. 45; 1959–1961, Vol. 17, Table 18, p. 47; 1962–66, Vol. 21, Table 19, pp. 57–58.

[a] FAO estimate. Some figures are two-, three-, or four-year averages.

[b] Unofficial estimate.

seed available in the region are the low-yielding, non-fertilizer-responsive varieties which, to become profitable, require a large amount of land. Compared to Indonesia and the Philippines, Thailand is relatively well-endowed with land; her resource base is particularly suited to the extensive type of agriculture demanded by the available seeds.

This is illustrated in Fig. 5, which shows the relationship between per capita land area and fertilizer used in various Asian countries.[4] As shown on the vertical axis, Cambodia and Burma, followed by Thailand, have the most land per person; South Korea, Taiwan, and Japan have the least. (One would expect that countries would adjust their economic conditions, e.g., price policies, crops produced in terms of their land use intensity,

[4] This figure is taken from Supan Tosunthorn, Praphan Chaverut, and Melvin M. Wagner, "Trends in Thai Fertilizer Imports," a paper presented at the Seventh National Conference on Agricultural Sciences, Bangkok, January 1968.

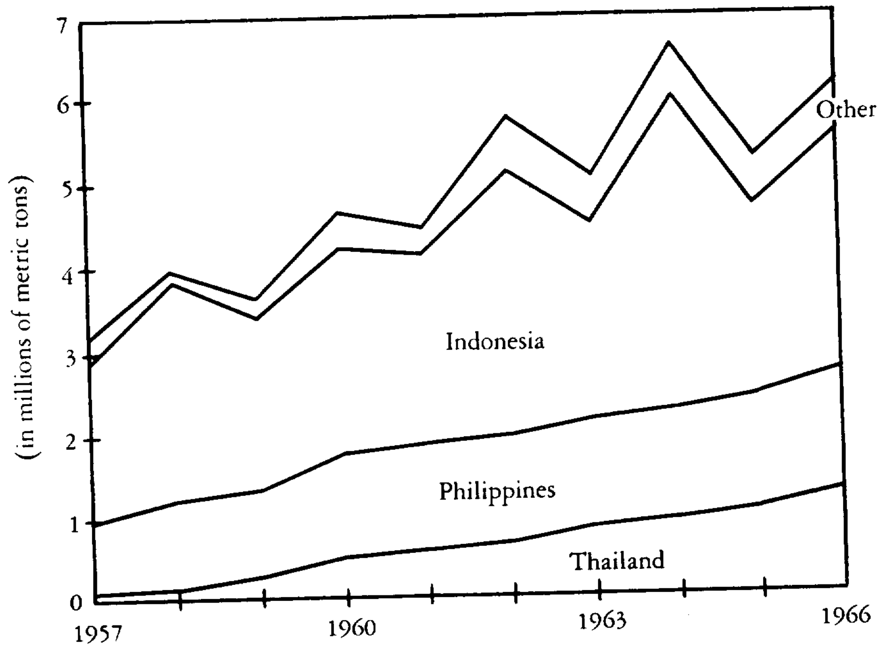

FIG. 4. Corn Production in Southeast Asian Countries, 1957-1966.

Source: Table 3.

transportation networks versus efforts to increase yields, etc., to take advantage of their resource base.[5]) The horizontal axis of Fig. 5 shows the kilograms of fertilizer use per person and suggests that, in general, countries with small amounts of land do indeed use large quantities of fertilizer.[6]

Based on Fig. 5, one might ask why Cambodia and Burma have not become major exporters of corn. A suggested answer lies at least partially in the accident of history that Thailand has received more assistance and has been able to concentrate with greater vigor on marketing, production,

[5] In part because much of the new technology which has created the agricultural revolution is yield-increasing, it has become more common to measure progress by yields; indeed, it is not uncommon to see comparisons of rice yields between Thailand and Japan or Taiwan with the implied or stated conclusion that Thailand's rice yields should be equal to those of Japan or Taiwan. Fig. 5 implies that it would be highly unlikely that equalizing yields among countries with such diverse resource endowments would be economically rational.

[6] On the basis of the hypothesis underlying this relationship, one would expect that Pakistan and India in particular would find it profitable to use more fertilizer. Indeed, India's projected fertilizer use by 1970 would place her somewhat to the right of the curve drawn in Fig. 5.

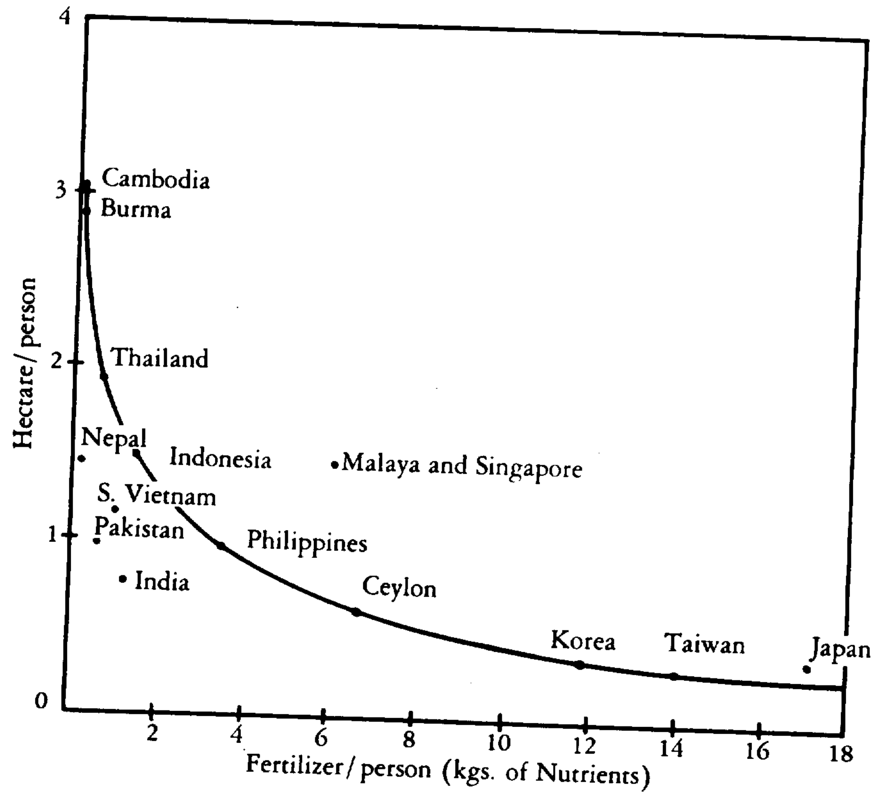

FIG. 5. Relationship Between Population Density and Per Capita Use of Total Plant Nutrients (N, P_2O_5, K_2O) in Selected Asian Countries, 1962-1963.

Sources: Land area: *Production Yearbook*, FAO, Vol. 18.
Population: *Demographic Yearbook*, UN, 1963.
Fertilizer Use: *Fertilizers: An Annual Review of World Production, Consumption and Trade*, FAO, 1962; *Present State, and Future Plans for the Future Development of the Fertilizer Industry in the ECAFE Region*, UN/ECAFE, Kiev.

and other problems. Perhaps, also, the political and monetary stability of Thailand since 1957 has been more conducive to the development of a product for export than it has in most Asian countries.

If the second thesis is correct that corn became a viable export crop for Thailand in large part because of the availability of only low-yielding, non-fertilizer-responsive varieties, then the development of better varieties could have important implications for the possibility of corn exports from Southeast Asian countries less well-endowed with land than Thailand. This leads to the question of demand.

It is now commonly feared that substantial increases in production associated with the rapid introduction of new grain varieties, greater use of fertilizer, and other improved practices, may result in serious overproduction and a considerable drop in prices for some Southeast Asian countries. The concern is that because the price elasticity of demand for most agricultural products is inelastic, total income actually might be reduced even if total production is increased. This fear may be well-founded for a grain such as rice: Asian rice production comprises a very large proportion of total production, and the income elasticity of rice tends to be quite low.

The situation is otherwise with respect to corn, and would tend to favor the position of prospective corn growers in Asia. Corn is both a food and a feed grain, but most of the corn traded in international channels is used for livestock feed. While corn is used primarily for direct consumption in most Latin American countries, contributing about 17 percent of total calories consumed in 1958, it is a consumption item to a much lesser extent in Asia, supplying only about 5 percent of total calories consumed in the same year.[7] Given the very low income elasticity of the "course grains," this amount will probably be reduced further as incomes rise.

The real importance of corn, therefore, is as a livestock feed in the production of meat, dairy, and poultry products. In the United States, where about half of the total world supply is produced, corn is almost exclusively a livestock feed. The same is true in Western Europe and Japan, which in 1965 together imported 93 percent of all corn moving in international trade channels. Meat, dairy, and poultry products have a much higher income elasticity of demand than the average of all foods, and it is not inconceivable that the combined effect of the two factors of population growth and increase of per capita income could raise the world demand for corn in the near future at an annual rate of as much as 10 percent.

Freeman[8] has shown that as incomes rise to the level of between $400 and $600 per capita, direct consumption of grain for food increases to about one pound per day; but with further gains, direct consumption of grain declines, so that at income levels of $1,000 to $1,200 it is only about 0.6 pounds per day. When incomes reach the level prevailing in the United States, only 0.4 pounds per day is consumed directly. Indirect utilization of grain, however, increases from about 100 pounds per capita (less than

[7] Lester R. Brown, *op. cit.*, p. 66.

[8] Orville L. Freeman, "Malthus, Marx, and the North American Breadbasket," *Foreign Affairs*, Vol. 45, No. 4, July 1968, p. 582.

0.3 pounds per day) at incomes of about $400 per person to about 1,700 pounds (over 4.6 per day) at $2,000 per person, an increase of about one pound for each dollar added to income. This grain used as feed for livestock can be any of several grains, but most of it is corn.

A second factor that would tend to enhance prospects for Asia's corn growers involves the current low proportion of Asia's rice production and exports relative to the world total and relative to Asian demand. At present, Japan buys most of the corn available in Asia, but this is not sufficient to meet domestic needs. Japan must therefore turn to the United States to fill the remainder of its requirements. A substantial expansion in the supply of corn from Southeast Asia would have two important implications. First, the increase would not greatly affect total world supply and consequently could not be expected to vastly depress prices. Second, as long as the United States pursues a policy of supporting the price of corn, it is possible for both importing and exporting countries in Asia to guarantee their farmers a fixed price without having to resort to buying and storing large amounts of the product, thereby tying up scarce capital resources.

I mentioned earlier the tendency to fluctuate between excesses of despair and enthusiasm—famine and "green revolution," crisis and miracle. In the case of corn, prospects for reasonable prices and for a viable and profitable export trade for some Asian countries give cause for enthusiasm. But in the case of the grains used primarily for direct consumption, prospects for the successful absorption of vastly increased production to some degree do give cause for despair.

The point I wish to make concerns what seems to have been one of the basic reasons underlying some of our problems. We have focused too much attention on increasing the supply of goods at the expense of analyzing demand and determining the quantities of various specific goods for which an effective demand exists. Failure to pay sufficient heed to the problems of demand in fact may have contributed to the food crisis which by contrast enables us to view current progress as an agricultural revolution. In other words, part of the production increases now being attained through the new technologies represent returns to an effort which might have been made years ago had agriculture received even a minimum of attention in postwar development plans.[9]

It appears in retrospect that after World War II many less developed

[9] Nor was the neglect just postwar; see Clifton R. Wharton, Jr., "The Green Revolution: Cornucopia or Pandora's Box?" *Foreign Affairs,* Vol. 47, No. 3, April 1969, in which he points out that virtually no attention was given to the development of staple food crops in the developing world prior to World War II.

countries searching for a model of development observed the industrialization of North America and Western Europe and said, "Aha! Developed countries are industrialized; obviously in order to develop we must first industrialize." Indeed, one gets the impression in looking over the literature of the fifties that economic development and industrialization were synonymous. (It is probably closer to the truth, however, to say that North America and Western Europe are industrialized *because* they are developed rather than the other way around. That is to say industrialization takes place when increases in income create an effective demand for industrial products so that a greater proportion of the economy is devoted to manufacturing these products than to providing necessities such as basic food and clothing. Emphasis on industrialization was tantamount to emphasis on supply, to the neglect of even asking for what goods an effective demand existed.[10])

The neglect of demand is especially unfortunate in its application to the agricultural sector. First of all, this is an area in which we can in fact make relatively accurate and useful predictions.[11] Second, if agriculture is to maintain the new respect it is being accorded,[12] it must move to meet the shifts in demand which are being brought about by rising incomes. Agriculture normally provides from one-third to one-half of total income in less developed countries and thus contributes far more toward determining the overall growth of the economy than it does in developed countries. Its con-

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[10] During the past 35 years, macroeconomic theory and related estimating techniques and models have been developed and used as important aids in guiding the economies of many developed countries; but many economists have felt this theory was not even applicable in the developing world and to the extent that macroeconomic models have been used there, emphasis has been placed on the equations representing the supply of goods and services, i.e., the production function. One result is that the very important and relatively stable consumption function which is of central importance in macroeconomic models is given very little emphasis in developing countries. In Thailand, for example, official estimates of disposable personal income (DPI) are not even available.

[11] See for example Schultz: "The advance in knowledge about consumption, including the demand for farm products, has been a major landmark of recent economic studies. Estimates of the price and income elasticities of demand, especially for farm products, have converged, and they have settled the main questions about the demand for farm products that arise in connection with growth." Theodore W. Schultz, *Transforming Traditional Agriculture* (New Haven: Yale University Press, 1964), p. 11. Reasons for this high degree of accuracy in our ability to predict the demand for farm products are not difficult to find. Total consumption of a product is per capita consumption times the population consuming the product. Population growth rates change rather slowly and in a reasonably predictable manner over the periods with which the economist is usually concerned. Because food consumption habits change slowly through the reasonably well-established relationship between change in income and change in food consumption, and because changes in income are becoming predictable within an increasingly narrow range, per capita food consumption is reasonably predictable.

[12] That greater recognition indeed exists seems unquestioned. See for example Lester R. Brown, "The Agricultural Revolution in Asia," *Foreign Affairs,* Vol. 46, No. 4, July 1968, pp. 688-698; but it may not differ from the earlier "recognition" of the need to industrialize in that the focus is again on supply.

tinued contribution depends, however, on anticipating the growing demand for the high-value products. In Thailand, which exports about 30 percent of its grain, grain production contributed less than 40 percent of the total value of agricultural production in 1965.

In conclusion, however important the agricultural revolution is in meeting basic food deficits, let us be careful not to exaggerate its likely contribution to income and growth. To do so is to encourage continued neglect of considerations of demand and to invite another round of disillusionment with agriculture's role in development.

APPENDIX

NINETEEN WORLD TRADE REGIONS AND COMPONENT COUNTRIES

United States

Canada

Japan

EEC (European Economic Community): Belgium, Luxembourg, France, Federal Republic of Germany, Italy, and Netherlands

EFTA (European Free Trade Association): Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and United Kingdom

OWE (Other Western Europe): Cyprus, Finland, Greece, Iceland, Ireland, Malta, and Spain

Australia: New Zealand, and South Africa

Eastern Europe: Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and Yugoslavia

U.S.S.R.

Communist Asia: Mainland China, Mongolia, North Korea, and North Vietnam

Latin America: All countries in Central and South America and the Caribbean

North Africa: Algeria, United Arab Republic, Libya, Morocco, Sudan, and Tunisia

West Africa: Angola, Cameroon, Central African Republic, Chad, Congo Republic (Braz.), Congo Republic (Kinshasa), Dahomey, Gabon, Gambia, Ghana, Guinea, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Portuguese Guinea, Senegal, Spanish Sahara, South West Africa, Upper Volta, and Togo

East Africa: Botswana, Burundi, Comoro Islands, Ethiopia, Kenya, Lesotho, Mauritius, Malawi, Malagasy Republic, Mozambique, Southern Rhodesia, Reunion, Rwanda, Somali Republic, French Somaliland, Swaziland, Tanzania, Uganda, and Zambia

West Asia: Aden, Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Saudi Arabia, Syria, Turkey, Lebanon, Qatar, and Yemen

South Asia: Afghanistan, Bhutan, Ceylon, India, Nepal, and Pakistan

Southeast Asia: Burma, Cambodia, Laos, South Vietnam, and Thailand

Other East Asia: Hong Kong, South Korea, Macao, Philippines,[13] Portuguese Asia, Ryukyu Islands, and Taiwan

Far East and Oceania: Australian New Guinea, Brunei, New Caledonia, Fiji, Guam, Indonesia, Malaysia, West Irian, Papua, French Polynesia, Sabah, West Samoa, Sarawak, and Singapore

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[13] For convenience, this paper groups the Philippines with Southeast Asia.

PROSPECTS FOR RICE AND CORN PRODUCTION AND TRADE IN THE 1970's

MARTIN E. ABEL

It is difficult enough to make reasonably accurate projections a decade ahead in a stable environment where there are high expectations that stability will continue. It is almost impossible to attempt such projections in a dynamic and rapidly changing environment. But even accepting that accurate projections may not be possible, the identification of major forces at work is useful. The operations of these forces can be followed from year to year, enabling us to discern the direction and magnitude of shifting patterns. The objective of this paper, therefore, is not to project specific levels of production and trade, but rather to look at some of the crucial forces that will affect rice and corn production and trade levels in the 1970's, and to indicate in a qualitative way what they mean for Southeast Asia.[1]

Two major sets of forces operating on the production, trade, and price picture for rice and corn in Southeast Asia over the next ten years will be production technology and government policies on prices and investments in agriculture—in the region and in other important exporting and importing countries. These include those forms of agricultural price and income-support programs in developed countries that lead to high-cost domestic production and to restricted import possibilities or subsidized exports, and programs that rapidly expand grain production in many of the developing countries.

There will be sharp interactions between these two sets of forces in the 1970's. The actual production and trade patterns that prevail will be significantly influenced by policy variables, both in Southeast Asia and in the major exporting and importing countries outside of Southeast Asia.

The future pattern and levels of trade in rice and corn will have important implications for the pattern of agricultural development that should be followed. They will affect the role of agriculture in the total development spectrum and the direction of future technological change. As this paper will point out, it is not obvious that a strategy of "more of the same" will be the correct one.

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[1] Mainland Southeast Asia is defined to include Burma, Cambodia, Laos, South Vietnam, and Thailand. Indonesia and the Philippines appear as part of the Far East and Oceania, and other East Asia, respectively; however, for convenience, the Philippines is sometimes grouped with Southeast Asia.

A review of the historical situation for the production, trade, and price of rice since 1950 in Southeast Asia and in other major rice exporting and importing regions may be helpful in developing a perspective for the 1970's. At least it will enable us to gain a better sense of what is "normal" in an historical context.

The bulk of world rice production is in Communist Asia and South Asia. Together these two regions have accounted for nearly 65 percent of total world production of milled rice. The other important producing areas are mainland Southeast Asia, Other East Asia, the Far East and Oceania, and Japan.

World rice production increased at a fairly steady pace between 1950 and 1966 (Table 1). The average annual rate of growth in world milled rice production was 2.7 percent between the 1950-52 and 1964-66 period. For mainland Southeast Asia, the comparable figure was 2.9 percent, or slightly faster than the rate of growth for the world.

The world trade picture is somewhat different (Table 2). Historically, mainland Southeast Asia has been the major rice exporting region, most of the rice going to other Asian countries. Exports from this region have been fairly stable, with the exception of a sharp decline since 1963. Exports from the United States and Communist Asia, in contrast, have been growing in importance since 1950.

Within mainland Southeast Asia, Thailand and Burma are the largest exporters (Table 3).[2] Between 1950 and 1960, Burma had a much higher rate of growth in rice exports than Thailand. Burma increased its exports of milled rice from 1.3 million tons[3] in 1950 to nearly 2.0 million tons in 1960, while Thailand's exports dropped from 1.6 million tons to about 1.2 million tons over the same period. However, between 1960 and 1966, Burma's rice exports declined to 1.4 million tons,[4] while Thailand's exports increased to nearly 2.0 million. Historically, the other rice exporters of Southeast Asia have been Cambodia and South Vietnam.

In the other parts of Asia, Taiwan has been the only other important exporter. Most of Taiwan's exports have gone to Japan.

The major importing regions have been Other East Asia and the Far East and Oceania, followed by South Asia, Japan, Africa, and West Asia, and Eastern Europe and the USSR.

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[2] This section draws heavily on the work of Virach Arromdee, *Economics of Rice Trade Among Countries of Southeast Asia,* Doctoral Thesis, University of Minnesota, July 1968.

[3] All rice quantities refer to metric tones.

[4] *Note*: This figure was revised to 1.1 million tones in Dr. Arromdee's paper, "Rice: The Historical Record." See p. 74 of this volume.

TABLE 1. World Production of Milled Rice by Region, 1950–1966.

Year	United States	Japan	Other Developed Countries[a]	Eastern Europe and USSR	Communist Asia	Latin America	Africa and Western Asia	South Asia[b]	Mainland Southeast Asia[c]	Other East Asia[d]	Far East and Oceania[e]	Total
					(1,000 Metric Tons)							
1950	1,159	8,783	823	214	41,180	3,220	2,817	31,008	11,895	5,837	6,459	113,395
1951	1,376	8,228	947	227	45,223	3,255	2,300	31,111	12,694	5,396	6,603	117,360
1952	1,438	9,030	1,085	233	50,908	3,204	2,379	33,311	12,220	5,273	6,934	126,065
1953	1,577	7,498	1,125	271	53,021	3,410	2,584	39,670	13,566	6,331	7,690	136,743
1954	1,916	8,293	1,073	275	52,816	3,649	3,121	35,844	11,891	6,466	8,184	133,528
1955	1,669	11,270	1,126	256	58,556	3,919	2,977	36,830	13,500	6,538	7,857	144,498
1956	1,476	9,918	971	294	62,212	3,797	3,273	40,109	15,195	6,221	7,964	151,430
1957	1,282	10,432	986	265	65,181	4,204	3,622	35,882	12,267	6,738	8,056	148,915
1958	1,336	10,913	1,063	244	67,912	4,175	3,251	40,891	15,121	7,258	8,404	160,568
1959	1,601	11,376	1,124	235	61,275	4,387	3,515	42,130	15,896	7,249	8,673	157,461
1960	1,629	11,700	987	210	58,657	5,039	3,724	46,206	16,447	7,172	9,253	161,024
1961	1,617	11,301	1,081	229	60,749	5,462	3,350	47,340	16,478	7,817	8,800	164,224
1962	1,971	11,838	1,054	240	61,103	5,709	4,298	42,880	17,564	7,493	9,399	163,549
1963	2,097	11,659	991	336	59,332	5,670	4,600	49,722	19,143	8,151	8,488	170,189
1964	2,184	11,451	1,068	376	64,169	6,221	4,465	51,929	18,464	8,569	8,905	177,801
1965	2,277	11,292	914	420	65,707	7,326	4,425	43,330	17,976	8,258	9,421	171,346
1966	2,539	11,598	1,027	523	61,904	6,090	4,604	42,379	18,772	8,765	9,730	167,931

Source: Economic Research Service, U.S. Department of Agriculture.

[a] Canada, EEC, EFTA, Other Western Europe, Australia, and New Zealand.

[b] Afghanistan, Bhutan, Ceylon, India, Nepal, and Pakistan.

[c] Burma, Cambodia, Laos, South Vietnam, and Thailand.

[d] Hong Kong, South Korea, Macao, Philippines, Portuguese Asia, Ryukyu Islands and Taiwan.

[e] Australian New Guinea, Brunei, New Caledonia, Fiji, Guam, Indonesia, Malaysia, West Irian, Papua, French Polynesia, Sabah, West Samoa, Sarawak and Singapore.

Table 2. World Trade in Milled Rice, by Region, 1950–1966.

Year	United States	Japan	Other Developed Countries[a]	Eastern Europe and USSR	Communist Asia	Latin America	Africa and Western Asia	South Asia[b]	Mainland Southeast Asia[c]	Other East Asia[d]	Far East and Oceania[e]
					(1,000 Metric Tons)						
1950	−453	799	228	86	−122	193	−23	1,069	−3,159	317	1,065
1951	−799	979	−79	59	−228	193	209	1,220	−3,197	416	1,065
1952	−741	1,079	−31	61	−354	63	238	843	−2,890	578	1,337
1953	−624	1,433	138	95	−332	268	284	933	−3,139	224	949
1954	−536	1,247	315	679	−495	119	485	488	−3,302	210	875
1955	−984	760	68	834	−988	118	316	1,278	−3,382	457	795
1956	−888	346	318	615	−567	−17	436	1,699	−4,026	579	1,654
1957	−650	505	190	834	−1,431	179	85	1,243	−3,152	465	1,305
1958	−709	280	582	1,050	−1,867	181	847	1,235	−3,353	281	1,737
1959	−1,034	178	374	927	−1,438	162	447	1,610	−3,656	507	1,815
1960	−860	126	271	286	−517	197	736	1,022	−3,511	634	1,885
1961	−1,183	178	281	554	−582	85	843	1,077	−3,293	407	1,755
1962	−1,212	203	366	519	−628	6	516	1,028	−3,608	700	1,639
1963	−1,323	416	499	627	−798	287	572	1,176	−4,020	678	1,841
1964	−1,505	985	297	532	−815	297	847	1,264	−3,436	767	1,934
1965	−1,444	822	659	447	−1,191	102	644	1,333	−2,127	307	807
1966	−1,856	517	262	542	−1,059	−182	431	905	−1,665	918	807

Source: Economic Research Service, U.S. Department of Agriculture.

[a] Canada, EEC, EFTA, Other Western Europe, Australia, and New Zealand.

[b] Afghanistan, Bhutan, Ceylon, India, Nepal, and Pakistan.

[c] Burma, Cambodia, Laos, South Vietnam, and Thailand.

[d] Hong Kong, South Korea, Macao, Philippines, Portuguese Asia, Ryukyu Islands and Taiwan.

[e] Australian New Guinea, Brunei, New Caledonia, Fiji, Guam, Indonesia, Malaysia, West Irian, Papua, French Polynesia, Sabah, West Samoa, Sarawak, and Singapore.

TABLE 3. Net Trade in Milled Rice for Selected Countries, 1951–1965.

Year	Ceylon	India	Pakistan	Burma	Cambodia	Laos	South Vietnam	Thailand	Korea	Philippines	Indonesia	Taiwan
					(1,000 Metric Tons)							
1951	447	828	−215	−1,269	−56	—	−208	−1,626	90	104	497	−73
1952	506	736	−29	−1,394	−76	—	−172	−1,556	136	63	758	−79
1953	477	410	−48	−1,303	−94	3	−108	−1,389	273	7	361	−52
1954	410	641	−117	−1,754	−226	—	−120	−1,039	—	17	369	−43
1955	370	310	−190	−1,898	−59	23	−145	−1,223	—	58	154	−183
1956	491	394	420	−2,036	−99	25	26	−1,288	79	45	892	−108
1957	523	786	320	−1,926	−207	66	−234	−1,724	178	144	581	−115
1958	494	397	337	−1,646	−254	52	−135	−1,170	5	146	894	−191
1959	592	391	245	−1,861	−167	7	−244	−1,089	3	1	1,042	−153
1960	548	778	275	−1,954	−305	9	−327	−1,185	−22	6	1,119	−34
1961	500	384	139	−1,625	−235	53	−152	−1,660	−8	141	1,029	−75
1962	411	577	85	−1,823	−159	43	−42	−1,345	−42	—	967	−39
1963	403	507	119	−1,625	−209	46	−323	−1,390	117	191	1,019	−134
1964	676	563	−63	−1,378	−725	42	−82	−1,879	−15	301	1,027	−87
1965	689	679	−76	−1,362	−359	41	236	−1,958	−3	559	182	−265

Source: Virach Arromdee, *Economics of Rice Trade Among Countries in Southeast Asia*, Doctoral Thesis, University of Minnesota, July 1968.

Indonesia, India, Ceylon, Japan, and for certain periods, Pakistan, have been the largest importing countries. Ceylon received almost all of its rice imports from Burma and Mainland China—88.5 percent in the 1951-55 period and 84.6 percent in the 1961-65 period. India's major sources of imports have been Burma and the United States, which was a significant supplier in the 1961-65 period. Burma and Thailand have been the major suppliers of Indonesia's rice imports. Japan's rice imports have come mainly from Thailand, Burma, Taiwan, and the United States. Mainland China supplied rice to Japan in the early 1950's and again in 1965.

In spite of the weakness of existing price data for rice in world trade and the lack of complete comparability among countries, it is useful to look at the near-term movement of rice prices (Table 4).

The export price for Thailand is probably the best indicator of world rice prices, particularly for Asia. The wholesale price series for Taiwan is much shorter but seems to follow the same pattern of movement. The pattern of price movement that seems to have predominated is one consisting of a significant decline in prices from the mid-1950's to about 1960, a rise in prices after 1960 and a very sharp increase in 1966 and 1967. This sharp increase carried over into the first half of 1968, with a rather abrupt break in rice prices occurring in the second half of 1968. Between 1960 and 1967 Thailand's export prices rose from $125 per metric ton to $220 per metric ton, an increase of $95. In the last half of 1968 the export price of rice in Thailand was 25 percent below the 1967 average.[5]

It can be safely said that the luster of high rice prices in world trade which prevailed, particularly in 1967 and 1968, is gone. It is not likely that the world will see such high prices for some time to come. The relevant question is, what will be the price outlook for rice in the 1970's? To answer this question we have to look at the production and trade and price behavior of a number of selected countries. The order of examination does not necessarily reflect a ranking of importance.

As we have seen in Table 2, Japan has been a major rice importing country in Asia. Imports were over one million tons annually in the early 1950's, dropped to a low of 120 thousand tons in 1960, and were as high as 985 thousand tons in the early 1960's. Imports dropped sharply in the mid-1960's, however, to the point where Japan attempted to export rice in 1968.

The continued growth in rice production in Japan reflects chiefly the combined effects of continued technological advance in rice production and

[5] "The World Rice Situation," unpublished manuscript, U.S. Department of Agriculture, Economic Research Service, January 1969.

TABLE 4. Selected Price of Milled Rice by Country, 1950–1967.

YEAR	THAILAND		PHILIPPINES	JAPAN	TAIWAN	INDIA	UNITED STATES
	Export Price[a]	Wholesale Price[b]	Wholesale Price[c]	Producer Price[d]	Wholesale Price[e]	Wholesale Price[f]	Wholesale Price[g]
			(U. S. $/Metric Ton)				
1950	—	102	188	118	—	63	218
1951	—	100	228	138	—	64	217
1952	—	107	216	160	—	62	249
1953	—	98	167	198	—	65	201
1954	171	99	156	185	—	68	209
1955	141	96	170	190	—	78	196
1956	138	72	169	185	—	89	193
1957	139	69	190	190	—	96	214
1958	148	80	218	190	—	98	203
1959	133	69	161	192	—	86	182
1960	125	61	164	193	132	94	181
1961	137	71	154	205	145	82	205
1962	135	85	118	226	137	100	206
1963	144	74	134	245	140	131	193
1964	137	68	162	278	145	119	183
1965	137	69	155	303	146	124	181
1966	166	94	165	331	148	146	185
1967	220	—	176	362	153	—	187

Sources: FAO Production Yearbook, Vol. 21, 1967, and *Monthly Bulletin of Agricultural Economics and Statistics*, FAO, Vol. 17, No. 9, September 1968.

[a] White rice, 5-7 percent broken.
[b] White rice, 15 percent broken.
[c] Wholesale price, Manila.
[d] Husked, brown rice.
[e] Polished, 2nd grade.
[f] Coarse rice, Sambalpur, Orissa.
[g] No. 2, Zenith, New Orleans.

very high prices paid to producers. Since 1960 the government purchase price of rice has been determined on the basis of production costs that take into account family labor valued at the comparable wage level of workers in manufacturing industries. Rice prices have gone up sharply with the increase in prices of purchased inputs and wage rates in manufacturing.[6] This rise is shown in Table 4, which shows an increase in the average price received by farmers at $193 per metric ton in 1960 to $362 per metric ton in 1967. The price was nearly $400 per metric ton in 1968. The Japanese government also subsidizes the price of rice paid by consumers.

[6] *Agricultural Policies in 1966: Europe, North America, Japan*, OECD, Paris, 1967, pp. 343-44.

Japan's rice price policy and continued advances in rice yields have already altered Japan's position as a rice importer and will keep Japan out of the rice market for at least several years. Milled rice production increased to 13,118,000 tons in 1967[7] and 14,449,000 tons in 1968.[8] Government stocks of rice were expected to exceed 5 million tons (currently estimated at 5.7 million tons) by November 1969.[9]

Clearly, rice supplies in Japan are such that imports (net basis) will not be required for several years. Future rice consumption in Japan is expected to increase only slightly, corresponding to the slow population growth.[10] Thus, it appears inevitable that Japan will cease to be a net importer of rice in the 1970's and could even become a small net exporter of rice, although this would require a very large subsidy of the prices received by farmers. The political difficulties in achieving fundamental changes in Japan's rice production and price policies would not indicate a rapid change in these trends. All this adds up to a set of forces exerting downward pressure on world rice prices.

Vietnam was traditionally an exporter of rice until the dislocations of war turned the historical situation dramatically around. In 1965 South Vietnam imported 236 thousand tons of rice, and imports grew rapidly through 1968. This rapid rise in imports certainly contributed significantly to the sharp rise in world rice prices during the past few years.

With peace in South Vietnam, this country could very quickly reach self-sufficiency in rice and even again become a net exporter. The new IR8 and IR5 varieties of rice have been introduced, and fertilizer use is also expanding.[11] Without trying to predict the exact course of events in Vietnam in the next five to ten years, it does seem fairly certain that developments there will contribute to a softer world price of rice in the years ahead.

Two other countries—the Philippines and Pakistan—traditionally have been rice importers but recently have achieved self-sufficiency and perhaps even an exportable surplus of rice. The developments in both countries are based on the new package of technology associated with IR8 and IR5. In 1967 Pakistan planted 100,000 acres of new rice varieties. The target for 1968 was 1,000,000 acres. In the same year the Philippines planted an

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[7] "The World Rice Situation," *op. cit.*

[8] *Bangkok Post,* Bangkok, April 10, 1969, p. 13.

[9] Leon G. Mears, "Upsurge in Japan's Food Imports Expected," *Foreign Agriculture,* Vol. VII, No. 5, U.S. Department of Agriculture, February 3, 1969, pp. 7-8; and *Bangkok Post, loc. cit.*

[10] *Agricultural Commodities—Projections for 1965 and 1986,* Vol. I, United Nations, Food and Agriculture Organization, Rome, 1967.

[11] Donald E. MacDonald, "While the War Goes on . . . ," *War on Hunger,* Vol. II, No. 12, October 1968.

estimated 590,000 acres of the new rice varieties.[12] During the 1968-69 crop year the amount of land planted to the new rice varieties exceeded an estimated 5 million hectares or 6 percent of the total riceland in South and Southeast Asia.[13] It appears likely that both of these countries could maintain physical self-sufficiency or have an exportable net surplus in rice for a number of years. Thus, two more moderately important rice importers will be self-sufficient or will export small quantities of rice in the near future. This, too, will put downward pressure on world rice prices.

India and Ceylon are also traditional rice importing countries. In India, great emphasis is being given to increased grain production through the package of inputs related to new varieties of rice, wheat, maize, sorghums, and millets. However, a very large-scale agricultural development program will have to be continued for many years if India is to achieve self-sufficiency in food. With continued emphasis on agricultural development, this could occur in the mid-to-late 1970's.[14] This would mean that India's rice imports could gradually decline, contributing further to a softening of the world demand for rice. The situation in India should be closely watched.

The level of imports in Ceylon has shown only a very slight upward trend since 1951 (Table 3). Even with improvements in domestic production, Ceylon could easily continue to be a major rice importer.

Indonesia is one of the largest rice importers in Asia. With the exception of the last few years, this country has imported about one million tons of rice annually since 1959. Extreme balance of payments problems in the past two years have forced a sharp curtailment of rice imports. The need for large rice imports will continue for some time, however, and improvement in Indonesia's financial picture may allow for a resurgence of rice imports from the recent low levels.

There are two aspects to this recovery that have implications for rice trade in Southeast Asia. First, Indonesia will receive part of its foreign aid in the form of rice. The United States, for example, has supplied between 200,000 and 250,000 tons of rice a year to Indonesia during the past two

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[12] Ralph W. Cumming, "Technological Change in Agriculture," *Development and Change in Traditional Agriculture: Focus on South Asia,* Michigan State University, Asian Studies Center, November 1968.

[13] Randolph Barker, "Economic Aspects of High-Yielding Varieties of Rice with Special Reference to National Price Policies: IRRI Report," paper prepared for the Thirteenth Session of the FAO Study Group on Rice, Manila, March 20-27, 1969. *Note*: For the revision of this paper, see p. 29 of this volume.

[14] Martin E. Abel and Anthony J. Rojko, *World Food Situation: Prospects for World* Grain Production, Consumption, and Trade, FAER No. 35, U.S. Department of Agriculture, Economic Research Service, September 1967; and William E. Hendrix, James J. Naive, and Warren E. Adams, *Accelerating India's Food Grain Production: 1967-68 and 1970-71,* FAER No. 40, U.S. Department of Agriculture, Economic Research Service, March 1968.

years under PL 480. Second, members of the Food Aid Convention of the International Grains Arrangement have expressed interest in providing aid to Indonesia in the form of wheat products.[15] Thus, for the next several years, this country's *commercial* imports of rice are not expected to reach the former high level of one million tons a year.

The principal market for Taiwan's exports has been Japan. Exports from Taiwan may decline in the future in response to lower world rice prices and the disappearance of the Japanese market. Land could move out of rice production into the production of a variety of fruits and vegetables. This would represent a continuation of an existing trend. Attractive markets are developing in Asia and elsewhere for fresh and processed fruits and vegetables from Taiwan.

In Korea, domestic production has not kept pace with increased population and rapid growth in per capita income, and it appears that it will be shifting toward imports of rice on a long-term basis. It is difficult now to clearly discern this new trend because domestic production was affected by drought in both 1967 and 1968; but longer-run developments should be watched carefully as this country may represent one of the few bright spots in the world rice trade situation.

Another factor in the world rice market of some significance is the growing consumption of wheat in the Asian area. Over time wheat has become an important substitute for rice. This is particularly true in Japan, Taiwan, East Pakistan, and parts of India, as well as in other areas of Asia. Increasingly, the price of wheat is affecting the price of rice. In the past, the price of wheat has been significantly below the price of rice and has exhibited less variation over time (Table 5). Future prices of wheat will definitely be lower than the higher prices of 1966 and 1967,[16] as world supplies of wheat will certainly be more abundant. In other words, world wheat prices will continue to be favorable relative to the price of rice, even with significantly lower rice prices. Efforts by wheat exporting countries to promote wheat consumption in Asia will continue. The recent action by some members of the International Grains Arrangement to provide food aid to Indonesia in the form of wheat products is one example.

In addition to the quantitative aspects of the near-term rice situation, there is also the qualitative side. The new high-yielding rice varieties so far are of much lower quality than the domestic varieties. The initial emphasis

[15] Japan can provide rice instead of wheat as its contribution in kind under the International Grains Arrangement.

[16] Martin E. Abel and Anthony S. Rojko, *op. cit.*

TABLE 5. Prices of Wheat in Selected Countries, 1950–1966.

YEAR	EXPORT PRICE			PRODUCER PRICE
	Australia	Canada	United States	Japan
	(U. S. $/Metric Ton)			
1950	78	74	—	77
1951	88	85	—	84
1952	82	82	—	93
1953	64	70	—	95
1954	59	65	—	99
1955	54	63	—	99
1956	57	64	—	97
1957	60	62	—	102
1958	56	63	—	102
1959	55	64	—	102
1960	56	62	—	104
1961	59	66	—	111
1962	60	67	64	116
1963	62	69	66	120
1964	59	67	65	125
1965	64	68	59	130
1966	—	71	67	139

Sources: FAO Production Yearbook, Vol. 21, 1967; and *Monthly Bulletin of Agricultural Economics and Statistics*, FAO, Vol. 17, No. 9, September 1968.

in the rice breeding programs was on yield, with little emphasis given to meeting the tastes and preferences of consumers. Consequently, the new rice varieties are selling at prices significantly below the prices of traditional local varieties—as much as 20 percent lower in a number of Asian markets.[17] This price discount may be even greater in the world market as countries begin to export IR8 and IR5. This can be viewed, however, as a short-run problem. Already, plant breeders are making strong efforts to improve the cooking and eating quality of the new high-yielding varieties.

What do these prospects for world rice production, trade, and prices mean for Southeast Asia, which is, of course, the major rice exporting region of the world? Most of the traditional rice exporting countries have programs for expanding rice production and exports. (Only the United States has had a supply management program to regulate the level of rice output.) All this adds up to lower returns from rice and lower total returns unless other crops that are close substitutes for rice in production are developed.

[17] Randolph Barker, *op. cit.*

The question of returns to producers is not a straightforward one for Southeast Asia. In Thailand and Burma the domestic price of rice is significantly below the world price because of the export tax systems employed by the governments. The difference in prices in Thailand is shown in Table 4. Arromdee[18] states that the export tax on rice in Thailand has averaged about 40 percent of the export price. These countries have open two basic price policy options to deal with lower world rice prices. First, they could reduce the export tax by an amount equal to or greater than the reduction in world rice prices without reducing the prices received by farmers. This assumes that the decline in world prices of rice will not be as great as the historical level of the export tax. Such an approach would maintain production and maintain or increase exports and the share of the export market because of the improvement in competitive prices, but would sharply reduce government revenues from the export tax. This would be a price-fiscal policy approach. Second, these countries could maintain the level of the export taxes and pass on all the reductions in export prices to farmers. This would result in a sharp reduction in producer returns if substitute crops that are reasonably competitive with rice in resource use are not practicable.

There is, then, a fairly clear signal for Southeast Asian rice exporting countries to start thinking about the necessity of resource reallocation within agriculture. This will not be an easy problem because there may not now exist good substitutes for rice, particularly in the irrigated areas or in those rainfed areas that must rely heavily on uncontrolled water application.

The near-term outlook for international rice prices and levels of rice trade that has been presented in this paper is considerably more pessimistic than one that would have been presented a few years ago. For example, Arromdee[19] forecast substantial growth in rice exports from Thailand based on historical trends that prevailed prior to 1965, and argued for a major expansion of rice production in Thailand. However, this analysis was centered on an historical period that did not reflect the dramatic impact on rice production of the new rice varieties, the increased availability of production inputs—particularly fertilizer—and the sharply higher prices that have existed in the past few years.

The main forces leading to much lower rice prices and levels of trade will be most pronounced in the near future and are likely to dominate the rice picture in the first half of the 1970's. The situation for the last half

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18 Virach Arromdee, *op. cit.*, p. 176.

19 *Ibid.*, p. 284.

of the 1970's is less clear. There could very well be a significant recovery in the level of rice trade and world prices.

This speculation about the latter part of the 1970's is based on the assumption that the rather sharp increases in rice production we are now witnessing may not be sustained over the longer pull. The recent dramatic increases in production have been based primarily on the spread of new high-yielding rice varieties combined with increased use of fertilizer, pesticides, herbicides, on land with adequate and controlled supplies of water, and extremely favorable rice prices. As we have already seen, however, rice prices are definitely destined to deteriorate.

But possibly more important is the limited amount of land in Asia with assured and controlled water supplies and the fact that there are no large-scale programs on the horizon for developing water resources in a significant way. The next major constraint to expanding rice yields in Asia may very well be the rate at which water resources can be developed. A number of writers have emphasized the critical nature of this problem in the years ahead.[20] Barker has reported recent evidence of water constraint in the Philippines:

> A seasonal pattern has begun to emerge. A large number of farmers are planting new varieties in the wet as compared with the dry season. The reason for this shift is related to the price differences (between high-yielding and local varieties) previously mentioned. Local varieties will respond to medium input levels of nitrogen during the dry season without lodging. This strategy of choosing separate wet- and dry-season varieties seems particularly appropriate on those farms with uncertain or limited dry-season water resources. Farmers in this situation can ill-afford the risk associated with the high levels of fertilizer input needed to maximize profits for IR8 during the dry season.[21]

Other factors to be considered will be the high rate of population growth in most Asian countries and modest to reasonably rapid rates of increase in per capita incomes during the 1970's. Thus, by the late 1970's we may again see population and income pressure against the rate of growth in grain production in Asia.

These points are mentioned not to start another world food scare—certainly not while we are in the midst of apparent "plenty"—but to direct attention to the fact that here are many resource and technological constraints

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[20] S. C. Hsieh, and V. W. Ruttan, "Environmental, Technological and Institutional Factors in the Growth of Rice Production in the Philippines, Thailand and Taiwan," Stanford Food Research Institute Studies, Vol. VII, No. 3, 1967; and Shigeru Ishikawa, *Economic Development in Asian Perspective* (Tokyo: Kinokuniya Bookstore Co. Ltd., 1967).

[21] Randolph Barker, *op. cit.*

yet to be eased before long-term sustained growth in rice production at reasonably rapid rates can be achieved. The downward movement in rice prices in the next few years should not detract from the longer-run situation. Beyond the need for continued work on the new varieties, two areas of research and action rank high in importance: the prospects for rapid development of water resources in Asia, and the need to find better substitutes for the use of resources currently applied to rice production. Progress in both areas would ensure a greater and more flexible set of agricultural resources.

Barker summarizes the situation well when he says:

> The time has come to examine the requirements of a more flexible agriculture, one which possesses alternatives to food grain production, and which directs research toward achieving this objective. The first and most obvious fact is that the kind of agriculture which can respond to price changes and can continue to absorb the growing labor force cannot be achieved by varietal improvement alone. The new research effort must include three other areas: (1) irrigation, (2) multiple cropping, and (3) marketing.[22]

CORN

Southeast Asia is not a major corn producing region. Corn, however, is an important domestic crop in Indonesia and the Philippines, and is a principal export crop for Thailand (Tables 6 and 7). Production has been increasing in all three countries with the major increase taking place in Thailand, which produced from 62,000 tons in 1954 to 1,250,000 tons in 1966. The reasons for this rapid expansion in corn production in Thailand are well known—the introduction of new varieties, the suitable internal transport network consisting of water and road facilities, and the growth of markets in Japan, Taiwan, and other Asian countries.

The markets for corn from Southeast Asia are Japan, Other East Asia, and the Far East and Oceania. Exports to Japan went from 6 tons in 1951 to nearly 600,000 tons in 1965, accounting for 60 percent of total exports from the region.

The high rate of economic growth and the expanded demand for livestock products in several Asian countries has sharply increased the demand for corn and other feed grains. This is especially true for Japan; it is also true for many other Asian countries. Prospects are good that there will be further growth in feed-grain trade in Asia, and Southeast Asia can certainly share in this growth.

[22] *Ibid.*

TABLE 6. Production of Maize in Selected Asian Countries, 1954-1956.

Year	Burma	Cambodia	Indonesia	Laos	Philippines	Thailand	South Vietnam
			(1,000 Metric Tons)				
1954	36	100	2,720	—	770	62	30
1955	38	104	1,971	—	907	68	27
1956	40	121	1,965	—	895	115	31
1957	40	133	1,860	—	852	137	30
1958	44	126	2,634	—	1,016	186	29
1959	44	157	2,092	—	1,165	317	26
1960	44	174	2,460	—	1,210	544	27
1961	45	152	2,283	—	1,266	598	32
1962	66	183	3,243	18	1,273	665	38
1963	73	204	2,358	15	1,293	858	37
1964	54	139	3,769	19	1,313	935	46
1965	48	136	2,283	23	1,380	1,021	44
1966	52	150	3,220	20	1,435	1,250	35
1967	56	155	2,960	—	1,483	950	30

Sources: The Far East and Oceania Agricultural Data Book, ERS-Foreign 189 and 219, Economic Research Service, U. S. Department of Agriculture, May 1967 and July 1968; and *FAO Production Yearbook*, Vol. 21, 1967.

Feed-grain trade will see a rapid growth, although at relatively low prices. The excess grain production capacity that now exists in the world will likely continue and even grow in the 1970's. Technological advances and investments in grain production in both the developed as well as the developing countries will outpace the fairly rapid growth in demand that is projected.[23] Thus, Southeast Asia could look forward to expanded levels of corn exports in the 1970's if export prices are competitive with those offered by the major exporters, particularly the United States. If we were to guess at a planning price, it would be one that was equivalent to a wholesale U.S. price (Chicago) of $45-50 a metric ton (Table 8). This means expansion of corn production in Southeast Asia at a relatively low cost.

The growth of corn consumption, particularly as a feed grain, within Southeast Asia should be looked at very closely. Consumption of livestock products will increase with growth in per capita incomes and population. This will mean a greater demand for feed grains within the region. The

[23] Martin E. Abel and Anthony S. Rojko, *op. cit.*

TABLE 7. Exports of Corn from Southeast Asia, by Area[a] of Destination, 1951–1966.

Year	Japan	Other Developed Countries	Eastern Europe and USSR	Communist Asia	Africa	West Asia	South Asia	Other East Asia	Far East and Oceania	Total
				(1,000 Metric Tons)						
1951	6	36	—	—	—	—	—	4	—	46
1952	—	52	—	—	—	—	—	—	18	70
1953	16	21	—	—	—	—	16	4	8	65
1954	29	38	—	—	—	—	4	2	9	82
1955	70	33	—	—	—	—	—	35	20	158
1956	114	25	—	—	—	3	1	19	31	193
1957	98	13	—	19	—	—	27	3	36	196
1958	124	56	—	—	—	—	—	8	69	257
1959	142	31	—	—	—	—	—	15	85	273
1960	415	—	—	—	—	—	—	43	107	565
1961	479	—	—	11	—	—	2	86	147	725
1962	243	—	5	—	14	—	3	120	215	600
1963	435	1	—	—	—	—	3	127	224	790
1964	746	49	—	—	55	29	4	100	75	1058
1965	591	1	16	10	13	2	1	170	181	985

Sources: *World Trade in Selected Agricultural Commodities, 1951–65*, Vol. II: *Food and Feed Grains*, FAER, No. 45, Economic Research Service, U.S. Department of Agriculture, June 1968.

[a] See footnotes to Table 1 for description of countries contained in each area.

TABLE 8. Wholesale Price of Corn[a] in the United States, 1950–1966.

Year	Dollars per Metric Ton
1950	68
1951	72
1952	63
1953	60
1954	58
1955	49
1956	52
1957	48
1958	48
1959	46
1960	43
1961	44
1962	47
1963	47
1964	50
1965	50
1966	54

Source: FAO Production Yearbook, Vol. 21, 1967.

[a] No. 3 yellow, wholesale price, Chicago.

pattern of development of livestock consumption and production in countries such as Japan, Taiwan, and Korea could generally be applicable to some of the countries of Southeast Asia.

Expanded production of corn and other feedstuffs in Southeast Asia could provide a profitable alternative to rice production in the years ahead. This would be particularly true in those areas and those periods of the year when assured water supplies are not available for intensive rice production. Corn and other feedstuffs, then, represent one adjustment mechanism for shifting some resources out of rice production as rice prices fall. To achieve a significant shift in resource use of this type, attention will have to be paid to several important aspects of production and marketing. First, corn exports from Southeast Asia will have to be price competitive with corn and other feed grains from other areas. Also, appropriate storage and marketing policies will have to be followed to assure a steady source of supply to importers. Second, domestic livestock production that can effectively utilize larger domestic feed-grain supplies will have to be further developed. Careful attention will have to be paid to both the technological and economic aspects of expanded livestock production in Southeast Asia.

There will be a fairly high degree of uncertainty and instability in the world grain markets during the 1970's. This will result from a combination of technological developments and agricultural production and trade policies and programs in both exporting and importing countries that will not be consistent with expansion of world grain trade and stable prices.

The formulation of appropriate technological and agricultural resource development for Southeast Asia must consider, among other things, the production and trade policies of other countries. The high-cost rice surplus in Japan and the drive toward self-sufficiency in grain in the European Economic Community, for example, are not happy prospects for the grain-exporting countries of Southeast Asia or other parts of the world. Yet, these are very real phenomena that cannot be ignored. The same is true for the temporary grain surpluses in some developing countries that are experiencing success with programs for achieving food self-sufficiency[24] Agricultural policies will have to formulate ways to cope with these developments. There are strong forces at work that call for a diversification of agricultural production in Southeast Asia and elsewhere in order to achieve an output mix that is more consistent than is the present one with the future growth in demand for agricultural products. The diversion of resources now devoted to rice production to the production of feed grains and livestock products represents a needed type of diversification.

In spite of the near-term prospects for surpluses and lower prices for rice and other grains, we should not forget the longer-run impact on consumption of continued rapid rates of growth of population and improvements in per capita incomes. There is not now sufficient evidence to assure a future rate of development of agricultural technologies, and investments in agricultural development, generally, that will match expected growth in population and help to generate desired rates of growth of per capita incomes.

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[24] These countries are discovering that as food grains such as rice move from traditional status of a subsistence crop to that of a "cash" crop, all the problems associated with cash crops come into play. It is also somewhat ironic that some of these countries are beginning to engage in practices that they have condemned developed grain exporters for following—namely, dumping surpluses onto world markets and causing serious world price problems.

DISCUSSION I

SEIJI NAYA

ALTHOUGH agricultural development in the growth strategy of developing Asian countries in the past has received relatively little attention and priority, more and more emphasis is being shifted to it. With this recent shift, coupled with technological breakthroughs in the production of food grains, especially rice, agriculture has shown real potential of developing into a viable and modernized sector.

Accompanying this potential, however, are strain and uncertainty in the developing Asian countries where rice has long been a major item of intraregional trade. Two writers, Professors Arromdee and Abel, have analyzed the production and trade problems of this important Asian crop.

Whereas the Arromdee paper is essentially an historical, factual account of the years up to mid-1960, Dr. Abel's is a more interpretive account of current dramatic changes and future prospects in the production of rice.

Another crop, corn, which differs from rice in demand and trade prospects, is dealt with by Professors Abel and Wagner. Both authors stress the need for strategy changes to achieve agricultural diversification. Wagner warns of the critical need for demand assessments of agricultural products.

Many pertinent points are presented by these writers, but some of their analyses are not as clear or as fully developed as others and prompt the inquiries raised below.

Arromdee gives a description of world and individual countries' production and trade pattern of rice and their changes over time. Generally, in common with many other food and primary products, rice has been affected by the low elasticity of demand (with respect to both income and price and supply, though export supply and import demand elasticities are shown to be larger. Furthermore, rice trade and production have been influenced by various domestic and trade policy measures, by the concessional and government trade of rice and wheat, and by the conflict in Vietnam which has changed this country from an exporter to an importer.

As shown by Arromdee (and also by Abel), a considerable change in export share has taken place, Southeast Asia losing and Mainland China and the United States gaining. Given this pattern, however, Thailand's performance is somewhat impressive compared with Burma's steeply declining export volume since the late 1950's. Both countries tax rice production heavily and depress the price received by farmers; but rice production is greatly and directly controlled by the government of Burma, whereas it is relatively free of direct control in Thailand. Further analysis of Burma (and also Taiwan) would have given some penetrating insights and contrasts. One wonders, for example, in what way stepping up centralization in rice production and trade by the Burmese government contributed to the relative and absolute stagnation of its exports.

Dr. Abel appraises the uncertain outlook of rice trade and a probable price decline through the mid-1970's, stressing significant influences that the agricultural policies and production technology of Southeast Asian and other major trading countries will have on production and trade patterns in this period. The technological improvement and diffusion in agriculture currently occurring in food shortage countries certainly appear to be anti-trade biased. This trade-reducing effect seems further enforced by the goal of self-sufficiency. Japan, which differs from other Asian countries in economic makeup, now apparently has an exportable surplus owing to its high productivity and protection of rice (as well as to the changing consumer preference away from rice).

Regarding the reappraisal of current rice tax systems, Abel, concerned with the uncertain and pessimistic outlook of rice trade because of increased output in the rice shortage countries, suggests two options for countries such as Thailand and Burma in dealing with the falling world price of rice: (1) reducing the tax to meet the competition, and (2) shifting the reduced world price back to the farmers by maintaining the export tax.

Thailand's controversial rice tax system contains many dimensions which need to be carefully considered. It is true that the rice tax is regressive since it is paid by a relatively small income group, the rice producers. But the tax accounts for a large share of government revenue—and its expenditure. Since the tax system is still relatively undeveloped, repeal of the rice tax would sharply reduce government revenue and expenditure, necessitating alternative means to raise the revenue. In addition, since the tax lowers the domestic market price of rice, it has the element of subsidizing domestic purchasers of rice. To some extent, the tax has a progressive element because it is a tax on the market rice rather than on production, and hence larger growers of rice with a larger marketable rice would pay more tax than small growers. Finally, there is a resource allocation effect of this tax, that is, it shifts resources away from rice toward other crops such as maize. Therefore, any reappraisal or change of the rice tax system ought to incorporate all of these effects and their relative strengths.

As Abel (and also Wagner) argues, Southeast Asian rice exporting countries should start to consider the necessity of resource reallocation within agriculture. Actually in the case of Thailand such change has already been taking place, and its overall export performance has been quite impressive compared with that of many other countries in the region.[1] The relative decline in its rice export has been more than compensated by the expansion of newer export items such as maize, kenaf and cassava, reflecting successful diversification of its primary commodity exports.

As mentioned above, in assessing the future outlook of rice, Abel does emphasize the importance of domestic and trade policies affecting production and trade. But his analysis leaves a few questions regarding the rice deficit countries unanswered. For example, how is the goal of self-sufficiency pursued in different countries? Given the "acceptable" desire to be self-sufficient, in what way should imports be restricted or allowed, and what are the possible present and future costs of self-sufficiency? There is also the question of a balance between the high price needed as an incentive to the farmers and the expected further fall in world price of rice. The strategy pursued by some of these countries may require as much modification as that for exporting countries such as Thailand. Further clarification and research of these aspects are likely to add to a better understanding of the trade prospect and problems as well as possible regional cooperation in rice and other products.

Papers by Drs. Wagner and Abel deal with corn as a profitable alternative to rice. Although Abel's is a briefer account, both agree that agricultural diversification is necessary to achieve an output mix consistent with the present and future growth of demand for agricultural products. There is considerable merit in their suggestion. For one, corn, unlike rice, is income elastic, and the prospect of further expansion of demand associated with increases in consumption of livestock products, income, and population seem bright, not only in Japan, but in other countries as well. So far, the only successful exporter of this product in the region has been Thailand.

According to Wagner, three factors have contributed to Thailand's success: a rice-tax policy, factor endowment, and the country's political and monetary stability. But interaction of these factors, as well as conditions that exist in other countries, also need to be considered in the analysis if we are to obtain a better grasp of the different patterns that exist.

A point that merits consideration and clarification is Wagner's warning of overemphasis of the supply-oriented strategy of less developed countries. The difficulty in less developed countries is said to stem mainly from their supply-oriented industrialization which neglects demand. This supply emphasis is said to be also applicable to the earlier food crisis and the cur-

[1] See, for example, Seiji Naya, "Variations in Export Growth Among Developing Asian Countries," *Economic Record,* December 1968, pp. 480-497.

rent progress in grain production. Both are said to have resulted primarily from inattention to demand. Wagner goes on to warn that however important the agricultural revolution is in eliminating basic food deficits, continued neglect of demand considerations would invite once again disillusionment with agriculture's role in development.

One can easily concur with Wagner's criticism that the industrialization strategy of less developed countries has generally been based on the notion that the main factor inhibiting growth is on the supply side, e.g., the lack of savings and of foreign exchange. Under this strategy, heavy import substitution programs aimed at establishing new industries, many of which are capital-intensive, were generally pushed to increase saving potential, attain larger investment, and conserve foreign exchange.

The experiences of those countries that have followed this strategy have not been very encouraging. The problem of supply deficiency remained and often grew worse; high costs and high protection tended to persist; exports lagged. In recent years, however, as a result of the attention given to the self-limiting, if not self-defeating effect of heavy import-substitution-oriented industrialization, countries have been moving away from this strategy.

In fact, the recent emphasis on agricultural development pursued by Asian countries is partly a reflection of such a shift. But whether or not the agricultural revolution is the duplicate of the earlier mentioned strategy that Wagner cautions against is debatable. There are major factors that tend to differentiate the current agricultural development effort from deliberate industrialization. In the latter, technical research and development and measures to increase efficiency suited to local conditions have not generally accompanied new and large-scale import substitution industries. In the former, current progress in production of high-yielding varieties of rice, is based on scientific breakthroughs and an intensive "package" approach adapted to local conditions. That is to say the new emphasis on agriculture is based on more sound and technical grounds than that of large-scale industrialization programs. The importance of the "package" program is that greater recognition is given to the improvement of neglected areas of physical and financial inputs, rural irrigation and transport systems, agricultural extention, and marketing.

Nevertheless, Wagner's concern for neglect of demand analysis is not unfounded. Sustained progress in the production of individual crops would require an expanding home and foreign market. In the formulation of planning policies and investment decisions, it becomes increasingly necessary to assess current and future demand patterns. Yet, as Wagner warns, relatively little effort has been made in the research of such assessments.

DISCUSSION II

KENZO HEMMI

As the three papers rely heavily on the records since World War II, it may be useful to approach the trade picture in grains from the vantage point of the prewar periods.

Although Western economic influence affected the island and peninsula of Southeast Asia as early as the 16th century, continental Southeast Asia was not reached until the mid-19th century with the opening of the Suez Canal. Tea, sugar, palm, oil, rubber, and tin, produced mainly in the island and peninsula (a rice importing region), became the primary commodities shipped to the Western market.

For some years after the opening of the Suez Canal, the price of rice in Burma increased by 60 to 70 percent. This price increase was the main cause of the development of the rice economy in lower Burma, in Thailand, and French Indochina. Although the market in the Western world was very limited, a fairly large volume of rice produced in mainland Southeast Asia was exported to the island and peninsula and to industrialized parts of Asia such as Singapore, Hong Kong, and Japan.

Briefly, the rice trade picture before World War II was one of regional economic integration, quite similar to that of the wheat economy around the Atlantic Basin before World War I.

After World War II, the export earnings of the island and peninsula were not sufficient to finance rapid economic development. The countries of the region faced serious balance of payments difficulties, especially after the Korean War, and were compelled to adopt a policy of reducing food imports in order to save on foreign exchange. A similar situation existed in India and Pakistan. The food self-sufficiency policy of these two countries was generally quite successful and, had it not been for the disastrous harvests of 1965 and 1966 in India, rice supplies would have been more abundant much earlier.

In this connection, it should be pointed out that the new varieties of rice are not ecologically suitable to the traditional rice exporting areas of Southeast Asia, where rice is mainly produced on deltas that are not amenable to water control. Hence, success with the new varieties is balanced in favor of those countries which can adopt the new technology.

In conclusion, the postwar picture is one of regional economic disintegration, a situation similar to that existing for wheat in Western Europe after 1930, when balance of payments problems forced this region to launch an agricultural protection program!

In Dr. Arromdee's paper, it is stated that Japan's rice imports showed wide fluctuations between 1951 and 1965: 799,000 tons in 1951, 1,433,000 tons in 1954, 126,000 tons in 1961, and about 1 million tons in 1965. Japan now has an annual surplus of 1.5 million tons. These wide fluctuations reflect swings in Japan's policy of alternating between the promotion of rice production and the encouragement of other crops and animal products. Japan's policy before 1954 was one of increasing rice production. Then, around 1960, the government adopted the policy of non-rice production, favoring other crops. In 1965 the policy was back to increasing rice production. Today, rice producers are once again being induced to switch to other crops. There is a lag of about five years from the time a new agricultural policy is launched to the year after which the results of the policy are felt.

Dr. Wagner shows that corn is one of the few grains that is not facing trade barriers in some developed countries. Although Professor Abel has written a good summary of recent events in the rice economy, and shows detailed knowledge of the situation in Japan, it is surprising that he does not mention the BIMAS program in Indonesia. I believe that consideration given to this program is extremely important to the future of the world rice economy.

DISCUSSION III

WILLIAM C. MERRILL

DR. Arromdee's summary of production and trade patterns among the major rice trading regions of the world contains the statement: "The two major countries causing instability in the world rice trade are the United States and Mainland China." Since "instability" is usually considered to be undesirable, this particular statement should be fairly well supported. However, the explanation given is that "the United States has a high capacity to export because of low domestic consumption, and the large volume of storage built up. It can therefore play the role of residual supplier to meet the gap in the world rice storage."

If "large amounts of storage capacity" indeed provide a country with a high capacity to export, then the way to increase rice exports is certainly obvious. I do not believe, however, that the cause-effect elements have been properly ordered. Equally difficult for me to understand is how a "residual supplier" causes instability. Indeed I would expect a "residual supplier" to add stability to the market. As the author illustrates in Fig. 1, rice exports from the United States increased sharply between 1959 and 1965, and variations around the trend were fairly small.

If becoming a large exporter causes instability, then why not add that Thailand may have caused instability in the world rice trade because its export tax policy on rice allowed the world price of rice to increase to the point where U.S. farmers found it profitable to begin producing rice in a big way? Again, the cause-effect relationship is questionable.

It would seem to me that if the United States *has* contributed to instability in world rice trade it has done so because of the Vietnam war, a condition which has at first tended to increase rice prices and investments in IRRI and programs to promote high-yielding varieties, but which resulted in the trend of decreased rice prices. In short, I am objecting to the use of the word "instability" and question whether the author has really said what he meant to say.

My overall impression from Dr. Wagner's paper is that it is somewhat easier to explain the patterns for corn trade than those for rice.

Dr. Wagner expresses concern over the fact that people have given so much attention to increasing the supply of goods and so little to analyzing the extent of the effective demand for them. I suspect that this expression of concern may be the result of one of two things:

(1) The lack of adequate, publicly available studies on effective demand for food grains or

(2) the lack of concern and the tendency on the part of some to ignore the information that is available.

I recall when Dr. Randolph Barker at IRRI in early 1967 explained to several members of the Rice and Corn Production Coordinating Council what could happen to world rice prices as the high-yielding varieties were introduced. He argued at the time that it would be a mistake for the Philippine government to attempt to become a large rice exporter on the assumption that world prices would remain as high as they were in 1966. It soon became clear that such statements were classified by many as a "negative approach," whereas the "positive approach" was to turn the Philippines into the largest possible rice exporter in the shortest possible time. Such a goal did not permit many resources to be devoted to determining how markets for other products would be affected if other countries did the same, or to studying multiple crop programs and the promotion of other crops. Fortunately, this situation is now beginning to change.

Closely related to this point are the questions: (1) What price self-sufficiency? and (2) What price exports?

Although I foresee that the Philippines has the capability of doubling and possibly tripling its rice production in the next ten years or so, I doubt this will actually happen: I do not believe the Filipinos are willing to pay the "price" that would be needed to bring this about. Indeed, it seems to me that it would be a mistake for them to try to double or triple output in such a short time. If their good sense does not prevent them from doing it the world market probably will.

It is tempting to view self-sufficiency as a "good thing" and "exports" as something better. However, at the end of 1966, when the Rice and Corn Administration was arguing that the Philippines had become not only self-sufficient in the production of rice but had rice to export, Leon Mears[1] was arguing that so-called self-sufficiency was fictitious—that the government had created self-sufficiency by increasing the price of rice relative to corn. Mears was not questioning the success of the government's rice production program. He was only trying to draw attention to how nebulous the con-

[1] Leon G. Mears was at this time a member of the University of Wisconsin Team at the University of the Philippines Training Program in Development Economics.

cept of self-sufficiency really is. It did not make him a very popular man at the time.

The concept of self-sufficiency should be defined in an economic framework. People frequently use the term with the implicit assumption that existing price levels will continue. There is usually some price level at which a country could obtain self-sufficiency in the production of a particular product, but in many cases that price level may not be politically feasible.

THE TASK OF RICE PRICE STABILIZATION IN THE PHILIPPINES, 1969-1974

MAHAR MANGAHAS

SPECTACULAR increases in rice production brought about by the dissemination of new high-yielding varieties in recent years have now caused some Asian countries to shift their concern from the production-population race to the search for export markets and the tempering of price "volatility."[1] In the Philippines, where the IR5 and IR8 varieties were developed, the policy emphasis has passed from ensuring a minimum per capita consumption of rice to supporting a minimum farm price level. In order for farm prices to be maintained, it seems certain that over the next few years a substantial part of domestic output will have to be diverted to the export market. Otherwise—and assuming the price level is unacceptably low—the government will be compelled to purchase part of the domestic output for indefinite storage.[2]

At the FAO Study Group on Rice in March 1969, the Philippines took the lead in the export expansion movement and made several proposals which briefly were (1) to minimize competition from concessional sales (reference here to certain exports of Japan and the United States) by the adoption of some code of behavior between exporting countries; (2) to establish an international price stabilization mechanism; (3) to establish an international payments arrangement (one that would conserve convertible currencies); (4) to establish an international buffer stock of 10-15 percent of world trade; and (5) to include rice as a commodity in international food aid.[3]

The response to these proposals was mixed. Some exporting countries, benefiting from the status quo, did not feel that an international agreement on rice was urgent; and importing countries naturally desired full gains from an anticipated decline in the world price of rice. The proposals

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1 See Documents from the Thirteenth Session, FAO Study Group on Rice, Manila, March 20-27, 1969.

2 Domestic purchase operations may have little effect on the open market price if government merely withdraws rice at the farmer's end and restores it at the consumer's end, with no net effect on supply, unless there are significant changes in demand due to the income changes of those who benefit from subsidy operations.

3 See "International Action on Rice: A Philippine Proposal," Document CCP: R1 69/CRS/10, Thirteenth Session, FAO Study Group on Rice, Manila, March 20-27, 1969. The Philippine delegation also expressed a willingness to support these proposals on a regional or subregional basis.

appeared to benefit mainly a new class of countries—the emerging exporters, including the Philippines.

It is intended that this paper will forecast the magnitude of the price problem brought about by the emergence of this new class of exporters. Discussion will first outline the traditional analysis of government forecasts, then follow with an alternative procedure, which should provide not only a more accurate measure of the task, but should suggest that the task may be larger than it would appear.

TRADITIONAL ANALYSIS

A first indication of the possible magnitude of these operations is given by government forecasts of output and of "requirements" from 1968-69 to 1974-75, in Table 1 and Fig. 1. These forecasts are based on the assumed continued diffusion of high-yield rice. They are not intended to project actual attainment but rather to determine the implications for price support policy.

The forecast for output Q is sustained rapid growth throughout the period at the rate of about 11 percent per year (roughly the same as the actual growth in output of crop year 1968 over crop year 1967). This pat-

TABLE 1. Government Forecasts of Rice Output, Requirements, Stocks, and Exportable Surpluses, 1968-69 to 1974-75, Philippines.

Crop Year	Output Q	Relative Change in Output (%) $\Delta Q/Q$	Beginning Stock K_1	Requirement R	$Q + K_1 - R = K_2$	Buffer & Ending Stock $.1Q = B$	Exportable Surplus $K_2 - B = X$
			(1000 metric tons)				
1968-69	3139[a]	11	575	3199	516	314	202
1969-70	3516[a]	11	314	3308	522	351	170
1970-71	3765	10	351	3461	655	376	279
1971-72	4060	10	376	3589	847	406	441
1972-73	4363	10	406	3722	1048	436	611
1973-74	4675	10	436	3859	1251	467	784
1974-75	4996	10	467	4392	1461	500	961

Source: Philippine Technical Working Group, 13th Session, FAO Study Group on Rice, Manila, March 20-27, 1969; *International Action on Rice*, Vol. II: *Background Papers, Charts and Tables*, pp. 55-56. A weight conversion ratio of .65 was applied to original data, which were in terms of rough rice.

[a] Lower bounds of forecast level.

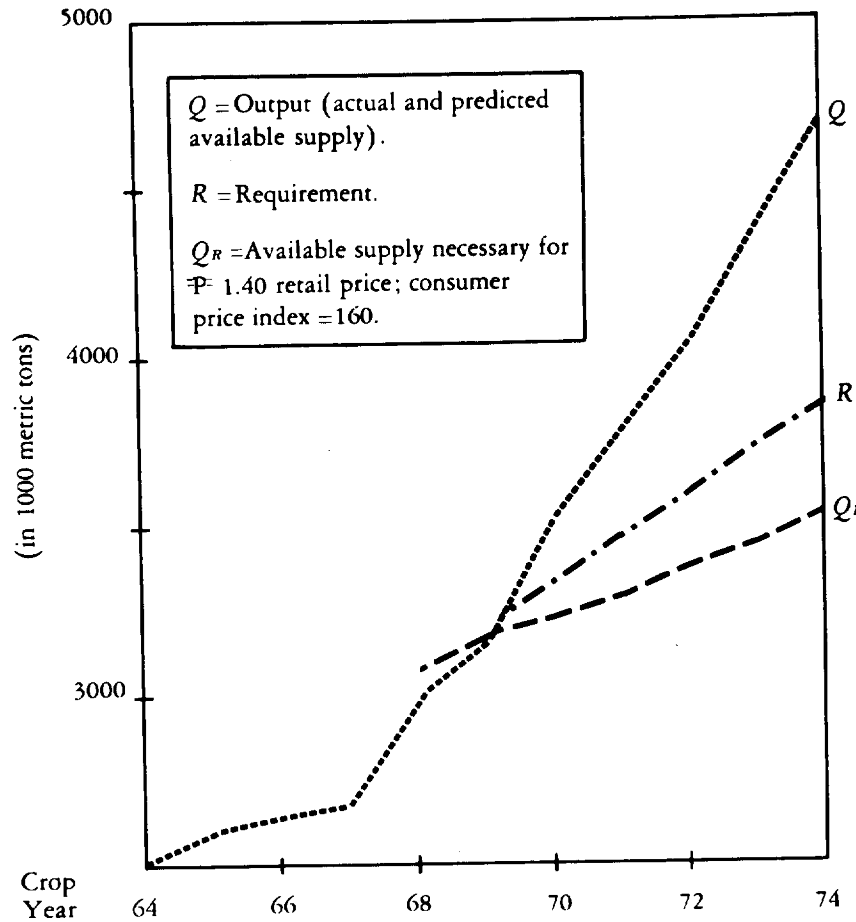

FIG. 1. Philippine Rice Output Versus Two Alternative Requirements Estimates: Projections for 1969-1974.

tern is based mainly on a projected increase in average irrigated yields of 10 cavans annually from a base of 70 cavans per hectare.[4] The projected increase in aggregate hectarage is not large.

Requirements R on the other hand are projected to grow from 3.5 to 4 percent annually. The projection is based on the forecast that the rice-eating population will grow nearly 3.5 percent yearly; on per capita consumption

[4] One cavan equals 44 kilograms rough rice.

levels for a base year (1959); and on allowances for waste, feed, and seed (estimates are proportional to output, hectarage, or human consumption). The food component represents at least 90 percent of the estimated requirement.

Rice import and export policy since 1959 has been based on estimated deviations in total supply ($Q + K_1$) from a so-called "requirement" or "self-sufficiency level" (human consumption based on 1959 per capita levels and allowances) plus a desired buffer stock B.[5] The implied exportable surplus[6] X is computed in Table 1 as growing from 202,000 metric tons in 1968-69 to nearly a million metric tons in 1974-75.

It may already be concluded from these forecasts that the maintenance of a domestic support price of about \$150 per metric ton[7] of milled rice will impose a tremendous burden on government unless substantial export markets are found.

AN ALTERNATIVE

An important deficiency in the use of the current method for price stabilization guidelines is the dearth of information on the effects of changes in output, local demand, and imports-exports on the price level. This may be remedied through a model[8] which has been reasonably successful in predicting the retail price level (Macan second-class variety, Manila):

$$(1)\quad M_t = a_o + a_1P_t + a_2t + u_{1t} \qquad \text{Demand}$$
$$(2)\quad M_t = b_o + b_1P_t + b_2I_t + b_3Q_t + u_{2t} \qquad \text{Supply}$$

where M_t is the quantity marketed during the calendar year, P_t is the retail price level (calendar year average), t is time in years (proxy for popula-

[5] This method of course subjects the residual to much greater estimation error than either supply or requirements. This is discussed extensively, and an improvement is suggested, in, "Efficient Forecasting and Philippine Rice Import/Export Policy," University of the Philippines, School of Economics Discussion Paper 69-20, December 4, 1969.

[6] Exports are subject to government licensing.

[7] In the discussion following it will be convenient to use ₱1.40 per ganta retail as the support price. Using the conversion: one ganta = 56/23.5 kilograms, then the price per metric ton is ₱586, or \$150 at the exchange rate ₱3.9 = \$1.

[8] This model was introduced in M. Mangahas, "The Effect of Importation on the Price of Rice," *The Philippine Review of Business and Economics,* December 1968. The rationale for separate coefficients for I_t and Q_t is contained in a theory of retailer behavior involving anticipation of government competition. The estimate of the reduced equation for 1956-1967 data (previous to small revisions for 1967) is $P_t = 281.5 - 1.536I_t - 9.735\,Q_t + 7.727_t$ ($R^2 = .81$). The new estimate therefore continues to support the conclusions drawn from the previous estimate, in particular that importation was a relatively ineffective means of price control.

Clearly, I_t and Q_t should represent levels available to the market, and this may be presumed for 1956-57 level of imports and outputs. However, large additions to RCA stocks, coming mainly from domestic procurements, were made over crop year 1967-68. The figure for Q for this year (Table 2) is an estimate of the *net available domestic supply.*

tion and real income growth), I_t is total imports (calendar year) and Q_t is total domestic output (the July-June crop year), and the u's are stochastic error terms. A type of six-month lag is thus assumed between output and the retail price.

The variable M is not exactly intended to indicate the marketable surplus out of Q; rather it is the total quantity sold on the market in the calendar year. These sales are both out of domestic stocks and out of imported stocks. But this point is really quite academic, since data on M—or for that matter on the marketable surplus—are not regularly collected.[9] M is introduced into the model to establish the rationale for forecasting P, that is, that a supply-demand framework can be found which is consistent with the estimation and forecasting procedure discussed below.

The variable t is introduced purely for computational efficiency. Because population is almost linear with time and real income is a rather inaccurately measured variable,[10] inclusion of these two factors in any other manner did not seem worth the effort. The most important consideration, after all, is whether it can be verified that a model's forecasts are accurate enough. The forecasting experience with this model is short indeed, but it is at least encouraging.[11]

Model (1) — (2) gives a reduced equation,

$$(3) \quad P_t = \text{const.} + c_1 I_t + c_2 Q_t + c_3 t + v_t$$

which is estimated, using the data for 1956-68 in Table 2, by

$$(4) \quad P_t = 250.4 - \underset{(1.369)}{1.688 I_t} - \underset{(2.516)}{8.254 Q_t} + \underset{(1.633)}{7.013 t}$$

$$R^2 = .794 \quad , \quad DW = 2.131.$$

where P_t is in centavos per ganta (1955 prices), I_t and Q_t are in units of 100,000 metric tons, and $t = 1$ stands for 1956.

Equation (4) implies that (a) given no change in I or Q, the effect of the passage of one year (population and real income growth) is to increase P by about seven real centavos per ganta; and (b) that in order for P to be kept constant over a succeeding year (stabilized) without resorting to

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[9] This data gap is generally true in less developed countries, and inspired Krishna's pioneering attempt to obtain a method for estimating the price elasticity of the marketed surplus if time-series data on the marketed surplus do not exist. Raj Krishna, "A Note on the Elasticity of the Marketable Surplus of a Subsistence Crop," *Indian Journal of Agricultural Economics*, Vol. 17, No. 3, July-September 1962, pp. 79-84.

[10] See for example G. P. Sicat, "On the Accuracy of Philippine National Income Accounts," *The Philippine Review of Business and Economics*, Vol. 1, No. 2, October 1964, pp. 21-39.

[11] Mangahas, *op. cit.*, p. 42.

TABLE 2. Philippine Rice Output, Imports, and Prices, 1956–1968.

Calendar Year	Average Deflated Retail Price of Macan 2nd Class in Manila, for the Calendar Year.[a] (pesos/ganta)	Net Milled Rice Imports of the Philippines, for the Calendar Year.[b] (1000 metric tons)	Philippine Palay Output in Milled Rice Equivalent, for the Crop Year.[c] (1000 metric tons)	Crop Year
1956	.8107	42	2125	1955-56
1957	.9406	78	2172	1956-57
1958	.9522	231	2079	1957-58
1959	.7533	6	2392	1958-59
1960	.8633	−2	2427	1959-60
1961	.8978	186	2405	1960-61
1962	.8251	0	2538	1961-62
1963	.8927	256	2575	1962-63
1964	.9676	299	2494	1963-64
1965	1.0020	560	2591	1964-65
1966	1.1314	108	2644	1965-66
1967	1.0855	234	2657	1966-67
1968	1.0211	−45	2960	1967-68

[a] Original monthly averages are (unpublished) Central Bank Data, available from Professor Leon Mears' collection of data, identified as Table 19. These averages were then deflated by the Central Bank Consumer Price Index for Manila, adjusted to exclude rice; deflator available from Mears' data, Table 18. Then the deflated data were averaged; weighted by the 1956 Central Luzon harvest distribution, found in D.A. Maulit, "Palay Harvest and the Supply of Rice," *The Philippine Statistician*, Vol. 6, No. 2, June, 1957. July-December 1968 data are from the Bureau of Agricultural Economics.

[b] Data for 1956-63 as revised and adopted by an Inter-Agency Committee of the government on March 31, 1965. Data for 1964-66 from the Bureau of Census and Statistics, *Foreign Trade Statistics of the Philippines, 1964-1965-1966*. Available from Mears' data, Table 5. Data for 1967 and 1968 are from the Rice and Corn Administration.

[c] From the Department of Agriculture and Natural Resources' Crop and Livestock Surveys (only 1955-56 to 1958-59 are published). Available from Mears' data, Table 1, except for 1966-67 and 1967-68.

imports ($I = O$), the necessary increase of Q over the preceding crop year is estimated at

$$\triangle Q_R = \frac{7.013}{8.254} \text{ x } 100{,}000 = 85{,}000 \text{ metric tons.}$$

If this increase is actually met, then it may be presumed that the nation has preserved the "degree of self-sufficiency" that obtained in the preceding period. For if, at a given price level, the per capita quantity demanded increases because of population and real income growth, and if the price level then remains unchanged, then per capita consumption of rice cannot have decreased.

Note that the estimated necessary increase in Q is much less than the increase in the estimated annual "requirement" (Table 1); R is 110,000 metric tons more in 1969-70 than 1968-69, and larger increases are predicted for years farther off. I would view this as an indication of error in the estimate of "requirement" rather than in the estimated $\triangle Q_R$. Roughly speaking, the "requirement" estimate is the food consumption estimate, which in turn can be roughly represented by the product raN, where r is the proportion of the population which is rice-eating, N is the total population, and a is a per capita consumption level. r and a are benchmarks from surveys in 1958 and 1959, respectively. N is a "medium" population projection. Therefore raN is not, conceptually, that level of supply which if attained will keep the price of rice stable.[12]

As the Rice and Corn Administration is required by law to sell rice at a current price per ganta within the range (₱1.00, ₱1.40),[13] let us then assume that the stabilization objective is to maintain the market retail price at ₱1.40[14] in current terms, and that the relevant general price index level is 160 (approximately 157 in 1968). Then for a real price level $P = (1.40\text{-}1.60)$, and $I = O$, equation (4) implies that the required levels of output Q_R over certain years of interest are:

	Crop Year	Q_R in 10^5 Metric Tons
$t = 13$	1967-68	30.5
$t = 14$	1968-69	31.4
$t = 15$	1969-70	32.2
$t = 16$	1970-71	33.0
$t = 17$	1971-72	33.8
$t = 18$	1972-73	34.7
$t = 19$	1973-74	35.6

[12] And if it were, it might still have to cope with substantial estimation error, since the relative error of estimate of the product is the sum of the relative errors of estimate of the separate three factors.

[13] The actual RCA retail price for ordinary varieties at present is P 1.40.

[14] Let g = the number of gantas in a 56 kilogram sack of milled rice, m = the number of 56 kilogram sacks of rice obtainable from a 44 kilogram cavan of rough rice, and s = the excess of marketing and processing costs (profit included) over the value of milling by products. Let P_f be the farm price per 44 kilogram cavan and P_r be the retail price, per ganta. Then $P_f = gm(P_r) - s$. Since the range of g is approximately (23.5, 24) and that of M is (.52, .57), then the range of (gm) is (12.2, 13.7). For $P_r = 1.40$, P_f has the range $(17.1 - s, 19.2 - s)$. This range is consistent with the RCA minimum purchase price for rough rice, namely ₱16 per 46 kilogram sack.

These levels of Q_R are indicated in Fig. 1, and are seen to be much less than R, the differences being of the order of 100,000 metric tons in earlier years and rising to about 300,000 metric tons in later years. (In the case of 1968, it is seen that Q_R is greater than the available supply. The average price level for that calendar year was ₱1.61.) Thus the empirical analysis indicates a much greater farm support problem than the analysis currently in use. Conversely, it indicates a much easier task of defending consumer prices.[15]

If the output forecasts are not exceedingly overoptimistic, the Philippine government will be forced to shoulder a heavy burden from domestic purchases and explorations for outside markets if it is to maintain the maximum government retail price. With this objective, the quantity of rice required to be removed from the domestic market may be estimated by the *forecasted increase* in output less the *necessary increase* in output.[16] The forecast increase in potential supply is 180,000 metric tons in 1968-69 and ranges from 250,000 to 320,000 metric tons in the rest of the period. The necessary increases in available supply on the other hand may be estimated by the differences between Q_R for that year and the available supply for the preceding year. For 1968-69, this is $31.4 - 29.6 = 1.8$ hundred thousand metric tons; for succeeding years, assuming that available supply is limited to Q_R, the necessary increase is estimated by $\triangle Q_R$, or 85,000 metric tons per year. Hence the estimated quantity of rice required to be removed, such that the market retail price would be supported at ₱1.40, is negligible for 1968-69 but ranges from 164,000 to 227,000 metric tons during the rest of the period. At the support price of $150 per metric ton, the implied purchase values range from $25 to $34 million for the period.

If the combination of export market and government market is not as large as this, then price decreases will not be avoided, leading to a redistribution of part of the gains from technological change from producers to consumers. Shifts of hectarage away from rice may then be expected to follow,[17] with a resulting dampening in the time path of output. This analysis suggests that the potential for consumer gain from technological change in agriculture is greater in developing countries than in developed ones, in spite of a policy which favors producers, because of the larger burden of farm support relative to total government resources.

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[15] The usefulness of the suggested analysis may be tested by taking forthcoming data for 1969, interpreting Q as total national output (for July 1968-June 1969) less the net addition to government stocks over the period, forecasting P from eq. (4) and comparing it to actual P after adjustment for inflation. It should be noted that, previous to 1967-68, government made no significant additions to its stocks from local procurements.

[16] Estimation error is considerably reduced by using *changes* instead of absolute values.

[17] See M. Mangahas, A. E. Recto, and V. W. Ruttan, *Market Relationships for Rice and Corn in the Philippines,* Technical Bulletin No. 8, International Rice Research Institute, forthcoming.

RICE PRICE AND PRODUCTION POLICIES IN INDONESIA

MUBYARTO

NINETEEN sixty-nine was a fascinating year to study price policy in Indonesia. After many months of debating the pros and cons, the government resolved to adopt a *positive* price policy that would give a real incentive to rice producers. This will become the first such policy known in the country.

A positive rice price policy for Indonesia has been by no means easily achieved. For years farmers have struggled unsuccessfully for some form of incentive system. It is doubtful whether their efforts would finally have been realized if the price of rice had not fallen precipitously between July 1968 and May 1969. During this period the price of rice dropped by more than one-third—from Rp. 38.80 to Rp. 25.00 per liter in the Djakarta retail market. At the same time, the price of other commodities within the so-called "nine basics"[1] increased.

Such "unbalanced" price behavior was a new phenomenon in Indonesia, and caused farmers excessive suffering. Top policy-makers, prompted by leading agricultural economists of the country, became convinced that a decisive effort to reverse trends could be no longer delayed.

THE HISTORICAL RECORD

Historically, the rice price policy in Indonesia has been urban-consumer oriented—that is, intended to guarantee food at a price low enough to protect the fixed wage earner. In general, the policy can be divided into three phases: the cheap food policy, from the Dutch colonial times until about 1959; the food wage policy, during the period of inflation 1959-66; and the "kill inflation" policy, from 1966 to 1969. All three policies culminated in the familiar "depressed rice price," which many foreign observers found so astonishing: because Indonesia, while trying desperately to encourage rice production, simultaneously discouraged it by depressing the output price.

The cheap food policy originated in Dutch colonial times. The Dutch government, at one time determined to serve the interest of the large plantation groups, imported cheap rice from abroad. The primary goal was to

[1] Sugar, salt, salted fish, cooking oil, soap, kerosene, coarse textile, batik, and rice.

lower production costs of the plantations to enable their products to compete more easily in the world market. The resulting huge profits of these companies were then to be recaptured by the government in the form of huge tax revenues.

When the period of galloping inflation began in 1959, government civil servants, members of the armed forces, and fixed income earners in general, were hardest hit. The government tried to reduce this burden by intensifying wage payments in kind, notably in rice. During this time, rice became a sort of currency in itself.

In 1967 a serious drought and the cancellation of the rice intensification program (BIMAS) during the dry season endangered Indonesia's rice supply. In September—the end of the dry crop harvest—the price shot up in Java, the most important rice producer, and remained high through the beginning of 1968. This "rice affair" provoked student demonstrations in Djakarta and several other cities and caused deep concern in the government. To meet the crisis, over 40 percent of the entire government budget of 1968 was allocated for the purchase of rice at home and abroad; the imported rice was then sold to consumers in the domestic market at half price.

This situation continued throughout the period of "killing the inflation," which began with the inauguration of the New Order government in October 1966. Realizing that rice makes up 65 percent by weight of the nine basic commodities and 31 percent of the cost of living, the government concluded that inflation could be "killed" by concentrating the attack on rice. This was achieved through large importation of food in rice, wheat flour, and bulgur wheat, amounting to over one million tons in 1968. It is no wonder that, coupled with record production in rice in 1968 (up 10 percent from 1967), the result was a depression of the rice price.

PRODUCTION INCENTIVES

The BIMAS Program

It should be clear from the historical record that the Indonesian government has been facing a dilemma. On the one hand, a price incentive is necessary to encourage domestic rice production, but on the other, a relatively more expensive rice, however small, would stifle the ever-suffering urban consumer.

As a way through, the government decided to resort to a non-price incentive system, well-known by the name of BIMAS (Bimbingan Massal), or mass guidance. In this method, rice farmers are guided to utilize a recommended input package system which will permit production increase by some 10-25 percent. There are five elements in the package attempt, namely, high-yielding rice seed, more fertilizer, more (efficient) utilization of insecticide and rodenticide, better irrigation methods, and better cultivation. Bank credit is used and integrated into the overall package.

The new approach, which was started in 1963 by a group of dedicated young students and staff of Bogor Agricultural University, spread very fast throughout the country. It eventually came to be considered as the best non-price method of boosting domestic rice production.

Unfortunately, the ever-growing BIMAS areas (from 100 hectares in 1963-64 to nearly one million hectares in 1968-69) have produced many administrative and institutional difficulties. There are not enough agricultural extension workers and university students to supervise the program, let alone administer it; the banks are unable to collect most of the credit loaned to the farmers; also, due to foreign exchange limitations, fertilizer imports are not sufficient to meet the natural growth of demand. During the drought of 1967, the program was cancelled because bank credit was not extended, and the entire system collapsed. As previously noted, the government had to react by committing all available resources to fill the gap in the domestic rice supply. It was then that the government became quite aware that a combination of price and non-price incentive systems seemed to offer the best hope of encouraging domestic rice production.

The Farmers' Formula

At the end of 1967 the Department of Agriculture adopted a guideline for the floor price of rice called *Rumus Tani* (Farmers' Formula). This formula stipulates that the floor price of rice at the farm level should be at least equal to the price of urea fertilizer. Since most of the urea still has to be imported, the formula can be written as follows:

$$P = (1.5\ A\ B)\ /\ 2$$

where, P = the minimum ex-farm price of dry stalk paddy

A = the CIF price of imported urea fertilizer and

B = the current BE (Bonus Export) rate, the free market exchange rate (rupiah per U.S. dollar). BE is the official exchange rate as paid by the government for export earning.

The price of urea, converted to rupiah at the BE exchange rate, is multiplied by 1.5 to cover the estimated cost of distribution from the main port to the local farm. The diviser *2* represents the conversion rate from dry stalk paddy to milled rice. If the present BE rate is Rp. 326, – per U.S. dollar, and the urea price is $0.07 per kilogram, then the minimum price of milled rice at the farm level is 1.5 times Rp. 22.82, or Rp. 34.23.[2]

This BE rate, and thus the "minimum" price of rice, has been stable since October 1968. The price of urea, however, was fixed at Rp. 31.50 per kilogram in September 1968 and has remained unchanged until today,[3] while the rice price declined from Rp. 35.26 in September 1968 to Rp. 25.00 per liter in May 1969.

Although the government announced the floor price of dry stalk paddy on November 1, 1969 (Rp. 13.20 per kilogram for the wet season harvest 1969-70), it remains to be seen whether sufficient funds will be available to meet this commitment if the paddy price really drops below this floor price. Previously, the Farmers' Formula was so widely publicized that even the farmers in remote areas were aware of it; but since the government was not then in a position to set aside sufficient funds to back the formula, it was unable to prevent the price drops.

Price Incentives

The official target of the Indonesian Five-Year Development Plan (1969-70 to 1973-74) and the Indonesian agricultural policy is to provide price incentives for the increased production of rice. A necessary condition to this, from the point of view of the rice producers, is the important question of how to use the Farmers' Formula as a basis for support of the rice price; that is, how to maintain the stable relationship between the price of rice and the price of fertilizer as the most important input to produce rice.

It has not been easy for the Indonesian government to switch the emphasis of the rice policy from "providing sufficient rice for the fixed income earners," namely, the civil servants, members of the armed forces, and the employees of the state enterprises, to "buying unspecified amounts of rice," especially at harvest time, in order to support the price received by the farmers "at a predetermined level." It seems to have been similarly difficult for the Indonesian policy-makers to justify credit expansion to back the Farmers' Formula. However,

> If the government is concerned about the possible inflationary effect of the credit expansion to back the formula, it should reconsider its attitude. Credit

[2] Recently the Minister of Agriculture stated that since the improvement of PN (Pertani's efficiency), the distribution cost can be now reduced to only 35 percent, not 50 percent, of the landed price on the main ports. This has resulted in a minimum formula price of only Rp. 30.81 per kilogram.

[3] On November 1, 1969, the government announced a price cut for fertilizer imported before January 1969 from Rp. 31.50 to an average price of Rp. 25.00 per kilogram to induce the farmers to buy more for the planting season, 1969-70.

expansion which merely finances price subsidies to rice consumers seems clearly inflationary. But credit expansion to support a floor price which is part of a buffer stock scheme need not be inflationary. The essential requirement is that the government should see rice in the *patjeklik* season at an average price not substantially below that at which it has bought stocks during the preceding harvest season.[4]

Another feature of the agricultural incentive program is the subsidization of the input price, notably the price of fertilizer. If, as indicated, the government is likely to have limited success in its support program, then a price subsidy for fertilizer would be considerably more logical. The extent of this subsidy depends upon several things: the likely behavior of the rice price; the probability of the expansion of fertilizer use; and the likely success of the government's effort to stabilize the price of basic commodities, especially non-rice commodities. An input subsidy is much less costly than price support programs and is more attractive to a government still concerned with preserving the result of the stabilization program.

Buffer Stock Scheme

The greatest advantage to the rice producers would be obtained through a national buffer stock scheme. This new approach is now being seriously implemented by the government, especially for the 1969-70 wet season crop.

The buffer stock policy defines as the main objective a certain level of *price,* or a particular range of prices, while the *quantity* of rice purchased is flexible, and becomes a dependent variable. Under the old system the BULOG (Badan Urusan Logistik), or government rice procurement agency, set a certain target of rice procurement every year on the basis of the government's requirements to supply enough rice to the urban consumer—for usual distribution as well as market injection—and bought this needed quantity at a certain price. Under that system the price was variable, sometimes based on prevailing market prices and sometimes below. Indeed, before 1964, the government's purchase price was much below the market price and thus represented a tax burden to the farmers.

The buffer stock policy is designed not to protect the producers only, but the urban consumers as well. In the harvest season, when prices generally drop, it operates to protect the rice producers, while in the *patjeklik* (preharvest) season it operates to protect the rice consumers from excessive price increases. This is the double leg of a price stabilization policy which in the

[4] Mubyarto, "Rice Price, Marketing and Food Policy in Indonesia," *Malayan Economic Review*, Vol. XIII, No. 2, October 1968, p. 106.

past has placed too much emphasis on the consumers' side and much less, or none, on the producers'.

This means that in this new scheme there will be a range of prices, with lower and upper limits. The upper limit constitutes the ceiling price and the lower limit the floor price.

A possible rationale for setting the upper limit or ceiling price would have to take into account a number of factors: first, the weight of rice in the consumers' budget; second, per capita income, which is quite closely related to the first factor; and third, the overall government food policy. Fourth, the fact that some 10 percent of Indonesia's domestic requirements still has to be imported indicates the need to relate the rice price in the world and in the domestic market.

In all these operations there is always involved a national stockpile, whether it functions as an iron stock, a reserve stock, or a buffer stock. It is clear that a good system of warehousing is a necessity, for the government would then be able to utilize this national rice stockpile as a lever to exercise a national rice policy.

In this case, it would be relevant to analyze carefully whether the best form of rice stock is milled rice or paddy. The BULOG, which had been buying both milled rice and paddy domestically for many years, decided to buy only milled rice in 1969. A number of reasons have been advanced: it is much more difficult to grade paddy; the procurement of paddy requires more warehouses, necessitating the hire of many private godowns; and certain methods of cheating and manipulation are possible that can cause considerable government loss.

It has been additionally argued that if the government is to encourage the modernization of the rice processing industry through the introduction of more rice mills and rice hullers, it should utilize these services in its programs. The best way to do this is by procuring rice through these mills.

But these reasons can hardly be accepted as legitimate, especially when the gain in buying paddy would be much greater in all respects. First, the grading method for paddy might be improved; certainly the grading "skill" could be learned. (Could not the IRRI or the FAO be asked to provide technical assistance for this purpose?) Second, rice in the form of paddy lasts longer in storage. This would be of special importance to the government because it increases the strength of the stock as an instrument of government policy. Third, there is no reason why BULOG cannot guarantee a "milling order" to those mills when it buys the paddy, and carry out its guarantee when the time comes in the *patjeklik* season to mill the rice.

Price Policy and the Marketable Surplus

No discussion of price policy in any developing economy can ignore the country's effort to build up a food surplus drawn from the rural sector and used for the urban sector. The difficulties of achieving this objective are usually temporarily remedied by food importation, whether through direct commercial purchase or through food aid. Following the example of India and Pakistan, the Indonesian government has placed the major emphasis of its present food policy on food aid, notably from the United States via the well-known PL 480. Arguments about the advantages and disadvantages of this food aid are not new. The declining rice price described above has caused deep concern in Indonesia; farmers all over the country have complained openly to the government and demanded "protection." It is no wonder that the "stop the imports" issue has prompted wide support.

> Although the present declining trend of the rice price has prevailed everywhere as a result of the rice surplus in other countries, we should refrain from trying to help solve their surplus problem (via importation) if this merely creates problems for our own farmers. Such a condition could produce a dangerous situation, because the rice farmers could become distrustful of the government's sincerity concerning their fate. Moreover, the rice production target of the Five-Year Development Plan may not be achieved. And we will become more and more dependent on foreign countries in our effort to satisfy the food requirements.[5]

If the rice price continues to fall, the farmers may be driven to reduce their production of rice to the amount they need for their own consumption, allocating the rest of their resources to other more profitable crops such as corn, vegetables, and tobacco.

We estimate the elasticity of the marketable surplus of rice with respect to price in Indonesia is 0.4. That is to say, a 10 percent increase in the rice price is associated with a 4 percent increase of the marketable surplus of rice from the rural sector within one or two rice seasons. This increase in the marketable surplus is derived from two sources: from the increase in rice production both via acreage and yield increase and from the reduction of the farmers' consumption (via food substitution). With the process of more commercialization of rice production, the price elasticity of the marketable surplus could be expected to increase. It is this fact which unfortunately has attracted little attention among Indonesian policy-makers but which so often produces undesirable consequences for the farmers. In the past the impact of increased rice production through mass guidance under the

[5] *Editorial Business News*, Vol. XIII, No. 1796, May 12, 1969.

BIMAS program has been undercut by the failure to adopt the required favorable price policy.

CONCLUSIONS

Indonesia's Five-Year Development Plan envisages a 10 percent annual increase in rice production. This "technically possible" target is to be achieved through the speedy introduction of the new IR5 and IR8 rice varieties, which would increase area from 790 thousand hectares in 1969-70 to 4 million hectares in 1973-74. But the plan also requires non-technical prerequisites such as the improvement of credit systems, marketing and processing facilities, agricultural extension, and above all the improvement of production incentives, especially price incentives.

But although it is fully realized that price incentives would be very important in securing the farmer's willingness to increase rice production, the country witnessed an unfavorable price pattern at the beginning of the Plan period. If this situation is not stopped we could expect a disappointing production performance in the next year or so. There is no doubt that in the long run, a combination of price and non-price incentive schemes would offer the best hope of success.

There is a real need for an integrated and more comprehensive rice policy in Indonesia. A "Rice Board" should be formed whose members would comprise some of the ministers directly connected with rice problems. This Board should be responsible for formulating and implementing the buffer stock operation of rice, emphasizing the maintenance of price incentives for the rice producers and the protection of urban rice consumers. Only with a well-designed rice (and food) policy is there hope that the rice production target of the Five-Year Development plan can be realized.

WORLD GRAIN PRODUCTION PROSPECTS AND TRADE STABILIZATION MEASURES IN SOUTHEAST ASIA

QUENTIN W. WEST

OPINION about the nature of world food problems has nearly completed another pendulum swing from extreme pessimism to extreme optimism. During the late 1960's the introduction and spread of the new high-yielding grain varieties in the developing countries of Asia greatly advanced the hope that their populations could be fed at acceptable levels of nutrition. However, a brief review of the world food situation over the last 30 years should place this revolutionary event in perspective.

In the late 1940's there was considerable concern about world food shortages. The first Director-General of FAO, Sir John Boyd Orr, warned that in the race between population and food supply, population was winning. The Malthusian theory that population would inevitably outrun food supply gained popular support.

The fear of food shortages disappeared in the early 1950's as surpluses began to accumulate, especially in the United States. The critical problem for many commodities then became surplus disposal. At the FAO Regional Conference in Kuala Lumpur in 1962[1] a rice study was presented which indicated that in five years there would be an excess of export availabilities over import requirements of more than 2.5 million tons[2] in the Far East.

During the mid-1960's, supply management, food aid programs, and expanded demands began to reduce these "burdensome surpluses." By 1966, world grain stocks had drawn down, and food grains prices increased. This was largely a consequence of greatly expanded imports of grain by India which had suffered two consecutive years of drought, and by the Soviet Union which had experienced two crop failures in three years. The drought in India was the chief cause of the reduction in per capita grain production in less developed countries to below the 1957-59 base period.

This situation once again raised the question of whether or not there would be sufficient food in the future to provide an acceptable diet to an expanding population.

The year 1967-68, however, was altogether one of unprecedented output

[1] Report of the Sixth FAO Regional Conference for Asia and the Far East, Kuala Lumpur, Malaya, September 1962.

[2] All grain quantities refer to metric tons.

in world agriculture. Record grain crops were produced in the USSR, Canada, and Australia. Feed-grain production established a new high in Western Europe and South Africa. The wheat crop was a near record in Western Europe, and world rice production was the highest in history.

More significantly, 1967 was a record year in grain production for less developed countries. India harvested close to 100 million tons of food grains compared to 72 and 74 millions in the previous two seasons. Crops also improved in Pakistan, Latin America, Africa, and West Asia. Per capita food output in free-world developing nations increased by about 5 to 6 percent, a recovery to the previous level of 1964 or slightly above.

Food-grain production advanced again in 1968 as rice and wheat output established new records (although per capita production for food in the less developed countries remained at the 1964 level). Improved domestic supplies enabled several major rice importers to reduce their purchases, and international prices showed a marked decline from the high levels of 1967. At the March 1969 FAO Study Group on Rice, discussion again centered on the problem of surplus rice production and poor trade prospects.[3]

This brief historical account of the world food situation is intended to point out the danger of overreacting to recent events in agricultural production and of making policy decisions which in the long run many have adverse effects.

LONG-RANGE OUTLOOK FOR GRAIN PRODUCTION AND TRADE

Impact of New Grain Varieties[4]

The new varieties that have disseminated most successfully in recent years are wheat, developed in the late fifties in Mexico, and rice, developed in the mid-sixties at Los Baños, the Philippines. The improved varieties of both grains are adaptable to wide differences in latitude, a feature which has accelerated their adoption. They have short, stiff straw that resists lodging or falling over. Compared to traditional varieties the new seeds have shorter maturity, thus increasing the potential for double cropping. They are more responsive to increments of fertilizer, and, under conditions of adequate irrigation their yields are from 30 to 100 percent higher.

That the spread of the improved varieties of wheat and rice has been rapid is attributed chiefly to vigorous adoptions programs promoted by gov-

[3] Report of the Thirteenth Session of the FAO Study Group on Rice, Manila, Philippines, March 20-27, 1969.

[4] *The Impact of New Grain Varieties in Asia,* ERS-Foreign 275, U.S. Department of Agriculture, Economic Research Service, July 1969.

ernments and the positive response of farmers who have demonstrated that new practices will be quickly adopted when the inputs are available and the returns substantial. These factors, combined with better weather, more fertilizer, and higher prices to farmers, have helped to bring about dramatic production increases in a number of Asian countries, especially in India, Pakistan, and the Philippines.

The improved wheat is used on all of Mexico's wheat areas; both the new wheat and new rice varieties have spread throughout Asia. In 1968-69 the new grains occupied about 7 percent of the riceland and about 16 percent of the wheatland in the less developed areas of Asia (excluding Mainland China). It is roughly estimated that in 1968-69 they contributed an additional 9 percent and 12 percent to rice and wheat production, respectively, in that year. In some countries with adequate irrigation, the new varieties have spread to a much higher percentage of the land devoted to rice and wheat.

Future Spread of New Grain Varieties

The future spread of the new varieties of wheat and rice is uncertain. It will depend greatly on prices of grain and inputs, improvement of irrigation systems, and damage from pests and diseases. Rated poorly by consumers, the new grains have sold at considerable discounts. Wet rice has been a problem and harvests now come before the end of the rainy season. Hence investment in artificial drying equipment sometimes has been necessary. The shortage of irrigation systems with adequate water supply could well turn out to be the most critical limitation to the spread of new varieties. Non-resistance to pests and diseases also could be serious drawbacks.

The effects on farm labor are as yet undetermined. In some situations, adoption of new grains will increase the demand, bringing about a rise in the wages of farm labor; in others, adoption may stimulate mechanization, with the consequent displacement of labor.

Evaluation of the effects of production increases on consumers requires judgment as to whether or not the increase will be in the form of net addition to supplies, will replace food aid, displace commercial imports, or perhaps to some extent will be exported. The actual outcome will depend not only upon market forces but upon government decisions.

It seems possible that the less developed countries of Asia could become nearly self-sufficient in grain before many years. However, after reaching self-sufficiency, if supplies grow faster than demand, prices will be depressed unless international markets can absorb additional increases. World supplies of grain have been growing relative to demand. The high producer prices which have provided incentives to the adoption of new technology probably will be impossible to maintain. Poorer countries generally cannot afford to subsidize the production of grain—either to give to consumers at low prices or to export. Already some export problems have arisen.

All these elements could slow the spread of new technology in the next few years and to some degree probably will. Therefore, the agricultural revolution should not be expected to solve all the food problems of less developed countries. However, substantial additions to locally grown food supplies such as livestock products, pulses and fruits and vegetables, should relieve the pressure to producer or import grains, and should enable these countries to provide sufficient quantity and variety of food to plan for a better quality diet.

Prospects for World Grain Surpluses

No proposal for the stabilization of grain trade in less developed countries can avoid consideration of the long-range outlook for world grain surpluses. The Foreign Regional Analysis Division of the U.S. Department of Agriculture is engaged in an analysis of the world situation for grain with projections to 1980 of production, utilization, and trade. Much of this work is being carried out in cooperation with the Agency for International Development under a research project entitled "Analysis of Demand Prospects for Agricultural Products of Less Developed Countries."

Our surplus projections are based in a number of basic assumptions:

(1) The recent success of the new technology will continue, accelerating the agricultural growth of less developed countries.

(2) There will be no crop failure of the magnitude of the 1963 harvest in the Soviet Union and of the 1965 and 1966 harvests in India.

(3) Current programs and policies affecting agriculture and trade in all countries outside the Southeast Asia region will not change, except as noted.

(4) Trade relations in the Middle East and Southeast Asia will return to normal.

(5) There will be a continuation of the current international political situation.

There are inevitably many uncertainties in an analysis of demand and production prospects, but preliminary results suggest that unless prices fall substantially or programs are adopted to attain a balance at reasonable price levels, there will be a considerable and growing excess of grain production (or capacity to produce) over the quantities that would be demanded through the market place. The problem of surplus is more acute for wheat than for rice. However, if the price of wheat should fall, or if large surpluses of wheat are available as food aid, exports of rice could be reduced. Although we do not have good measures of the degree to which consumers in rice-eating areas will substitute wheat for rice as prices change, it is clear that many are not reluctant to do so.

The annual imbalances that show up in these 1970-80 projections, although small relative to world production, are increasingly large relative to trade and current stock levels—about 22 million tons in the case of wheat and 13 million tons in the case of coarse grains.

For the less developed countries (excluding Argentina), our projections to 1980 show a growing grain "import requirement." Net imports of grain are expected to increase from 24 to 44 million tons. More than half of this increase will be in wheat and the rest in coarse grains. Net rice imports will remain at about 1.5 million tons (Table 1). Imports into South Asia are expected to decline from the high levels of 1965-67, but imports by the rest of the developing world, particularly Latin America and Africa, are projected to increase. It could be argued, of course, that Latin America and Africa will not be slow to adopt the Asian experience and that their import requirements will also decline. However, there is little evidence that African countries, with the exception of East Africa, are moving very quickly in this direction. Furthermore, in Latin America, transfer of the Mexican experience with new varieties has been very limited.

Wheat projections. Although only about one-fourth of world grain production is accounted for by wheat, it is the most widely traded of the grains. Twenty percent of all wheat produced enters international trade. In 1968 wheat output soared in the major food deficit countries. Wheat production in the five largest exporting countries was also a record. Stocks have been building up as import demand—both commercial and concessional—has slackened. Consequently, producer and export prices have fallen in several of the major producing countries. The International Grains Arrangement, despite many problems, probably has prevented a greater decline in prices.

Our long-range projections on the whole reflect a continuation of the trend of the last few years—slowup in the growth of import demand and abundant supplies in major exporting countries. There will be persisting downward pressure on prices; exporters will continue to vie keenly for the commercial markets, perhaps also for concessional markets.

TABLE 1. Net Grain Imports in the Less Developed Countries.

Region	1965–66 Wheat	1965–66 Rice	1965–66 Coarse Grain	1965–66 Total	1970 Wheat	1970 Rice	1970 Coarse Grain	1970 Total	1975 Wheat	1975 Rice	1975 Coarse Grain	1975 Total	1980 Wheat	1980 Rice	1980 Coarse Grain	1980 Total
	(1,000,000 metric tons)															
Central America	1.0	.4	−.7	.7	1.3	.3	−.7	.9	1.7	.3	1.5	3.5	2.4	.4	2.0	4.8
East South America[a]	3.0	−.4	−.2	2.4	3.6	−.2	−.7	2.7	4.1	−.2	−.8	3.1	5.0	−.2	−1.0	3.8
West South America	1.2	.1	.1	1.4	1.8	.1	.5	2.4	2.3	.1	.6	3.0	3.4	.1	1.0	4.5
North Africa	3.6	−.3	.1	3.4	4.6	−.3	.3	4.6	5.0	−.4	.7	5.3	7.1	−.4	1.0	7.7
West Africa	.6	.4	−.1	.9	.8	.4	.8	2.0	1.0	.6	1.6	3.2	1.5	.7	2.0	4.2
East Africa[b]	.3	.2	.1	.6	.4	.3	−.4	.3	.5	.4	−.5	.4	.7	.4	−1.0	.1
West Asia	1.9	.3	.5	2.7	2.1	.4	1.2	3.7	2.5	.5	1.8	4.8	3.7	.5	2.5	6.7
South Asia	9.3	1.1	1.3	11.7	6.6	.7	1.0	8.3	5.3	.8	1.0	7.1	5.5	1.0	1.0	7.5
Southeast Asia	.2	−2.4	−1.3	−3.5	.3	−1.4	−1.0	−2.1	.3	−2.2	−1.3	−3.2	.4	−2.4	−1.5	−3.5
East Asia[c]	2.1	1.7	.3	4.1	2.6	1.9	.8	5.3	3.1	1.6	2.2	6.9	4.1	1.5	3.0	8.6
Total, Free-World LDC's	23.2	1.1	.1	24.4	24.1	2.2	1.8	28.1	25.8	1.5	6.8	34.1	33.8	1.6	9.0	44.4
Communist Asia	5.7	−.8	−.1	4.8	4.8	−.9	−.2	3.7	4.8	−.7	−.2	3.9	4.5	−.5	−.3	3.7
Total	28.9	.3	—	29.2	28.9	1.3	1.6	31.8	30.6	.8	6.6	38.0	38.3	1.1	8.7	48.1

Note: Minus indicates net exports.
[a] Excluding Argentina.
[b] Excluding Republic of South Africa.
[c] Excluding Japan.

Table 2 depicts the change from a balanced base period in 1964-65 to a surplus in 1980-81. In South Asia there will be increasing consumption. Production will rise to a projected 43.5 million tons (nearly 150 percent higher than the base period) as a result of the production success of the dwarf varieties. Underlying the projections are the assumptions (a) that the total wheat area in India and Pakistan will not change much from recent levels; (b) that two-thirds and three-fifths of the wheat area of India and Pakistan, respectively, will be sown to dwarf varieties on irrigated land; and (c) that yields of the dwarf varieties will average 2,200 kilos per hectare (33 bushels per acre).

According to projected domestic production and disappearance, net imports in 1980-81 will total 5.5 million tons. Even though this figure is well below the base period of 9.3 million tons, it contradicts other proclamations that India and Pakistan will be self-sufficient by the mid-seventies. It also differs from the unbalanced projections of the FAO Indicative World Plan which show India and Pakistan exporting 19 million tons of grain in 1985, of which 7.5 million tons would be wheat.[5]

In the United States, projected production in 1980-81 is 48.4 million tons, a rise of 37 percent over the base period.[6] Production in Canada and Australia and New Zealand is projected to rise by nearly 35 percent, but food use will decrease by 7 percent. There will be a greater use of wheat for feed. The overall result could be an increase in export availability of 12.5 million tons over the base period level. Japan is expected to continue to be an expanding wheat market. The Soviet Union will have its supply problem well in hand: stocks will be at desired levels, and net exports may approximate levels attained during the period prior to 1963.

There appears to be a growing market potential in less advanced regions experiencing accelerated economic growth. These include Central America, South America (East and West), East Asia, Southeast Asia, and West Asia. Net imports of most African regions are projected up and these will likely be in food aid shipments.

If population and incomes rise as projected, there will be no slackening in the import requirements in the developing economies. This appears to be a paradoxical situation in an agricultural revolution; however, an acceleration in income growth rate will mean greater consumption of food grains. There also has been a significant upward trend in wheat consumption in

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[5] Report of the Ninth FAO Regional Conference for Asia and the Far East, Bangkok, Thailand, November 1968.

[6] These projections were made only to complete the world picture. Acreage was held constant for the projected period at the level of the 1969 national wheat allotment of 51.6 million acres.

TABLE 2. Production, Domestic Disappearance, and Net Imports of Wheat, by Regions, Average 1964–1965 to 1966–1967 and Projected 1970–1971, 1974–1975, and 1980–1981.[a]

Region	1964-65 to 1966-67[b]			1970-71			1974-75			1980-81		
	Production	Domestic Disappearance	Net Imports[c]	Production	Domestic Disappearance	Residual[d]	Production	Domestic Disappearance	Residual[d]	Production	Domestic Disappearance	Residual[d]
	(1000 metric tons)											
United States[e]	35,478	18,637	−21,163	40,580	19,320	−21,260	43,530	19,990	−23,540	48,450	21,100	−27,350
Canada	18,846	4,159	−13,848	20,300	3,950	−16,350	21,500	3,860	−17,640	23,260	3,620	−19,640
Japan	1,185	4,759	3,645	1,310	5,600	4,290	1,410	6,410	5,000	1,560	7,400	5,840
EEC	28,759	27,703	−1,288	31,260	28,900	−2,360	33,260	29,820	−3,440	36,259	31,170	−5,089
United Kingdom	3,813	8,166	4,329	4,010	8,410	4,400	4,170	8,600	4,430	4,413	8,760	4,347
Other W. Europe	10,202	11,501	1,340	11,050	11,410	360	11,730	11,260	−470	12,752	11,090	−1,662
Australia & N. Zealand	10,207	2,720	−6,339	12,060	2,740	−9,320	13,540	2,750	−10,790	15,820	2,810	−13,010
South Africa	770	1,136	366	850	1,350	500	900	1,520	620	1,000	1,770	770
Developed	109,260	78,781	−32,958	121,420	81,680	−39,740	130,040	84,210	−45,830	143,514	87,720	−55,794
U.S.S.R.	63,067	65,475	2,408	73,400	68,900	−4,500	79,000	74,500	−4,500	84,300	79,800	−4,500
East Europe	20,848	26,563	5,715	23,850	29,080	5,230	26,250	31,240	4,990	29,848	34,660	4,812
Communist Asia	22,933	28,655	5,722	23,800	28,600	4,800	27,000	31,800	4,800	32,000	36,500	4,500
Centrally Plan	106,848	120,693	13,845	121,050	126,580	5,530	132,250	137,540	5,290	146,148	150,960	4,812
Central Am. & Carib.	1,894	2,870	976	2,330	3,630	1,300	2,680	4,340	1,660	3,200	5,550	2,350
Argentina	7,846	3,863	−5,063	8,440	4,150	−4,290	8,900	4,390	−4,510	9,590	4,720	−4,870
Other East So. America	803	3,813	3,010	920	4,490	3,570	1,010	5,110	4,100	1,150	6,190	5,040
West So. America	1,615	2,836	1,221	1,710	3,490	1,780	1,790	4,130	2,340	1,900	5,350	3,450
North Africa	4,120	7,691	3,571	4,740	9,380	4,640	6,100	11,050	4,950	7,200	14,280	7,080
West Africa	26	653	627	31	850	819	35	1,070	1,035	41	1,520	1,479
East Africa	484	789	305	580	970	390	660	1,140	480	784	1,480	696
West Asia	12,475	14,442	1,947	14,630	16,740	2,110	16,600	19,070	2,470	19,600	23,270	3,670
South Asia	17,311	26,654	9,343	26,040	32,660	6,620	33,030	38,350	5,320	43,480	49,000	5,520
Southeast Asia	74	253	179	84	350	266	92	390	298	104	520	416
East Asia & Pacific Is.	332	2,410	2,078	370	2,960	2,590	400	3,510	3,110	452	4,580	4,128
Less Developed	46,980	66,254	18,194	59,875	79,670	19,795	71,297	92,550	21,253	87,501	116,460	28,959
Total World	263,088	265,728	−919	302,345	287,930	−14,415	333,587	314,300	−19,287	377,163	355,140	−22,023

[a] Projections made under a constant domestic price assumption.

[b] Includes changes in stocks where data are available.

[c] Minus indicates net exports.

[d] Difference between projected production and domestic disappearance.

[e] Production projected using 1969 national acreage allotment of 51.6 million acres and yield of 28.9, 31.0, and 34.5 bu./acre, respectively. In 1949–51, seeded acreage averaged 77.9 million acres; in the last fifteen years, 67.8 million acres in 1967 has been by far the largest seeded area.

many of these regions, reflecting some change in patterns of consumption. This trend may be partly the result of food aid imports, but a liberal food aid policy is also assumed for the projections. Thus, substantial increases in per capita consumption and a total growth rate could very well exceed increases in production. In addition, in a large part of the developing world, virtually no wheat can be produced because of unsuitable climatic and agronomic conditions.

In sum, this projection set indicates that in spite of some increase in imports from less developed countries, supplies of wheat from the developed countries should continue to be bountiful. Unless major producing countries come to grips with their production problems, the supplies will be too bountiful.

Rice projections. Although rice is the staple food of about half the world's population, the export volume is only 3 percent of the world output of rice and is little more than one-tenth that of wheat. World production changed little during 1963-66, and international prices rose sharply despite import substitution of wheat and other grains. The world harvest for 1967-68 rose 10 percent, a record and, although exportable supplies were relatively low, prices went down. The United States became the leading rice exporter, shipping 1.9 million tons of milled rice (about 27 percent of total world exports).

The favorable weather years in most Asian countries, along with the continued success of advanced technology on progressively larger acreages, have already alleviated the situation of tight world rice supply. The Philippines and Pakistan have offered rice for export at what appear to be rather low prices. Japan, traditionally a rice importer, has excessive stocks and is attempting to export several hundred thousand tons of rice on liberal terms. Japan may reduce area in rice and use 1 to 2 million tons of rice as a feed grain.

By 1980 we believe that the world rice situation will have adjusted from the pattern of relatively high prices and scarce supplies exhibited in recent years to one of generally adequate exportable supplies and significantly lower prices in absolute terms as well as in relation to wheat, its nearest substitute. We expect a substantial increase in production and therefore a reduced import requirement in many of the importing countries (Table 3). However, depressed producer prices in the developing countries may dampen production gains.

Among the developing countries, exports from Thailand, Mainland China, Taiwan, and the UAR are projected to drop from the high levels of

TABLE 3. Production, Net Imports, and Apparent Utilization of Milled Rice for Selected World Areas, 1965–1967 Average with Projections for 1970, 1975 and 1980 for Comparison.[a]

Region	1965–67			1970			1975			1980		
	Production	Domestic Disappearance	Net Imports[b]	Production	Domestic Disappearance	Residual[c]	Production	Domestic Disappearance	Residual[c]	Production	Domestic Disappearance	Residual[c]
	(1000 metric tons)											
United States[d]	2,553	1,014	−1,527	3,060	1,034	−2,020	3,520	1,076	−2,444	3,920	1,153	−2,767
Canada	—	45	45	—	60	60	—	65	65	—	70	70
Japan	11,447	11,922	750	11,600	12,000	100	11,200	11,300	100	11,100	11,200	100
EEC	453	654	199	550	670	140	480	720	240	500	770	270
United Kingdom	—	109	109	—	115	115	—	120	120	—	125	125
Other W. Europe	422	451	29	470	520	50	500	570	70	525	605	80
Australia & N. Zealand	105	44	−71	155	40	−110	225	65	−160	230	80	−150
South Africa	2	75	73	2	102	102	4	120	116	5	145	140
Developed	14,982	14,314	−393	15,837	14,541	−1,763	15,929	14,036	−1,893	16,280	14,148	−2,132
U.S.S.R.	341	588	247	750	1,050	300	1,000	1,250	250	1,200	1,400	200
East Europe	99	389	290	115	405	290	125	435	310	130	455	325
Communist Asia	63,927	63,124	−803	71,000	70,100	−900	76,000	75,300	−700	81,000	80,500	−500
Centrally Planned	64,367	64,101	−266	71,865	71,555	−310	77,125	76,985	−140	82,330	82,355	25
Central Am. & Carib.	665	1,031	367	850	1,105	255	1,100	1,400	300	1,300	1,700	400
Argentina	141	118	−29	190	130	−50	220	180	−40	250	225	−25
Other E. So. America	4,891	4,509	−382	5,340	5,115	−225	6,060	5,835	−225	7,100	6,850	−250
West So. America	853	924	71	900	1,000	100	1,275	1,325	50	1,480	1,555	75
North Africa	1,301	960	−341	1,700	1,370	−330	2,050	1,600	−450	2,300	1,900	−400
West Africa	1,301	1,723	422	1,450	1,880	430	1,550	2,180	630	1,700	2,400	700
East Africa	1,019	1,199	177	1,110	1,430	320	1,300	1,660	360	1,450	1,900	450
West Asia	921	1,256	334	1,075	1,500	425	1,270	1,760	490	1,500	2,000	500
South Asia	45,868	47,005	1,137	56,100	56,800	700	62,450	63,250	800	70,650	71,600	950
Southeast Asia	18,215	15,873	−2,417	19,900	18,550	−1,350	22,500	20,350	−2,150	25,000	22,650	−2,350
E. Asia & Pac. Is.	17,867	19,595	1,728	20,000	21,880	1,880	22,900	24,524	1,624	24,800	26,290	1,490
Less Developed	93,042	94,193	1,067	108,615	110,760	2,155	122,675	124,064	1,389	136,530	139,070	1,540
Total World	172,391	172,608	408	196,317	196,856	82	214,729	215,085	−644	235,140	235,573	−567

[a] Except for Australia, production refers to harvest beginning late in the years preceding the indicated year; for Australia, production refers to the harvest early in the indicated year. Trade statistics are for calendar years.

[b] Minus indicates net exports.

[c] Difference between projected production and domestic disappearance, except that changes in stocks for 1970 were projected for the United States, Japan, EEC, Australia and New Zealand and Argentina.

[d] Area used for U.S. projections is 2.2 million acreas.

the late 1960's. Burma is expected to regain her previous export position, and South Vietnam should again become a rice exporter. Although Indonesia's imports have dropped off considerably from the high level of the late 1960's, this country is still shown to be importing significant quantities of rice. South Korea will have a hard time increasing rice production above present levels: virtually all the land for rice production has been developed, and yields are already relatively high; also, population and incomes are rising. The country therefore is expected to remain a heavy importer of rice. Both Ceylon and Malaysia will need fewer rice imports. India, on the other hand, is expected to raise her import demand, while Pakistan (despite expanded production in West Pakistan) will find it more difficult to maintain the net export level of the mid-1960's.

Coarse grain projections. Coarse grains account for almost half of world grain production. Less developed countries use 65 percent of their coarse grains for food, compared to only 6 percent for developed countries. World output has increased about one-fourth in the past decade, and world trade has more than doubled. One-tenth of the grain produced is now traded.

Table 4 shows our projections for coarse grain production in less developed countries. There will be relatively rapid expansion in output in Central and South America, primarily in corn production. North and West Africa will have a slower rate of growth than East Africa because coarse grain production (primarily barley) is largely on marginal, unirrigated land. Coarse grain production will not increase as rapidly as that of wheat and rice in Asia because of the preference for the latter for food, and because of the more advanced development of these grains for high yield. The largest absolute increases in exports among the less developed countries are projected for Argentina and East Africa. More modest increases are indicated for Brazil and Thailand.

The use of coarse grains for feed, particularly in the production of poultry, will likely lead to an increase in coarse grain utilization in parts of Asia, Africa, and South America. West Asia (especially Israel) and East Asia (especially Taiwan and South Korea) will expand feed-grain imports. North Africa, West Africa, and Central America are also seen as outlets for coarse grain exports for 1975 and 1980, largely because of expected developments in poultry production.

The volume of coarse grains moving under aid arrangements is not expected to increase significantly above the base level.

TABLE 4. Production, Domestic Disappearance, and Net Imports of Coarse Grain by Regions, Average 1964–1965 to 1966–1967, and Projections to 1970–1971, 1974–1975, and 1980–1981.

Region	1964-65 to 1966-67			1970–71			1974–75			1980–81		
	Production	Domestic Disappearance	Net Imports[a]	Production	Domestic Disappearance	Residual[b]	Production	Domestic Disappearance	Residual[b]	Production	Domestic Disappearance	Residual[b]
	(1000 metric tons)											
United States[c]	136,620	124,493	−21,765	161,800	138,700	−23,000	190,000	160,000	−30,000	216,000	181,000	−35,000
Canada	13,809	13,226	−688	16,800	15,675	−925	17,500	16,900	−1,000	19,000	18,700	−1,100
Japan	1,439	7,423	6,027	1,200	11,200	10,000	1,200	13,800	12,600	1,200	17,000	15,800
EEC	30,895	43,042	11,854	39,000	49,000	10,000	44,000	54,000	10,000	50,000	60,000	10,000
United Kingdom	9,494	12,948	3,487	11,000	14,000	3,500	13,000	15,000	2,000	14,500	16,000	1,500
Other W. Europe	19,384	24,929	5,561	23,000	27,500	3,800	25,000	28,500	3,500	28,000	31,500	3,500
Australia & N. Zealand	3,142	2,369	−707	4,200	2,750	−1,450	5,200	3,100	−2,100	6,500	3,500	−3,000
South Africa	5,108	4,704	−463	6,500	5,100	−1,400	8,500	6,100	−2,400	11,000	7,100	−3,900
Developed	219,891	233,134	3,306	263,500	263,925	525	304,400	297,400	−7,000	346,200	334,800	−12,200
U.S.S.R.	51,581	50,327	−1,254	57,000	56,150	−850	67,000	66,150	−850	78,000	77,150	−850
East Europe	43,716	44,026	310	48,130	47,850	−280	51,400	50,300	−1,100	55,800	54,300	−1,500
Communist Asia	53,940	53,843	−97	58,100	57,900	−200	60,500	60,300	−200	66,500	66,200	−300
Centrally Planned	149,237	148,196	−1,041	163,230	161,900	−1,330	178,900	176,750	−2,150	200,300	197,650	−2,650
Central Am. & Carib.	11,122	10,464	−658	13,700	13,000	−700	15,500	17,000	1,500	18,000	20,000	2,000
Argentina	8,977	3,872	−5,175	11,200	5,000	−6,200	12,200	5,600	−6,600	13,500	6,500	−7,000
Other East So. America	11,987	11,750	−237	15,000	14,300	−700	17,200	16,400	−800	20,000	19,000	−1,000
West So. America	2,802	2,891	89	3,000	3,500	500	3,100	3,700	600	3,200	4,200	1,000
North Africa	6,388	6,484	96	8,300	8,600	300	9,500	10,200	700	11,000	12,000	1,000
West Africa	11,120	11,058	−62	12,100	12,900	800	12,900	14,500	1,600	14,000	16,000	2,000
East Africa	12,095	12,209	114	14,800	14,500	−450	17,000	16,500	−500	20,000	19,000	−1,000
West Asia	8,240	8,700	460	9,200	10,400	1,200	10,000	11,800	1,800	11,000	13,500	2,500
South Asia	25,852	27,153	1,301	30,500	32,000	1,000	33,600	34,600	1,000	37,000	38,000	1,000
Southeast Asia	1,364	235	−1,251	2,000	950	−1,050	2,700	1,400	−1,300	3,500	2,000	−1,500
East Asia & Pacific Is.	6,420	6,749	329	8,200	9,000	800	9,800	12,000	2,200	12,000	15,000	3,000
Less Developed	106,367	101,565	−4,994	128,000	119,650	−4,500	143,500	143,700	−200	163,200	165,200	2,000
Total World	475,495	482,895	−2,729	554,730	545,475	−5,305	626,800	617,850	−9,350	709,700	697,650	−12,850

[a] Minus indicates net exports; changes in stocks have been taken into account.

[b] Difference between projected production and domestic disappearance. Except for 1970–71 some projected changes in stocks have been taken into account.

[c] Assumption on area and yield for U.S. production in 1974–75 and 1980–81 are as follows:

	Corn Grain	Oats	Barley	Sorghum Grain
1974–75:				
Million acres	58	12	10	15
Bushels/acre	98	56	50	64
1980–81:				
Million acres	60	11	11	15
Bushels/acre	110	62	55	68

The problem of trade stabilization in Southeast Asia centers upon rice. Wheat is imported into the region from the United States, Australia, or Canada. Corn is a very new export item. Most of it moves from Thailand to Japan, although recently Thailand shipped large quantities to Taiwan, Singapore, Hong Kong, and Malaysia. Japan has also purchased small amounts of corn from Cambodia and Indonesia. This trade will likely expand, but net export availability of the region should remain at only about 1.5 million tons. However, this will represent at least 40 percent of production.

Rice exports from Southeast Asia have fallen sharply in recent years—from over 4 million tons in 1964 to less than 2 million in 1968. Imports have fluctuated between 1.8 and 3.0 million tons. In the last two years, the region's imports exceeded exports. U.S. rice exports into this area increased from 186,000 tons in 1964 to 1.2 million tons in 1968.

This volatile trade situation was reflected in export prices. The Thai export price (5 percent broken f.o.b. Bangkok) had fluctuated between $125 and $150 per ton between 1956 and 1965. It went up sharply to more than $280 in 1967.[7] It has now fallen to about $175 as favorable weather in most Asian countries and increased production have alleviated the tight rice supply situation.

International Efforts to Stabilize Trade

Although beset by enumerable problems, international commodity agreements are often useful instruments for effecting international trade and price stabilization in specific agricultural commodities. Agreements that have had considerable success over a period of years are the International Wheat Arrangement, the International Sugar Agreement, and the International Coffee Agreement. The International Grains Arrangement is now in operation, albeit with much difficulty and criticism.[8] It should be emphasized that all such arrangements are slow in developing. To be effective, they require the full commitment of the signers and the involvement of all countries heavily engaged in international trade, either as exporters or as importers. It may be that in the short run less all-encompass-

[7] "Economic Aspects of High-Yielding Varieties of Rice with Special Reference to National Price Policies: IRRI Report," paper prepared for the Thirteenth Session of the FAO Study Group on Rice, Manila, March 20-27, 1969. *Note*: For the revision of this paper, see p. 29 of this volume.

[8] *Note*: In late summer of 1969 the IGA became ineffective because the major exporters agreed to sell below the minimum price.

ing arrangements would offer greater opportunity for the stabilization of grain trade.

During the past several years, developing countries have tried to improve their international trade position by obtaining preferential entry into the markets of the advanced countries. This effort has centered in the United Nations Committee for Trade and Development (UNCTAD). Two UNCTAD meetings, the last of which was held in New Delhi in March 1968, adjourned with virtually no progress made in this direction. For the immediate future, this, too, would appear to be an impractical approach.

Bilateral Arrangements

In the past, various bilateral arrangements have achieved some sort of stabilization of international trade in rice, and it is likely that these will continue as the principal instruments for some time.

Historically, most of Burma's exportable surplus of rice has been committed, often in advance, by bilateral arrangements with India and other countries. Burma has signed a recent agreement with India to exchange 200,000 tons of rice for textiles and other manufactured products. Burma has a tripartite cotton agreement with the United States and Pakistan whereby the United States sends cotton to Pakistan to be spun into yarn and shipped to Burma. Burma then sends rice to East Pakistan. Burma sent 32,000 tons of rice to the USSR in exchange for fertilizer and machinery in 1967. This arrangement could expand when exportable supplies increase in Burma.

Ceylon in recent years has traded about 200,000 tons of rice for 75,000 tons of rubber from Mainland China. Pakistan also has had a trade agreement with Mainland China involving the exchange of rice for jute and cotton. Singapore receives from 60,000 to 100,000 tons of rice annually from Mainland China and pays for this at least partially in rubber, teak, and other products. Indonesia has a barter agreement with the UAR to exchange rice for tea and spices: in 1968 the UAR sent 60,000 tons of rice to Indonesia.

Probably the most significant bilateral arrangements have been the agreements between the United States and several of the countries of Southeast Asia for shipments of rice, wheat, and coarse grains under PL 480. The United States has had agreements with Burma, Indonesia, the Philippines, Taiwan, Thailand, and Vietnam, and through 1968 shipped $750 million worth of grains to these countries.

How important U.S. food aid will figure in the grain trade of Southeast Asia in the future will depend on many policy decisions, both by the

United States and these countries. A shift from local currency to dollar credit sales is scheduled for the end of 1971. Although the dollar credit terms are the best available in any trade transactions, there is evidence of the reluctance of countries to utilize this program as fully as they have in the past. (Payment terms are 40 years with a 10-year grace period at 2 percent interest and 3 percent interest thereafter.)

Even if the countries of Southeast Asia attain self-sufficiency in rice or can supply their own requirements within the region, demand for wheat will increase, as will, to a lesser extent, demand for coarse grains as poultry production increases. And, with the excess production of the United States and other wheat producers, it is likely that wheat will be available to these countries under fairly liberal credit terms.

Regional Trade Measures in Southeast Asia

Since World War II the newly independent countries of Asia have attempted to develop a feeling of community interest through various regional organizations—an effort which has been more political than economic. The first association, Maphilindo, which was formed by Indonesia, Malaysia, and the Philippines, never got off the ground. The second, known as the Association of Southeast Asia (ASA), composed of Malaysia, the Philippines, and Thailand, was formed in 1961. It lasted a few years but was then more or less dormant until 1967 when it was superseded by the Association of Southeast Asian Nations (ASEAN), composed of Indonesia, Singapore, and the former ASA members.[9]

The Economic Commission for Asia and the Far East (ECAFE) has tried from time to time to develop regional cooperation in trade. In 1948 a Working Group was set up to report on the financial arrangements needed to facilitate intraregional trade. In 1954 a group of central bank exports was asked to report on the possibility of setting up an Asian Payments Union. In 1959 the Asian Trade Promotion Talks were initiated by ECAFE to facilitate trade contact among the countries.

Very little interest was shown in these activities until the European Economic Community was formed. In 1960, at the Sixteenth Session of ECAFE, a resolution was passed urging member countries to note the recent developments in trade cooperation in other regions of the world and to seek suitable measures for increasing intraregional trade.[10]

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[9] Committee for Development Planning, United Nations Economic and Social Council, Bangkok, Thailand, March 1969.

[10] *Annual Report,* United Nations Economic Commission for Asia and the Far East, March 1960.

At its Seventeenth Session ECAFE enumerated the difficulties of achieving any far-reaching program of integration in the near future and pointed to the greater need of trade with developed countries than trade within the region. (Most countries of the region depend on outside sources for their supplies of capital goods and materials.[11] In 1960, 25 percent of the imports of the developing countries of Asia and the Far East came from countries within the region. By 1965 this figure had fallen to less than 20 percent.)

At the Sixth Session of the Subcommittee on the Economic Aspects of Rice of the FAO Committee on Commodity Problems (CCP) held in 1962, several measures were considered and recommended to facilitate trade stabilization. These included national research stocks, long-term bilateral contracts, regional cooperation for economic development and international stabilization arrangements.[12]

The Ministerial Conference on Asian Economic Cooperation was established in 1963. At these meetings trade problems were discussed. Among the cooperative efforts proposed were regional harmonization of development plans, regional trade liberalization, and shipping freight rates. During its Third Session, held in December 1968, several studies were recommended, one of which included the present and potential trade flows of the region.

The Working Group of Experts on Trade Liberalization which met at Bangkok in 1964 recognized that the complete removal of quantitative restrictions and/or tariffs within the ECAFE region was not feasible. They advocated instead (1) bilateral and multilateral trade agreements for increasing imports of relevant countries over specified periods; (2) a list of commodities to be drawn up by each member country which would be completely free from all quantitative restrictions with respect to interregional trade; and (3) fixed import quotas for selected commodities.[13]

Since the same recommendations have been made year after year, it is evident that most of them have not yet been carried out. Even so, some important things have been accomplished that will be of assistance in arrangements for trade stabilization in Southeast Asia. One of these is the establishment of the Asian Development Bank. The Bank makes loans for agricultural development, including crop diversification. Second, ECAFE has organized annual Trade Promotion Talks among the countries of the region. These Talks have elicited a very good response, and several bilateral

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[11] *Ibid.*

[12] Report of the Sixth FAO Regional Conference for Asia and the Far East, Kuala Lumpur, Malaya, 1962.

[13] "The Asian Development Bank and Trade Liberalization," *Regional Economic Cooperation Series,* No. 2, United Nations, New York, 1965.

trade agreements have emerged from the discussions. Third, there is now an agreement to form The Asian Coconut Community. Coconut is one of the major export commodities of Asia, but the industry has largely stagnated for the past two decades. As a result of a study on the coconut industry, the coconut producing countries intend to make a concerted effort to solve the problems of production, processing, and marketing.[14]

Proposals for Stabilization of Rice Trade

The most important commodity from the point of view of regional cooperation is rice, now under study by ECAFE. Two types of cooperation have been suggested: (1) a long-term agreement between the surplus and deficit countries, and (2) an agreement for the coordination of national buffer stock operations.

At the FAO Far East Regional Conference in 1968 the Director-General of FAO proposed that further consideration should now be given to the possibility of evolving an international rice agreement modeled on the International Wheat Agreement. This proposal was discussed further at the Thirteenth Session of the FAO Study Group on Rice in March 1969, in which the FAO Secretariat suggested an international arrangement in rice which would be flexible but which would include such broad features as agreements on quantities to be purchased by importing countries in terms of percentages; an agreement on price which would be subject to annual negotiations; and arrangements for stockholding. Since many of the countries concerned had limited financial ability to hold stocks, some form of international financial support was proposed.

As a supplement to these proposals, or as an alternative, it was suggested that interested countries might subscribe to a joint declaration of intent which would cover such matters as the avoidance of undue competition between the advanced and the less advanced countries in international rice trade; the granting of due preference to the rice exports of developing countries; the adjustments of rice production in the light of feasible demand; and the holding and release in an orderly manner of national rice stocks in excess of normal requirements.[15]

At the same meeting the Philippine Delegation submitted proposals on four types of international action to stabilize the present volatile world rice situation. These involved a price stabilization agreement, an interna-

[14] "A Study on Regional Plan Harmonization and Economic Cooperation in Coconut and Coconut Products," United Nations Economic Commission for Asia and the Far East, Bangkok, 1968.

[15] Thirteenth Session of the FAO Study Group on Rice, Manila, March 20-27, 1969.

tional payments arrangements, international buffer stock, and the inclusion of rice in food aid. The Delegation of Thailand proposed that consideration be given to (1) an international or regional agreement based on government-to-government transactions in rice (this could have a general stabilizing influence as these transactions account for approximately half of world trade); (2) the recommendations of advanced countries for national action aimed at adjustments in their production, to avoid uneconomic production and surpluses that have an adverse effect on world trade; and (3) a lowering of trade barriers to give developing exporting countries freer access to markets.[16]

The group recognized the difficulty of arriving at an acceptable agreement in rice because of the special characteristics of world trade in this commodity. There was the added fact that certain exporting and importing countries were not members of the study group, and one major rice exporter was not a member of the United Nations. The decision of the group was to recommend that the Director-General of FAO and the countries themselves give trade stabilization problems and proposals further study before any action was taken.

CONCLUSION

The countries of Southeast Asia are largely in the same position they were a decade ago with respect to trade stabilization in grains. Many proposals have been approved but very little progress has been made in actual implementation. The conclusions of the Working Group of Experts on Trade Liberalization still seem to hold true today:

> The importance given to trade with the developed countries as the suppliers of capital goods, the predominence of aid, and the import substitution strategy of development, have made it difficult, if not impossible, for the developing countries of the region to establish any regional preference system. Moreover, any system of tariff reduction on a preferential or universal basis has been found by experience to be extremely difficult and complicated even when countries have joined in formal customs unions or free trade associations. Without such associations it is well-nigh impossible to come to an agreement on tariff reduction. Efforts at general trade liberalization or quoto restriction have now more or less been abandoned in the region. What has achieved a fair degree of success are bilateral trade agreements among pairs of countries. Obviously greater efforts are needed in developing trade agreements, not only for disposing of current surpluses, but also for planning future production and price stabilization.[17]

[16] *Ibid.*
[17] "The Asian Development Bank . . . ," *op. cit.*

DISCUSSION I

AUGUSTINE H. H. TAN

DR. West's paper provides us with a highly useful summary of developments in world grain production and trade since the 1940's. His long-term projections indicate a considerable and growing excess of production over consumption in wheat, and, to a less acute extent, in coarse grains and rice, with consequent downward pressure on prices. Dr. West points out that there has been considerable stabilization in rice trade because of various bilateral arrangements. But surely such arrangements (as also the low trade-production ratio) must be a major cause of recent rice price instability in the free portion of the market.

Dr. West then traces various Asian attempts at regional cooperation, especially in rice, and notes the inaction relative to the multiplicity of proposals for price stabilization agreements, international payments arrangements, buffer stocks, and inclusion of rice in food aid.

Mr. Mangahas' paper calls our attention to the change of emphasis in the Philippines from ensuring a minimum per capita consumption of rice to supporting a minimum farm price level. The purpose of the paper is to improve on the prevailing forecasting method for coping with the problems by using an econometric model, incorporating the effects of changes in output, local demand, imports and exports on the retail price level of rice. He finds that the problem of financing a rice price support program is more severe than hitherto estimated.

Dr. Mubyarto's paper traces the developments of Indonesia's negative rice price policy which had been oriented toward protection of civil servants and other fixed income earners. This culminated in an absolute price decline of rice in 1968 leading to a reversal of government policy toward a positive price incentive orientation in 1969. He advocates a national buffer stock scheme to implement a price support program, which is considered necessary to encourage improved yields and output increases.

The papers by Mr. Mangahas and Dr. Mubyarto seem to be unduly concerned with *price* maintenance rather than *income* maintenance for producers. The crux of the matter is that the two objectives are not necessarily mutually consistent. Let us consider a number of propositions that can be made concerning *trends* in output and demand. First of all, with an increasing output trend owing to the new technology, it would be an uphill if not impossible task to try to stabilize price. Second, if demand is price-elastic, that is, if absolute value of price elasticity is greater than unity, producers will achieve greater income with increasing supply, *even with a declining price.* Third, even if demand is price-inelastic, declining price does not necessarily signify declining income because we still have the 3 to 4 percent annual rightward shift in demand.

Next, consider the question of *fluctuation* around the trend, which is the proper concern of any buffer stock operation. In a situation where fluctuations in price arise primarily from supply fluctuations rather than demand shifts, any buffer stock operation not run by the producers themselves will lead to greater instability in the incomes of the producers if demand is price-elastic, even if complete price stability were to be achieved. The result would be indeterminate if demand were price-inelastic.

The authors of the papers might ask: What about the question of price incentives for agricultural producers? In other words, if price were allowed to fall, might not this adversely affect the agricultural revolution? I submit, by way of answer, that the proper question should be: Is price rather than technology, availability of inputs, and information dissemination really the critical determinant? It does seem to me that, given all the other factors, especially the possibility of doubling and tripling yields, the rational producer would still go ahead and join the agricultural revolution even if price were to decline, because his proper concern is with *income* and *cost* rather than with price alone!

Dr. Mubyarto, in his paper, raises the possibility that a decline in the price of rice might lead farmers to allocate some of their resources to more profitable crops such as corn, vegetables, and tobacco. I should like to ask: Why not? I can see transitional problems caused by the agricultural revolution; but surely a longer-run perspective must bring us to the position that countries ought to begin considering questions of comparative advantage and specialize accordingly, rather than together causing a glut of any one commodity, however critical. I believe countries should think in terms of capability rather than self-sufficiency. What the agricultural revolution has brought is the technological capability to free each country from the embrace of famine, but, given this basic freedom, might not our attention be given to more *economic* considerations, guided by comparative advantage and trading possibilities? Moreover, we should be mindful of the fact that, as incomes grow, tastes switch, not only from rice and coarser grains to wheat (as Dr. West points out in his paper) but also from cereals to meats. Thus reallocation of resources away from rice is not necessarily a bad thing.

Another concern about the possibility of a price decline in rice in the wake of technological changes, is that some of the fruits of such changes will be passed on to the urban sector instead of being retained for the farmers' benefit. One can certainly understand this concern, in view of the urban-rural income disparity, but there is a larger viewpoint that one must confront, namely, the necessity for extracting surplus funds and labor from agriculture for economic development. Even if there were no agricultural revolution this transfer process would be inevitable. The new technology will remove some of the transfer pains by making more agricultural surplus available. An agricultural price-support program would be an impediment to the transfer process. It would also be very costly relative to similar programs in advanced countries because of the much larger agricultural base in less developed countries. Advocates of agricultural price support often point to the apparent success of such programs in the advanced countries. I would like to pose the question of whether the apparent success has been *due to* or has occurred *in spite of* the programs. Proponents of agricultural price support would do well to scrutinize carefully the role of agricultural research and extension activities in the United States and elsewhere.

In the final analysis, the real cost of agricultural price support in less developed countries may well be a lower rate of overall development.

DISCUSSION II

Dragoslav Avramovic[1]

In 1930, in the midst of the Great Depression, Keynes wrote, with the vision of which only he was capable:

> From the sixteenth century, with a cumulative crescendo after the eighteenth, the great age of science and the technical inventions began, which since the beginning of the nineteenth century has been in full flood—coal, steam, rubber, cotton, the chemical industries, automatic machinery and the methods of mass production, wireless, pringing, Newton, Darwin, and Einstein, and and thousands of other things and men too famous and familiar to catalogue. . . .
>
> There is evidence that the revolutionary technical changes, which have so far chiefly affected industry, may soon be attacking agriculture. We may be on the eve of improvements in the efficiency of food production as great as those which have already taken place in mining, manufacture, and transport. In quite a few years—in our own lifetimes I mean—we may be able to perform all operations of agriculture, mining, and manufacture with a quarter of the human effort to which we have been accustomed. . . .[2]

The vision materialized, first in agriculture in the United States during the Second World War, then in Western Europe and in other developed countries during the 1950's. Judging by the majority of the views currently expressed, it is spreading among the developing countries, primarily in Asia, where most of the world population is concentrated and incomes are lowest. This latest agricultural advance is a result of new types of rice and wheat developed after many years of effort by scientists working in the different parts of the world, particularly in the Philippines and Mexico under the auspices of the great American foundations.

For a non-expert, several major questions arise:

(1) Is the advance clearly attributable to the new technology, or is it significantly influenced by favorable weather?

(2) What is the desirable level and growth rate of production of cereals needed to raise consumption to the physiologically required level, to create a reasonable reserve against emergencies of poor crop years, and to meet the expected rate of population growth?

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[1] The discussant, who was not present at the meeting, submitted this separate article on trade stabilization policies.

[2] John Maynard Keynes, "Economic Possibilities for our Grandchildren," in *Essays in Persuasion* (London: The Macmillan Co., 1931).

(3) What changes in the international trade pattern in cereals can now be expected, and how best can the inevitable adjustments be carried out, with a minimum of adverse effects on the present exporting nations?

(4) How can it be made reasonably sure that the right quantities of rice, wheat, and corn are produced, and in the right places?

(5) What are the likely employment effects of the technological change, and what policies are needed to absorb in non-agricultural occupations the surplus agricultural labor likely to follow?

(6) If the agricultural revolution represents the solution of the agricultural problems of Asia, what implications does this have for the growth objectives and for the resource allocation strategy of the developing countries, and what changes are called for in international economic and financial policies, including assistance policies, to help achieve the new objectives and the new strategy?

I cannot discuss any of these issues at any length in this note. Instead, I shall make several general points. In doing so, I shall assume that the answer to the question 1 is positive, that is, we are witnessing a major genuine productivity advance and therefore substantial shifts are now indicated, both in growth objectives and in the strategy to achieve them (question 6).

It is probable that the additional quantities of rice and wheat which can be absorbed in final consumption in the near future are limited: the cereals gap in Asia at present income levels is a relatively small fraction of aggregate output, although it is this missing margin which has been critical in causing famines. If this is correct, as the use of new varieties spreads, the Asian countries will face, for the first time in their modern history, the blessings—and the problems—of surpluses. It would be a tragic paradox if a major break were to occur in rice and wheat prices in the near future, leading to a serious slowdown in the rate of absorption of the new technology even before the needed increase in consumption and supply has taken place. The gap between production and consumption would then reappear several years hence.

The implication is that the Asian economies, with the help of the international community as needed, would have to think fairly soon of a coordinated program of commodity stabilization in the broad sense: price policies, the desirable level of publicly held stocks, warehouse needs, trade adjustment, and production planning. The first step would be detailed coordinated staff work on the likely trends in production and consumption at alternative price levels and the associated stocking, warehouse, and production planning needs over the next half-decade or so.

The likely impact on international trade in rice and wheat in the immediate future is probably easy to predict. The same holds for the severity of the immediate adjustment problems in the exporting countries. What is more difficult to visualize, and where serious research work is required, is to reappraise the comparative advantage of particular areas in Asia in the production of cereals, in the light of natural resource factors, transport costs to major consuming centers and the wage level differentials in the different producing regions.

Such analysis cannot be limited only to the developing countries. It is between the developed and the developing countries where the differences in domestic support prices are enormous, indicating, in rough fashion, the differences in production costs and in comparative advantage. The support price for rice ranges from less than $100 per ton in the major developing exporting countries to $360 per ton in the major developed importing area.

Therefore, if the trade and production adjustment problem is to be tackled, it would have to include, in any sensible world, the agricultural policies, and other trade and production policies, of the developed countries as well. The present agricultural programs of these countries—in North America, Europe, and Japan—are a result of a mixture of past catastrophies and of noble objectives. The catastrophic price fall in the Great Depression of the 1930's led to massive price supports and import restrictions. The shortages during and after the Second World War led to incentive schemes and price supports again. The rapid technological advance during and after the Second World War was accompanied by a massive increase in domestic output and a corresponding lag in import demand (partly because there was understandable reluctance to let the farming population carry the brunt of adjustment and of technological unemployment); while the great shortages of foodstuffs in the developing countries, and particularly in Asia only a few years ago, helped disguise basic comparative advantage differences and called for a continuing high output level in the developed countries, particularly in North America which was willing to supply food free and on an unprecedented scale.

Whatever the factors that have brought about the present situation, there are now prospects in the making that may lead to a world surplus situation in key food products. This would happen if the agricultural revolution spreads to ever-larger areas and if no fundamental reexamination of the agricultural policies takes place in the developed countries.

There is an alternative, and it may be more realistically possible than most of us are accustomed to believe. Never before in modern economic history have such large areas in Western Europe and North America experienced labor shortages on the scale of the 1960's. At the same time, there are growing doubts in at least some of these countries whether their present national agricultural and trade policies are consistent with their own requirements for growth. The same applies, to a smaller extent, to the policies covering products of the light industries—textiles and food processing are the obvious examples. Unless labor is transferred from these areas to the sectors which are experiencing shortages—in heavy manufacturing and even more in services requiring high skills—aggregate output, and certainly the standard of living, will rise at a slower rate than would otherwise be possible.

This issue may be of marginal importance for the developed countries. It is of critical importance for the developing areas. Unless they are enabled to expand their exports of foodstuffs and of light industry products, they will be inevitably driven to accelerate further their import substitution for limited national markets in an increasing range of products which require much larger markets and a sophisticated organization of the service network in order to yield high returns. Even so, industrialization will proceed, but it will be accompanied by inefficiencies, balance of payments difficulties, and liquidity crises, thus ultimately resulting in a lower growth than potentially feasible and socially necessary.

But this outcome is not inevitable, and matters may turn out quite differently. There are now at work powerful economic forces in both developed and developing countries calling for the restoration of common sense in the world economy: that rice be produced in those Asian countries where it costs $100 per ton to produce rather than in those where the cost is fourfold; that wheat be produced in those South American areas and elsewhere where the cost is one-half or one-third of that in many developed countries; that sugar be produced in the South at the cost two-thirds less than in the North; that vegetable oils be produced as much as needed in West Africa, since they cost there only a fraction of the cost of butter in the North, where it goes out of fashion anyway; that textiles, shoes, and other soft goods be produced in the developing countries where they are cheaper and probably better if the markets are large and stable. If this were to happen, the developing countries would probably refrain from starting industrial plants where costs are likely to be prohibitive for a long period; and the consumers in the developed countries would be able to find repair shops for their cars, and repairmen for their plumbing, at a decent cost and on time.

Despite all the inefficiencies in the allocation of resources, capital and wealth have been accumulated during the last two decades at a rate without precedent in any earlier period of the known history. Who would have believed, twenty years ago, that Japan would attain income per capita exceeding $1,000 by the end of the 1960's; that Germany's currency would be the strongest in the world; that Italy would be one of the leading automobile producers; that Israel, China, and Yugoslavia would become large exporters of manufactured goods; that Brazil would create the São Paulo industrial machine; that Mexico would become a major supplier of high-class foodstuffs for the choosy American market; that Pakistan would develop a surplus of cereals for export? Such is the power of modern technology, whether applied in industry or agriculture, that it can overcome the worst possible mistakes in the allocation of resources, on a national and world scale. It is now only a matter of imagination that progress can be achieved in the next quarter-century if the creative powers of technology are reinforced by common-sense decisions to locate production of the different goods in those places where they are cheapest to produce.

Keynes ended his article of 1930 by saying that "assuming no important wars and no important increase in population, the economic problem may be solved, or be at least within sight of solution, within a hundred years." No one will ever know whether he had in mind the developing countries, but he may have. The crux of their development problem is in agriculture and in the capacity to export: once the decisive advance is achieved on these two fronts, their industrialization may proceed at amazing speed. If the agricultural revolution proves lasting and if the developed countries decide to open their markets for the goods the developing countries are best suited to produce cheaply, even Keynes may prove to have been overpessimistic. The only remaining secret might then be in the force that determine the rate of population growth.

REGIONAL COOPERATION IN SOUTHEAST ASIA: PROBLEMS AND PROSPECTS

THEODORE MORGAN

THIS paper examines the role of regional cooperation in the economic development of Southeast Asian nations. Discussion begins with a brief classification of integrative and cooperative measures that might be tried, including a number that have been adopted, then summarizes certain data from a full study of *Economic Interdependence in Southeast Asia*,[1] and concludes with policy and political comments.

THE RANGE OF COOPERATIVE MEASURES

The range of organizations and policies for regional cooperation is broad. The most informal cooperative activities among countries are occasional meetings and exchanges of information, advice, and published documents among private organizations such as technical and professional societies, cooperatives, and literary or political groups. Somewhat more formal are the occasional, ad hoc meetings of government officials that focus on special problems as they arise. There may be agreements to consult, or regular meetings, on subjects of joint interest. The Association of Southeast Asia (ASA), during its active period (1961-63), held such ad hoc consultations and maintained joint committees and working parties.

Provision by one organization of a public service useful to several states is another form of regional cooperative action. This category includes research activities, art exhibits, and exchange visits of specialists and groups. The U.N. Economic Commission for Asia and the Far East (ECAFE) carries on research in regional economic problems; the Southeast Asia Treaty Organization (SEATO) has undertaken research in tropical medicine; and ASA has initiated studies on the feasibility of such research. ECAFE, SEATO, the Colombo Plan (CP), and the Asian Productivity Organization (APO) have provided technical advice and organized technical education programs.

[1] The materials here are excerpts and summary items from a study carried out primarily with Agency for International Development support. Supplementary help came from the Ford Foundation, the Economic Research Centre of the University of Singapore, and from the Graduate School and other resources of the University of Wisconsin. The study began in March 1964 and is still in progress.

Of the four tables below, I am indebted for the first and fourth to Professor Seiji Naya, and for the second and third to Dr. Nawal Fag el Naour.

There may be commitment of economic resources in the joint interest of contiguous countries in individual fields, such as road or river valley development. The Committee for Coordination of Investigations of the Lower Mekong Basin (known as the Mekong Committee), on which the four bordering states of Thailand, Laos, Cambodia, and South Vietnam are represented, envisages this kind of joint interest. Or resources may be committed for more broadly regional purposes. Several years ago, ECAFE recommended the formation of a regional development bank, a proposal now matured into the Asian Development Bank. Cooperative deep-sea fishing and fish canning and the establishment of regional air and shipping lines have been discussed by several organizations, including ASA and ECAFE. There can be regional joint effort to conduct research, to explore the market for products such as rubber, coconuts, tea, and fibers, and to set up cooperative marketing arrangements for expanding foreign sales. In late 1968 seven Asian nations agreed to form an Asian Coconut Community to improve production and marketing through standardization of products, production research, training of technicians, and market research.

At the meetings of the United Nations Second Conference on Trade and Development (UNCTAD) at Delhi in early 1968, the less developed countries sought common agreement on trade policies, commodity marketing agreements, shipping rates, and the like. Their aim was to face high-income countries in a better bargaining position.

None of the forms of cooperation listed above requires abrogation of sovereignty—that is, there are no significant commitments to change domestic government policies. Domestic policies *may,* however, be altered by regional cooperation. There can be agreement to limit production of export crops in order to raise market prices, as under the Stevenson Rubber Agreement of the 1920's. Sanitary regulations may be agreed on for enforcement in two or more countries.

Trade can be encouraged within the region through joint simplification and standardization of customs regulations. ECAFE has recommended such measures, and ASA undertook to carry some customs liberalization measures into effect. Trade within the region also can be encouraged by lowering or eliminating tariffs and other trade barriers. Thus in 1963 ASA urged study of the possibility of setting up a regional free trade area. In the same year a meeting of foreign ministers accepted as a policy aim the establishment of a customs union or free trade area within the region, and agreed that national development plans should be harmonized in order to achieve rational location and size of new industries.

Restrictions on intraregional trade may be reduced through agreement on a regional payments union by countries with deficits in their total world trade. The desire for stable trade and payments relationships in turn exerts pressure to coordinate monetary and tax policies, so that prices will be stable or will change at similar rates.

There also may be coordination of other economic policies and regulations, and even mutually adjusted policies for political change. Finally, there may be more or less complete political union, as exemplified in the assimilation of West New Guinea by Indonesia, and in the checkered history of Malaysia and Singapore.

Cooperation may exist within one region only or within one or more countries of the region and countries outside. In the first category are ASA (composed of Malaya, Thailand, and the Philippines); Maphilindo (Malaya, the Philippines, Indonesia); and the Mekong Committee. In the second category are the Asian Development Bank, set up in 1966 in Manila; the Asian Productivity Organization, with nine members in Southeast Asia and outside; ECAFE, with 23 Asian members in Southeast Asia and beyond; the Colombo Plan, with 15 Asian members plus countries outside; and the Asian and Pacific Council (ASPAC), which also has a mixed grouping.

We have so far listed cooperation measures along a scale according to their formality and degree of official commitment. Other patterns of classification are possible. Five are listed below.

There are regional projects that require the agreement of two or more regional countries, versus those that do not. Among the latter are enterprises with regional implications set up in one country, perhaps with support from outside the region—from the United Nations or some other international organization, the United States or other external government, or a private foundation. Examples are the Southeast Asia Research Centre set up in Singapore by the Singapore government, and the Ford Foundation regional office in Bangkok.

There are also regional physical investment projects (the Asian Highway, the Mekong River Project) versus educational and technical projects (the International Rice Research Institute at Los Baños, the APO, the U.N. Economic Research Institute at Bangkok), technician exchange agreements, and any educational or research programs that attract students from other countries of the region. This division parallels the economic theory issue of emphasis on conventional physical investment in contrast to emphasis on human and non-material resources for growth.

There are agreements among governments on purely economic matters (for example, trade and payments agreements) versus those on political, cultural, educational, and social and physical research matters. There are arrangements with invidious economic and/or military implications (SEATO, and trade or investment agreements leading to national location of iron and steel, metal-working, electronics, chemical and like industries), versus arrangements that have no invidious implications (educational and research projects) with entry open to students from other countries and with research findings freely available.

Finally, there are organizations that have functioned (ECAFE, SEATO, ASA, CP, APO) versus regional proposals that have never come into being. Sukarno's NEFO—"Newly Emerging Forces"—is an example of the latter. Maphilindo was hardly more than a name and a slogan, and ended with Sukarno's campaign of *Confrontasi* against Malaysia and Singapore. ASA, after its founding in 1961, carried on for a time a number of modest and useful cooperative activities, but was broken up by the Philippine claim to Sabah in North Borneo, a part of East Malaysia. Its successor, the Association of Southeast Asian Nations (ASEAN), composed of Thailand, the Philippines, Malaysia, Singapore, and Indonesia, which was launched in 1968, has suspended its meetings because of the same Philippine claim.

ECONOMIC INTERDEPENDENCE IN SOUTHEAST ASIA

We should expect less developed areas to have comparative advantage in manufactures with relatively low levels of productivity per employee and with relatively low value added from both labor and capital components. These manufactures are in general textiles and clothing, wood products, furniture, leather products, "miscellaneous," and other narrowly defined manufactures. (Exceptions to this generalization arise from variation in management and local skills.) Climate, soil, mineral deposits, and other local resources can provide comparative advantage in special primary products such as rubber, wood and cork manufactures, and iron and steel products.

The region as a whole has been doing badly in its exports to the more developed countries (Table 1). While from 1956-57 to 1964-65 total imports of developed countries rose by 76 percent, the region's exports to them rose by only 28 percent. Two-thirds of this 48 percent lag is due to a negative "composition effect"—that is, the region has a high concentration in primary products, whose share of exports has been increasing only very slowly in the world market. One-third of the lag is caused by a negative "competitive effect"—that is, the region has been outcompeted in the kinds of goods it does export.

TABLE 1. The Compositional and Competitive Effects of Exports to Developed Countries from Asian Countries, Averages of 1956–1957 and 1964–1965.

Country	Exports (in 1000)		Growth of Exports (%)		Competitive Effect (%)	Compositional Effect (%)	Difference in Growth (%)
	1956–57	1964–65	Actual (A)	Hypothetical (H)	(A-H)	(H-D)[a]	(A-D)[a]
Burma	67,617	63,284	−6.41	79.28	−85.61	3.47	−82.22
Ceylon	194,219	215,434	10.92	26.48	−15.56	−49.33	−64.89
India	914,833	1,060,360	15.90	45.63	−27.73	−32.18	−59.91
Indonesia	592,632	590,476	−0.28	38.45	−38.73	−37.36	−76.09
Pakistan	266,064	244,609	−8.07	31.52	−39.59	−44.29	−83.88
Philippines	461,731	750,468	62.64	40.77	21.67	−35.04	−13.17
Taiwan	72,097	274,361	280.54	183.54	97.00	107.73	204.73
Thailand	152,747	277,069	81.39	36.75	44.64	−39.06	5.58
Total[b]	2,721,940	3,477,059	27.74	43.81	−16.07	−32.00	−48.07

Source: United Nations, *International Trade Statistics*, various issues.

[a] The average growth of more developed countries' imports, D, is 75.81 percent.

[b] Aggregates for all countries of exports and percentages.

The best performing countries with respect to export sales are Taiwan (+ 281 percent in this period), Thailand (+ 82 percent), and the Philippines (+ 63 percent). The poorest performers were Indonesia (– 0.3 percent), Burma (– 6.0 percent), and Pakistan (– 8.0 percent). The main explanation of this wide divergence in performance is the competitive effect: in a variety of commodities good performers typically did well and poor performers typically did badly. The commonly held view that countries with a concentration in primary products perform poorly is not supported in our data. Thailand and the Philippines have done very well despite high specialization in primary products.

One tentative induction, or hypothesis, to be drawn from these data is that export success and failure, which is closely correlated with general economic growth trends, is influenced in major degree by the extent of overvaluation, equilibrium, or undervaluation of the exchange rate of a country. Further, it is implied that efforts to compensate for the frequent overvaluations by various forms of export subsidies and import price adjustments are inadequate, both because of the administrative costs and administrative weaknesses normal in less developed countries and because of the political pressures and uncertainties that are characteristic of all countries. A confirmation of this hypothesis would imply that regional cooperation to shift disequilibrium exchange rates toward agreed on equilibrium levels, with minimum intercountry disturbance, would speed up economic growth.

The share of intraregional trade of these countries varies greatly, from 79 percent for Laos, to 57 percent for Singapore and 50 percent for Burma, down to 6 percent for Ceylon and 4 percent for the Philippines. Countries performing poorly in intraregional trade are also those with negative competitive effects. Most countries show a recent decline in intraregional trade. Hong Kong's share has declined because its external trade has been growing very fast. Pakistan, Korea, and the Philippines, on the other hand, have shown rapid increases in their intraregional trade.

It is sometimes argued that regional trade among less developed countries is a will-of-the-wisp because "they all produce the same thing." This view is mistaken. Successful economic growth is characterized by the opening-up of small but swelling niches of comparative advantage from which is gradually built up a large and complex network of exchange.

Quantitative restrictions and tariffs are obstacles to trade and distort the structure of production. Their effects are best measured not by the nominal in-the-books tariff and equivalent levies, but by the "effective protection" the restrictions produce. Effective protection is the effect of the regulation or duty on net value added by the producing firm in the protected country, or alternately, on its rate of profit. Effective rates of protection are erratic and generally much higher than the rates stated or implied in the legal codes. Protectionism in general is therefore both more erratic in its economic effects and a much sharper bar to economic growth than it would seem.

In the region as a whole, quantitative restrictions appear to be more important than tariffs. The Philippines has recently become the least restrictive. As to tariff rates, primary products are in the region, as elsewhere in the world, typically subject to low or zero rates. Intermediate fabrication products have higher rates; highly fabricated products have the highest rates. The Philippines often imposes the highest duties of all the countries.

Our analysis and sample calculations indicate that a typical Southeast Asian country would suffer little reduction in tariff receipts from entering a regional free trade area. Tariff reductions would probably occur gradually over the years, so that any revenue loss also would be gradually spaced out.

Less developed countries judge that expansion of manufactures has special feedback (dynamic) advantages to them in the training of skills, improvement of organization, and capital formation. Gains in efficiency can also be achieved through the encouragement of simplification and standardization coming from larger-scale production for a larger market, through the development of skills and entrepreneuring abilities in one industry that are useful in others, and through better communications: a road or railroad developed for one business can often be used by others. New industries can emerge out of the specialization encouraged by larger-volume production and more across-boundary contacts.

These dynamic effects deserve much attention. Though not amenable to quantitative estimation, they are the main source in the longer run of potential gains from a regional preference or freer trade agreement. A regional scheme should be especially solicitous toward freeing trade in those kinds of production that offer the most promise of great efficiency with greater scale. Conversely, attempts to secure these efficiencies through protectionism will invite the blockages, through rising costs, that have been weighing down import-substitution policies during recent years in Latin America and elsewhere.

Exports of manufactures from less developed countries and from Southeast Asia are small at the present time, but despite protectionist barriers they are growing rapidly. Without protectionist hurdles or with fewer, these exports would grow still more rapidly. Hence a lowering of protection against imports of manufactures, through regional or other agreements, promises to be a strategic stimulus toward more rapid economic growth.

Prospective candidates for the negotiation of lower trade barriers in

Southeast Asia are a long list of manufactures that recently have been showing very rapid growth rates—from 19 to 81 percent a year. These include perfumes, soaps and other cleaning products, certain rubber, wood, and cork manufactures, pearls, precious and semiprecious stones, iron and steel products, cutlery, electrical machinery, telecommunications equipment, plastic articles, toys, and sporting goods (Tables 2 and 3). Among these products are many whose average costs will fall significantly if the volume of production is large enough. Here is logical ground for regional agreement toward freeing trade.

One promising form of encouragement to freer regional trade measures could be trade preferences extended by high-income countries on condition of reciprocal lowering of trade barriers *within* the Southeast Asia region. Nationalist sentiment and pressure to keep up trade barriers against imports

TABLE 2. Export Performance of Nine Asian Countries.[a]

Standard International Trade Classification (SITC)	Percent of Total Exports 1962	1965	Percent Rate of Growth 1962–65
0 Food and Live Animals	22.58	21.87	22.27
1 Beverages and Tobacco	1.52	1.36	13.14
2 Crude Materials	34.89	30.12	9.05
Total	59.00	53.36	14.21
3 Mineral Fuels	3.86	3.49	14.15
4 Animal and Vegetable Oils and Fats	1.70	1.96	45.53
5 Chemicals	1.51	1.61	34.53
Total	7.08	7.07	26.05
6 Basic Manufactures	21.84	23.84	37.86
7 Machinery and Transport Equipment	3.04	3.34	38.75
8 Miscellaneous Manufactures	7.98	10.59	67.63
Total	32.87	37.78	45.17

Source: See Table 3.

[a] Singapore, Malaysia, Philippines, Hong Kong, Taiwan, India, Pakistan, Thailand, Republic of Korea.

TABLE 3. Manufactured Exports of Dynamic Character for Selected Southeast Asian Countries.

SITC	Product	Percent Composition 1965	Percent Rate of Growth 1962–65
03	Fish and Preparations	1.10	38.84
04	Cereals and Preparations	5.26	40.10
042	Rice	4.17	31.91
046	Wheat Meal or Flour	.16	63.60
053	Fruits Preserved and Prepared	1.00	73.09
055	Vegetables Preserved and Prepared	.53	78.57
081	Animal Feeding Stuff	1.62	32.51
24	Wood, Lumber, and Cork	3.38	48.79
242	Wood Rough	2.49	45.65
243	Wood Shaped	.87	83.31
27	Crude Fertilizers	.64	28.22
332	Petroleum Products	3.30	26.15
422	Fixed Vegetables Oils, Non-soft	1.89	64.34
51	Chemical Elements and Oxides	.30	45.82
512	Organic Chemicals	.15	28.65
513	Inorganic Elements and Oxides	.07	71.98
53	Dyes, Tanning and Coloring Products	.15	35.67
541	Medicinal, etc. Products	.27	64.03
55	Perfumes and Cleaning Products	.45	167.48
554	Soaps, Cleaning Materials, etc.	.14	121.63
561	Fertilizers Manufactured	.13	60.21
581	Plastic Materials	.03	26.29
61	Leather Manufactures	1.06	42.76
62	Rubber Manufactures n.e.s.	.24	117.73
621	Materials of Rubber	.04	59.09
629	Rubber Articles n.e.s.	.19	62.43
63	Wood and Cork Manufactures	1.21	138.65
65	Textile and Yarn Fabric	14.19	31.15
651	Textile Yarn and Thread	1.41	52.97
652	Cotton Fabrics, Woven	4.38	48.81
657	Floor Coverings, Tapestry, etc.	0.41	29.86
66	Non-metal Mineral Manufactures	1.10	80.27
664-5	Glass and Glassware	0.10	26.82
667	Pearls, Precious, and Semi-precious Stones	0.63	166.81
67	Iron and Steel Products	1.07	138.89
673	Iron and Steel Shapes	0.36	92.59
674	Iron and Steel Universals, Plates, Sheets	0.25	176.18
678	Iron and Steel Tubes, Pipes, etc.	0.18	128.02

(Continued on next page)

TABLE 3.—*(Continued)* Manufactured Exports of Dynamic Character for Selected Southeast Asian Countries.

SITC	Product	Percent Composition 1965	Percent Rate of Growth 1962–65
68	Non-ferrous Metals	4.49	49.50
684	Aluminum	0.10	71.69
687	Tin	4.29	48.74
69	Metal Products n.e.s.	0.93	26.69
695	Tools	0.04	30.38
696	Cutlery	0.07	202.98
71	Machinery Non-electric	0.95	26.47
711	Power Machinery Non-electric	0.20	46.57
715	Metal Working Machinery	0.03	64.00
72	Electrical Machinery	1.30	100.64
723	Electrical Distributing Machinery	0.06	42.67
724	Telecommunication Equipment	0.55	242.30
729	Electrical Machinery n.e.s.	0.45	54.48
812	Plumbing, Heating, and Lighting Equipment	0.30[a]	51.33
831	Travel Goods, Handbags	0.13[a]	38.85
841	Clothing	5.39	70.50
851	Footwear	0.72	53.20
861	Instruments and Apparatus	0.12[a]	44.82
89	Miscellaneous Manufactured Goods n.e.s.	3.54	80.52
892	Printed Matter	0.28	33.18
893	Articles of Plastic	0.24	116.54
894	Toys and Sporting Goods	1.08	123.41
896	Works of Art, etc.	0.13	64.75
897	Gold, Silverware, and Jewelry	0.15	46.86

Source: Calculated from United Nations, *Commodity Trade Statistics 1965*; United Nations, *Foreign Trade Statistics of Asia and the Far East 1962*; and United Nations, *Yearbook of International Trade Statistics, 1965*.

[a] India not included.

from the more developed countries is strong: the fear is that domestic producers would be forced to the wall by efficient producers in the old colonial powers. But the extension of such unilateral preferences by the more developed countries (especially by the United States, the major importer), would meet the official and emphatic wish of the less developed countries—a wish more firmly rooted in fact and analysis than the usual arguments have conveyed. The United States might well be in the forefront in exploring the practicalities of preferences, which it now in principle supports.

The trend of world trade since 1900, and also recently, reinforces the argument that less developed countries should seek to upgrade their skills, organization, and technology as urgently as they can. Commodities with low skill-and-capital requirements comprise a falling proportion of world trade as a whole; those with high skill-and-capital requirements comprise a rapidly rising proportion. The value of exports of food and raw materials from less developed countries, for example, has been rising at less than one-fifth the growth rate of manufactures.

A regional payments union, though in general attractive as a means of economizing on foreign exchange and of reducing somewhat the costs of making payments, offers only very modest gains in Southeast Asia. The reason is that trade within the region is very unbalanced: there are persistent heavy creditors and heavy debtors. The imbalance exists both in the short run (in quarterly data) and in the longer run (over a recent eight-year period). There is little reason to expect that the regional creditors (Thailand, Indonesia, Cambodia, Burma) would be willing to extend long-run credits to the regional debtors (the Philippines). On the other hand, this form of regional cooperation, as well as a number of others, has a general argument in its favor: it provides the experience and encourages the habit of cooperating in the obvious general interest.

The payments shifts that will result from the prospective ending of the Vietnam war offer useful opportunity for regional cooperation in forecasting and offsetting problems of dislocation. There will also be, during the next few years, payments shifts resulting from national successes and failures in adopting the new "miracle" grains. Foreign assistance programs could support studies of probable payments shifts and formulate proposals, and aid regional organizations such as the Asian Development Bank in this effort.

All quantitative judgments on the effects of policy changes, cooperative measures, and normal growth on trade in Southeast Asia, rest on the foundation of existing statistics. We have tested the accuracy of trade statistics from 1962-63 for seven countries: Burma, Ceylon, Indonesia, Malaysia, the Philippines, Singapore, and Thailand. The basic method was to compare total exports reported by each of these countries with total imports reported by their trading partners. (Similarly, imports reported by each of the seven countries were compared with exports reported by their trading partners.) There were 29 trading partners, both less developed countries within the region and more developed countries outside.

The two reports on the same trade *should* vary by only a modest margin, in general in the same direction, to allow for transport and related charges. In fact, the ratios of the two vary widely. Many display flagrant discrepancy, with the higher figure of a pair twice or more the value of the lower (Fig. 1 illustrates import pairs). Often the discrepancy is in the wrong direction from the modest gap caused by the transport margin. Of the ratios for total bilateral trade, 62 percent have a discrepancy wide enough (taken as below .9 or about 1.3, where 1.1 is in the neighborhood of a normal expectation) to present a firm presumption of error. A breakdown into ratios for commodities separated out into Standard International Trade Classification (SITC) one-digit classes, which we studied for a sample country, increases the visible discrepancies, which are averaged out in the total ratios. The use of free or black market exchange rates for total ratios does not significantly alter the findings.

We can conclude that quantitative reports based on available trade statistics of the region, even allowing for the special cases of entrepot economies (Hong Kong and Singapore) and of Indonesia, are resting on feet of clay. Nor is the situation likely to improve rapidly: substantial errors will probably continue in countries where the incentives for error continue, that is, in countries with high tariff or other barriers to trade, or with legal or other barriers to the flow of capital. Since the trade statistics will emphatically not sustain much of quantitative conclusions on the trade implications of regional cooperation, we are compelled in the main to make qualitative judgments only.

Estimates of the prospects of individual export commodities are subject to a further caveat: the success or failure of individual businesses and of their exports depends in major degree on their individual circumstances, above all on the quality of management. Past experience of the *kinds* of commodities can at best offer only crude guides to the future.

Even more basic worries pertain to national income statistics, including specifically their savings and investment components. (a) Their margin of error is probably large (and unlike trade data they cannot be checked), chiefly because agriculture is usually the largest sector of less developed economies, and because the uncertainty inherent in estimates of farm production is greater than that for most other economic sectors. (b) When national income, by one of its definitions, is used as a measure of growth, it is at best an average that can be misleading for individual sectors; and it is in any case only a rough proxy for the multiple economic, social, and cultural changes that are the essence of development. Kuwait was recently the most developed country of the world, by the national income measure! (c) For analyzing the causes of growth, the standard national income accounts are still more vulnerable. Their concepts were shaped, especially in the 1930's and 1940's, primarily for business-cycle and classification-of-

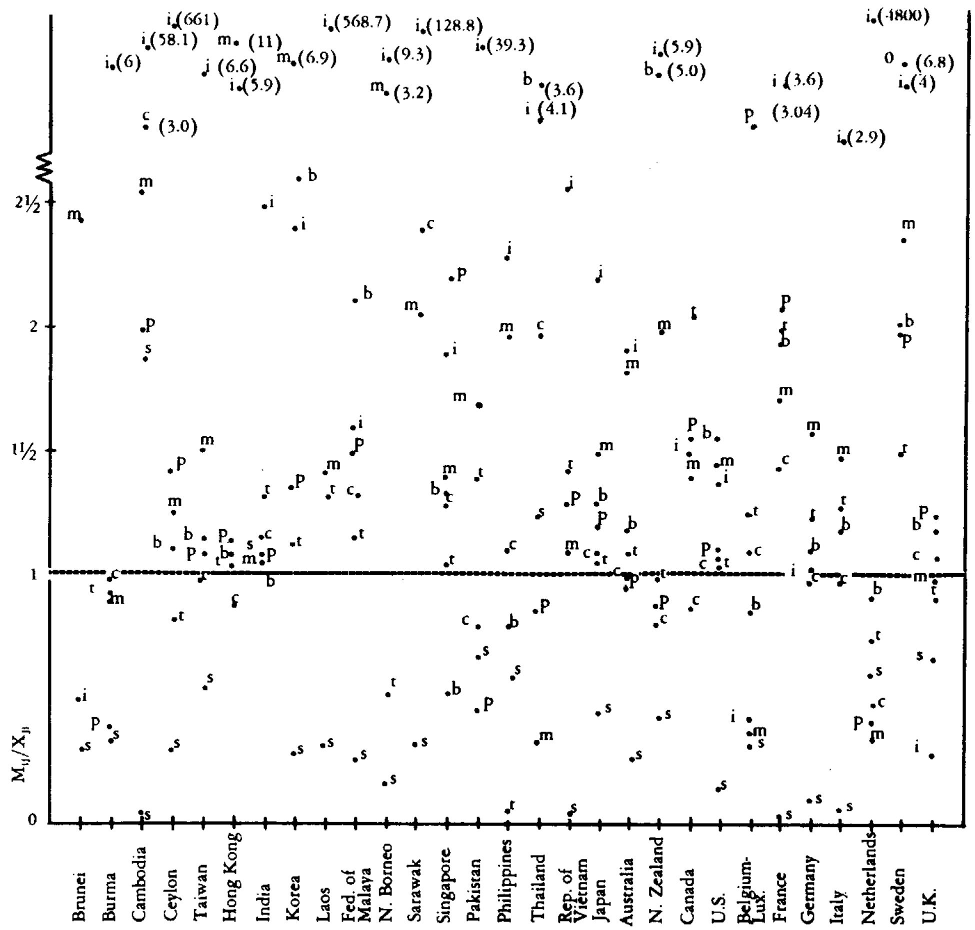

FIG. 1. Ratio of Trading Partners' Imports from Southeast Asian Countries (M_{ij}) to Corresponding Exports of Southeast Asian Countries (X_{ji}), 1962-1963 Averages.

Source: United Nations: *International Trade Statistics and Direction of Trade,* various issues.

Note: M_{ij}/X_{ji} for
Burma = b
Ceylon = c
Fed. of Malaya = m
Indonesia = i
Philippines = p
Thailand = t
Singapore = s

final-product purposes—and not for separating out the uses of resources that do and do not lead to economic development.

An extensive effort to redefine national income aggregates, especially consumption, savings, and investment so that they fit more adequately the purposes of economic development analysis, has been carried out with U.S. data by John Kendrick of the National Bureau of Economic Research. It gives an estimate of "total investment" nearly four times the official estimates. This more useful approach, from the point of view of the conditions for growth, when applied to the national accounts data of the less developed countries of Southeast Asia, implies that estimates based on the effects of regional cooperation measures—for example, effects on reported savings and investment—would shed only modest light on the probable changed rates of growth. Recalculation of national income accounts of Southeast Asian countries along the lines pioneered by Kendrick would be highly useful. The Agency for International Development or other outside assistance agencies might well support such efforts.

National economic plans in the region often suffer from shifts of government faces and policies, and from lack of firm government intention to carry them into effect. Malaysia alone has won praise for its evocation of felt wants in the villages and towns, for its incorporation of plans into the government budget, and for the vigorous execution of these plans.

Because of the weakness of planning and for other reasons also, the harmonization of individual country plans into a regional pattern confronts extremely difficult problems. There are sensitive negotiation problems, especially concerning the location of prestigious and militarily important industries. Recent proposals for harmonization suffer from insufficient emphasis on competitive efficiency and from lack of reliable data on economies of scale. (The statistics used have come mainly from high-income countries.) Detailed studies of local economies of scale are needed, and might well be supported from outside the region.

In none of the national development plans in Southeast Asia is there reference to the possibility of accelerating development through regional cooperation. Outside agencies, foundations, and donor governments can be helpful through directing attention to regional activities and policies that also further national aims.

Specific proposals for regional activities call for individual cost-benefit analyses, which, with all their difficulties and inherent uncertainties of valuation, are indispensable. Any cost-benefit studies on regional industrial potentials need to consider both current efficiency (comparative advantage), and also the dynamics of feedback effects on skills, organization, values, social change, and capital formation. Cooperative effort within the region, perhaps supported by international agencies and by foreign national donors, can usefully undertake such studies. Ad hoc and continuing groups of technicians who are nationals of countries in the region might well be formed to evaluate the promise of national and regional proposals, including those that might attract support from abroad or from the Asian Development Bank. Once projects are under way, such groups of specialists could follow through to check and report on project efficiency.

A major commitment to overall integration, as in ECAFE's formal harmonization proposal, must hold forth the promise of great gain for the participants if it is to be acceptable. Gains from such harmonization have been assumed to be substantial, but in our view it remains unproved that the gains would be large enough to justify the approach even if requisite political compromises could be achieved.

There is one useful rule-of-thumb for the initial evaluation of such proposals. Projects that expand production and/or productivity have a strong presumption in their favor. Conversely, projects that seek higher money returns through curbing production and/or productivity—for example commodity agreements to limit output—are highly suspect. They deny the basic meaning of economic progress, which consists of *increasing* production. They carry inevitable administrative burdens—and administrative efficiency is a major problem in less developed countries. Their intent is apt to be frustrated by the obvious, the subtle, the manifold inroads of competition—both from other producers of the same product and from substitutes—in the short run and the long run.

Regional cooperation measures may well offer their greatest benefits through indirect influence. Southeast Asia appears to distant people as a tolerably homogeneous area; it is, in fact, widely heterogeneous in its relevant aspects—in history, culture, mineral resources, soil fertility, population density, exposure to the West and to modern technical methods, and local patriotisms and antagonisms.

Such contrasts historically have proved to be opportunities: the cooperative mixings of people of diverse backgrounds has repeatedly provided, in various parts of the world, a mutual stimulus to practical achievements. The potential gain for Southeast Asia is great.

POLITICS AND POLICY

Unqualified conclusions regarding the prospects of regional cooperation cannot validly be drawn from facts, analyses, and evaluations with as many aspects of uncertainty as Southeast Asia presents. But we do need guidelines for policy—guidelines that are neither unduly vague, in view of what we know, nor unduly positive, in view of what we do not know.

The obstacles to mutually useful cooperation in Southeast Asia have been, much as elsewhere in the world, mainly political. The causes of such cooperation, when it has occurred, have also been mainly political. Both new and old antagonisms divide the countries of the region and cause them to be sensitive to the political and military implications of regional measures. "Confrontasi" between Indonesia and Malaysia has deeper roots than Sukarno's fancy, and these roots will give rise to continued tension. There is longstanding antagonism between Cambodia and the Vietnams and also Thailand. Malaysia and the Philippines nurse a continuing quarrel over Sabah.

The problem is shown most vividly in the succession of attempts at cooperative activities in Maphilindo, ASA, and SEATO. Maphilindo, a purely political vehicle, died getting born. ASA's imaginative effects were halted by political falling-out between Malaysia and the Philippines. SEATO survives chiefly because of its political-military implications. Other organizations such as ECAFE, APO, and CP survive and are effective to a great extent because of continuing outside support, which is partly political-economic in motivation and only partly disinterested. Fairly basic policy differences are likely to continue, and to appear and disappear at intervals. An election in the offing can stir up naionalist sentiments; joint danger can draw countries together.

National economic plans inevitably have multiple political, social, and economic goals. Economic growth is only one purpose among many. Four countries of the region broadly defined—Burma, Ceylon, India, and also Indonesia at least until recently—have been "inward looking." They have been disposed toward strict resource allocation, have direct trade controls, strictly limit capital movements, and often nationalize foreign enterprises. Five others—Malaysia, Thailand, Pakistan, the Philippines, and Taiwan—have been "outward looking." They have the above characteristics in lesser degree or not at all. They have had a better record in growth of GNP, productivity, and imports, and also in price-level stability and import-substitution success.

Indonesia, Laos, and Cambodia have been mainly neutral between East and West, although the West has often thought they leaned toward Peking or Moscow. Now Indonesia again leans to the West. Burma has nearly retired from this world. Malaysia, Singapore, Thailand, the Philippines, and Taiwan have been sympathetic toward the West.

The political differences and sensitivities among Southeast Asian nations imply a moral: any meaningful approach to regional cooperation must recognize the diversities of history and cultures, of recent experience with economic development, and of goals and policies of the countries in the region. Outside encouragement to regional cooperation will have the best chance of success when the cooperation achieves a joint maximum of two purposes: contribution to the obvious benefit of the region and intraregional political neutrality and colorlessness. The avoidance of political suspicions and antagonisms is an absolute requisite.

A modest one-thing-at-a-time policy is desirable, focusing on some one obvious problem whose solution is in the unmistakeable joint interest. Starting out on a small scale is desirable where it is possible because the risk of failure is lessened. Projects that do fail should be promptly dropped; those that succeed can be expanded.

More developed countries that are concerned with encouraging cooperation among the countries of Southeast Asia could do worse than consider seriously as a guide to policy the two key provisions of the highly successful Marshall Plan of 23 years ago. First, international cooperation was proposed for planning and carrying through programs to solve some single obvious problem, while the nations concerned could if so disposed persist at odds on the other matters. Second, the United States pledged good will, cooperation, and a share of the goods and capital needed to make the plan work.

In conclusion, nationalism is a central fact. Formal cooperation plans that would compel the nations of the region to redefine their national goals and modify their national policies are unlikely to be viable. Attempts at regional cooperation should be prudently viewed as subordinate to the main theme of nation-building, that is, how can nations and their elites consciously gain through measures that advance the region and its people as a whole? Modest, ad hoc measures can gradually soften the edge of nationalism. In time, the experience of various forms of cooperation, and the disciplines imposed on diverse economic policies by success and failure (so causing convergence of those policies), can lead to a deepening sense of regional joint interest, and hence to willingness to deepen and broaden regional cooperative ventures.

DISCUSSION I

SOMSAKDI XUTO

MANY of the thoughts contained in Professor Morgan's clear and well-balanced paper are challenging and should be studied in detail. However, as I am not an economist, I shall limit my comments to a general political perspective of regional cooperation in Southeast Asia.[1]

First of all, I am impressed by statements in the paper which have the effect of exploding many commonly held myths about Southeast Asian trade and regional cooperation. To cite a few outstanding examples—

* Countries with a concentration in primary products do not necessarily perform poorly.
* A regional free trade area does not mean that Southeast Asian countries would suffer great reduction in tariff receipts.
* The fact that all Southeast Asian countries are producing "the same thing" is not necessarily a barrier to regional trade.
* Protectionism is a sharper bar to economic growth than it would seem.
* Southeast Asia appears tolerably homogeneous but is, in fact, highly heterogeneous (although Professor Morgan's opinion that such contrasts could prove to be opportunities seems arguable).

Professor Morgan's classification of various forms of regional cooperation and other cooperative measures is admirably successful. The important point, in my view, seems to be that all these forms share the same characteristic—that is, the commitments of the countries involved are general, tentative, and flexible. I should also emphasize that the kinds of cooperation which demand closer attention are those initiated by the Southeast Asian nations themselves, such as the Association of Southeast Asian Nations (ASEAN) and the Asia and Pacific Council (ASPAC).

I am in full agreement with Professor Morgan that existing regional plans often suffer from lack of firm government intention to execute them as well as from shifts of government faces and policies. Politically, this is another way of saying that regional commitments in Southeast Asia are still flexible and tentative.

[1] *Note*: Dr. Somsakdi is at present conducting research into the whole question of Southeast Asian regional cooperation, and his presentation here should be regarded as tentative.

Professor Morgan's main contention that the bars to regional cooperation are primarily political could not be better argued. The forces that divide the nations of Southeast Asia are aggravated by the fact that no country in the region seems to have seriously and realistically faced up to the task of examining its national interest. Some of the more important constraints include an overemphasis on solving internal problems, a lack of serious consideration of the relation of national interest to regional cooperation, a knowledge gap among Southeast Asian nations, and inassertive political and intellectual leadership. The result has been confusion in the assessment of national priorities.

Difficult as these problems are, they are complicated by the existence of attitudes toward development among the Southeast Asian people in general and in the region in particular. The people of Southeast Asia are just as eager to develop themselves as other people elsewhere, but judging from their attitudes toward competition, time, and self-advancement, it must be questioned whether their attitude toward development is rational. All Southeast Asian governments are actively engaged in nation-building. It is doubtful, however, whether any one of them has thought seriously about a workable relationship between national development and regional cooperation. Even among Southeast Asian economists who are at present shaping national development efforts, there is a stronger tendency to think in terms of their own national economies rather than to "think regional." As Professor Morgan states it, regional cooperation still must be viewed as subordinate to the theme of nation-building.

In posing these problems, I am aware that the leaders in Southeast Asian countries should be given credit for accomplishing some notable cooperative measures in a short period of time. But I feel that there is a tendency among them to view regional cooperation either with unwarranted optimism or with extreme cynicism. Neither view seems relevant to the existing situation, and each could conceivably produce a reaction that would undermine the whole idea of regional cooperation.

Regional economic cooperation, in addition, seems to be used as a kind of "blanket" term with implications of instant success. Should we, therefore, talk more in terms of specific measures of cooperation? Could more emphasis be given to "private" regional cooperation as against the present excessive identification of regional cooperation with "public" (or government) cooperation? How do we bridge the gap between the optimistic visionary, who is convinced and committed to the idea of regional cooperation, and the general public which, by and large, is indifferent to the whole idea? These are some of the questions that need to be looked into, and the solutions to which should be included in any overall regional cooperation strategy.

Once this difficult task is accomplished, political leaders will still have to be convinced, and their conviction has to be strong enough to win public acceptance. This is no time for complacency. Hard and realistic thinking upon all aspects of regional cooperation is now in order. What is needed is, for want of a better expression, a "regional cooperation strategy" which could be defined as hard-headed, step-by-step, short-term as well as long-term, and accompanied by periodic assessment of performance. Professor Morgan advances the sound idea of a modest one-thing-at-a-time policy and good, working bilateral cooperation.

In the final analysis, I agree with Professor Morgan that what is crucial is time in order to gain experience in success as well as failure, which could lead to a deepening sense of regional interest. Southeast Asian nations have not done too badly so far, but they cannot afford to be complacent. The future stake of regional cooperation is high and the challenge and difficulties enormous.

DISCUSSION II

BERNARD K. GORDON

IT is a pleasure to record that Professor Morgan now refers to his subject as regional "cooperation" rather than regional "integration"—the term used when his paper was initially read at the conference. To a political scientist, the distinction is important because of the extreme unlikelihood that anything approaching integration is to be expected in the foreseeable future from the separate, though anxious-to-cooperate Southeast Asian states.

The general thrust of Professor Morgan's paper is to be applauded, for he is opposed to protectionist measures that inevitably reward economic inefficiencies and require additional administrative measures from government bureaucracies already hard-pressed to manage their societies. I also welcome his suggestion that developed countries open up their markets to the products—particularly the light manufactured products—that he hopes the developing countries increasingly will produce. What is more difficult, of course, is to envisage how that will be done. "Preferential" arrangements is one step Professor Morgan suggests, and while I endorse the goal, the rub, it seems to me, is in the implementation.

I can imagine, though not without difficulty (as UNCTAD meetings have shown), that the United States and other developed nations might accept a system of trade preferences, including special tariff agreements, designed to encourage the imports of manufactured goods from less developed countries. But this approach also has become somewhat difficult because it may not be possible to fine-tune a system of preferences to achieve precisely the goal sought—without at the same time leading to consequences that may not necessarily be wanted. Consider, for example, a system of lowered tariffs on imported rubber overshoes, in which the purpose is to encourage producers in Singapore, the Philippines, and Malaysia to enter the market of the developed countries. In such a system, it would have to be anticipated that producers in other developing countries, such as Taiwan and Hong Kong, would also be encouraged to enter the market. With their greater experience and superior efficiency, they would have some initial advantage. Southeast Asian countries would need to devote considerable energy to maintain competitiveness, even in a system of preferences provided by the developed nations.

Of course, part of this problem arises in connection with Professor

Morgan's paper, because he is primarily concerned that developing Southeast Asian countries improve their ability to produce and market manufactured goods. As he persuasively points out, that is where the large growth potential is, in terms of the historical development of world trade. My difficulty with this proposition, however, is that I cannot ignore the fact that Japan did not enter and successfully compete in the world's manufactured-goods market overnight. Instead, the process has taken several generations; and what is more important, the Japanese people, like those who have settled in Hong Kong and those who manage affairs in Taiwan, have behind them several centuries of experience with very highly-finished goods—whether in porcelain, ivory, amber, wood, lacquer, or metalware.

With some exceptions (as in Vietnam and to a lesser extent in Thailand), this experience has not been a characteristic of Southeast Asia. It is not an accident that the "best work" in Southeast Asia's craft and art is that which follows the Chinese and in some cases the Indian pattern; nor can it be altogether ignored that in centuries past the Chinese loaded as *ballast* on their vessels destined for Southeast Asia sculptures and other work that was regarded as high quality by the recipients.

I do not for a moment mean that in Southeast Asia there is not the capability to produce finished goods that will be competitive on the world market. I mean only to suggest that others have a long head start, and it is best to recognize this. There is no pat answer to rapid development, and I suspect that preferential trade arrangements such as liberalized quotas will provide no exception.

It is for that reason that I remain troubled by the general absence from Professor Morgan's discussion of the subject that was central to the conference: the role and place of agricultural development—particularly the new high-yield cereal strains—in the context of Southeast Asia's regional affairs. For one thing, as I have perhaps intimated already, I am not so much of the school that emphasizes manufacturing industry as the golden path to development. Only in recent years, for example, have the people of Australia and New Zealand achieved a degree of individual prosperity equalled nowhere outside of the United States and Canada, and it is based almost entirely on the exploitation of agricultural and other natural resources.

Now there is much that needs to be done in the Southeast Asia region before farmers achieve even a significant fraction of the income earned each year by orchardmen, growers, and sheepherders of Australia and New Zealand. What is necessary, as other papers in this volume have pointed out, is a genuine revolution in the way in which farming is done in Southeast Asia, including the much greater application of fertilizers, insecticides, and vastly improved market methods. This implies a greater application of modernization to agriculture, with attendant consequences for industrialization, and a demand for the products of medium and heavy industry that are related to agricultural development. As soon as that is said, it should also be apparent that demands have a bearing on the prospects and need for regional cooperation in certain industrial fields. As the UNCTAD meetings have shown, there are major inhibitions in the developed nations that retard the introduction of preferential arrangements, and it should by now be clear that less developed countries cannot merely wait patiently for the advanced nations to adopt enlightened policies. Indeed, when one considers the costs of the petrochemical facilities that are required for the efficient production of fertilizers, some steps in regional cooperation appear not as a luxury but as an absolute imperative. Surely if all the states in the region attempt to create their own fertilizer-producing plans, the prices of the products will be higher than they might be otherwise, and the tragedy of the scarce foreign exchange spent to build such regionally redundant facilities will be great.

A wise Thai banker tells me, moreover, that even greatly improved and efficient commodity production will not be completely effective in the economies of Southeast Asian nations unless their marketing and distribution arrangements can be significantly improved. In that sector, too, there is much that the nations could achieve, if they *cooperated more closely*. Some steps have been taken already—as in the unfortunately titled Asian Coconut Community. But the point is more important than its designation: and this is to put the commodity-producing countries in a better bargaining position with the consumers. Professor Morgan in his reference to UNCTAD briefly alludes to this, but the subject deserves more attention than he gave it; for Southeast Asian leaders well realize that unless they can rationalize and lower the shipping rates on which they depend, and unless they can achieve a better return from the sale of the products produced by their peoples—both by improving production efficiency and by arresting declining prices—no amount of foreign assistance and other measures will help.

Regional cooperation in Southeast Asia has a mighty contribution to make in that respect, and it is for that reason that I confess to my disappointment that Professor Morgan has not paid more attention to a most promising political development. He cites the Colombo Plan, ASA, Maphilindo, ECAFE, and other fossils and legacies, but makes only the barest and somewhat inaccurate reference to ASEAN—the Association of Southeast Asian Nations established in Bangkok in August, 1967. That group comprises all the Southeast Asian states that count—Indonesia, Malaysia, Singapore, Thailand, and the Philippines—which have a population base equal to that of the United States and Canada. Very slowly, very pragmatically, the leaders of this ASEAN group—and it has the support of the senior *political* leadership in each capital—is coming to grips with the economic requirements and facts of regional cooperation. ASEAN has gone to ECAFE for an economic survey of the group's economy, the thing that ECAFE does best, and at its 1969 meeting in Kuala Lumpur the ASEAN states identified more than ninety projects for regional cooperation. High on their list are commodity marketing arrangements, shipping, and joint research into better and cheaper production of commodities common to most or all of the members. It is a very encouraging step.

Professor Morgan is correct in his conclusion that politics has been at the heart of regional considerations in Southeast Asia—both in terms of conflict and cooperation. Conflict, while not yet altogether behind us, appears now to be giving way to a very deep realization that only by pooling some resources are the states of the region going to become "their own men" in Asian and world affairs. The first focus will be on economic cooperation, quite properly. And I, at least, am sanguine that the problems with which this conference was concerned, particularly the somewhat premature anxieties over the impact of the "green revolution," will be manageable if Southeast Asian states can achieve even a modest degree of joint and cooperative economic planning. They have taken the first steps, by establishing some of the infrastructure for such cooperation, for example in the ASEAN framework to which I have referred. It seems to me that the obvious task of wealthy outsiders such as the United States and Japan, which share a deep interest in ensuring that Southeast Asia does not again become a zone for major international conflict and war, is to encourage and to assist those steps.

DISCUSSION III

Edward J. Mitchell

Professor Morgan argues that one of the promising forms of encouragement to a Southeast Asian free trade zone would be the possibility of the United States' granting tariff preferences on the condition that trade barriers be reduced among the countries of the region. If this is viewed as one of the promising forms, then the outlook for integration is grim indeed. In the first place the United States would probably be opposed to the general idea of establishing another trade bloc. It is well known that it has been bothered by certain special arrangements between the EEC and associated African countries. If the United States were to support preferences among less developed countries, it would no doubt insist that these be instituted without discrimination among *all* developing countries.

And with good reason. One of the great disadvantages of regional trade blocs is that they create new vested interests in the maintenance of the trade bloc and discourage steps toward more general liberalization. A general non-discriminatory reduction in tariffs tends to reduce the size and influence of inefficient suppliers. The regional approach does weaken locally inefficient suppliers on a global basis. The greatest gains from trade, if we take the factor-endowments theory at all seriously, are likely to result from trade with peoples residing in a substantially different environment—in other words, outside the region. Thus, whatever gains may accrue initially from regional integration may be offset in the long run by a generally higher level of tariffs with respect to the rest of the world.

In addition, one could hardly expect the United States to support such integration in one part of the world and oppose it elsewhere. To the extent that one region integrates, of course, all other regions will be worse off. Thus, it is not likely that a regionally integrated world will be much better off than the present one.

This brings me to the specific question of the immediate gains from a Southeast Asian trade zone. Professor Morgan points out the deplorable state of trade statistics in the less developed countries (or for that matter in developed countries). Nevertheless, some efforts must be made to determine the new trade flows resulting from integration. Could we not focus on just those products and countries where data are consistent and plausible? In this way we might at least obtain approximate estimates of some critical magnitudes. Judging from a few exercises I have seen with trade between developed and less developed countries, one has every right to be pessimistic about the gains from intraregional preferences in Southeast Asia. Perhaps the Southeast Asian governments are correct in holding on to a few political advantages and foregoing uncertain, and probably small, economic gains.

EXTERNAL POLICY IMPLICATIONS IN THE RICE TRADE OF SOUTHEAST ASIAN COUNTRIES

(CONCLUDING COMMENT)

SEIJI NAYA

THE preceding papers and discussions make clear that much more needs to be accomplished in technological, economic, and organizational fields before individual Southeast Asian countries can derive greater benefit from recent innovations in agriculture. Agriculture is the largest sector and rice the most important commodity in all Asian countries, so that even a small improvement in productivity could significantly raise real income. Today, technological improvement and greater production possibilities are beginning to change the rice situation from one of scarcity to surplus. The transition has been quickened by the goals of self-sufficiency in many deficit countries (a goal not difficult to understand where rice is the major staple food, especially when it is scarce). The result, however, is that traditional patterns of production and trade in rice are being drastically altered, adding to the "volatility" and "uncertainty" of the international and regional rice trade scene. The situation appears to be exacerbated by the agricultural protectionism of some of the developed countries, which restricts the exports of less developed countries. Under these conditions, three participants at the conference—Drs. Barker, Abel, and Wagner—have argued for a reexamination of current rice policies.

Commodity Agreements

One wonders whether the rice trade problem could not be better examined by regional countries as a group, and more broadly, by some sort of commodity agreement by countries engaged in rice trade. Dr. West raised this point when he stated that "international commodity agreements are often useful instruments for effecting international trade and price stabilization in specific agricultural commodities." It is evident from past experience, however, that commodity agreements are extremely difficult to negotiate. As outlined in Dr. Mangahas' paper, the Philippines proposed regulatory agreements to control world rice trade at the 13th Session of the FAO Study Group on Rice in March 1969. It is reported that the proposal received little attention and support from the participants, with the exception of Thailand (which made its own proposal), and the meeting ended with the familiar and convenient recommendation for further study on the nature of the rice problem.

The question of a commodity agreement on rice is complex. The "volatility" and "instability" of present rice trade has many unknown elements. At the conference, no general consensus was reached on whether the presently falling rice price is part of a cyclical phenomenon or the beginning of a long-term trend. Were the current apparent surplus of rice due to random or natural changes in production, a commodity agreement might stabilize the price in the short run. All indications, however, point to a long-term trend. If technological innovation develops further in some countries, and continues to spread to other Asian countries, it will be difficult (and perhaps undesirable) to rely on a commodity agreement to change or raise the price set by the average trend in supply and demand.

In general, less developed countries favor the commodity agreement as a potential form of aid to them from developed countries. Demand for such agreements is often based on legitimate complaints against the protectionist policies of developed countries. It is said, for example, that Japan's rice price policy has helped to expand rice output, eliminate imports, and place the country in a position to export on concessional terms. Similarly, it is considered that the rice policy of the European Economic Community penalizes the rice exports of Asian nations.

The provision of rice by the United States under the foreign aid program, while a benefit to receiving countries, is competition directly and indirectly to Asian exporters. The United States is the only country which has had a supply management program regulating the output level of rice, its entrance as one of the largest exporters having been facilitated not long ago by a production increase through this program in response to the world rice scarcity problem.

With a clearer indication of surplus, a supply restriction should be more manageable in the United States than elsewhere, although it is questionable whether this country would presently reduce its production and exports to accommodate the exports of some Asian nations.

The rice trade of not only the United States but of all countries is quite isolated from the operation of market forces, and is regulated by government transactions. The presence of such transactions which are often politically motivated is likely to add to rather than ease the complexity of negotiating for an international commodity agreement. Also, the commercial policies of non-United Nations members, particularly Red China, remain an important question mark because they could potentially serve as disruptive forces in the operation of a regulatory trade agreement negotiated by others.

Conflicts of interest and over what should be the goals of a commodity agreement are likely to be great in the case of rice, and would arise not only from differences between developed and Asian countries but also among Asian countries, as reflected in the lack of consensus at the aforementioned FAO meeting on rice. Rice is a major traded item intraregionally. Unless it is compensated by developed countries (which include Japan), trading at a stabilized price by a commodity agreement would involve intraregional transfer of income. For example, rice exported to one Asian country from another at an agreed price higher than that in the free market would be like a subsidy and income transfer from the importer to the exporter; and vice-versa when the price is lower. Developing Asian countries would be the least able to afford the implicit burden of such transfers (as well as the cost of maintaining the international buffer stock).

Although the production and consumption of rice are large in Asian countries, the trade share of rice as a proportion of production is, on the average, very small (however, it is large in comparison to other commodities). Hence there is a practical possibility that many rice shortage Asian countries would attempt to gain self-sufficiency in production. This is especially true at the present time when the scope of technologically increasing rice production has expanded, and the comparative advantage of individual countries is changing. Commodity agreements, even those which require consideration of specialization and efficiency, would thus be less appealing to some importing countries. Difficulty would also arise in agreeing upon an adequate cooperative scheme to control exports and imports and actual and potential supply which is needed in a "successful" commodity agreement.

The variation of existing domestic situations and internal assessments of the international market partly explain why Asian countries fail to take a unified position vis-a-vis developed countries. The approaches taken by individual Asian nations at the FAO meeting range from those of the Philippines and Thailand to India's and Pakistan's view that the situation is not yet serious, to Korea's general preference for the present arrangement of receiving rice on concessional terms from the United States and Japan.[1]

It is not certain, therefore, that an international commodity agreement in rice is the best way to tackle the rice problem. Even with a broad front, negotiation is difficult; and in the absence of consensus, such agreements are not likely to be taken seriously or supported by developed countries.

Despite the lack of consensus at the FAO meeting, it is significant that

[1] Peter Frieland, "The Politics of Rice," *Far Eastern Economic Review,* May 1969, pp. 286-289.

two Southeast Asian countries took the initiative in proposing concrete measures to stabilize rice trade. Furthermore, it was the Philippines' position to incorporate arrangements such as a subregional payments agreement in Southeast Asia.

Diversification of Crops

Many participants at the SEADAG conference argued that there is a need to shift some of the emphasis from rice to other crops such as maize for which the international demand is greater. As Drs. Wagner and Abel have shown, this is already being done in Thailand. The point is, productivity gain in rice should be effected not for the sake of rice alone but in the context of agricultural development and diversification and, further, as a step toward structural changes in the economies of Southeast Asian countries. With the international rice situation as uncertain as it appears, a proper balance in rice, and the channeling into other areas of part of the resources procured by increased productivity, are likely to be called for. Price support programs, which the Philippines, Indonesia, and Pakistan have been adopting, will be costly, especially if the surplus proves to be a long-run trend.

Regional Cooperation

Because rice is such an important Asian product, the domestic and trade policies of an individual country directly and indirectly affect not only the trade of rice and other commodities of that country but other Asian countries as well. Considering the economic and trade structures of Southeast Asian nations, this writer has argued that regional cooperation would be more effective when primary products (including rice) are included than when they are not.[2]

It is difficult to assess how far the Philippines, Thailand, and other Asian countries would move toward a regional approach—as it affects rice and more broadly as it affects trade and development as a feasible and concrete alternative. But the possibility and interest, especially among ASEAN countries, as well as the need, appear to be greater today. The rice problem confronting these countries may very well turn out to be a facilitating factor.

[2] Seiji Naya, "Variations in Export Growth Among Developing Asian Countries," *Economic Record,* December 1968.

INTERNATIONAL CONFERENCE ON IMPLICATIONS OF TECHNICAL CHANGE FOR GRAIN PRODUCTION AND TRADE IN SOUTHEAST ASIA

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CHAIRMAN

Dr. Vernon W. Ruttan
Department of Agricultural Economics
University of Minnesota
St. Paul, Minnesota 55101

SPEAKERS

Dr. Martin E. Abel
Program Advisor in Economics
The Ford Foundation
55 Lodi Estate
New Delhi 3, India

Dr. Virach Arromdee
Faculty of Economics and Business Administration
Kasetsart University
Bangkok, Thailand

Dr. Dragoslav Avramovic*
Chief Economist
South America Department
International Bank for Reconstruction and Development
1818 H Street NW
Washington, D. C. 20433

Dr. Randolph Barker*
International Rice Research Institute
Box 583
Manila, Philippines

Dr. Howard W. Beers
Director, Center for Developmental Change
University of Kentucky
Lexington, Kentucky 40506

Dr. Matthew Drosdoff
Department of Agronomy
Cornell University
Ithaca, New York 14850

Dr. Bernard K. Gordon
Project Chairman, Southeast Asia
Research Analysis Corporation
McLean, Virginia 22101

Dr. Yujiro Hayami
Department of Agricultural Economics
University of Minnesota
St. Paul, Minnesota 55101

Dr. Kenzo Hemmi
Department of Agricultural Economics
Faculty of Economics
University of Tokyo
Bunkyoko
Tokyo, Japan

Dr. W. David Hopper
The Rockefeller Foundation
17, Kautilya Marg, Chanayapuri
New Delhi 11, India

* Although contributors to this volume, Drs. Avaramovic and Barker were unable to attend the conference.

Dr. S. C. Hsieh
Projects Department
Commercial Center
P.O. Box 126
Makati, Rizal D708, Philippines

Dr. Nicolaas G. M. Luykx II
Department of Agricultural Economics
Michigan State University
East Lansing, Michigan 48823

Mr. Mahar Mangahas
School of Economics
University of the Philippines
Diliman, Quezon City, Philippines D505

Dr. William C. Merrill
Department of Economics
Iowa State University of Science and Technology
Ames, Iowa 50010

Dr. Edward J. Mitchell
Council of Economic Advisors
Office of the President
Washington, D. C. 20506

Dr. Theodore Morgan
Social Science Building 7422
University of Wisconsin
Madison, Wisconsin 53706

Dr. Mubyarto
Bureau of Economic Research
Gadjah Mada University
Jogjakarta, Indonesia

Dr. Seiji Naya
Department of Economics
University of Hawaii
Honolulu, Hawaii 96822

Dr. Ernest W. Sprague
Agricultural Project Leader
The Rockefeller Foundation
G.P.O. Box 2453
Bangkok, Thailand

Dr. Augustine H. H. Tan
Department of Economics
University of Singapore
Singapore

Dr. Melvin M. Wagner
Visiting Professor of Agricultural Economics
Uttar Pradesh Agricultural University
Pantnagar
Nainital District, U.P., India

Dr. Quentin M. West
Director
Foreign Regional Analysis Division
Economic Research Service
U.S. Department of Agriculture
Washington, D. C. 20250

Dr. Delane E. Welsch
The Rockefeller Foundation
G.P.O. Box 2453
Bangkok, Thailand

Dr. Somsakdi Xuto
Faculty of Political Science
Chulalongkorn University
Bangkok, Thailand

Dr. Pan A. Yotopoulos
Food Research Institute
Stanford University
Stanford, California 94305

PARTICIPANTS

Mr. John E. Arthur
Associate Assistant Administrator for National Development
AA/VN, Room 6311 NS
Agency for International Development
Washington, D. C. 20523

Dr. Milton Barnett
Agricultural Development Council
630 Fifth Avenue
New York, New York 10020

Mr. John A. Brownell
East-West Center
Honolulu, Hawaii 96822

Dr. Dana G. Dalrymple
Staff Economist
International Agricultural Development Service
U.S. Department of Agriculture
Washington, D. C. 20250

Dr. Jack Davidson
Head, Department of Agricultural Economics
University of Hawaii
Honolulu, Hawaii 96822

Mr. Don Davis
Chief Agriculture and Rural Development Division
EA/TECH, Room 3316A NS
Agency for International Development
Washington, D. C. 20523

Mr. A. John DeBoer, Rapporteur
Department of Agricultural Economics
University of Minnesota
St. Paul, Minnesota 55101

Mr. Irving M. Destler
Regional Coordinator, International Development
Foreign Agricultural Service
U.S. Department of Agriculture
Washington, D. C. 20250

Dr. J. Price Gittinger
Lecturer
Economic Development Institute
World Bank
1818 H Street NW
Washington, D. C. 20433

Mr. Ralph N. Gleason
Deputy Director
WOH/ARDS, Room C-501 SA-10
Agency for International Development
Washington, D. C. 20523

Dr. Wytze Gorter
Dean of Graduate Division and Director of Research
University of Hawaii
Honolulu, Hawaii 96822

Mr. Wesley Haraldson
USAID
APO San Francisco 96528

Dr. Richard Lee Hough
Edward R. Murrow Centre of Public Diplomacy
Fletcher School of Law and Diplomacy
Medford, Massachusetts 02155

Mr. Robert R. Johnson
Director
Office of Technical Services
EA/TECH, Room 3313 NS
Agency for International Development
Washington, D.C. 20523

Mr. William F. Johnson
AA/TA
Agency for International Development
Washington, D. C. 20523

Dr. Charles Kaut
Department of Sociology and Anthropology
University of Virginia
Charlottesville, Virginia 22903

The Honorable Everett Kleinjans
Chancellor, East-West Center
Honolulu, Hawaii 96822

Dr. Arnold Larson
Department of Agricultural Economics
University of Hawaii
Honolulu, Hawaii 96822

Miss Jane E. Levitt
SEADAG
The Asia Society
112 East 64th Street
New York, New York 10021

Mr. Alexander R. Love
Philippine Desk Officer
EA/NEAP, Room 4218A NS
Agency for International Development
Washington, D. C. 20523

Mr. Martin D. Mulholland
Agriculture and Rural Affairs Director
East Asia Office of Regional Development
EA/RD, Room 3317 NS
Agency for International Development
Washington, D. C. 20523

Dr. Gayl D. Ness
Department of Sociology
University of Michigan
Ann Arbor, Michigan 48104

Dr. Shao-er Ong
Senior Specialist
Institute of Advanced Projects
East-West Center
Honolulu, Hawaii 96822

Mr. John J. Quinn
SEADAG
The Asia Society
112 East 64th Street
New York, New York 10021

Mr. Edward B. Rice
PPC/POL/ES, Room 3881
Agency for International Development
Washington, D. C. 20523

Dr. Fred W. Riggs
Social Science Research Institute
University of Hawaii
1914 University Avenue #101
Honolulu, Hawaii 96822

Miss Avery B. Russell
SEADAG
The Asia Society
112 East 64th Street
New York, New York 10021

Dr. Shujiro Sawada
Institute of Advanced Projects
East-West Center
Honolulu, Hawaii 96822

Mr. Frederick F. Simmons
Deputy Director
USAID/Thailand
APO San Francisco 96346

Mr. Walter F. Stettner
Director, Office of Economic Policy
VN/PEP, Room 409F RP
Agency for International Development
Washington, D. C. 20523

Dr. Aram A. Yengoyan
Department of Anthropology
221 Angell Hall
The University of Michigan
Ann Arbor, Michigan 48104

The Honorable Kenneth T. Young
Chairman, SEADAG and President, The Asia Society
112 East 64th Street
New York, New York 10021

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AGRICULTURAL REVOLUTION IN SOUTHEAST ASIA

CONSEQUENCES FOR DEVELOPMENT

VOL. II

Report of the Second SEADAG International Conference on Development in Southeast Asia, New York, June 24-26, 1969.

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SEADAG

The Asia Society
112 East 64th Street
New York, N. Y. 10021

THE Southeast Asia Development Advisory Group (SEADAG) is a private international organization of persons who have special competence in the fields of economic and social development. While all of its members are not Southeast Asia specialists, SEADAG represents a major concentration of these area experts. The SEADAG membership is drawn from all relevant professional fields, including agencies of the United States and Southeast Asian governments, international organizations, research institutions, universities, foundations, business and financial institutions, and others, both in the United States and elsewhere.

Organized under The Asia Society in New York, SEADAG is dedicated to the solution of problems of development in Southeast Asia and to the encouragement of Southeast Asian research initiative and capacity. Toward this end, SEADAG organizes international conferences, seminars, and workshops in the United States and Southeast Asia; awards grants for research on Southeast Asia; and publishes and distributes papers on relevant topics. SEADAG renders advisory and research services under contract to the U.S. Agency for International Development. Such services are available to other institutions within the framework of SEADAG's purposes.

VOLUME One of *Agricultural Revolution in Southeast Asia* consists of nine papers—with formal discussions—read at the SEADAG Rural Development Seminar Meeting on "Implications of Technical Change for Grain Production and Trade in Southeast Asia." The Meeting was held in Honolulu, June 19-21, 1969.

VOLUME Two of *Agricultural Revolution in Southeast Asia* consists of five papers—with formal and informal discussions—read at the Second SEADAG International Conference on Development in Southeast Asia. This conference, held at Asia House in New York June 24-26, 1969, focused on "The Implications of Agricultural Innovation for Development in Southeast Asia."

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CONTRIBUTORS

LESTER R. BROWN, senior fellow with the Overseas Development Council in Washington, D.C., is former administrator of the International Agricultural Development Service, U.S. Department of Agriculture. Recognized as a leading authority on world food problems, Mr. Brown is the author of three books, *Man, Land, and Food* (1963), *Increasing World Food Output* (1965), and *Seeds of Change* (1970), and numerous articles for professional journals and popular magazines.

JOSEPH FISCHER, comparative educator, is research associate at the Institute of International Studies, Center for Southeast Asian Studies, the University of California at Berkeley. He has carried out extensive research on education and development in Southeast Asia and is currently director of an Indonesian social science project. His most recent publication is *Social Sciences and the Comparative Study of Educational Systems* (International Textbook Company, 1969).

ARTHUR T. MOSHER, president of The Agricultural Development Council in New York, has made a special study of the process of agricultural development and agricultural education in South Asia, Southeast Asia, and also Latin America. He is the author of *Getting Agriculture Moving*, published by Praeger in 1966, and "Creating a Progressive Rural Structure to Serve a Modern Agriculture," published by The Agricultural Development Council in 1969.

MANNING NASH is professor of anthropology at the University of Chicago. His professional interests concern principally the dynamics of economic development and cultural change. Professor Nash's field work includes studies of Burmese family and social life, and political, economic, and religious integration in Kelantan, Malaya. His latest book is entitled *The Golden Road to Modernity*, published by John Wiley in 1965.

GENERAL NETR KHEMAYOKHIN, until his recent retirement, for several years held the dual post of Secretary-General of the National Research Institute in Bangkok and Under-Secretary in the Office of the Prime Minister. For many years he has contributed to educational planning in Thailand, and has now succeeded the former Ambassador to the United States, Dr. Sikish, as Director of the Southeast Asia Ministers of Education Secretariat (SEAMES).

NIBONDH SASIDHORN, Dean of the Faculty of the Social Sciences at Chiengmai University in Thailand, and lecturer in the Faculty of Political Science at Chulalongkorn University, was formerly attached to the Office of the Prime Minister. He received his M.A. at the Fletcher School of Law and Diplomacy in Massachusetts, and his Ph.D. from the University of Indiana.

NONGYAO KARNCHANACHARI, Chief, Curriculum and Accreditation Division, Office of the National Education Council in Bangkok, Thailand, holds several posts concerned with national planning for higher education in Thailand. In addition to her administrative work, she is teaching English as a second language and writing articles on higher education. Mrs. Nongyao is a member of the Thai Association on University Women, the Education Society of Thailand, and the National Education Association in the United States. She attended Columbia University in New York in 1957.

VERNON W. RUTTAN is chairman of the department of agricultural economics, University of Minnesota, and former chairman of the SEADAG Rural Development Seminar. Dr. Ruttan's research and writing have concentrated on the economics of technical change, including specifically the environmental, technological, and institutional factors in the growth of rice production, in the Philippines, Thailand, and Taiwan.

SELOSOEMARDJAN is director of the Institute for Regional Research in Kebajoran Baru, Indonesia, and Dean of the Faculty of Social Sciences at the University of Indonesia. Professor Selosoemardjan's special interest is political sociology and the sociology of economic underdevelopment. He is the author of *Social Changes in Jogjakarta* and *Social and Cultural Implications of Indonesia's National Revolution,* both published in 1962. In addition, he has written many articles for use by Indonesian students.

SOEDJATMOKO, Ambassador of the Republic of Indonesia to the United States, has had one of the most distinguished and varied careers of any diplomat and intellectual in Indonesia. In addition to his political activities, he has been at various times a medical student, world traveler, newspaper publisher, journalist, and teacher. From 1961 to 1962 he became guest lecturer on Southeast Asian history and politics at Cornell University. He has written widely on Indonesian history and on the cultural and political development of Indonesia and Southeast Asia. Prior to his appointment as Ambassador in 1968, Mr. Soedjatmoko was personal advisor to Foreign Minister Adam Malik.

GELIA TAGUMPAY-CASTILLO, associate professor of rural sociology, College of Agriculture, University of the Philippines, was visiting professor at Cornell University in 1966-67. Her writings on the sociology of development and rural sociology include "Technical and Social Change: The Case of Miracle Rice"; "An Alternate View of the Subculture of Peasantry"; and "Toward Harnessing Science and Technology for Agricultural Productivity and Community Development." Among Dr. Castillo's many professional commitments, she is chairman of the program committee for the 1971 Asian conference on teaching and research in the rural social sciences.

VU VAN THAI, former Ambassador of the Republic of Vietnam to the United States, is presently consultant to the administrator of the United Nations' development program in Asia and Africa, and to the RAND Corporation. Between 1954 and 1961 Mr. Thai served as a top administrator in the planning and budget and foreign aid programs of South Vietnam. His work in the field of agriculture includes the responsibility as coordinator of the joint FAO/UNDP mission on agricultural development in South Sumatra, Indonesia (1968) and consultant to the establishment of the West African Rice Development Association (1968-1970).

FRED R. VON DER MEHDEN is Albert Thomas professor of political science and director of the Center for Research in Development and Social Change at Rice University in Houston. In 1959-60 he received a Fulbright Faculty Research grant to Burma. Professor von der Mehden is the author of *Politics of the Developing Nations,* published by Prentice-Hall and revised in 1969, and co-author of *Issues of Political Development*, also published by Prentice-Hall, in 1967.

KENNETH T. YOUNG, former Ambassador of the United States to Thailand, was president of The Asia Society and chairman of SEADAG from 1964 to 1970. Among his diplomatic duties, Mr. Young was deputy representative at the Panmunjom Political Talks, delegate to the Summit Conference of 1955 and chief of the United States delegation to the plenary session of UN/ECAFE. Mr. Young is the author of *Negotiating with the Chinese Communists 1953-67*, and is currently undertaking a study of future U.S. policy in Southeast and East Asia as a senior fellow at the Council on Foreign Relations in New York.

INTRODUCTION

THE "green revolution" in Asia is by now well known, but its human and social consequences still need to be assessed. It could be another case of technology racing ahead of society and upsetting institutional arrangements; it could be, as has been suggested, just another commodity boom that will run its course; or it could be, with timely analysis, forecasting, and policy, an engine of development that will be of tremendous benefit to the peoples of Southeast Asia.

To identify and examine the possible consequences of the agricultural revolution, the Southeast Asia Development Advisory Group of The Asia Society organized a conference of Asians and Americans, which was held at Asia House from June 24 to June 26, 1969.

This was the second time in two years that SEADAG has held an international conference to explore and discuss national and regional development in Southeast Asia. The first, held in January 1968 in Honolulu, provided the first occasion for the exchange of Asian and American views on social science research in and on Southeast Asia. One of the most important outcomes of this meeting was the conclusion that development research should be determined in much greater measure by Asians themselves, and carried out within an Asian cultural context. It was felt that with this Asian orientation, some of the failures of American development research in the past might be avoided. Such an approach also would open new and viable channels of communication between the scholarly communities on both sides of the Pacific.

This conference adjourned with the overwhelming recommendation for a second international meeting on Southeast Asian development, this time to be conceptualized and designed with Asian collaboration. It was agreed that now that this much needed and long overdue critique of research orientations had taken place, the way was open for a meeting that would deal with problems of substance, as distinct from problems of attitudes. The theme would relate to a broad range of countries and development concerns in Southeast Asia; and it would reflect the concerns of the SEADAG membership, the scholarly communities, and AID and American foundations.

The topic chosen, after careful review by the Conference Planning Committee and in accordance with the suggestions of Asian scholars, was the role of agricultural innovation in the development of Southeast Asian nations. Agricultural innovation in this context was understood to include not

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only advances in the technique of food production but its related social and political aspects as well.

No subject is more central to the development process in Asia than agriculture. A majority of the population lives in the rural areas and earns its livelihood from agricultural work. Any radical change in the methods and volume of agricultural production would necessarily affect the fate of millions and ultimately the development prospects of Asian nations. With the introduction of the new rice technologies during the past few years, some of the countries in Southeast Asia have experienced a dramatic rise in food production. It is to an assessment of its impact on the region that participants of the second conference were asked to address themselves. What, specifically, would be the effect of agricultural innovation on the economies, on the patterns of rural and urban life, on education and manpower resources, and on the intracountry and international relations of Southeast Asian countries? Last of all, what could be the contribution of social scientists to the management of rapid agricultural change in order to benefit not only individual countries but the region as a whole?

Heeding the lessons of the first conference, Asian social scientists were asked to take the lead in providing the answers to some of these crucial and comprehensive questions. The papers and discussions published in this book are the written results of their efforts. I wish to express my deep appreciation to them and to the other Asian participants for making this conference a notable success, by bringing new Asian perspectives on a major issue to public attention. I wish also to thank our one participant from Australia, and the American authors and conferees for giving us the important Western view. Last but by no means least, thanks go to Lionel Landry for providing the guiding spirit and managing hand behind the conference planning.

KENNETH T. YOUNG

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IMPACT OF AGRICULTURAL INNOVATION ON PATTERNS OF RURAL LIFE (FOCUS ON THE PHILIPPINES)

GELIA TAGUMPAY-CASTILLO

TODAY is an era of revolutions, some of which are "cultural," some "black," some "green," and some "academic." What we are now witnessing in the Philippine countryside may not qualify as a revolution by Latin-American or New York standards, so it will suffice to say that: *Changes are taking place.*

Predictably, any innovation, but particularly a revolutionary one, ushers in or is ushered by a new set of behavioral and institutional requirements which, in turn, give rise to what are characterized as second-generation problems. This paper attempts to sketch the role of agricultural innovations in Philippine rural life, starting from the environment of the traditional world to the emergence of these second-generation problems. Patterns of communication, adoption, response, and adjustment to innovations are identified and described, utilizing data from published and unpublished sources. In addition, my observations and experience as a student of rural life over the years are brought to bear on the subject.

THE "TRADITIONAL" WORLD

Before we can discuss the impact of agricultural innovation on traditional rural life, we have to begin with an idea of what is changing. Covar's study of the Masagana/Margate system of rice cultivation gives us an excellent start. This system includes the nine basic steps usually followed by Filipino farmers but involves more careful and intensive operations. Covar's prognosis of the system's prospect for adoption is as follows:

> The Masagana/Margate system is a product of specialists or experts in agriculture. The older method, on the other hand, has been polished and hallowed by tradition and experience. The gap between the new and the traditional is large enough to create a situation whereby the new can be misunderstood. Furthermore, the relationship between those who are introducing and those who are going to accept the innovation is not on an equal plane in terms of age, education, and other socio-cultural factors. It may be assumed that there are socio-cultural barriers, such as respect for old age and farming experience, which very much affect acceptance.
>
> The farmers accept only within the framework of their viewpoint as

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conditioned by their experience. Thus their readiness to accept is definitely limited. In connection with this, there should be an identification of a need, and the meeting of such a felt need should be the basis of any program of community development. Do the farmers feel a need for the Masagana/Margate system? Again the farmers respond only within the limits of their training, experience, and understanding. . . . A case which seems to be relevant is cited as an analogy. If, for instance, a beautiful pamphlet is given to a primary grader, and his response is recorded, one would notice that the pupil will only scan the pages and then put it aside. The case is identical to that of the farmers. They have been given pamphlets with instructions for a new way of planting rice. However, they only become interested in looking at the pictures, never applying what they have seen and read.[1]

Although the setting of Covar's study, and several other studies that will be reviewed further on, is Laguna Province, Jocano's analysis of economic development and cultural change in a Visayas barrio bears out Covar's evaluations. His analysis is prefaced by a note of caution:

> . . . To talk about acceptance of modern technology in terms of demonstrating its economic advantages is to be naive about the dynamics of human study. One needs to view acceptance in terms of the meanings people have of economic advantages. . . .

Jocano describes the Malitbog farmer's reaction to leasehold arrangement, cooperative labor, and scientific farming practices:

> . . . the rental is fixed and risks are borne by the lessee alone. When farming is dependent only on the vagaries of an uncontrolled natural environment, these risks are indeed great. This unpredictability of nature is one of the major elements in Malitbog's general ecology that wields an overriding influence on local agricultural activities. . . . In a word, lack of technological control over nature, like irrigation, makes farming a gamble. It is thus understandable why the farmers do not appreciate the value of risk in agricultural management or on-the-spot decision-making in any agricultural activity. On the other hand, they have learned to be slow in their actions and have developed elaborate planting, caring, and harvesting rituals to help them determine and control the behavior of nature. One miscalculation means dislocation of the annual economic income which is in any event very small. Moreover, credit is difficult to obtain, and if it is available the interest is indeed exhorbitant. . . .
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> . . . . . . Farming is a nuclear family affair with members as the basic working unit. This does not mean that other forms of cooperative labor are ruled out in the process but that full cooperation of an extended household in the production of staple food or of any crop is relatively rare. They help one

[1] Prospero Covar, *The Masagana/Margate System of Planting Rice: A Study of an Agricultural Innovation,* Study Series No. 5, University of the Philippines, Community Development Research Council, 1960.

another in many agricultural endeavors—like plowing and transplanting, but they cultivate different fields and feel solely responsible only for their own fields. There are cooperative labor patterns in the barrio which involve the participation of nonkin. . . .

. . . . . . Other factors which need to be considered in talking about land use and production in Malitbog are the financial resources of the people and the market prices of crops they produce. Given the chance, farmers would prefer scientific farming over the traditional because they are aware that it would bring better harvests. However, they are also aware that acceptance of modern technology would entail more expense than they could afford. Fertilizer and insecticides are needed. Measured spacing during transplanting is time-consuming and labor-demanding. The seeds have to be selected. All of these have to be purchased in addition to labor expenses which have also to be met. Thus the limited financial resources of the farmers at the beginning of the planting season prevent them from accepting modern farming as the means of resolving their economic problem . . . . . . this pressure of limited economic opportunities has led to conservatism in outlook and preferences for traditional methods in farming in that tried ways are more assuring and more predictable than new alternatives which have greater elements of risk that the farmers are not quite prepared to take.

Not only do financial resources but also the possible market price of the crops enter into this pattern of decision-making at the beginning of the planting season. Prices of crops planted, harvested, and sold during the previous year are reviewed and the lower-priced crops are avoided. For example, when the wholesaler in the town in 1964 lowered the price of new varieties of rice —Manila rice, BE-3, etc.—because of poor milling return, the farmers did not plant these varieties in 1965. In the nearby barrio of Igsuli, there was a rush for sugarcane cropping in 1963-64 because the price of sugar went up in 1962. In fact, many rice fields were converted into cane fields. . . .

. . . . . . Rituals, prayers and other ceremonies are performed during the planting and harvesting seasons in order to hasten the growth of rice, to ward off evil spirits from the field and to insure a good harvest. The observance of these rituals follows the agricultural cycle.

In emphasizing the significance of rituals and sympathetic magic on the economic activities and social behavior of the people, I do not imply that they are not aware of scientific, tested methods of farming. They know that when commercial fertilizers are used their crops will give them a rewarding yield. They also know that they have to take good care of their fields if they expect to have a good harvest. It is only within the realm of recurrent events in which their technological knowledge cannot effectively operate that rituals are used. The farmers are aware that there are certain culturally sanctioned ways of reinforcing their agricultural knowledge. The use of sympathetic magic is an important one. As one of the farmers reasoned: "I lose nothing if it does not work; I have everything to gain if it does."[2]

[2] F. Landa Jocano, *The Traditional World of Malitbog: An Anthropological Study of Economic Development and Culture Change in a Philippine Barrio,* University of the Philippines, Community Development Research Council, 1967.

It is into this kind of environment (as seen by the social scientist) that agricultural innovations have to make their way. How have farmers and the rural community in general responded to these incursions into their traditional life? Before we can answer this, we need to describe the adoption process of an innovation—from the farmers' initial awareness of its existence to its eventual implementation.

COMMUNICATION PATTERNS

It does not require great wisdom to postulate that an innovation, before it can be accepted, must first be brought to the attention and consciousness of the potential acceptor. From the results of several studies that have investigated the channels and processes by which agricultural information reaches the Filipino farmer, certain patterns emerge.

Sources of Information

All of the studies reviewed for this paper show that information on agricultural innovations—regardless of stage in the adoption process—is obtained predominantly from personal sources and to a more limited extent through institutional and extension channels. This general observation does not coincide with findings in the United States which show mass media (TV, radio, newspapers, magazines) to be the most important first sources of information.[3]

Bueno classified personal sources into *personal cosmopolite* (extension workers, agricultural storeowners, landlords, other farmers—all of whom come from outside the barrio) and *personal localite* (co-farmers, neighbors, relatives, other people from within the barrio). Early adopters tend to obtain information from cosmopolite personal sources; other sources are either persons or mass media.[4] Once the innovation has entered the barrio, localities then become the predominant sources.[5] In a more economically advanced area of the Philippines, for example, most farmers heard of new rice varieties

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[3] Hsueh-Yi Lu, "Some Socio-economic Factors Affecting the Implementation at the Farm Level of a Rice Production Program in the Philippines," unpublished Ph.D. Thesis, University of the Philippines, College of Agriculture, 1968; and Herbert F. Lionberger and H. C. Chang, *Communication and Use of Scientific Farm Information by Farmers in Two Taiwan Agricultural Villages,* Research Bulletin 940, University of Missouri, May 1968, p. 38.

[4] Gloria D. Feliciano, *The Flow of Information: Some Emerging Patterns in Selected Philippine Barrios* (seminar paper presented at the International Rice Research Institute, June 10, 1965), Communications Studies Series 2, University of the Philippines, Institute of Mass Communications, Diliman, Quezon City, 1965-67.

[5] Pedro B. Bueno, "The Role of Mass Media in the Adoption of 2,4-D, in Two Laguna Barrios," unpublished B.S. Agriculture Thesis, University of the Philippines, College of Agriculture, 1966.

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from neighbors, although the earliest adopters obtained their information from an extension worker or from a managing landlord.[6] Dealers provided more information for insecticides, rodenticides, rotary weeders, and fertilizers than for other practices. Seed selection has been an age-old practice traditionally learned from parents and ancestors.[7]

The frequent mention of extension personnel as sources of information should not be interpreted as a sign of their overriding influence. At the trial and adoption stages, the Filipino farmer usually finds himself on his own.[8] Clues as to what most likely occurs are given in Lu's study. Of 395 farmers interviewed, 88 percent were aware of the extension worker's presence in the barrio. When asked how often they had contact with the extension worker, however, 45 percent replied seldom; 22 percent said never; 18 percent said often; and 15 percent said very often. "Often" meant once or twice a month.

The reason given for this infrequent contact was that the extension worker was unable to stay in the barrio long enough to become acquainted with the farmers before he was transferred. As one extension worker remarked: "What is the use? Tomorrow I may go to another barrio."

As to actual advice, only 30 percent of the farmers received guidance from the extension worker on the use of fertilizers, 39 percent on the use of farm chemicals, and 47 percent on cultural practices.[9]

When IR8 seeds were first distributed in the Bicol region, primarily through offices concerned with rice production, only half of the initial recipients were given technical assistance. The remainder trial-planted IR8 on a purely "self-help" basis. One farmer, in fact, expressed surprise when asked about technical assistance received: "I did not know there should be someone to give us that kind of assistance."[10]

The role of mass media in the dissemination of information on new technologies appears to be secondary to personal sources. Frio found that in spite of broadcasts of IR8 information over two radio stations and the placement of posters and billboards at strategic points, only 2.5 percent of the 80 farmers in the community under study reported hearing about

[6] David S. H. Liao, "Studies on Adoption of New Rice Varieties," paper presented at the International Rice Research Institute Saturday Seminar, November 9, 1968.

[7] Hsueh-Yi Lu, *op. cit.*; Alice M. de Guzman and Conrado M. Dimaano, "Coralan Rice Farmers' Response to Change in Cropping Pattern: A Case Study," The Seminar Workshop on the Economics of Rice Production: papers presented at a conference at the International Rice Research Institute, December 8-9, 1967, pp. 7-1 to 7-82; and Soledad L. Pahud, "Some Factors Associated with the Adoption and Rejection of Recommended Rice Practices," unpublished M.S. Thesis, University of the Philippines, College of Agriculture, 1969.

[8] Pedro B. Bueno, *op. cit.*

[9] Hsueh-Yi Lu, *op. cit.*

[10] Blanda R. Sumayao, "The Bicolano Farmers' Response to an Improved Rice Variety—IR8-288-3," University of the Philippines, College of Agriculture, 1969.

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IR8 through these channels. This pertained even with a very high percentage of radio ownership and listenership.[11] Pablico's study of the adoption of the hand tractor also revealed that in spite of mass media publicity, neighbors, tractor renters, salesmen, and dealers were the major sources of information.[12]

These findings are corroborated in Feliciano's study of traditional barrios, except where there existed "change-readiness" among farmers—that is to say when there was a keenly felt need for a specific new practice. In this case, mass media were able to trigger immediate trial and/or adoption. Eighteen out of 198 respondents reported adopting a new practice after reading or hearing about it. Thus one farmer who had long wanted to own a knapsack sprayer decided to buy one after having heard its merits proclaimed over the radio; another farmer who had accepted the idea of fertilizing for greater crop yield bought Atlas fertilizer right away after reading an advertisement for it in *Liwayway Magazine*.[13]

Mass media, in other words, tend to function more as reinforcers or triggers for action after personal sources have made potential adopters aware of or interested in the innovation.

Flow-Non-Flow of Agricultural Information

Parties responsible for the introduction of agricultural innovations consider it desirable to facilitate and encourage a free flow of information about an innovation. Farmers, however, may not necessarily subscribe to this notion. For a variety of reasons they may wish to have a monopoly on innovation. Of 199 farmers interviewed in Feliciano's study, 56 did not as a general rule share agricultural news with their wives because they believe that "the woman has no secrets." Nor did they tell their fellow farmers. The motive for this "hoarding" of newly obtained information seems to derive from the fact that the farmer

> cannot take the risk of being embarrassed or ridiculed if the new practice fails. The farmer is a doubting Thomas; he is not sure it is really good until he has tried it; further, the farmer is not sure it is important enough to others until he tries it and succeeds and sees the other farmers' favorable reactions to his success. Also, being a recipient of new technological informa-

[11] Antonio S. Frio, "Leadership Preference, IR8 Adoption, and Communication Sources Among Dry-Season Farmers of Morong, Rizal," unpublished B.S. Agriculture Thesis, University of the Philippines, College of Agriculture, April 1968.

[12] Sosimo Ma. Pablico, "The Process of Adoption of the Hand Tractor and the Role of Communicating Agents in a Philippine Rural Setting," unpublished B.S. Agriculture Thesis, University of the Philippines, College of Agriculture, April 1968.

[13] Gloria D. Feliciano, *op. cit.*

tion bolsters the farmer's ego: he's got an edge over the other farmers now, so why tell them? Furthermore, it is the farmer's *suwerte* or good fortune. His neighbors will have it, too, for life is a wheel of fortune anyway, so why not let them wait? They will have their turn.

News about politics or social happenings in the barrio on the other hand is shared readily. According to 8 out of 10 male respondents and 7 out of 10 females, news of deaths, births, good fortune and bad, travels quickly through women "carriers" in the barrio.[14]

Being secretive about agricultural news can be compared to the "businessman's trade secret" in the competitive market. The desire to receive the earliest releases of the most recent rice varieties is directly related to the opportunity to plant it for seed which will then command a premium price in the community. The farmer who succeeds in getting even a handful of these early seeds is not about to part with any of it. Of course, after the first harvest, his secret is automatically shared.

Fear of a glut in the market and a consequent drop in price is another reason why farmers may want to have a monopoly on innovation. This was true of sweet corn seeds introduced in a barrio that grows and sells green corn as a cash crop. A previous experience with the rapid diffusion of popcorn seeds had precipitated an abrupt price slump, so that when the sweet corn seeds were obtained from the extension worker, they were kept within the immediate families until the middleman who purchased the previous season's harvest spread the world around that the first adopters made so much money.[15]

Concealing agricultural information is usually a temporary situation, and when practiced is liable to provoke social sanctions against it from the community. After all, who knows whether the "hoarder" will be the pioneer recipient or the bearer of new information?

A more general communication pattern is the tendency of farmers to seek or receive information rather to give it. Unfortunately, researches conducted fail to distinguish whether information reaching the farmer was brought to him by the extension worker or whether he deliberately sought it out. Such information on who takes the initiative in the information flow is important to have.

Once the farmer is in possession of the information, it may be asked whether or to whom he communicates it. Hamada's study observed that

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[14] *Ibid.*

[15] Edgardo P. Agravante and Pablo L. de Guzman, "Introduction of Sweet Corn in a Philippine Barrio," mimeo, University of the Philippines, College of Agriculture, Farm and Home Development Office, undated.

farmers turned to fellow farmers for discussion and information on farming and non-farming matters much more often than they turned to others. In other words, farmers tended to reinforce, clarify, or relate information to individuals within their own information category, becoming potential information dead-ends unless other people gravitated to them.[16]

Additional evidence concerning this information-receiving rather than information-giving tendency was forthcoming in data from seven barrios where the new rice varieties were introduced.[17] One hundred eighty-seven farmers interviewed adopted the new varieties primarily from crop technicians. Only 42 out of 187, or 22 percent, discussed the innovation with neighbors or with other farmers. Again, it is not known whether this was shared voluntarily by the recipient or whether it was sought by the next potential receiver.

Problems of Farm Level Implementation

Contrary to the Western (Beal-Bohlen) model of the adoption process which postulates that farmers go through five distinct stages of awareness, interest, evaluation, trial, and adoption, Filipino farmers most frequently proceed directly to adoption after obtaining information, with less frequent instances of passage through other stages. This short-circuiting of the adoption process could be a reflection of the tendency of Filipino farmers to act on the mere sayso of people whom they perceive to be dependable authority sources. Some tenant farmers, for example, adopted the hand tractor through mediating personal sources (tractor renters, salesmen, and dealers) and only afterwards sought additional information.[18] Other farmers planted IR8 because of the landlord's decision; only after trial and adoption did they evaluate the innovation and seek further information.[19]

The movement of farmers from the awareness of innovation to its actual adoption is more often than not a difficult transition, however. An understanding of the nature and complexities of this process may be gained from Lu's study of farm level implementation of a rice production program. Of 395 farmers interviewed, 178 were aware of the existence of certified seeds; 127 were aware of the source; 41 were able to obtain the seeds; but only 36

[16] Dorothy M. Hamada, "A Communication Analysis of Vegetable Farmers in Paoay, Atok, Benguet," unpublished M.S. Thesis, University of the Philippines, College of Agriculture, 1968.

[17] Unpublished data from the pilot study of a cooperative approach to rural development in Sta. Maria-Mabitac, Laguna, University of the Philippines, College of Agriculture.

[18] Sosimo Ma. Pablico, *op. cit.*

[19] Aurora Pal, unpublished data from a study of farmers' adoption of IR8 in Macabling, Sta. Rosa, Laguna, University of the Philippines, College of Agriculture; and David S. H. Liao, *op. cit.*

actually used the seeds. The 359 non-users gave a total of 609 reasons for not using certified seeds. The reasons are distributed as follows[20]:

Reasons Given	*Percent of Farmers*
(1) Never heard about it	48
(2) Not available locally, limited supply and stocks arrive late	36
(3) Prohibitive price and no money	6
(4) Not interested, not applicable, haven't tried it yet	6
(5) Planting seeds provided by landlord or overseer	3
(6) Poor germination	1

Commercial fertilizer was not used by 156 farmers for the following reasons:

Reasons Given	*Percent of Farmers*
(1) Not available locally, stocks arrive late and limited supply	43
(2) Not interested because the farms were fertile	19
(3) No money to buy and prohibitive price	22
(4) Unavailability of irrigation water and belief that fertilizers produce no good effects on the farm	10
(5) Landlord or overseer does not allow the use of fertilizer	3
(6) No reasons given	3

In the first example, the difference between 359 farmers interviewed and the 217 found to be unaware of the certified seeds represents the *communication* or *information gap.* The difference between the 178 farmers aware of the certified seeds and the 36 users represents the *awareness-adoption gap.* This gap is probably best described as an inverted pyramid, in which the number of farmers participating declines from awareness of the innovation to its actual use.

The difference between the number of potential users of information (those aware of the innovation) and the actual adopters dramatizes the magnitude of the development effort which is needed to unfreeze the insti-

[20] Hsueh-Yi Lu, *op. cit.*

tutional or infrastructural constraints that paralyze or prevent a higher percentage of innovation implementation at the farm level.

Another aspect of farm level implementation is the influence exerted on the farmer's decision-making by other individuals. Data from Lu's study show who exerts this influence:

Decisions on Farm Business	*Wife*	*Landlord*	*Extension Worker*	*Other Specialists*
	No. of farmers who would consult with:			
		Total N = 395		
(1) Buying fertilizers	62	52	37	5
(2) Where to sell agricultural products	69	4	–	–
(3) Engaging in a new enterprise	78	2	2	–
(4) Buying a carabao	83	7	0.2	–
(5) Buying farm tools and equipment	75	6	6	–
(6) Buying farm chemicals	67	41	48	4
(7) Where to borrow money	84	25	12	–
(8) Changing new varieties	60	52	40	3
(9) Changing new rice cultural practices	58	50	40	8

Feliciano's findings confirm the active participation of the wife in decisions relating to farm operations—from purchase of fertilizer to marketing of agricultural products. Only about half of the farmer-respondents said they make decisions without consulting the wife.[21] In Guerrero's study, buying land, borrowing money for the farm, and decisions on what to plant are regarded more as joint husband-wife rather than husband-only decisions. Buying farm tools and determining how large an area to plant are largely the husband's domain.[22] The pervasive influence of the Filipino wife in farm business decisions derives from her role as uncontested family treasurer, with facilitative or veto power on expenditures.

Landlords also affect decisions which require a financial outlay for fertilizers, chemicals, new varieties, and new cultural practices. This is an important factor particularly where tenants and landlords share the expense of implementing changes in farming practices.

[21] Gloria D. Feliciano, *Sociological Considerations in Communicating Change to Filipino Farmers in Five Barrios of the Land Reform Pilot Area in Bulacan,* Communication Studies Series 2, University of the Philippines, Institute of Mass Communication, Diliman, Quezon City, 1965-67.

[22] Sylvia H. Guerrero, "Decision-Making Among Farm Families in a Philippine Barrio," unpublished M.S. Thesis, University of the Philippines, College of Agriculture, 1966.

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Perhaps no single agricultural innovation more dramatically tells the story of adoption patterns among Filipino farmers than the introduction of the new rice variety, IR8.

The Miracle Rice Package Pattern[23]

When IR8-288-3 (more popularly known as "miracle" rice) was introduced, it was emphasized that full-yield potentials could be attained only if everything were "done right." It was made clear that the production of IR8 could not be left to God; man was held responsible for its favorable growth, with indispensable assistance from irrigation, fertilizers, insecticides, weeding, and "tender loving care."

IR8 is referred to in this paper not for itself alone, but because it is the prototype of a revolutionary plant type, numerous variations of which are being developed, and because the very nature of the plant generates or requires certain changes. First, because of its short stature, IR8 is easily distinguished in the paddy field: anything which stands taller is either another variety or a weed. This "dwarfness" serves only to draw attention to the heavy load of grain in its upright stems. The fact that it is visibly different from traditional varieties is a virtue in itself because it is easier to maintain purity of seeds. The position of its leaves also keeps out birds (as has been frequently observed, there are few rice birds in areas planted to IR8). Its stiff straw proved to be quite a selling point when plants remained upright even after a raging typhoon.

Second, IR8 takes about 120 days to grow as against 140 to 160 days for traditional varieties. This early maturity forces some group agreement, at least among farmers cultivating adjacent fields, to plant the same or similar varieties. Otherwise, if a late-maturing variety were planted side by side with IR8, the former would be left to ripen in the fields to be the concentrated object of birds, insects, rats, and disease. Early maturity has also contributed to a faster diffusion of IR8 because of the shortened "wait-and-see" period.

More important is the greater precision required in the timing of seedbed preparation, transplanting, fertilization, and spraying. Accompanying every release of IR8 seeds are instructions indicating *when* farmers should do *what*. This calendar of operations constitutes a whole new rhythm in rice

[23] Gelia T. Castillo, "The Case of the Miracle Rice: Technological and Social Change," *Solidarity,* Vol. 3, No. 12, December, 1968, pp. 37-47.

production. The growth pattern of the plant relative to the weeds, the life cycle of the stem borer, and the effectiveness of insecticides—all have involved a time synchronization of cultural practices which farmers to some degree have had to comply with in order to succeed. In this regard IR8 has become a pacesetter.

Third, because IR8 can be planted any time of the year, it can also be ready for harvest at any time—even on a rainy day. A delay in harvesting could result in germination of the seeds in the panicle when the rains come. A corresponding drying and storage problem results, especially with the increase in yields; the bamboo baskets under the *nipa* house no longer suffice.

In adopting IR8, farmers not only adopted a new rice variety, but also accepted a more general concept of modernization of other cultural practices. International Rice Research Institute studies have shown that IR8 requires a higher level of inputs than local varieties—three times as high on the average for fertilizer and insecticide and more than 50 percent higher for labor.[24] In Sumayao's study of 161 IR8 seed recipients from two cities and four provinces in the Bicol region,[25] the phenomenon of "special variety deserves special treatment" was very much displayed. The adoption scores of twelve recommended rice production practices were analyzed over four cropping seasons (Table 1). It was found that farmers growing both IR8 and traditional varieties gave the former preferential treatment. The adoption scores of other variety users were higher before IR8 was introduced than after (Table 2). The trend after IR8 was for traditional varieties to be left much more to nature, as shown by a drop in adoption scores. For all four cropping seasons, IR8 adopters registered no zero scores, while 10 to 14 percent of those also growing other varieties applied none of the recommended practices.

Unpublished data on 75 IR8 adopters and 114 non-adopters from seven villages similarly indicates greater adoption of the twelve cultivation practices among the former than among the latter. IR8 enjoyed more pampering even in comparison with other relatively recent varieties.[26]

On the other hand, Barker reported what appears to be a spillover effect from the successful experience with the new package of practices associated with IR8, when the yield of certain premium varieties increased. Malagkit, a glutinous rice used in preparing native delicacies, is grown only in a few

[24] Randolph Barker, "Economic Aspects of High-Yielding Varieties of Rice with Special Reference to National Price Policies: IRRI Report," paper prepared for the Thirteenth Session of the FAO Study Group on Rice, Manila, March 20-27, 1969.

[25] Blanda R. Sumayao, *op. cit.*

[26] Soledad L. Pahud, *op. cit.*

TABLE 1. Practices Adopted for IR8 and for Other Varieties Planted Before and After the Release of IR8

Practices	Before IR8	After IR8 (Season) First	Second	Third	Fourth
		(Percent)			
(1) Seed treatment					
IR8		56	70	63	69
Other varieties	43	43	39	35	41
(2) Spraying or soaking seedlings in chemicals before transplanting					
IR8		80	79	73	68
Other varieties	61	66	47	49	54
(3) Dapog method					
IR8		41	38	38	35
Other varieties	7	8	10	8	13
(4) Application of fertilizer before transplanting					
IR8		30	43	38	37
Other varieties	14	14	13	15	16
(5) Application of fertilizer anytime after transplanting					
IR8		39	67	55	54
Other varieties	41	29	24	26	23
(6) Making and application of compost					
IR8		15	4	3	3
Other varieties	7	10	5	3	3
(7) Straight-row planting					
IR8		93	93	91	89
Other varieties	60	61	58	54	54
(8) Hand weeding					
IR8		62	69	75	70
Other varieties	43	37	43	39	44
(9) Rotary weeders					
IR8		32	70	63	64
Other varieties	49	49	42	43	44
(10) Weedicides					
IR8		31	38	39	40
Other varieties	41	37	25	27	27
(11) Spraying against rice insect pests					
IR8		89	81	80	76
Other varieties	76	69	62	57	59
(12) Rat control					
IR8		39	77	72	80
Other varieties	75	77	72	66	73
N = IR8		70	96	132	121
= Other Varieties	72	65	104	89	70

Source: Blanda R. Sumayao, "The Bicolano Farmers' Response to an Improved Rice Variety, IR8-288-3," University of the Philippines, College of Agriculture, 1969.

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TABLE 2. Adoption Scores of Adopters and Non-Adopters of IR8 During Dry Season 1967

Barrios	Adopters			Non-Adopters		
	Number Reporting	Total Adoption Scale	Average Adoption Scale	Number Reporting	Total Adoption Scale	Average Adoption Scale
(1) Bagumbayan	14	92	6.57	12	50	4.16
(2) Talangka	12	92	7.66	5	12	2.4
(3) Coralan	27	190	7.03	25	136	5.44
(4) Paagahan	2	11	5.5	26	100	3.84
(5) Cambuja	14	101	7.21	19	104	5.47
(6) San Antonio	2	7	2.5	8	20	2.5
(7) Nanguma	4	18	4.5	19	47	2.47
TOTAL	75	511	6.81	115	469	4.11

Source: Unpublished data from pilot study of a cooperative approach to rural development, University of the Philippines, College of Agriculture.

local areas. In 1966 and 1967 this variety commanded a price approximately double that of IR8.[27] The high price was an incentive to farmers not only to plant Malagkit but to give it more care and inputs than were customarily given to local varieties. Wagwag, another high-priced fancy variety, produced higher yields than usual because of the application of new practices.[28] Although Wagwag has nowhere near the level of IR8 yields, the high price it commands, combined with its lighter bulk in handling, processing, and transporting, are compensating factors.

The Demonstration Effect

One of the most frequent generalizations about the nature of developing societies is the slow rate at which change takes place. In the case of IR8, however, rapid adoption was its unexpected character. This dramatic response is illustrated in studies at the village small-farmer level. From the first planting season to the next, the number of farmers who planted IR8 showed the following trend: 1 to 10 to 16 to 60; 6 to 77; 3 to 44; 5 to 56; 8 to 42[29]; 7 to 49 to 70; 9 to 50; 15 to 113[30]; 70 to 96 to 132 to 121.[31] In

[27] Randolph Barker, *op. cit.*

[28] Gelia T. Castillo, "Central Luzon—Promise or Promised?" report on a three-day fact-finding trip to Bulacan, Nueve Ecija, Tarlac, Pampanga, for on-the-spot interviews with landowners, share-tenants, lessees, land-reform personnel, teachers, priests, agricultural school administrators, irrigation administrators, middlemen, and overseers.

[29] "Semi-Annual Reports 1966-67," for the project on alternative extension approaches, University of the Philippines, College of Agriculture, Farm and House Development Office.

[30] Preliminary data from USAID and Asia Research Organization Survey data, farm statistics for 1965 and 1967 from four villages.

[31] Blanda R. Sumayao, *op. cit.*

May 1966 in another province, forty-seven cooperators scattered in 18 towns planted IR8 for seed purposes. By October 1967, six of the eight barrios in the town of Morong had planted a dry-season crop of IR8. Two did not because of their inaccessibility to irrigation water. In the six barrios, 194 out of 645 farmers, or 30 percent, planted the variety for the first time.[32]

This dramatic shift from the local to the new variety occurred even among small, share-tenant farmers, in spite of predictions that IR8 was a "Cadillac" variety with ultramodern requirements which small farmers could not meet.[33]

Latest indications point to the impending exit of IR8, but this is more a manifestation of *change-orientation* than of retrogression. In other words, those who drop IR8 tend to pick up the newer varieties rather than revert to the traditional ones, except when the latter are premium varieties that command a higher price. This trend too will probably fade away because newer varieties of comparable eating quality have been developed by the IRRI and the University of the Philippines College of Agriculture and are rapidly gaining acceptance. As the 58-year-old toothless Filipino Farmer of the Year (1969) replied upon his return from Washington, D.C. when asked what variety he was going to plant the next season: "I don't know. I'm still waiting for a newer variety."

The influence of "seeing is believing" on this pattern of response cannot be discounted. Followup studies for six seasons in seven villages (three dry and three wet seasons) from 1964 to 1967 picture the rise of the new varieties and the fall of the traditional, not only in terms of number of farmers but also in area planted:[34]

Plantings of Traditional or Non-Recommended Varieties

Dry Season	*1964*	*1965-66*	*1966-67*
No. of farmers planting	163	151	84
Hectares planted	304.66	272.36	116.20
Wet Season			
No. of farmers planting	155	96	29
Hectares planted	242.04	148.81	39.5

[32] Antonio S. Frio, *op. cit.*

[33] Gelia T. Castillo, "A New Look at Old Concepts in Development," *Solidarity,* Vol. 3. No. 5, May 1968, p. 14.

[34] Soledad L. Pahud, *op. cit.*

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Plantings of Recommended Varieties

Dry Season	*1965*	*1966*	*1967*
No. of farmers planting	29	41	142
Hectares planted	30.41	54.23	172.84
Wet Season			
No. of farmers planting	25	81	220
Hectares planted	46.91	144.83	257.10

Although eight varieties were recommended, the most conspicuous change involved IR8. In the 1966 wet season only one farmer planted it—in an area of 0.75 hectares. In the dry season of 1967, sixty farmers planted a total of 68.85 hectares. Trial plantings of IR8 were made extensively, usually with technical supervision by knowledgeable persons. Its performance therefore was its own advertisement. The adaptability of the variety to different areas was still another advantage.

The supportive function of this widespread success is illustrated in one village where the planting of IR8 was considered a failure because the yield was only 70 cavans per hectare. While such yields had been rarely experienced before, the farmers' point of reference was not the traditional yield but the reputed and expected yield of IR8 which was 100+. In spite of this "defined" failure, more farmers planted IR8 in the following season. Any doubts they may have had about adopting the innovation had been dispelled by the demonstrably higher yields of other farmers who had planted IR8 under similar conditions.[35]

The Risk-Distribution Pattern

When accepting anything new, the farmer assumes certain risks, and he responds to change in ways that will enable him to reduce these risks. Some farmers, however, are more prepared to take risks than others.

Gradual adoption. Liao's study categorized 155 farmers according to two criteria: the percent of their farm area planted to new varieties; and time of adoption. On the basis of the first criterion, three categories were defined:

(a) *Full adopter*—any farmer who planted 100 percent of his area to the new varieties (39 percent of all farmers in the study).

[35] "Semi-Annual Report for 1966-67," *op. cit.*

(b) *Partial adopter*—any farmer who planted only a portion of his farm to the new varieties (31 percent).

(c) *Non-adopter*—any farmer who continued to plant the old varieties (30 percent).[36]

Liao then classified farmers as *earliest, relatively early, relatively late* and *latest* adopters, according to the span of time taken between awareness and adoption. The earliest adopter took 4 months, the relatively early, 7 months; the relatively late, 13 months; and the latest, 19 months. The average percentage of farm area planted to new rice varieties for the first time gradually increased from 42 percent for the earliest adopter, to 66 percent, to 74 percent, and then to 83 percent for the latest adopters. This indicates that the first adopters, although more immediately responsive to the change, were faced with greater risks and were therefore less inclined to go all the way than the latest adopters who were able to benefit from the experience of others.

Multiple-variety planting. Multiple-variety planting over four seasons was observed by Dimaano and de Guzman.[37] Only 15 out of 45 farmers using recommended varieties for the first time planted their fields to one variety alone; 24 planted one recommended variety in combination with local varieties. For four seasons the trend was for the number of farmers planting one recommended variety to increase and then decline because they switched to two or more recommended varieties and not back to the local types. The reason most frequently given for the multiple-variety planting was the desire of planters to find out which would give more yield. In the earlier stage, the farmer would plant as many as six varieties, including the old one. This was done for insurance purposes just in case the new one failed. In the later stage, when confidence in the new plant type had been established, multiple-variety planting was more of an experiment to test which one performed better. Such farmers have moved up one more step toward modernization.

In some non-rice areas, diversified farming is practiced in a uniquely enterprising and yet security-oriented fashion. As a farmer of one village describes it:

> Upland rice is for assured food supply; corn is for animal feed and supplementary income; vegetables are marketed for everyday expenses; garlic is a favorite cash crop just like a piggy bank because it can be stored and sold

[36] David S. H. Liao, *op. cit.*

[37] Alice M. de Guzman and Conrado M. Dimaano, *op. cit.*

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at a later date to meet school and emergency expenses. "Business" consists of poultry, swine, or fattening cattle after they have been used as work animals.[38]

This strategy is definitely one which says: "Do not put all your eggs in one basket."

A seasonal pattern. A seasonal pattern for adoption of recommended rice varieties has been reported by Pahud in studies carried out among 179 farmers in seven barrios from 1965 to 1967.[39] The number of farmers adopting new varieties was found to be higher for the wet than for the dry season. Barker saw the same trend:

> This strategy of choosing separate wet and dry season varieties seems particularly appropriate on those farms with uncertain or limited dry season water resources. Farm operators in this situation can ill-afford the risk associated with the high levels of fertilizer input needed to maximize profits for IR8 during the dry season. On the other hand, local varieties respond to medium input levels of nitrogen during the dry season without lodging.[40]

However, when the supply of irrigation water is more assured, there is a preference for planting IR8 during the dry season to avoid the problem of drying.[41] Even in the case of corn, the crop is planted in both the dry and wet seasons but for different purposes. During the wet season, corn is harvested during its dough stage and sold as green corn which is relished as a vegetable or as boiled corn on the cob. In the dry season the corn crop is left to mature in the field. It is then marketed and the stalks are stored for feeding cattle.[42]

Rainfed-irrigation response pattern. Closely related to the seasonal pattern is the differential treatment given to rainfed and irrigated areas. In rainfed areas, little or no fertilizer is used, and the trend has been to plant traditional varieties.[43] Irrigated areas have more quickly adopted IR8. However, there has been an observed decrease in yields as the number of adopters has increased. Barker explains that as more and more farmers switched to new varieties, both the farm resources and the level of inputs of the later adopters were considerably lowered. This fact was clearly observed with

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[38] Sylvia H. Guerrero, *op. cit.*; and Edgardo E. Agravante and Pablo L. de Guzman, *op. cit.*

[39] Soledad L. Pahud, *op. cit.*

[40] Randolph Barker, *op. cit.*

[41] David S. H. Liao and V. Cordova, "A Managing Landlord in Laguna; A Report of an Interview," International Rice Research Institute, April 19, 1969.

[42] Edgardo E. Agravante and Pablo L. de Guzman, *op. cit.*

[43] Interview with a managing landlord, International Rice Research Institute, May 7, 1969.

respect to the most critical input, irrigation. Nearly 100 percent of the farms of early adopters were fully irrigated. This level dropped to 50 percent for the later adopters. Because of the uncertainties involved, poor irrigation facilities are associated with lower input levels, lower yields, and lower farm profits.[44]

Change in Cropping Pattern

Cropping patterns, comprising all stages from planting to harvesting and time and place of planting, are established in the village and are usually pursued from year to year with little or no deviation. Now and then, however, certain occurrences—either induced deliberately or though a *force majeur* such as floods, typhoons, drought—disturb these routines.

A change in cropping pattern takes the form of a structural change; it is not just a change in technique. Availability of water during the growing period of the rice plant has been a basic element of the cropping pattern. With the advent of the new varieties, which mature earlier than local varieties, a fundamental readjustment had to take place. In some cases, the change required by IR8 has been strategic for the introduction of a whole package of practices. In other instances, the new variety, in combination with the development of irrigation systems, has forced a change from one to two or even two-and-a-half crops a year. Preparation of the land for the next crop has become more urgent; hand tractors either bought or hired have been employed to speed up the work. A flood-avoidance strategy also has been effected in certain areas by changing the planting season from June-July to November-December. (Farmers have been amendable to the change since they grow only one crop a year without irrigation anyway.)[45]

Recognition of the need to change cropping pattern has almost always come about through technical advice from outside the villages. In case studies described by Pahud, de Guzman and Dimaano, change was brought about in the following manner.[46] First, although change in the cropping calendar meant missing almost one crop, the crop technician was able to convince the farmer to do this because the previous season had produced very low yields. Severe virus infestation was primarily responsible. Other related factors were insufficient water supply which made straight-row planting, the use of rotary weeders, and application of fertilizers virtually impossible; and weeds, which had grown taller than the crop, becoming a favorable environ-

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[44] Agricultural Economics Annual Report, International Rice Research Institute, 1967. See also, Barker, *op. cit.*

[45] Gelia T. Castillo, "Central Luzon—Promise or Promised?" *op. cit.*

[46] Soledad L. Pahud, *op. cit.;* and Alice de Guzman and Conrado M. Dimaano, *op. cit.*

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ment for leaf hoppers transmitting the virus. An examination of the rainfall distribution and irrigation water readings for two previous seasons revealed that farmers had been planting when the supply of irrigation water was inadequate. Because of the water problem, only nine of the twenty initial farmer-operators of the preceding season were able to follow some practices the next season. All told, a measure of receptivity to IR8 resulted from desperation rather than from a real positive incentive.

Second, the crop technician's proposal to change planting time to take advantage of periods with more abundant water supply was presented to the farmers on a *majority* or *not-at-all* basis. Although the nature of the problem and the prospect of a solution were explained to the farmers individually, commitment to the change was sought in a group meeting, and social pressure to conform was brought to bear on the reluctant ones by the farmers themselves, particularly when they were cultivating adjacent fields. Fifteen were willing to go along with the plan, although the farmer with the largest acreage was critical in this approach because change could be initiated on his farm without the agreement of other farmers.

Third, planting at about the same time required planting similar or identical varieties over a wide area. Small, scattered changes would not accomplish the objective. This system became a perfect entree for new varieties. Mass planting of varieties with similar maturity is a *must,* to avoid exposure of the dissimilar crop to birds, rodents, pests and disease.

Fourth, initial agreement among most, though not all, farmers led to intensive lessons through a barrio rice school and a new calendar of farm activities prepared and followed up by the technician.

The effects of the change in cropping pattern can be seen in the before and after increase in adoption of new farm practices. Almost twice as many farmers adopted new practices along with the change in cropping pattern as those who did not. The practices which decreased after the new cropping pattern was inaugurated were seed selection, because seeds of the new varieties were obtained from outside the village; compost-making, because more commercial fertilizers were used; and rat control, because mass planting and clean culture reduced infestation. Initially, farmers who did not follow the change produced higher yields; those who did change, however, either caught up with or even out-yielded them. In one village the yield doubled. After adopting the new cropping pattern, farmers also visited their farms more often (at least once a day) than those who did not follow the change. As the farmers themselves remarked: "We became more industrious."

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Acceptance, Rejection, and Discontinuities in Adoption

In spite of all the exciting developments in rice production over the past three years, the adoption process has not been a uniformly linear climb. Observations to this effect were made by Sumayao,[47] who classified those IR8 adopters as *initial planters* who received and planted the seeds when they were first distributed; *persistent planters* who planted IR8 for the first time after the first IR8 crop; *dropouts* who stopped planting IR8 the following season; and *replanters* who planted IR8 for the first season, dropped it the second season, and picked it up again during the third season.

Adoption graphs for twelve practices studied for four seasons show zigzag steps rather than a smooth upward increase. Pahud[48] observed the same trend over six cropping seasons. He classified as *early persistent adopters* farmers who adopted 50 percent of all the recommended rice practices during the first three seasons and continued to do so for the last three consecutive seasons; *late persistent adopters* those who adopted 50 to 60 percent of all the practices during the last three consecutive seasons; *late adopters* those who adopted 60 to 70 percent of the practices during the last two seasons; *readopters* those who adopted, dropped, and picked up practices irregularly during the six seasons (the largest group of farmers belonged to this category); and *dropouts,* farmers who adopted 40 percent or more of the practices during the first three seasons but adopted only 10 to 20 percent for the last three seasons.

Only a season-by-season analysis would indicate these discontinuities; a long-term trend would not reveal this zigzag. Long-term trends are described in Liao's comparison of farm practices between 1954-55 and 1965-66. In 1954, land preparation—the tillage, harrowing and levelling—had been done by carabao and man-labor; by 1965, 32 out of 87 farmers studied were using hand tractors. Similarily, transplanting had been carried out by the ordinary and broadcast method; ten years later, 49 out of 87 farmers were practicing straight-row planting. The number of farmers applying fertilizer increased from 61 to 78; and average per hectare application increased 43 percent. Chemical weeding which was unknown in 1954 was used by 75 farmers in 1965. Forty-five farmers applied insecticides and pesticides.[49] Follidol, Dol granule, BHC, and Basudin became part of the farmers' vocabulary.

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[47] Blanda R. Sumayao, *op. cit.*

[48] Soledad L. Pahud, *op. cit.*

[49] David S. H. Liao, "Factors Affecting Productivity and Adoption of Improved Practices in Rice Farms," unpublished M.S. Thesis, University of the Philippines, College of Agriculture, February 1968.

To better understand the patterns of acceptance, rejection, and discontinuities in adoption of IR8 and the new package of practices, farmers' reasons were analyzed in a number of studies. The most often cited reasons for its adoption were the demonstrated superiority or effectiveness of IR8[50]; the expected high yield[51]; the consequent minimization of loss and increased efficiency of farming operations[52]; the relative advantage of the new practices over the old.[53] Besides the general expectation of high yield from IR8, specific varietal characteristics were mentioned such as dwarfness, early maturity, bigger seeds, and ease in threshing.[54] Early in the history of IR8, expected high price was an important incentive for adoption. Even in the case of sweet corn, its high price and saleability compared to the old White Flint was the major attraction for the farmer.[55]

Specific institutional, personal, or group pressures for adoption, such as desire to follow the neighbors, to comply with landlord's wishes or with the change agent's recommendations, were reported by some farmers. The significant influence of the landlord will be discussed below.[56]

Non-adoption of innovations was very much conditioned by the perceived incompatibility of the practice with existing conditions in the farm and in the village. Anticipation of undesirable effects, lack of resources, limited comprehension of cause-effect relationships, and ignorance of the new practices and how to apply them, disposed farmers to resist the new varieties. They stated that fertilizers could not be used because the fields were always flooded; that rat control measures were of limited usefulness unless neighboring farmers adopted the same measures; that straight-row planting could not be done as long as skilled planters were not available; that rotary weeders could not be used because of the lack of water; and that there was no capital to buy fertilizers. Misunderstanding of cause-effect relationships was expressed in objections to fertilizers because their constant use would lead to "fertilizer-addictedness" of the soil; in hesitation to spray insecticides for fear of killing the chickens, pigs, and carabaos; in the statement that rotary weeders agitated the soil and caused the rice plants to wilt, and that empty grains were caused by highly concentrated chemical solutions used for spraying. Ignorance of proper fertilizer application was another reason for non-adoption.

[50] Pablo B. Bueno, *op. cit,* and Alice M. de Guzman and Conrado M. Dimaano, *op. cit.*
[51] Aurora G. Pal, unpublished data . . . , *op. cit.*
[52] David S. H. Liao, "Factors Affecting Productivity . . . ," *op. cit.*
[53] Soledad L. Pahud, *op. cit.*
[54] Blanda R. Sumayao, *op. cit.*
[55] Edgardo E. Agravante and Pablo L. de Guzman, *op. cit.*
[56] IRRI Annual Report, 1967; Alice M. de Guzman and Conrado M. Dimaano, *op. cit.*; David S. H. Liao, "Studies on Adoption of New Rice Varieties . . . ," *op. cit.*

The stereotyped image of the superstitious Filipino farmer, nevertheless, is not reinforced by these findings. Only two farmers specifically referred to superstitious beliefs as their basis for rejecting rat control. Instead of applying rodenticides, one farmer set aside a field solely for the rats and begged them to take their share and leave the rest alone. The other believed that rats are God's creation and must not be harmed.

An innovation's failure to demonstrate its superiority or effectiveness has been a major reason for discontinuing a practice. "I sprayed my field with 2,4-D, but it did not control the weeds in my field,"[57] complained one planter. Most of the time the conclusion of ineffectiveness was a result of improper application of the innovation.

Dropouts from IR8 were caused by low selling price but high cost of production, landlord's objection, and lack of irrigation water.[58] (In spite of reversals along the way, however, it is worth noting that entire villages shifted to new varieties in less than three years.[59])

VILLAGE LIFE AND PROBLEMS OF LINKAGE WITH THE OUTSIDE WORLD

Modern "Corruption" of Traditional "Virginity"

Increased mobility. About six years ago, in what was then a virgin barrio relatively untouched by the promise of Development Program X, Y or Z, Coralan was a typical poor village with miserable-looking rice fields. Dwarfed rice plants were not a product of genetics but of a virus locally known as "low waist"; houses almost waited to be blown down, and barrio folk went to town on foot through the mud or the dust. Today the village is still poor but less miserably so. There are fourteen recently-constructed or renovated houses made of hollow blocks and galvanized iron roofs, and sixteen hand tractors doubling as passenger jeepneys with a roofed body, big hind wheels, and two rows of seats. For 20 centavos, one can easily get to town in this tractor-jeepney, which is better suited than an ordinary jeep to dirt roads, especially during the rainy season. As the villagers themselves remarked: "Nowadays people here do not want to walk anymore." The housewives have ceased marathon hikes just to do their "grocery" shopping, sacks of rice find their way to the market more readily, and even children find greater pleasure in going to the high school in town.

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57 Soledad L. Pahud, *op. cit.,* and Alice M. de Guzman and Conrado M. Dimaano, *op. cit.*
58 IRRI Annual Report, 1967, *op. cit.*; Aurora Pal, *op. cit.*
59 Farm and Home Development Office, *op. cit.*

Growing contractual relationships. Besides doubling as a means of transportation, these hand tractors are used for custom plowing and harrowing. A general consciousness of the sizable investment in these and other new pieces of agricultural machinery, and their depreciation, have led to new norms governing their use. There has been a very apparent decline in the *bayanihan* system (mutual exchange of labor) and a growth of more business-like relationships. A definite hiring price for tractor services rendered, either in cash or in palay, is becoming customary. This side income raises the cash needed to cover installment payments. When asked if tractors are borrowed under the traditional mutual exchange of labor, farmers smile and say: "Only if one's own tractor breaks down does one attempt to borrow someone else's." The tacit understanding is that at some future date the other party will reciprocate. This implies that if a farmer does not have a tractor, he has no basis for the exchange. Sprayers are borrowed for free by friend, relative, compadre or neighbor only once or at the most twice. Lender and borrower alike understand the potentially disastrous effects for both parties if the application of insecticides and rodenticides is misunderstood or mishandled. The net effect of all this has been for farmers to want to purchase their own equipment or to rent for a fee, so that they can use it regularly without embarrassment.[60]

Other implications of hand tractor use for contractual relationships can be seen in the results of a tractor survey among lowland rice farms in Laguna. The number of tractors per farm increased from 1.25 for crop year 1964-65; to 1.44 for 1965-66; to 1.66 for 1966-67. Average horsepower per tractor also went up from 4.6 to 4.8 to 5.0. The purchase price per tractor went up from ₱2,544 to ₱2,935 to ₱3,225. Although the size of the farm remained the same, yield increase was considerable, but so was the cost of production and use of fertilizer and chemical inputs. Of greater significance is the fact that during the first year of the survey there was some sharing of tractor purchase. In the second year, each farmer owned at least one tractor, and by the third year, 50 percent of the operators owned two or more tractors. On the other hand, the percentage of tractors used for contract hire declined. The explanation given was that repair and maintenance costs were often higher than the income derived from tractor hire. An important side effect of this has been the skill farmers have acquired in the operation and repair of machinery.

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[60] Felix M. Eslava, Jr., "The Sprayer That Was Nearly Rejected," a case study prepared for a graduate course in social and cultural change, University of the Philippines, College of Agriculture, 1969.

The pattern of tractor introduction in the province of Laguna is shown in the following figures:

Year	*No. of Tractors Purchased* (at ₱1,000 to ₱4,900)	*Cumulative Total*
Prior to 1959	5	5
1959	4	9
1960	4	13
1961	12	25
1962	33	58
1963	35	93
1964	55	148
1965	88	236
1966	93	329
1967	102	431

About one-third of the farmers owning the tractors worked from two to three hectares of paddy land; another third had from three to four hectares; the rest had five to eight hectares. Contract work away from the owner's farm lasted from 15 to 30 days. The contract rate was between ₱25 to ₱35 per hectare. Lower rates required meals to be provided for the two operators of each tractor.[61]

Although these examples point to the breakdown of the old rules of exchange and a growth of contractual relationships between the tractor owner and farmer, carabaos are proving to be a most enduring traditional fixture. Even the International Rice Research Institute continues to employ the carabao in some of the land preparation. The performance of the animal is still unmatched in certain terrains where there is no right of way or access roads, and in plowing close to the levees. In several instances it is a question of using both carabao or tractor for specialty jobs, particularly when more than one crop is grown. The carabao is best used for the wet season and the tractor mainly for the dry season.

Disappearing local practices. The romantic village practice of planting rice accompanied by guitar music has disappeared. Of course this practice could have been romantic only to the tourists taking pictures by the roadside. Guitar music was actually provided for a very functional reason—that of keeping time and rhythm to the regulated spacing of rice plants as they

[61] S. S. Johnson, E. U. Quintana, and L. Johnson, "Mechanization of Rice Production," The Seminar Workshop on the Economics of Rice Production: papers presented at a conference at the International Rice Research Institute, December 8-9, 1967, pp. 3-1 to 3-41.

were being transplanted. At present, planting boards, strings, and specifications such as 20 x 20 or 25 x 25 distancing between plants have taken over from the guitar. Haystacks which had been the setting for local movie love scenes are also fast disappearing: there is no place for them in the rush to prepare the land for the second crop.

Aspirations, expectations, and perceptions. Nineteen sixty-three benchmark data gathered from 692 farmers in eight villages show that improved farming methods were not perceived as the avenue to increased income. Twenty-seven percent of the farmer-respondents said that to raise their incomes they would work harder. An equal number said they would look for another job. Only 1 percent indicated they would consult technicians about new methods of farming. Nine percent admitted not knowing what to do.[62] In the same villages, farmers were also asked for a general evaluation of their rice yield. Fourteen percent said their yield was good (32 cavans per hectare); 33 percent said their yield was acceptable (31 cavans per hectare); 63 percent said it was low (22 cavans per hectare); 4 percent had no yield evaluation (15 cavans per hectare). From these figures it is apparent that the yield evaluations of the respondents were realistic. This realism becomes all the more impressive when their explanations for low yield are given. In the order of their frequency they were: attack by pests and diseases, unfavorable weather conditions, soil either very fertile or very poor, improper care and time of planting, too many weeds, poor seeds, low tillering capacity, lodging and empty grains. It is evident from these responses that farmers perceived a direct relationship between yield and actual procedures involved in rice-growing.[63]

Three years later, after the change of cropping pattern, the experience of better yields, and greater faith in technical assistance from crop specialists, farmers were asked if it were still possible to increase yield beyond the volume obtained in the three immediately preceding seasons. Ninety percent said yes, 8 percent said no more, and 2 percent were uncertain. In the first category, farmers were asked by what means they planned to increase yields. Their responses included weeding, fertilizer application, spraying against pests and disease, fertilizer irrigation, and planting good seeds. At that time their average yield was about 50 cavans, almost 20 cavans more than that in 1963.[64] In early 1969 a conversation with some farmers in front

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[62] Unpublished data from a study of social and political factors in barrio development, University of the Philippines, College of Agriculture.

[63] Gelia T. Castillo, "Toward Understanding the Filipino Farmer," *Philippine Agriculturist*, Vol. 49, Nos. 6-7, November-December, 1965, pp. 423-427.

[64] Unpublished data from a pilot study of a cooperative approach to rural development, University of the Philippines, College of Agriculture.

of their new dryer and warehouse in Barrio Coralan elicited the following statement: "In 1963, our highest yield was 40 cavans, but now, unless one has four successive harvests of at least 100, a farmer still has a lot to learn. He had better go back to school [the barrio rice school]."

Besides this heightened ceiling to their yield aspirations, farmers have changed their definition of what constitutes a "ridiculous" farming practice. In 1964, straight-row planting was laughed at. It was regarded as a waste of money. Today the farmer who does not plant in straight rows is the butt of jokes. The same form of ridicule was applied to farmer holdouts who continued with the traditional variety after the majority had discontinued it. This barrio has now converted 100 percent to the new varieties, and the race for the newer ones has begun.

Change-orientation is related not only to the social pressure to conform to the new behavioral pattern, but also to the demonstration effect in the sense that modern practices have actually contributed to a higher level of achievement. Another study carried out found very high positive correlations between a farmer's aspired-for yield and actual yields obtained in the barrio. These findings suggest that recognition of what is possible and knowledge of actual achievement influence yield aspirations and expectations.[65] In other words, the actual yield performance of the farmer himself as well as of the barrio becomes a reference point for the expectation.

Regarding more general perceptions of the state of their livelihood, farmers in the 1963 benchmark study believed that their present state was worse than that of their parents, but they expected their own future to be better than the present.[66] Considering the expanding ceiling of expectations and aspirations, this "better" future can only be expected to move upward not downward.

Another insight into the proverbial "revolution of rising expectations" is presented in the findings of an agro-industrial community. The Canlubang Sugar Estate has 7,356 hectares stretched out over portions of five municipalities, with 3,935 hectares of sugar cane, 2,467 hectares of coconuts, and the rest of the area planted to coffee and upland rice. Other agricultural enterprises are poultry, piggery, and beef cattle. The total population is 12,718 with 2,161 family heads and 1,800 additional laborers during the milling season. The Estate has two elementary schools, two high schools, an adult school, a public market, bakery, cooperative store, medical and

[65] Tej Pratap Singh and Gelia T. Castillo, "The Effect of Aspirational Level on Adoption of Recommended Practices in Rice Cultivation," *Allahabad Farmer,* Vol. 52, No. 5, September 1968, pp. 238-295.

[66] Soledad L. Pahud, *op. cit.*

hospital facilities with free hospitalization, medical and dental service, a church and a parish priest, a community library, outdoor free movies twice a week, baseball, softball, volley ball, bowling alleys, tennis courts, public TV sets, reading centers, free quarters, light and water, subsidized rice and sugar, Christmas and crop bonuses annually, free college scholarships for four deserving high school graduates every year to take agriculture, forestry and chemistry, and so on. Incidentally the Estate employs modern technology to streamline operations and makes their investments pay. This enables them to provide such benefits to workers. And, of course, the United States sugar quota and the price of sugar have been a tremendous help.

Given what looks to be Utopia compared to village life in other parts of the country, it is understandable that 75 percent of the industrial workers and 84 percent of the agricultural workers expressed contentment with their jobs. Surprisingly, only 20 percent of the industrial workers wanted their children to work in the same place but in a different job (more professional and white-collar than their parents' work). Among agricultural workers 51 percent wanted their children to work in the Estate, but only 19 percent wanted them to have the same occupation as their parents; 32 percent wanted some other job for their children; and 49 percent specified white-collar work. It should be pointed out that industrial workers had higher incomes and more education than the agricultural workers. Ninety-two percent of them, as against 56 percent of the agricultural workers, aspired to a college education for their children. Actual expectations of a college education for their children, however, reduced the numbers to 58 percent and 39 percent respectively.[67]

It is very evident that those who have more aspire and expect even more, if not for themselves then for their children.

Entrepreneurial behavior. While certain aspects of traditional rural life have been eroded by the adoption of innovations, some new behavioral patterns have emerged as a direct or indirect consequence of modern technologies. One of these is entrepreneurial behavior. To illustrate, just recently in two places centrifugal pumps drawing irrigation water from the river have been installed, and land previously idle for lack of water has been brought under cultivation. Some enterprising individuals in the community have purchased such pumps on an installment basis, and have entered into a contract to provide water for a fee to farmers cultivating neighboring fields. Since the fee is a definite percentage of the yield, the entrepreneurs have a

[67] Fabiana A. de Leon, "Study of Some Social and Economic Aspirations of Workers in the Canlubang Sugar Estate," unpublished M.S. Thesis, University of the Philippines, College of Agriculture, 1969.

further incentive to introduce high-yielding varieties and other modern inputs in addition to supervising farming operations for the purpose of increasing yields. They also provide credit to enable farmers to purchase inputs such as fertilizers and chemicals. Promising though this may seem, a negative note comes from the possible violation of water rights by these entrepreneurs. If they could get away with it, would they resort to little acts of corruption? Who knows?

For a longer history of entrepreneurship at the village level, it is impossible not to mention Barrio J, which has been covered by the Farm and Home Development Project of the College of Agriculture for almost twelve years. Because it is an excellent place for visiting VIP's, it has been facetiously referred to as a "tourist" barrio. More appropriately, it is named an "economists" barrio, dedicated to the pursuit of profit. This barrio is the economists' dream and the home economists' frustration. The prevailing norm is one of conspicuous investment rather than conspicuous consumption. The former term was used to characterize Gorokan investment activity in the Eastern Highlands District of New Guinea. As Finney describes it:

> Expenditure on costly consumption goods like radios or private automobiles is not particularly valued by Gorokans, but the purchase of a truck for carrying cargo and passengers or a trade store for selling goods is. And, it seems, the more highly visible the capital asset involved . . . the more investment is esteemed. The prestige Gorokans derive from such conspicuous investment and the consequent increment to the investor's status are primary goals behind Gorokan investment behavior. But other motives are also involved. Gorokans expect to gain service benefits from their investments. . . . Last but not least Gorokans want their investments to earn profits. . . .[68]

Barrio J displays all the characteristics of conspicuous investment. For some time, hog houses were better looking than people's houses because the latter were considered a *dead,* if not a crazy investment—that is, they did not earn money. Observers who are very knowledgeable about the village claim the place is worth half a million pesos. Instead of eating some of their chickens and eggs, those who raise poultry sell everything and buy dried fish. Typical of the questions they ask of agricultural specialists who visit the place are: which enterprise will give faster returns—swine or poultry? Which poultry project has faster returns—broilers or layers, or breeding or fattening pigs? Which enterprise entails the least risk and the surest profit?

[68] B. R. Finney, *New Guinean Entrepreneurs,* New Guinea Research Bulletin No. 27, The Australian National University, New Guinea Research Unit, February 1969, pp. 22-24.

Barrio J is the rare village which has a Credit Union, a cooperative marketing association, a service cooperative, a civic association, a waterworks system and recently, a feed plant. Big trucks and jeepneys for hauling both produce and passengers are an everyday sight. In fact, there are so many jeepneys in the village that the inhabitants go out only on alternate days in order to give everyone a chance to earn. For the use of water from their waterworks system, poultry and swine raisers pay a fee per animal to the Service Cooperative.

Barrio J is also the village where change has originated and spilled over to the *poblacion* or town proper instead of the other way around. Needless to say, villagers not only are receptive to innovations, they become the source of new practices themselves.

On the debit side, because of the intensive involvement of the people with their "business"—swine, poultry, cattle, vegetables, garlic, and rice—housewives and children as well participate in farming operations. Those who do not own land or have their own enterprise work as wage laborers. These labor-intensive requirements prevent the wives from devoting much time to meal preparation and household chores. As the student-extension trainees assigned to the barrio described the situation: "Their meals are mostly red and white [tomatoes and rice]." Lately, problems have arisen in the functioning of their cooperative associations. But if their past achievement is any gauge, they should be able to weather any storm.

The need for collective action. Group agreement or entire community action is called for not only in matters of change in cropping pattern or in rice variety, but in effective irrigation, rat control, and marketing. In a country which proudly characterizes itself as a *bayanihan* or mutual help society, however, getting farmers organized for collective action has been the bane of many a Filipino extension or community development worker. Innovations which require individual decisions are relatively easier to bring about. Farmers themselves, leaders, and landlords frequently complain of factionalism and lack of cooperation within the barrio.[69] Preliminary data on twelve communal irrigation systems reveal the minimal existence of a sense of community responsibility and the virtual absence of established operational procedures for maintaining and managing the system and distributing water. Farmers' organizations which were set up in some cases to enable a community to qualify for grants-in-aid, or other forms of assistance from government agencies, are paper-facilitating organizations rather

[69] Unpublished data from a study of social and political factors in barrio development, *op. cit.*

than social machineries to manage the irrigation system. In practice, at least three types of *modus operandi* have been identified:

(1) By tradition or inheritance someone is assigned the honorary position of being in charge of the irrigation system, and people look up to him for leadership.

(2) Where there are constant disputes among the farmers themselves over water use, they seek the assistance of an authority figure outside their group, that is, a policeman, a mayor, or a landlord, to help allocate water and assign maintenance functions to different members of the community.

(3) The person in the worst position with respect to water supply takes the initiative in calling the farmers together for the periodic cleaning of canals, water distribution, and so on. On an ad hoc basis, whenever absolutely necessary, farmers can be mobilized immediately for group action in the *bayanihan* fashion, but an organization for sustained, regular, and systematic management is hard to find in these so-called communal irrigation systems.[70]

With respect to joint action on rat control, the manager of an active Farmers' Cooperative Marketing Association (FACOMA) in Cotabato asserts that if one examines the map of the province, areas of heavy rat infestation tend to coincide with communities where cooperatives do not exist or where the cooperatives are inactive. In other words, where the tradition of collective action is weak, rats thrive. A rat control expert has also observed that in predominantly Ilocano immigrant communities, where a high degree of solidarity exists, it is easier to carry out extermination campaigns. In this connection, a research project using experimental and control barrios had to give in to demands from the latter for the experimental treatment which they felt had been "denied" to them. On the other hand, in mixed regional and ethnic barrios, mobilizing for community action is no minor task, especially when combined with the planting of rice varieties which mature at different times.[71]

On the brighter side, where six years ago it was "every man for himself" in Coralan, one can see the beginnings of community action. A farmers' association has been organized; an idle piece of land is being cultivated as a seed production plot by members themselves. Before this organization

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[70] From interviews by Professor Petronio Ongkingko in connection with an ongoing study of communal irrigation systems.

[71] Personal interview with Professor Pablo Alfonso, Director of the Rodent Research Center, College, Laguna, March 17, 1969.

was set up, there was constant competition to wangle the most recent rice variety from the crop technician so that early producers could grow the crop for premium priced seeds. Now the seeds are produced by the group and sold to the members with profits retained for the entire organization rather than for individual farmers. Members bought an irrigation pump to provide water for their production plot, a dryer, and warehouse to help meet the needs of their wet-season yields.

Although this is a big step forward, the village-centered, local-oriented farmers' association is bound to prove inadequate in the near future.

Linkage with the outside world. As soon as the farmer adopts modern agricultural innovations and begins to produce more than his family can consume, he becomes increasingly dependent on the world outside his farm and his little village. Past efforts in community development focused on local effort and local resources revolving around the village do-it-yourself philosophy. One wonders now whether such programs have not been "anti-development" in certain aspects. They certainly have been anti-revolutionary. Present-day farmer demonstrations, either self-generated or led by non-farm sectors of society, are almost the reverse of the community development approach. Current demands by the Filipino Agrarian Reform Movement (FARM), for example, are for wider coverage of the land reform program, land to the landless (each Filipino is entitled to a God-given two hectares of free land from the government),[72] passage of the land tax deleted from the original land reform code, inclusion of sugar and coconut lands in the coverage of the land reform code, condominium housing, restoration of the operational outlay of ₱8.7 million for land reform, and overhaul of the entire banking system so that credit will be available to everybody and not exclusively to the rich landed. Even Benquet, Mt. Province vegetable farmers are urging the passage of a bill limiting the privilege of engaging in vegetable farming.[73]

This turn of events constitutes quite a shift from the past, and calls for structural changes. Socio-psychological approaches no longer enjoy the potency that they were thought to have had.

Agricultural innovations have contributed in various ways to the demise of the farmer's isolation. Although there are many other innovations which

[72] Alfredo R. Roces, "Peasants' Ideology (in Light and Shadow)," *Manila Times*, April 29, 1969, p. 4A.

[73] "Farmers Rally, Want Former U.S. Base Lands," *Manila Times*, March 25, 1969, p. 1; "For Land Reform: 30-Day Rally Starts Today," *Manila Times*, May 19, 1969, p. 1A and 8A; "Marcos Proclaims Amnesty; Declares All Central Luzon a Land Reform Area," *Manila Times*, April 29, 1969, pp. 1 and 12A.

point out the practical impossibility of a farmer's complete independence from the outside world, IR8 is the product of the scientific approach to problem-solving. It was designed by scientists who studied and analyzed what structure would best suit the hot, humid tropics. The seed itself and the ingredients which would enable it to realize its potential, such as fertilizers, weeders, insecticide, technical assistance, credit, and even the transplanters who would follow the straight-row method, came from outside the farmer's usual spatial and institutional orbit.

With the increased yields and surplus from consumption needs, the farmer is faced with problems of drying, storage, marketing, low price, and perhaps even the demand for high-quality rice for the world market. He is no longer immune to the politics of international trade, the consequences of government policies, and the decisions of those who influence the inputs and outputs to and from his farm. Recent developments in rice production have given rise to more agricultural supply dealers, warehouses, dryers, and millers in the town center. The farmer will have to learn to relate to a wider range of factors, most of which are beyond his control as an individual farmer.

Organizational requirements. Filipino farmers can no longer survive contentedly in isolation. They have already been initiated into the mainstream of modernization. To cope with problems generated by the achievements in the biological production process, they must organize and cooperate with one another. We have already noted some of the problems of collective cooperation among Filipino farmers. In Central Luzon some farmers complain of the difficulty of dealing with these problems collectively: "We have tried forming an association but farmer leaders become suspect to the Huk, the landlords, and the Philippine constabulary for a number of reasons; hence farmers are understandably reluctant to assume leadership for such undertakings." However, this may be more of a rationalization than a reason. What deserves greater scrutiny, therefore, is the "organizational propensity" of the Filipino farmer.

The magnitude of the task of organizing farmers can be glimpsed from the report of the Agricultural Cooperative Development Committee:

> In spite of recent revitalization efforts, the status of agricultural cooperatives has not significantly improved. In the case of palay FACOMAS only 40 per cent (of 234) are active, 7 per cent semi-active and the rest inactive. Membershipwise only 16 per cent of the members (188,071) of palay FACOMAS are active. As of June 30, 1968 only 67 (out of 94 active) palay FACOMAS had net savings and 23 reflected positive net worth. Although there are 152 warehouses owned by the FACOMAS in the 15 provinces of

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the First Priority Area of the Rice and Corn Productivity Coordinating Council, with a total rated capacity of 3,857,200 cavans, these warehouses are utilized only up to 38 per cent of this capacity. Among the problems cited in the Report which underlie this state of affairs are:

(1) Since the FACOMAS in general have been promoted and organized chiefly as a medium for channeling liberal credit to farmer, the farmer-members of the FACOMAS have become credit-oriented. Consequently, most of the farmers look upon these FACOMAS as credit agencies and not as a marketing arm for them. Their cooperative activities therefore are dependent on the availability of the loan funds of the ACA (Agricultural Credit Administration).

(2) Because of this misconception regarding the principal purpose of the FACOMA, most of the members do not market their produce through it. As a result, the FACOMA is unable to generate a sufficient volume of business to make it an economically viable society.

(3) Farmers are reluctant to join or support the FACOMAS because most of them have impaired capital. In the meantime, these FACOMAS continue to operate and incur losses. Under these conditions, the agricultural cooperative movement has failed to attract new members and has alienated the support of a number of the old members.

(4) Many FACOMAS do not have adequate facilities to perform the marketing functions that will enable them to serve their members effectively.

(5) There has been no concerted and sustained education and information campaign among the farmer-members before and after the organization of their cooperative.

(6) The present arrangement whereby the Agricultural Productivity Commission (the national extension service) promotes and organizes, and the Agricultural Credit Administration (ACA) regulates, agricultural cooperatives, gives rise to a vague delineation of activities in the matter of supervision.

(7) Present ACA resources are insufficient to meet the credit requirements of farmers and cooperatives.[74]

Directly related to this problem of getting farmers organized is the government support price for rice, the harvest bonanza, and the stipulation that the Rice and Corn Administration (RCA) will buy palay only if it is clean and dry. Individual farmers who have no access to driers are forced to sell to the middleman below the support price, especially during the rainy season. As one barrio leader remarked: "In any market it is the seller who names the price of his goods, but in the case of our palay it is the buyer who dictates the price." It has also been claimed that because the RCA does not have money to buy, middlemen hoard the stocks sold to them and wait

[74] Vicente U. Quintana, *Report of the Agricultural Cooperative Development Committee* to Executive Secretary Rafael M. Salas, Agricultural Credit and Cooperatives Institute, College, Laguna, September 20, 1968.

for the President to release funds for the RCA's program. The rice subsidy therefore has been perceived as more beneficial to the middlemen than to the farmers.[75] Whether or not there is a real basis for this accusation is beside the point. As long as farmers perceive their plight in these terms, a sense of frustration and injustice will remain. Their judgment of a fair return for their produce depends on amount received relative not to cost of production but relative to what they expect from the support price. Ironically, the traditional middleman who is condemned every so often as an "exploiter" and an "evil" who should be done away with has assumed a more important role: his services have become even more indispensable and his enterprising abilities put to an even greater test. From all indications, he is responding energetically to the challenge.

What the farmers need now is an organization that will enable them to cope more effectively with the forces and institutional framework outside themselves. This will give them more bargaining power, better services for their production needs, a greater share of the good things in life, and a meaningful linkage with new information. The implication of such an organization is that the extension and community development worker who was originally trained to assist the farmer to help himself at the farm or village level will rapidly outlive his usefulness unless his functions are redefined in the light of recent developments. As one bewildered farmer remarked: "We have not had any farm management technician here for almost two years. He said that there is not much for him to do anymore. We have new varieties, new practices, and increased yields." And yet, the whole village was complaining about low price for their palay, which they could not dry to qualify for the support price.[76]

AGRICULTURAL INNOVATIONS AND THE LAND REFORM PROGRAM

In a land tenure system where the expenses of farm operations are shared by landlords and tenants, studies show that managing landlords for the most part make the important decisions. They decide on the fertilizers and the variety to plant; they make other decisions that are not routine in nature, especially when it is they who finance these inputs. The decisions left mostly to tenants cover time of planting and harvesting, except when there is a non-managing or absentee landlord, in which case the tenant or the overseer may make the decisions.[77] If the landlord is progressive, innovations are

[75] F. H. Magno, "RCA Aids Middlemen," *Daily Mirror,* February 1969, p. 7 .
[76] Gelia T. Castillo, "Central Luzon—Promise or Promised?" *op. cit.*
[77] E. Bernal Torres and P. R. Sandoval, "Landlord Participation in the Farm Business," *The Philippine Agriculturist,* Vol. 61, June 1967, pp. 65-76.

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readily adopted; but if he is conservative, the application of innovations may be inhibited.

It has often been argued that without the promise of enjoying the full benefit of their additional efforts, share tenants will not have the incentive to produce more. But simple arithmetic tells us that even in a 50-50 arrangement, 50 percent of 100 is greater than 50 percent of 50. Furthermore, in a sharing system, it is not only the output that is shared, but the inputs and the risks as well.

With the land reform program and the conversion of share tenants to leaseholders, the role of high-yielding varieties and other modern farming practices has become controversial.[78] In a non-land reform area, the share tenants' success in increasing yields under the intensive guidance of a crop technician has made them realize the potentialities of their farm and has given them the self-confidence to apply for leasehold arrangement. Earlier, they were reluctant to shift because they had to bear the risks alone. Before increased yields materialized, there were nine leaseholders. After that, their number doubled to eighteen.[79] Somehow they have managed to keep their lease rentals low.

In land reform areas, the issue has taken on a different twist. The question has been: Which should come first, measures to increase productivity or the declaration of an area as a Land Reform District? Given the objectives of land reform, the initial step has been to shift from share to leasehold, with lease considerations based on the average normal harvest during the three agricultural years immediately preceding the establishment of the leasehold. The owner receives 25 percent of the net production after deducting the cost of seeds, harvesting, threshing, loading, hauling, and processing.

With this provision in the Land Reform Code, high-yielding varieties have performed conflicting functions for the tenant and the landlord. If IR8 had been adopted on a farm before the shift to leasehold, it raised the rental and the eventual purchase price of the land. Landlords who obtained IR8 right away raised their yields before the land reform declaration of their area; hence the cost of the lease became high (20 to 25 cavans per hectare).

Under the circumstances, landlords consider leasehold not only satisfactory but lucrative. As one of them remarked: "The only difference to me is that I have ceased to be a land*lord*. I am only a land*owner* now." They

[78] Gelia T. Castillo, "Miracle Rice as 'Produced' by the Press," paper prepared for the International Seminar on Communications Media and National Development, University of the Philippines, Diliman, Quezon City, November 13-December 2, 1967.

[79] Alice M. de Guzman and Conrado M. Dimaano, *op. cit.*; and Gelia T. Castillo, "Propensity to Invest in Agriculture: Observations from a Developing Country, the Philippines," *International Journal of Agrarian Affairs,* Vol. 5, No. 4, July 1968, pp. 282-310.

have no obligations to the tenant to provide credit irrigation; their relationships are strictly contractual. In fact, this fixed lease arrangement discourages the landowner from investing on his farm. When the Land Reform Program cannot meet all the tenant's needs for credit or irrigation, the latter finds it difficult to operate under the leasehold system. To a tenant who pays only 10 to 12 cavans per hectare for his lease and who has access to capital for operating expenses, leasehold is a boon. The lower rental means that his average yield—either reported or actual—was low when his farm was included in the land reform area.

There has been some accusation that landlords have "forced" their tenants to plant IR8 in order to increase land rentals. Studies have shown, however, that while there were tenants who used IR8 because of their landlord's decision, there were those who did not adopt it because for one reason or another their landlords did not want them to.[80] Whether or not they made these decisions in spite of implications for land reform is not known. At any rate, to the share tenant who is aware of IR8 and its potentials, the dilemma is how to increase his yield without raising his rental if he later decides to change to leasehold. One way out of the dilemma is to increase yield "in fact" but not "in report." In areas expected to be under land reform, share tenants were cautioned by some lawyers to stay away from IR8. However, the yield prospects were too great a temptation for many of them; they planted it anyway but "depressed" their yield reports.

For some landlords, also, the high yields from IR8 were too great to ignore, and there was some interest in taking over the farm as an owner-operator using hired labor. To do this the landlord had to figure a way of easing out his share tenants. Even if his strategy failed, he had nothing to lose from increased production. Actually one incentive for the landlord to use the services of private farm management firms is to prepare for land reform. Higher yields mean higher rent and higher land value. The contrast in yields attained in owner-administered and tenanted land belonging to the same landlord is shown in a case study of a 330-hectare farm. The tenanted land had an average yield of about 45 cavans per hectare; the non-tenanted portion had yields of 79 and 98 for two different seasons.[81] Since this farm is located in Central Luzon, the desire of share tenants to

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[80] Aurora Pal, unpublished data . . . ," *op. cit.*

[81] Joseph Drilon, Jr., and Ray Goldberg, "The Sanchez Rice Farm," a study prepared for the Interuniversity Program for Graduate Business Education in the Philippines, 1969; and Joseph D. Drilon. "Toward Self-Sufficiency in Rice," a report on case studies involving farm management and development projects handled separately by two agriculture management firms in the Philippines, *Philippines Review of Business and Economics,* November 1967.

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"depress" yields could be one explanation for the substantial yield differentials between the two portions of the same farm.

Considering the interactions between increased productivity and land reform, it is hard to estimate whether agricultural innovations serve as reinforcers of the existing tenure system, or whether they have created a rupture in the existing tenure structure. There are reports of both tendencies, but it is too early to tell which trend predominates.

Structurally speaking, another trend which bears watching is the proposed vertically integrated rice production complex, which involves thousands of hectares under extremely modern management and technology.[82] This full-blown debut of rice as a highly commercial cash crop with all of its institutional implications would never have entered into the picture if the needed technology had not been developed.

POULTRY AND LIVESTOCK INNOVATIONS— A NEGLECTED AREA OF STUDY

Because of the "fairy tale" quality of the new, high-yielding varieties of rice, other agricultural innovations have failed to attract as much attention. This is unfortunate, because it is in poultry and livestock that we have excellent examples of direct transplantations or importations of technology from the developed world. The White Leghorn, Vantress, Landrace, or American Brahman from the United States have been brought into the Philippines for propagation. Unlike the production situation in rice, corn or wheat, livestock and poultry projects can tolerate only a minimum of compromise between the traditional and the modern in order to succeed. The requirements are much more demanding because they have to be cared for every single day. Postponement of marketing means a definite loss. Furthermore, animals have a highly visible mortality which dramatizes the necessity of skillful management and sophisticated concepts of nutrition, sanitation, disease prevention and contamination. Record-keeping is also a must because of continuous investment and the definite market-orientation of the enterprise.

In the Philippines there are numerous small poultry and livestock undertakings which have folded up. Meanwhile there are blossoming vertically integrated projects which go from eggs to chicken to feeds to barbecue.

[82] "NEC Gets New Investment Plan," *Philippines Herald*, February 1, 1969, p. 8. The rice projects referred to are that of (1) Agricultural Research Farms, Inc., which envisions an integrated rice program with the development of 700 hectares in addition to 200 hectares already developed and (2) American Factors Associates of Honolulu which calls for inviting big rice producers in Luzon to undertake the development of a 36,000-hectare site in Eastern Palawan (Eddie Monteclaro, "Land-Swap Deal Backed," *Sunday Times*, March 23, 1969, p. 16A).

Studies of these large agribusiness enterprises, not only in livestock but also in cash crops like pineapples (Dole and Del Monte) and bananas (Standard Fruit), and their impact on our society, are very much in order because of the almost instant modernization that accompanies their establishment. Some of the changes they initiated are:

(1) A whole set of physical and institutional infrastructure such as roads, housing, electricity, water systems, transportation, schools, churches, markets, health facilities, communication networks, etc., where they were nonexistent or only vaguely developed before.

(2) A new social stratification system superimposed on the local and community structure based on a managerial-technical-laboring class system rather than on a land tenure system.

(3) Development of a "corporate" community within an existing geographically and politically defined community.

(4) A cash wage system, specified working hours, and a more highly differentiated division of labor.

(5) Participation of workers in labor unions and other organizations characteristic of industrialized societies.

(6) Intensive exposure of modern agricultural and industrial practices and their eventual acquisition of essential knowledge and skills.

(7) Short-circuiting of the adoption process where contract marketing is practiced, because the guaranteed market provides the incentive to meet certain minimum standards for their products to be accepted.

(8) Possible enhancement or deterioration of international relations where the enterprise is foreign owned or managed.

On example of such big-scale enterprises coming into a hitherto isolated community is a four-year-old, 1,500-hectare Texas-style cattle ranch in Barrio Laconon of Surallah, Cotabato. The owner has imported about 27 American Brahman bulls and 180 heifers for breeding stock, and has sunk more than ₱1 million in pasture lands, fences, roads, housing, and electricity. He has six tractors and twenty-five key men employed in technical jobs involving the scientific and practical ways of raising cattle. But more than that, his ranch has affected the life of the Bilaans (indigenous mountain tribes who practice slash-and-burn cultivation). An average of 100 Bilaans a day work on his farm planting forage grasses and weeding. The owner introduced schools and churches and has begun to train a few of the natives to operate a tractor and do other more skilled jobs. For their day's wage the Bilaans are given

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coupons which they can exchange for groceries in the canteen at the ranch. If cash is preferred, they can exchange the coupons for cash. The roads he built are of great benefit to an area where inaccessibility to markets is a major problem.[83]

CONCLUDING AFTERTHOUGHTS

The materials reviewed for this paper tell us that despite the social scientist's pessimistic prognostications on the acceptability of agricultural innovations, current developments indicate that these innovations have in fact found their way into the village, into the farm, and have touched the lives of our rural people.

If by all this we have found for ourselves a Pandora's Box,[84] then by all means let us open it, for the alternative to change is non-change; the alternative to big change is small change. And if in the process we are dislocated, allow us the privilege of finding our way back. As the typical Filipino saying goes: *Bahala na* (God will take care). When we entrust ourselves to the Almighty we do not expect Him to do a poor job. In the meantime this gives us the "guts" to take risks and even the careless abandon to be reckless and daring without which our country will not move and will forever be known as "developing" but never "developed."

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[83] From a personal interview with Antonio Nocom, the owner of the ranch, and Ramiro C. Alvarez, "Lone Ranger of Surallah," *Philippines Free Press,* December 30, 1967, p. 49.

[84] Clifton R. Wharton, Jr., "The Green Revolution—Cornucopia or Pandora's Box?" *Foreign Affairs,* Vol. 47, No. 3, April 1969.

DISCUSSION

Manning Nash

From Dr. Castillo's very excellent and abundantly documented paper, one gets a feeling of optimism and, like all anthropologists, I am going to accuse her of being ethnocentric. I think the Philippine model probably is not the best model for all of Southeast Asia. If we look at Burma and Indonesia as against the Philippines and Malaya, the structural conditions for an agricultural revolution, notwithstanding the effects of IR8, probably do not yet exist. Most of the problems of Southeast Asia will not be solved by straight-line manure furrowing, I think, but by other sorts of inputs.

From a more theoretical point of view, I am struck by the cycle of social analysis of technological innovation. Years ago the unit of study was the community (and still is partly), and the framework of analysis was social-psychological. Communities, however, are not very useful units of study if one is going to take a whole country. What I think is now the useful unit of study is something best conceptualized as an agro-system—involving all of the cultivators as they are locked into a pattern and tied into the cities. The unit of study of the individual adopting farmer or community and the social-psychological framework does not produce any kind of cross-cultural generalization that I can see. The adoption model which Dr. Castillo used and which is now partly abandoned, was never and is not now a theory of innovation or acceptance. At best, the stages in the adoption model were never more than a handy checklist of what ought to be taken into account. Almost every empirical instance of adoption about which we know violates one of the stages in that model, and it has, for my taste, "zero" explanatory power and less and less descriptive power.

So I think what we are moving into in an understanding of innovation (at least in the countryside) are agro-systems and structural variables. The growing assumption is that whatever is on the farmer's mind is probably less interesting than the buffetings and constraints against him as an actor in a system of agronomy and of political city relationships. What we will have to work out are some handleable models of complex societies in which the farmer is only one ganglion in a whole system where choices and impulses are hitting him all the time. I think that nowhere in Southeast Asia, except maybe in tribal areas, can we think of the virgin, pristine community. If it ever existed, it does not exist now. All of the farmers are transitional;

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all of them have been hit by all kinds of new information and new kinds of innovations.

Another important change—and one that cannot be stressed enough—is that in modernization and in agricultural innovation or in any kind of innovation, the key element is the developed science of the world. The tinkerers and the felt needs of village people will not provide the solution to their economic and social problems. Farmers themselves only make small marginal and incremental changes. The big inputs will come from research centers and scientists. The developed products which will change the shape of Southeast Asia are being made in research laboratories somewhere in the world and not in community discussions and self-help which were never very fundamental to the process of social change. If one compares the difference between IR8 and a Peace Corps worker, one gets the kind of image for which I am striving.

One other last category has to do with the way we feel about social change—"we" being those who hope to see it and those who are undergoing it. Change used to be thought of as some kind of supervised, bureaucratic enterprise without social upheaval. People who were tied to the government were sent out, worked in some kind of hierarchy, and tried to give some knowledge to the benighted masses and farmers. This kind of supervised, bureaucratic change has been notoriously slow, unsuccessful, and usually unimaginative. The image of change is now one, I think, of social risk—an open challenge in which nobody has an idea of the outcome. With such an image of change as social risk, a government is needed which can take these social risks, which has confidence that however it turns out—and it may turn out badly for the elite—the government is willing to live with it.

Now the Philippines is more ethnically homogeneous than almost any other country of Southeast Asia. Its elites and its masses are, much more articulate, and, I think, it can afford the image of such risk more easily than most other Southeast Asian countries. The crux of getting innovation spread around is that the elites are willing to pay the price of the increased mobility of the kinds of people they really do not like—the nouveau riches. The casique classes are willing to sit down at their country clubs with people who made a lot of money very quickly in unorthodox forms. I submit that to get a social structure to the point where it can run such a risk is probably beyond the ability of anybody to plan or any input that we can make as scientists or as developers. But if we keep that in mind, maybe we will help make the right kind of inputs which will move societies along that course.

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THE CHALLENGE OF AGRICULTURAL INNOVATION TO EDUCATION AND MANPOWER DEVELOPMENT (FOCUS ON THAILAND)

NONGYAO KARNCHANACHARI

SKIMMING through a number of agricultural documents and survey reports of national as well as international agencies directly involved with or interested in agricultural development in Southeast Asia (Thailand Ministry of Agriculture, the FAO, the Asian Development Bank), one becomes convinced that there exists a great opportunity to expand productivity in the region, that "it needs only the purposive activities of man to mold and contain the region's rich potential to bring forth a vast abundance to satisfy human wants."[1]

Southeast Asian governments are determined to implement both short- and long-term plans to accelerate the economic and social development of their countries. Yet in spite of their efforts, great masses of people suffer from poverty, hunger, and poor living conditions. The present high population growth rate indicates that even more challenging tasks are at hand. It is clear that the political and social tensions which are shaking his part of the world will not be lessened unless the conditions which produce them are eliminated.

AGRICULTURAL INNOVATION AND HUMAN RESOURCE DEVELOPMENT

In most Southeast Asian countries the agricultural sector is the foundation of the national economy. Countries depend heavily on agricultural products for domestic consumption and for export earnings. About 80 percent of Thailand's population alone is engaged in agricultural employment. It would seem logical, therefore, that the policy objectives of most Southeast Asian governments would be balanced toward increasing agricultural productivity and agricultural innovation. Indeed, Thailand's Second National Economic and Social Development Plan (1967-1971) reads:

> The primary policy objective in the development of the agriculture sector is to accelerate and diversify production, to assure that the benefits of higher productivity accrue to the farmers, and to promote the security and dignity of agricultural occupations. The following objectives are designed to realize the general sector policy objective:

[1] *Asian Agricultural Survey*, Vol. I, Regional Report, submitted to the Asian Development Bank, Manila, the Philippines, March 1968, p. 33.

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(i) To improve and expand the government infrastructure projects such as irrigation and transportation in the rural areas.

(ii) To develop the natural agricultural resources and to utilize them efficiently to obtain the maximum long-term economic benefits.

(iii) To improve and strengthen research and experimentation so as to modernize farming techniques and increase productivity.

(iv) To improve the quality and grading of agricultural products to satisfy domestic and foreign demands.

(v) To improve the land tenure systems in order to promote commercialization of agriculture while maintaining the equities of the contracting parties.

(vi) To promote agricultural institutions, such as farmers' associations, cooperatives, people's irrigation associations, and young farmers' associations, so that these institutions can represent the farmers and express their interests.

(vii) To improve the marketing system of agricultural products and to strengthen the bargaining of the farmers so that they will receive an equitable share of the final retail price of the commodities they produce.

(viii) To extend increased government services to the farmers, especially in the field of agricultural credit, price support for the principal crops, and various extension services.[2]

The objectives described in the Plan seem to cover all the essential elements of agricultural innovation. Compared to six or seven years ago the need of planning for agricultural innovation is fully recognized, and at least some of the requirements are well known. Withal, the degree to which projects will be able to reach developmental goals is a matter for serious debate. In 1967-68, the Asian Development Bank Survey Team on Asian agriculture pointed to major constraints on agricultural innovation, among them lack of organization and infrastructure. More particularly, they pointed to the nonavailability of qualified agriculturally trained personnel —in the research and experiment stations, in the extension agencies, in the cooperative units, and even in the administrative departments dealing with agriculture and allied subjects. The Survey Report noted that the shortage of skilled personnel has pivotally deterred the implementation of agricultural development programs.

Another report, on the past performance in Thai agriculture during the First National Economic and Social Development Plan (1961-1966), cited three main categories of activity involved in the production of agricultural

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[2] *The Second National Economic and Social Development Plan 1967-1971* (Bangkok: The National Economic Development Board, Office of the Prime Minister, Government House Printing Office, 1968), pp. 84-85.

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crops, research and experimentation, pest and disease control, and agricultural services, which were suffering from insufficient personnel and equipment. The ADB Survey Team reaffirmed the seriousness of the situation:

> Measures to correct the situation with regard to the availability of an adequate number of trained agricultural personnel are among the significant neglects in the development planning of most regional countries. The investment in the development of human resources has a long gestation period, but to neglect or pay half-hearted attention to such a vital factor will be self-defeating. A positive policy for training manpower must be undertaken without any loss of time, since time is the vital factor in the whole process. It should be sufficiently clear to the planners and policy-makers that it is futile to proceed on a program of institutional innovation without ensuring beforehand the availability of trained manpower.[3]

The acute shortage of agriculturally trained personnel cannot in my view be traced wholly to neglect on the part of planners and policy-makers in Southeast Asian governments. Policy statements and significantly increasing national budget allocations should testify to this. Rather, I think, it is due to the failure to formulate comprehensive national development plans that would correlate education and manpower development with national agricultural goals, and to base these programs on sound manpower forecasts. Certainly there are development projects for all levels of education, from kindergarten and lower primary education up to the university level. One senses, however, that these are oriented mainly to a broad general education, without enough attention given to appropriate education and training in agriculture. Little attempt is made to carefully study and analyze personnel requirements in agriculture, to decide the appropriate levels of training, the number of students to be produced, or the distribution capacity.

This view finds support in the statements of the ADB Survey Team:

> No regional government has a comprehensive program for manpower development. Indeed, in most regional countries, there are no inventories of trained personnel presently available, and little effort has been made to formulate a national education policy that is responsive to anything more than a broad assessment of future needs for skilled manpower.[4]

Proper planning for agricultural manpower development must also depend upon adequate nationwide statistics on agricultural employment and

[3] P. K. Mukherjee, "Role of Rural Institutions in Asian Agricultural Development," *Asian Agricultural Survey,* Vol. II, Sectional Reports, submitted to the Asian Development Bank, Manila, the Philippines, March 1968, p. 756.

[4] *Asian Agricultural Survey,* Vol. I . . . , *op. cit.,* p. 109.

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labor productivity, and upon a continuous survey and assessment of requirements. The Second Five-Year Plan of Thailand acknowledged past deficiencies in such statistical information and proposed the establishment of a Manpower Advisory Council to upgrade the planning programs. This Council is to consist of representatives of the government who would concentrate on problems of employment creation, manpower development and utilization, and organization of vocational training in relation to the manpower requirements of the country.

PLANNING FOR EDUCATION AND MANPOWER DEVELOPMENT

Since 1963, five different manpower forecasts[5] have been made in Thailand, each based on extensive study and involving the participation of both Thai and foreign technical advisers. One would assume that some attempt had been made to relate manpower needs to educational planning, and that the forecasts would be far from arbitrary. However, at the beginning of 1969, these forecasts and the state of educational planning in general in Thailand were exhaustively reviewed. The author's findings were straightforward and shocking, particularly to those associated with past planning performances:

> The weaknesses of manpower forecasting in Thailand are not essentially a function of inadequate data but of an inadequate conceptual apparatus. The key to the difficulty is the arbitrary view that is always taken by manpower forecasters of the relationships between education and occupation.
>
> What is needed is a composite approach: none of the current approaches now practiced in educational planning around the world is entirely satisfactory by itself, but each contributes something to the general picture. What we should be doing now is to concentrate our efforts on reconciling them. Even when we have accomplished that, we have only succeeded in integrating education with *economic* development.[6]

It may be worthwhile to add that one outcome of this report has been the recommendation that the cost-benefit approach or rate-of-return analysis

[5] They are (1) The Joint Thai-USOM Resources Study, "Preliminary Assessment of Education and Human Resources in Thailand," in 2 vols., the first of which was published separately in 1967 by the Ministry of Education (Bangkok: AID-USOM Thailand, 1963); (2) "Current and Projected Secondary Education Programs for Thailand: A Manpower and Educational Development Planning Project," Publication 9 (Bangkok: Educational Planning Office, Ministry of Education, 1966); (3) "Methodology on Manpower and Employment Projection in the Second Plan in Thailand" (Bangkok: N.E.D.B., Office of the Prime Minister, 1967): (4) G. Hunter, "Higher Education and Development in Southeast Asia," Vol. III, Part 1, "High-Level Manpower" (Paris: UNESCO-IAU, 1967); (5) I.L.O.'s, "Asian Employment and Training Projections, Report on Case Study in Thailand" (Bangkok: cyclostyled, 1968).

[6] Mark Blaug, "The State of Educational Planning in Thailand," a report submitted to the National Education Council, October 31, 1968, p. 42.

be adopted for the first time in the history of education and manpower planning in Thailand.

A national agricultural development plan, as part of an overall development plan, should be the primary basis for developing the manpower required to attain production targets—over the short run and the long run. Various types of personnel should be taken into account, such as those directly engaged in crops, livestock, fisheries production, as well as agricultural services such as irrigation, transportation, land reform, market assistance, farm supplies, processing and storage. Equally important, as a means of producing the manpower quantitatively and qualitatively to meet the demands of agricultural innovation, is a comprehensive plan for agricultural education and manpower.

Undoubtedly there are difficulties in planning, particularly for manpower and education. The Ministry of Agriculture, the various offices and departments that deal with national manpower projection and education planning, the Ministry of Education, and other educational institutions, should exchange points of view and combine their efforts to upgrade agricultural human resources. Here, essentially, is the place for foreign assistance to Southeast Asian countries. Once again, in the words of the ADB Survey Team:

> Technical assistance in manpower planning, the assessment of future manpower needs, and the development of educational facilities to meet these needs, could be an important factor in accelerating the closing of the gaps between the demand and the supply of skilled people.[7]

I feel compelled to warn, however, that technical assistance, in order to be worthwhile—and effective—must have two things: genuine experts from abroad who know the country, and full-time high-calibre host counterparts. Without such expertise and such collaboration, it be futile to make new efforts in education and manpower planning.

PROBLEMS OF EDUCATION AND TRAINING IN AGRICULTURE

Assuming that sound overall estimates of manpower requirements have been prepared, with the categories specified in both the fields of agriculture and related agricultural service fields, let us examine present undertakings at different levels of education to produce trained personnel for agricultural activities.

Any increase in agricultural productivity using the new technologies

[7] *Asian Agricultural Survey*, Vol. I . . . , *op. cit.*, p. 109.

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involves three categories of personnel: the farmers—those directly engaged in agricultural production; the changing agents—extension workers and field technicians; and senior supervisors and specialists—the suppliers of specialized knowledge and modern techniques in agriculture who are responsible for research service and the formulation of agricultural development programs. The proper agricultural education and training given to all categories should provide a crucial force for agricultural innovation.

Primary Rural Education

It is evident that in an agrarian society the percentage of labor employed in agriculture is generally the highest. It is also unfortunately true that in rural areas most pupils leave school at the end of their primary studies—that is, approximately after four years of schooling. In Thailand, where roughly 80 percent of the labor force is agriculturally employed, the enrollment pyramid—a cause for great concern—shows that by the fifth grade only 17 out of an initial 100 pupils survive to continue their education. During this lower-level experience, therefore, the curriculum should be playing a vital role in inculcating in this army of farmers-to-be a consciousness of the importance of agriculture; simultaneously, it should lay the foundations of good citizenship through general education, with preparation applicable, once they leave school, to their former agricultural setting.

This raises the question of whether this concept has ever been taken into real consideration in Thailand. A review of the curriculum designed for the lower primary level suggests that very little has been done to relate or orient the pupils' academic studies to rural activities. From a typical provincial agricultural extension officer who has had nearly forty years of experience in the field, we hear strong criticism of the present curriculum. He says, in effect, that it may be appropriate for city-bred children, but for the rural children, who constitute the majority of the pupils enrolled in provincial schools, it has little reference to the kind of life they will lead after they leave school.

This failure to create enough consciousness of the importance of agriculture is not directly a function of the curriculum but of two things: one is the misconception of the pupils' parents, who view school as the place to equip their children with the basic academic tools of reading, writing, and arithmetic and for this reason discount the value of practical work in school gardens or on small farms. Another problem is the absence of teachers who understand this concept, or who understand but do not appreciate it, or who may possess both the understanding and the appreciation of it but who, unfortunately, for lack of both time and agricultural background (most fall into this category) do not make enough effort to instill in their pupils this conceptual consciousness.

Whatever the problems, I would strongly recommend the revision of the existing curriculum for primary education.

With respect to teaching personnel, an orientation to the teaching of rural science would likely bring good results. It is here that cooperation between the Ministry of Agriculture and the Ministry of Education is essential.

Farmers' Education

There are many proven instances of subsistence farmers who, equipped with modern commercial techniques of farming, have cast off negative attitudes based on individual and traditional background. Farmers have shown that they will be interested in new ideas, will understand the economic advantages of changes recommended to them, and will be willing to risk their money—if they understand what is involved.

To foster the adoption of new farming methods, vocational training and local leadership development programs should be provided for both youth about to enter farm life, and for adults already engaged in it. The training program should be adapted to local farming practices and concerned with the farmers' current interests and needs. Time allotted to each training program may vary with the suitability of the programs' objective. Young farmers should have the opportunity to attend regular courses, in succession, and for a period of time long enough to teach them thoroughly the necessary farming methods. This kind of training should be considered as a form of out-of-school education with curriculum designed accordingly. Adult courses should be short yet intensive, and applied to some specific farming problems, such as the increase of yield with improved seeds, or the application of chemical fertilizer, and so on.

If it is not feasible to introduce such courses in the near future, demonstration plots are likely to prove interesting and educational to farmers. Centers for this kind of training should be established and their location decided, after taking into account the ecological patterns and farming systems of each locality. Ideally, one such center for each area identified as typical should be set up.

In Thailand, efforts have been made for some time to educate farmers through organizations such as the Rice Farmers' Groups, Agriculturists' Groups, Peoples' Irrigation Groups, and the Young Farmers' Association.

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Although some success has been achieved with these organizations, much more needs to be done. The formal training of young farmers has not advanced very far either. The problems that have retarded training programs are perhaps common to all countries: the high rate of illiteracy among farmers, the lack of competent extension workers, the imbalance of the farmer-extension worker ratio, the inaccessibility of certain areas to transportation and communication facilities, and insufficient funds to launch the programs.

Vocational and Technical Agricultural Education and Training

Good vocational and educational schools are important because they produce the middle-level trained personnel urgently required in large numbers in the early phase of agricultural development. It is the graduates from these schools who will be working most closely with the farmers. Instruction and curriculum, therefore, should be carefully designed to prepare young people for a changing agricultural and industrial economy. Generally, admission to vocational schools follows the last year of upper elementary education, the seventh grade. Levels of instruction provided in the vocational and technical schools may vary from country to country. In Thailand, there are three levels—the lower vocational level (grades 8-10), the upper vocational level (grades 11-13), and the technical institutes or junior college level (grades 14-15). Since the graduates from these three levels are expected to associate closely with farmers, they should be able to demonstrate or extend improved agricultural practices to farmers in the villages. For this reason curricula offerings for vocational and technical training in agriculture at all levels should give first priority to practical training.

It is helpful to locate agricultural vocational schools close to farms and experiment stations. Close cooperation with existing agricultural extension services and other related branches such as cooperatives and farm machinery centers is also beneficial. In this way, students will become familiar with the environment in which they will later work and will at the same time become acquainted with the functions of experiment stations.

Although it is policy objective of the Thai government that vocational and academic secondary schools should serve distinctly different functions and purposes, in practice the course offerings of the two schools are very similar. There are unhappy debates as to whether the curriculum for vocational and technical training is suitable and harmonizes with the main objectives of producing vocational students. Students who have chosen vocational studies because of their preference for a practical education often find themselves coping with formal academic subjects beyond their capabilities, in addition to their vocational subjects and field work. As a result, both public and private organizations and agencies complain about the inefficiency and lack of practical ability of these vocational students. Obviously the attempt to serve both purposes at the same time means that the student is trained in neither very well.

The question is being asked whether the agricultural vocational pattern as now constituted is outmoded in view of present technological advancement, and whether lower secondary vocational education should be given up. Others are worrying about prevailing deficiencies in the teaching personnel, and the lack of facilities which cause schools to rely heavily on lecture instruction to the neglect of practical training. Still others assert that a large number of these schools are placed in unsuitable areas. In conclusion, it seems inevitable that the entire structure of this level of vocational education and training will undergo reconsideration. A strong recommendation has already been made to the government of Thailand to look into the matter.[8]

Higher Academic and Agricultural Education

Graduates of higher agricultural institutions are needed to handle problems of planning, administering, and supervising public agricultural programs and services, to manage public and private bodies, and most important, to do research, teaching, and extension work. Without them, it is impossible to reach a higher stage of agricultural development. Agricultural countries are becoming increasingly aware of the importance of supporting the establishment of colleges of agriculture in both the old and the new universities, and are giving more attention to the preparation of graduates in various fields of agriculture.

Agricultural education, even more than university education, must perform the three functions of research, instruction, and extension. It may be worthwhile, in this connection, to quote an impressive summary statement from an unidentified source on the integration of these three functions:

> The mutual stimulation of research, training, and extension is essential to the best progress of colleges of agriculture. Teachers need contact with research in order to keep abreast of their profession; research workers need the stimulation of students and of farm problems which they can help solve; and extension specialists have nothing to extend unless they have research results.

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[8] See, "Current and Projected Secondary Education Programs for Thailand: A Manpower and Education Planning Project," Publication 9 (Bangkok: Ministry of Education, Educational Planning Office, 1966), pp. 169-170.

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To fulfill these functions and to meet changing requirements, institutions of higher learning must have autonomous status. Unfortunately, this condition does not exist in Thailand. Some of the reasons why Thai universities are engaged mostly in teaching, why they do not attract and retain good professional talent, why their research activities have not been supported as strongly as they should be, are related to their peculiar organizational structure are part of the civil service. This problem was discussed at the SEADAG International Conference several years ago.[9] It is a pleasure, however, to announce that this matter is under review by the Board of the National Education Council, and that the system of higher learning in Thailand may undergo a great change in the near future.

Of the many obstacles that are faced by Thai universities and perhaps agricultural colleges, one which causes the greatest concern is the incoming students' lack of preparation for higher academic studies. Secondary education contributes significantly to the students' educational background. However, not only does the university find students ill-prepared in the natural sciences, mathematics, social sciences and the humanities, but it finds them incapable of undertaking the kind of independent study that should later enable them to enrich the community. To compensate, the university tries to equip students with these prerequisites within a limited time, thus loading them with too many class hours and allowing too little time for the very independent study that is the ultimate aim of their education.

Second, curricula offerings for the most part are fashioned after those in countries which are already advanced in science and technology—namely, the highly industrialized Western countries. One explanation is that persons in the position of issuing curricula are many of them Western-oriented. Not enough effort therefore is being made to adjust Western curricula requirements to the students' needs and the needs of the country.

A related point is that many curricula are too rigid and offer little room for electives that would help prepare students to meet changing conditions. For example, there seems to be insufficient study of and concern about the requirements of the various consumer sectors, including those of the agricultural industry, that change quite rapidly. Studies which reflect concern for changing requirements should be developed. Evaluation of the productivity of the graduates would shed light on the suitability of the curriculum as well. Curriculum evaluation and revision should also be made at intervals, to promote academic progress.

Third, it has long been a topic of criticism that research in Southeast

[9] Patya Saihoo, "Discussion," *SEADAG/ASIA: A Special Report by The Asia Society on Social Science Research in Southeast Asia,* 1968, pp. 17-18.

Asian countries is not as progressive as it should be. The question arises as to whether the universities in the region should for the time being consider research as the most important of the three university functions, in order to upgrade university standards and to serve the country's urgent needs. If the answer is affirmative, all possible effort should be directed toward eliminating constraints related to research activities. Such constraints include insufficient funds, weak incentives to draw attention to research, and scarcity of library facilities and research laboratory equipment. One of the most crucial defects is the absence of university master plans common to universities in the West. This is particularly the case in Thailand, where programs concerning enrollment target, expansion of fields of study, staff requirements, facilities acquisition, space utilization, budget requirements, and the like, are only dimly comprehended. With the exception of one already in process of completion, none of Thailand's nine universities has a plan which embraces academic and physical planning. The explanation is simple: institutional research, its process and advantage, is still new to university administrators in Thailand. Until its objectives are well understood and its techniques are learned, it is hard to say when effective guidelines for Thai universities can be issued.

The obstacles to carrying out research apply even more to agricultural research, which plays such a vital role in agricultural development. The following comment should indicate how the lack of resource inventories has retarded the course of agricultural development in Southeast Asia:

> In most regional countries there is a significant dearth of knowledge about national resources . . . maps and inventories for land use, soils, mineral deposits and geologic information, surface and ground water hydrology, ocean resource—and inshore fishing areas, forest resources, even good photographic and cadastral maps and basic meteorological data beyond temperature and rainfall are often lacking. Deficiencies in national resource inventories place a significant constraint on the alternatives that can be opened for agricultural development investments . . . irrigation projects are difficult, even dangerous to design and execute without sufficient hydrolic, geologic, and meteorological information; land settlement programs are almost impossible without detailed soil, topographic, and land-use studies; onshore fisheries and forestry programs depend on accurate maps of coastal waters and land cover . . . and until basic resource studies are made, many regional countries cannot make the best use of their national heritage and properly exploit their full potential for development.[10]

In Thailand, in the past few years, the agricultural universities, Ministries, and departments engaged in agriculture, in cooperation with several

[10] *Asian Agricultural Survey,* Vol. I . . . , *op. cit.*

foundations and foreign universities, have conducted a number of important and advantageous studies and researches in agriculture. If there is still a lack of resource inventories, the deficiency may be traced to mismanagement in setting priorities for research projects, which results in inadequate research support by the Budget Bureau. Such basic studies should be undertaken immediately to ensure the success of agricultural development programs.

The best place to develop research studies on natural resources should be in the agricultural colleges or universities. Such studies will provide institutions of higher learning with opportunities to participate in the nation's programs of development, and will also fortify the institutions themselves, since the teaching staff will be enriched with new knowledge of their own country. Not only might this result in more effective teaching and extension, but the frequent accusation of how little teaching is given to agriculture and rural conditions might be eliminated.

CONCLUSION

Of the many factors which account for the failure of a number of development plans and projects in Thailand, two are paramount, and require urgent and careful consideration. The first is insufficient effort or ability to plan, coordinate, and/or formulate projects for all levels of education and training in agriculture in such a way that they correlate with national policy objectives. The second is inadequate knowledge of existing situations, which result in effective planning. To tackle the first, it seems essential to review agricultural manpower requirement plans and to reconsider the entire structure of agricultural education and training as well as related existing development projects and programs. To remedy the second requires research.

These suggestions here should not in any way be misunderstood to mean that present efforts in education and manpower development should be given up. I am merely proposing that the objectives and activities of each program should be reexamined.

To carry out such highly ambitious undertakings will require time, financial support, and human resources. But is it not better for us to start or turn in the right direction rather than to keep moving without knowing why? It is in this endeavor that technical assistance from developed countries is wholeheartedly welcome. However, should there be any assistance in future undertakings, it is my sincere hope that it will be given by experts with a thorough understanding of the people and the existing conditions in the recipient country—experts of high calibre with the breadth of vision necessary to lead us realistically and wisely in the planning process.

DISCUSSION I

JOSEPH FISCHER

I am happy to say that Mrs. Nongyao is aware that if there are problems of what constitutes appropriate agricultural innovation, there are enormous problems of what constitutes educational innovation. If there is any one large institution in any society that can be more valued than education, I would like to have it pointed out to me.

Instead of commenting on Mrs. Nongyao's paper page by page, I think I will make some general statements about the relationship of education to development, with some reference to agriculture.

I think if one talks about planned development of any kind, then one is talking about some kind of relatively intended consequence or expectation, whether it is highly predictable or not. Otherwise why plan? We are talking here primarily about planned and purposeful agricultural development. I would maintain that development in general is more a social, cultural, and political reality than a technological and economic one. This may be a trite thing to say, but I find there are major international agencies, foundations, and private enterprises that still view development in much more limited terms. Although their definition of "technological" has expanded, it has not yet expanded sufficiently to include the social sciences and the humanities or other related fields, particularly when they are talking about schools; because I suppose that what we are interested in is not whether to innovate or develop agriculture, but how these innovations are used and what the net consequences are for the people who use them. What social or political difference, as well as what economic difference, does it make to have a new grade of rice or to develop a new kind of school? So far as we know, educational systems tend to be reinforcement systems rather than change-oriented systems. A great many changes *have* come out of educational systems, but most of these have been unintended. Schools tend to be sites or focuses for change, often not because of curriculum, the way in which schools are organized, or the way in which research is carried out, but because gathered together in a particular place are a great number of young, impressionable, sometimes alienated people between the ages of 13 to 25 who represent in some countries more than 40 per cent of the total population.

Agricultural schools tend also to reflect what seems to be a rather universal characteristic in human systems, that is, people will use it for their

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own purposes whatever the needs of development or the requirements of the state—except perhaps in a very strong political system which makes all the social, education, and political decisions for everyone.

I grant that there is a great potential for change in educational systems; however, the history of organized educational systems really demonstrates how intractable some of them are—particularly at the highest levels. I hope that Dr. Nash is not going to rely entirely on traditional centers of knowledge to produce innovations. They are not very innovative about their own structures. Witness our educational system, for example. Women in this country are not yet receiving by any measure the average rewards of higher education. In looking through the *SEADAG Directory* I noticed only eight women listed, and two of them are from Southeast Asia. Yet this is a country which educates all of its women practically through high school and about 40 percent of them through college. Why is this so? Because there are other values that determine how women use the educational system.

Agricultural education is particularly vulnerable to the charge of intractability. A good agricultural school that recruits good students will produce a large number of people who wish to go into the general political-economic system that generally speaking has little to do with agriculture, and certainly little to do with barrio or peasant agriculture.

There may be some visionaries, some people who are willing to go back into the agricultural sector from whence they came, but if education gives anything to those who obtain it, it is, to use a cliché, increased expectations. It means they wish to live and work in urban sectors, they wish to be involved with those forces which represent power, reward, and status.

A transformation of the educational system seems to imply a transformation of other kinds of institutions—political and social. (The family, for example, is still perhaps the most important value-setting institution in society.) We know that schools are effective in changing some values but we do not know quite how. In an open-ended system, changes are very difficult to predict through the generations.

In planning for agricultural or industrial development, manpower evaluations are obviously of some use. But they are deceptive. Most of the highly developed countries of the world have never used manpower studies at all. The point is not the number of bodies that are produced in medicine or agricultural engineering but in how people perform when they become adults. The family is an important institution in this regard; perhaps the school can be if so used.

I agree with Mrs. Nongyao that there is a great shortage of agriculturally

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trained people in Thailand. But how much do we know of the relationships between agricultural development and education? Do we have any models around the world that could be instructive about this relationship? With some exceptions, vocational education has not fared very well in many countries; a large investment continues to be made in schools in the hope that they will produce or make up the difference in agricultural manpower.

I question this. We need a great deal more research. If we are deficient in our knowledge of economic development in general and of how people respond to agricultural innovation, we are still in the Neanderthal age when it comes to research on why people go to school, why they stay, why they choose certain fields, and what happens to them after they leave.

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DISCUSSION II

SOEDJATMOKO

I would like to add a little about the need of relativizing the question of how education systems can help speed up the developmental process. I wish especially to turn the discussion away from too great an emphasis on the training of skills. Such a bias reflects I think the prevalence here of so many experts. Most of my thunder has been stolen by Professor Fischer, but there are a few things left that I would like to say.

On the whole, I go along with much of what has been said; and I think some of the points have been very pertinent. However, when I hear that educational patterns should be restructured from scratch and related specifically and almost exclusively to economic development goals, I start to shudder. I do not agree with the view that the orientation in the humanities will come by itself as in a blank automatic assertion of the humanity of man. To think that such an orientation need not be built into the educational system is simply not realistic. On the contrary, if we are to think in terms of restructuring and redirecting our educational system for development, it is very important for us to realize that skills constitute only one aspect of the requirement.

Mrs. Castillo has given us a picture of the political developments resulting from the introduction of agricultural innovations in the barrio. She has shown us that the peasants are much more rational and have a better nose for profits than had been previously expected, and that this has been a very important factor in the successful introduction of innovation. Nevertheless her paper certainly raises a number of questions that relate to the political structure of the village; for one of the results of the application of new technology are structural changes, increasing inequalities, and social tensions.

This leads us to the fundamental question: What kind of village do we want once these innovations have been introduced? Obviously this is a normative question that cannot be answered by an expert alone. Questions like this relate to basic concepts of life, of community, to notions of the purposes that economic development is supposed to serve, the answers to which require capabilities beyond those related specifically to development purposes. This holds true for the villages; this holds true for the developing nation as a whole. Once technological innovation has been introduced and the process of social change has started, questions will come up of a normative nature that relate to the kind of political vision people have—consciously or unconsciously. Questions of this kind are not only policy questions, they are very much political questions. They can only be answered by people who do have an inkling of, let us say, the broader purposes of life; who, in the pursuit of economic development, have a notion of what kind of society they are after. The educational system surely should be able to produce people who, apart from their skills, also have the developed capability to answer these questions.

Looking at this problem from an even broader perspective, we have been speaking as if economic development were a fixed goal, as if it were determined in character, almost determined in time, as something that will not move. This we all know is definitely not the case. There is no point in time or in this whole process of development that we can say, "Now, we have developed enough, so we can stabilize society again." The requirements for development are bound to shift constantly, and so will the skills that are needed. Our problem therefore is not only to acquire the skills necessary for one particular stage, but to internalize the drives and to stimulate the motivations for development. It is this rather than the possession of certain skills that will keep the development process going.

People in the developing nations are beginning to realize that many of the problems that have preoccupied us in our own situation are quite irrelevant in terms of the real requirements for survival as a nation. Our educational system should be able to produce the kind of people who not only have a vision of what they want their societies to become, but who also have a vision of what kind of world they want to live in. The capacity of the developing nations to maintain their freedom, and to make a contribution to a more rational world order, will very much depend on that capability.

As I am one of the few non-professionals to have attended this meeting, I have taken the liberty of making a plea for maintaining a more broadly gauged educational system. Of course, I am fully aware of the need and the urgency of a greater development orientation in the educational systems in Southeast Asia. In my own country I am one of the protagonists of this point of view. At the same time, in the process of our development we will be faced with crucial problems of a normative nature relating to the kind of society we want. And our educational systems should produce people capable of answering these questions.

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IMPACT OF NEW CEREAL VARIETIES ON SOUTHEAST ASIA'S PATTERN OF INTERNATIONAL RELATIONS

LESTER R. BROWN

THE breakthrough in cereal production in Southeast Asia and elsewhere is having significant repercussions in world trade—repercussions which were entirely unanticipated only two or three years ago. There is now more rice available for export than can readily be absorbed by the world market. The effects of a glut could be falling prices, declining trade, and decreasing foreign exchange capabilities of countries which have traditionally exported rice. If the rice market should collapse at a time when the Vietnam conflict is subsiding, the economies of the region could be severely depressed. The opportunities for overall economic growth and for raising the incomes of millions of farmers that have been created by the new cereal varieties could be lost unless the problem of overabundance is faced. There are solutions to this crisis, but they will not be arrived at easily. They require an awareness of the facts, and a willingness of governments to cooperate.

PATTERN OF WORLD RICE TRADE

Wide fluctuations in the price of rice over the last few years have occurred in part because of the character of the world rice market. As commodity markets go, it is very thin—that is, the amount of world production moving into intercountry trade is small. At present only about seven million tons enters world trade. This is less than 4 percent of the total world rice crop of 180 million tons milled. Thus a modest change in exportable supplies, say, a million tons either way, can have a traumatic effect on price.

This contrasts sharply with the situation for wheat, the second dominant food grain. Although the total crop of wheat is of about the same magnitude as rice, the amount entering world trade channels totals 50 to 60 million tons or about 20 percent of the total crop.

Another factor in the fluctuation of rice prices is the fact that no country plays a strong role in the stabilization of world supply and demand, a role which in the case of wheat is played largely by the United States. Each year the U. S. Department of Agriculture projects domestic wheat requirements and external demand for the year ahead, in terms of both commercial and concessional exports. Acreage allotments are then adjusted according to

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projected demand. Thus in the world wheat market the principal variable is not price but U.S. wheat acreage.

In order to stabilize world wheat prices the United States undertook two major actions during the 1950's. It developed a food aid program that increased world consumption by roughly 500 million bushels, and it took some 15 to 20 million acres of wheatland out of production. The wheat market is very much like the market for Chevrolets. General Motors determines what the price ought to be, and then it produces the number of cars to meet the market. And so it has been with world wheat prices for a decade and a half, a period during which world wheat prices have been remarkably stable.

The fluctuation in rice prices is a relatively new phenomenon. Until a few years ago the pattern of world rice trade was more or less static. For decades, Burma, Thailand, and the Indochinese countries had the comparative advantage in rice production, such that the Thais and Burmese could add a very substantial export tax to their rice and still compete effectively in the world market.

Then, in the mid-1960's, a number of events combined to drastically reduce exports from the major rice suppliers. Among them were two consecutive monsoon failures on the Indian subcontinent during the summers of 1965 and 1966. At about the same time the growing conflict in Vietnam caused this country to lose its exportable surplus of rice and to become a heavy importer. Japan moved from a position of near self-sufficiency at the beginning of the decade to one of importing several hundred thousand tons yearly in the middle sixties. Burma mismanaged its rice economy with poor price and export policies and succeeded in reducing its rice exports by one-half in four years.

As these developments took place, the world price of rice climbed to about $200 per ton, an increase of almost 50 percent over the previous average.

Encouraged by high prices and a reduction in exports from the major rice suppliers, other countries began to expand their production of rice. U.S. farmers began to challenge Southeast Asia's preeminence in the world rice market. In 1968, rice exports from the United States reached 1.8 million tons, surpassing exports from Thailand, the leading rice exporter.

The price of $200 per ton prevailed for two years and made a deep impression on decision-makers in many countries. It made eminent sense to the ministers of finance and agriculture in major rice importing nations to make an all-out effort to eliminate imports by achieving self-sufficiency in rice.

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Existence of this favorable environment for raising the production of rice coincided with the breakthrough in new rice technologies. New, high-yielding varieties of rice, developed in research stations around the world, began to be distributed in 1966 and spread with amazing speed. By 1968-69 they were planted on nearly 13 million acres throughout Asia. The U. S. Department of Agriculture estimates that this may have increased the rice crop 9 percent.

For many countries, the spread of the new varieties has brought the aim of self-sufficiency within the realm of possibility. Production increases are already altering long-established trade patterns. Malaysia predicts self-sufficiency by 1972 and Indonesia before the end of the Vietnam war. Vietnam, whose rice imports were increasing between 1966 and 1968, appears to be reversing the trend and predicts self-sufficiency shortly after the end of the war. In other parts of Asia, West Pakistan may be on its way to becoming a major exporter of rice. If logistical problems can be solved, East Pakistan's import requirements may be filled by West Pakistan. The Indian rice deficit is also declining.

The country most dramatically affected, however, is the Philippines, which for the past half-century has been a rice deficit country. In 1967, 11 percent of Philippine riceland planted to the new seeds produced 27 percent of the total crop. By 1969 an estimated one-third of the total rice growing area was planted to the new varieties. As a result, rice imports decreased from one-half million tons in 1965-66 to less than 200,000 in 1966-67. By 1968 the Philippines was able to reach self-sufficiency and even to export 400,000 tons.

Japan, also a rice deficit country in the past, has accumulated a record surplus. The Japanese Ministry of Agriculture estimates that the 1969 crop exceeded domestic requirements by about one million tons. Approximately one-third of this is being exported to Korea on concessional terms; the rest will have to be added to the 5.5 million tons already in Japanese warehouses. The explanation of Japan's rice surplus is its very high support price of $420 a ton—more than double the world price.

The particular character of the new high-yielding rice varieties, which require a controlled water supply, large amounts of fertilizer and solar energy, will be a strong factor affecting the comparative advantage in rice production. In the opinion of many agronomists and economists, favorable ecological conditions in the Indus Plain in West Pakistan may offer the definitive challenge to Southeast Asia's long-standing dominance as a world supplier of rice. It has both a controlled water supply, without the problem of flooding that inhibits the use of new varieties in much of Southeast Asia, and little cloud during the growing season, which means that solar energy is more available than elsewhere.

FUTURE OF WORLD RICE TRADE

The vagaries of the weather aside, the outlook for the seventies shows a decreasing demand for rice imports and a growing ability on the part of most countries of Asia to reach self-sufficiency or to produce an exportable surplus. A recent survey of the U. S. Department of Agriculture estimates that 1970 will show a world excess of supply over demand. The estimates of supply may even be conservative. The Soviet Union, for example, is shown to require imports of 335,000 tons in 1970, but the Russians themselves have just set a target of self-sufficiency for this year.

While India, South Korea, and West Africa should continue to import substantial quantities, the overall picture indicates a buyer's market for some time to come.

Thus, across the world, the future of rice trade looks grim. Already the price of rice has fallen. The FAO world export price index for rice, which had reached a high of 158 in March 1968, declined nearly 13 percent by January 1969. All indications are that prices have continued to fall and that the December-January harvest may severely depress prices in early 1970.

The effects of production increases and falling prices are already being felt in Southeast Asia. A number of governments have established price support programs, to ensure profitability and security for farmers prepared to experiment with new varieties. Some governments are being forced to intervene in the market-place in order to maintain the support price: they have accumulated a large volume of storage procured at prices above world market prices. This happened in the Philippines in 1968 when the fund of the Corn and Rice Administration was largely depleted in efforts to maintain the price of rice.

Unfortunately, the decline in world price to a level well below the purchase price means that much of the expenditure cannot be recovered. When governments find themselves in this position they discover that they have used scarce resources to buy a commodity which cannot be sold at the world price. They also discover that if the trend continues they will be paying heavy storage costs on the commodity. This increases the pressure on the resources. A similar situation has become particularly apparent with wheat in Western Europe. Recently, wheat has been exported from France with a subsidy that is greater than the actual export price. Exports to Taiwan, for example, were sold at $48 a ton when the price within the Common Market is above $100 per ton.

General concern about the future of the rice trade was expressed at the Thirteenth Session of the FAO Study Group on Rice in March 1969. Several members of the group, notably the Philippines and Thailand, suggested that some form of international action was necessary to control the rice trade. Proposals were made to prevent "undue" competition between the developed and the developing countries, to grant preferences to the rice exports of developing countries, to adjust rice production and prices in response to prospective demand, and to control the release of national rice stocks. However, opposition to these proposals was voiced both from the rice producers in the developed countries, especially the United States, Japan, and the EEC, and from those importers who stood to gain from declining prices and the maintenance of concessionary rice supplies.

The problems associated with attempts to reach worldwide agreement on such issues are amply illustrated by recent difficulties with the International Grains Arrangement. The system of minimum prices for wheat has broken down under the pressure of excess supply.

The importance of rice as a staple food and as a major source of foreign exchange earnings makes it imperative that the nations of Southeast Asia try to reach some agreement on these issues. In the absence of worldwide agreement, they can work to improve existing arrangements for forecasting import requirements and export availabilities and for providing information on price, contracts, stocks, and production programs and targets. Individual countries can lower production costs and make a concerted effort to improve rice quality and marketing techniques.

Neither regional cooperation nor the techniques of individual countries in Southeast Asia, however, will be sufficient to advance the competitive position of the region as a whole or to avert a collapse of the world rice market. What these countries desperately need are markets for their present and prospective surpluses.

SUGGESTED SOLUTIONS

Two possible solutions offer a means of avoiding a rice crisis in Southeast Asia. The first involves a shift in Japan's present policy of protection to a more flexible import policy. The second, to be phased with the first, involves a diversification of riceland into other crops, particularly into feed grains.

Japan

Japan now ranks among the big three countries of the world, trailing only the United States and the Soviet Union. Although Japan has a gross national product smaller than the Soviet Union's, it is a far more important trading nation (Japan's trade doubles that of the Soviet Union). The significance of Japan's economy, however, lies not so much with the present as with the future. If current trends in economic growth continue for another twenty years, per capita income in Japan could pass that of the United States.

Japan is a major trading partner for most Southeast Asian countries. It is the only high-income rice-consuming country of any size. At the same time, it is the most flagrant violator of any country of the laws of comparative advantage in cereal production. Thus, what happens to Japan, in terms of rates of growth and decisions on trade policy, especially for agricultural and raw materials, bears directly on the future economic progress of Southeast Asian nations.

As pointed out earlier, the big safety valve in the world wheat market is U.S. wheat acreage. Only one country has the size of market and the economic strength to play this role in the world rice market. That is Japan. Japan is the only country that can absorb large imports of rice without adverse effect on its foreign exchange position.

At present, Japanese rice policy is highly protectionist, a fact officially recognized in a report from the Price Stabilization Council, a commission appointed by the Prime Minister. The purpose of course is to protect the income of the farmers, a powerful political bloc in Japan. However, even with the rice price support program, the ratio of non-farm to farm income is two to one. This gap is almost certainly to widen in the next two years, given the great industrial growth and the wage increases that result from the growing shortages of industrial labor.

There are already signs of movement on the issue of rationalizing rice production and reducing the levels of protection. The commission mentioned above is examining the question. There are indications that Japanese consumers are becoming restless over the increasingly high prices of rice; now they are being asked as taxpayers to subsidize exports of rice on concessional terms. The press is beginning to raise the issues and editorials are appearing. Morally and economically, Japan is going to find it difficult to justify continued protection of very inefficient rice production at $420 per ton, when the world market price is sinking toward $150 a ton and may go even lower.

Although the stage is being set to do something about the situation, as of now no real action has been taken. Ten-year projections of the Japanese

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Ministry of Agriculture estimate that the country's rice demands, which were 12.5 million tons in 1966, should stand at 12.4 million tons in 1977, which, taking into consideration projected population increase, reflects a marked decline in per capita consumption. The Ministry foresees that rice production within Japan will be able to meet this demand and that net imports in 1977 will be zero.

As competition develops between Southeast Asian rice exporters and exporters elsewhere for a market that is not going to be very large, I think the time has come for Southeast Asian countries represented in the FAO Study Group on Rice to confront Japan on the question of its rice policy. I believe that these countries will have greater leverage in obtaining a meaningful response if they approach Japan on this issue as a group, rather than as individual countries. I would further suggest that it is very much in the interests of this group to prepare a paper which addresses the problem specifically in terms of the rice export situation in Southeast Asia over the next several years. This paper should also examine the Japanese market situation, the relationship between price and production in Japan, and the kinds of alternatives that exist for a phased reduction of their rice price support. The implication of these alternatives for imports from Southeast Asia should be carefully explored.

There are powerful interests within Japan that would support this kind of initiative on the part of Southeast Asian countries. Industrialists should favor it, since if rice can be used to expand the volume of trade between Japan and Southeast Asia, the opportunity for increasing industrial exports will be much greater. In addition, the transfer of labor from the rural to the industrial sector would relieve labor shortages. Labor should support such action because of its interest in raising the exports of industrial products. From the point of view of government, there are two distinct advantages in promoting the import of rice from Southeast Asia. The first is that it would reduce the substantial trade surplus with that region. The second is that the reduction in the price of rice to the consumer would help the fight against inflation.

A phased reduction in rice price supports and an opening of the market to rice imports, combined with a transfer of rural labor into industry, could have major economic advantages for Japan, perhaps enough to offset the domestic political difficulties such a move would entail.

Diversification of Crops

As population and per capita incomes rise, the world demand for poultry and livestock products is mounting and with it the demand for feed grains.

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The other important strategy to avert a world rice crisis should be a phased plan to diversify some rice-growing land into the production of feed grains for domestic and export use. Coincident with the increasing demand for feed grains, new technologies, and in particular new hybrid corn and sorghum varieties, are raising the productivity and profitability of this type of agriculture.

In a number of Southeast Asian countries, feed-grain production is already becoming recognized as a viable alternative to rice production. One outstanding example is Thailand, which has greatly diversified what was once a rice monoculture. The area planted to corn was expanded from an average of 52,000 hectares in 1953-55 to 608,000 in 1967, while yields rose from 1,154 to 1,974 kilograms per hectare over the same period. In 1968 Thailand's corn exports reached 1.5 million tons, exceeding its rice exports. Ninety-eight percent of Thailand's corn production is exported, of which more than half goes to Japan. The rest goes to Hong Kong, Singapore, Taiwan, and Malaysia. Cambodia, too, is exporting feed grains, and Indonesia has just begun.

The market situation for feed grains is very much better than it is for rice and is likely to remain so as domestic livestock programs are instituted and Japanese demands soar. The ten-year projections of the Japanese Ministry of Agriculture, which show rice imports at zero in 1977, estimate that imports of feed grains, principally corn and sorghum, will rise from 6.6 million tons in 1966 to 14 million tons in 1977—that is, by more than 100 percent. Southeast Asian countries are in a geographical position to supply these needs easily, a fact recognized by Japanese agribusiness firms. As a consequence they are establishing marketing, input, and technical assistance systems in Thailand, Cambodia, Laos, the Philippines, and Indonesia to promote the production of feed grains for export to Japan. Soybean imports are also projected to double in the decade investigated. Some breakthroughs are occurring in soybean breeding in India, with U.S. varieties being modified to tropical and subtropical conditions. These are proving to be adaptable to Southeast Asian conditions, causing the possibilities for soybean export to be very attractive.

It is possible that sorghum will provide the most exciting potential of all for export in the near future. An interesting aspect of sorghum is that its use as a feed grain on a large scale anywhere in the world is restricted to the last decade. Sorghum came to the United States initially from Africa. It was the staple food for slaves as they cross the Atlantic two or three centuries ago. For a long time it was a food grain, grown in garden patches behind the slave quarters in the South. When the dry land areas of the Great

Plains were opened up, farmers began to use it as a feed grain. Its special advantage in these areas is resistance to drought: when there is too little moisture, sorghum simply becomes dormant. In the early 1950's, sorghum was hybridized (the first cereal after corn for which successful hybrids were found). With this breakthrough in the United States, yields doubled within the decade and production tripled, with the result that sorghum is now a leading United States cereal export.

The prospect for sorghum in the tropics and subtropics is good because of all cereals it is the only one which is botanically a perennial. Sorghum will mature and be harvested and then, if enough water and nitrogen are present, will mature again for a second harvest and sometimes even a third. This characteristic is utilized successfully in the Philippines in a program of intensive multiple-crop combinations with rice. One rice crop is planted during the rainy season, then sorghum is planted at the end of the monsoon and harvested two or three times before rice is planted again. Using such combinations, the International Rice Research Institute has obtained eight tons of grains from one acre in a 12-month period.

With these new feed-grain technologies, and with the growth in demand for their products, together with the possibility of a shift in comparative advantage in feed-grain production from the temperate zone to the tropics, Southeast Asian countries should pay close attention to the strategy of diversifying riceland in their search for exports to substitute for rice.

DISCUSSION

VERNON W. RUTTAN

MR. Brown has focused attention on a number of specific issues facing the nations of Southeast Asia in their attempt to work out domestic price and market policies and international trade relationships in response to the technical revolution in grain production. Since my own view on these issues is similar in many respects to the views outlined by Mr. Brown, I will not attempt a comprehensive critique of his paper. Rather I shall focus on two points which, in my judgment, need further consideration.

First of all, Mr. Brown is particularly concerned with the need to design new trading arrangements to prevent a collapse of the world rice market. He points out that the world rice market is very thin, with less than 4 percent of a total world crop of around 180 million tons entering world trade. Modest changes in the exportable surplus could thus result in great instability in the price of rice traded internationally.

The problem of instability of export prices is clearly of greatest concern to two countries of the region, Thailand and Burma. However, the concern with price stability in international markets should not be allowed to obscure the fact that the chief significance of the new grains technology is internal. The real cost of grain production in South and Southeast Asia has lowered. As these lower costs become reflected in lower real food prices in domestic markets, they can exert a pervasive impact on the rest of the economy by affecting the costs of producing sugar, copra, plywood, and other export commodities which may experience more rapid growth in export potential.

Thus while most countries in the region have an interest in orderly market processes, both in domestic and international markets, efforts to stabilize prices at the high levels of the late 1960's would result in diversion of limited resources into unproductive uses, and would limit the total economic impact of the potential productivity gains of the new cereals technology.

Second, Mr. Brown points to the role of the United States in the world wheat trade during the last several decades as a residual supplier which has managed through its domestic wheat programs and trade policies to produce remarkably stable prices in international markets. He suggests that Japan now has both the capacity and an obligation to assume a similar role in the world rice markets.

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There is a major difference between the United States and Japanese situations, however. The United States is a major wheat exporter. For Japan to assume a stabilization role in the world rice market it would be necessary to again become a major rice importer. Brown is, in effect, suggesting that Japan assume the same role with respect to the world rice economy in the last third of the 20th century that Great Britain occupied with respect to the world wheat and feed grains economy in the last half of the 19th century after the repeal of the "corn laws." This would clearly have important benefits for Japanese consumers and for the export industries. It would be strongly opposed by organized agriculture.

I would assume that even if Japan were to undertake responsibility for managing its domestic rice price policies and its rice trade policies in a manner that would (a) open up large new markets for potential rice exports from South and Southeast Asia and (b) assure a reasonable degree of price stability in these markets, Japan would want assurances that the United States would accept responsibility for reasonable management of its rice export program. Except for the shortage years in the late 1960's, American rice exports have typically moved into world trade only with substantial export subsidies. It would be entirely unrealistic to expect that Japan would be willing to cut back on domestic rice production and absorb increased supplies of rice from Southeast Asia if the United States were to simultaneously engage in an active rice export expansion program. Responsibility for assuming a reasonable degree of price stability in international rice markets should be viewed as at least a joint responsibility of the United States and Japan. It would also require at least implicit concurrence from other developed country rice exporters such as Australia.

Finally, in spite of Mr. Brown's persuasive arguments, I remain skeptical as to the economic value and the political feasibility of efforts to achieve price stability in the international rice market at this time.

IMPLICATIONS OF AGRICULTURAL INNOVATION FOR DOMESTIC POLITICAL PATTERNS IN SOUTHEAST ASIA

VU VAN THAI

ONLY three or four years ago a paper of this title would have been taken as a piece of utter wishful thinking. In the developing world, and particularly in Southeast Asia, the two decades following the end of World War II were characterized by an almost generalized lack of progress and innovation in agriculture. As late as 1967 many observers predicted that rising expectations in the face of accelerating population growth, lagging food production, and increasing dependence on food aid would generate serious political instability in the "Third World." The prevailing pessimism is illustrated in the following quotation:

> If present trends of population growth and food production continue, in the early 1970's India, Pakistan, and Communist China will be candidates for massive famine.[1]

Thus, had it been written three years ago my paper might have been entitled "Political Implications of Agricultural Stagnation."

Such gloomy prognostications have today given way to a general sense of optimism bordering on overenthusiasm. People are talking more and more of the "green revolution" in Asia and of "a new agricultural era" in the tropical world. Lester R. Brown of the Overseas Development Council described it in these terms:

> The new era is characterized by explosive increases in production of principal crops in the larger developing countries of Asia. The 1968 Pakistan wheat harvest was up 37 percent over the *previous record,* possibly an increase without precedent in any major country. India's wheat crop this year was up 35 percent over the *previous record,* its total food grain harvest up 12 percent. Ceylon's rice crop has increased 34 percent during the past two years. The Philippines with two consecutive dramatic gains in its rice crop, has apparently ended half a century of dependence on rice imports. Increases in per acre wheat yields in Pakistan and India and of rice yields in the Philippines over the past *two years* may exceed those of the preceding *several decades.*
>
> Thus far the most rapid advances have been concentrated in Asia, a region containing more than half of the world's people. But countries elsewhere—Mexico in Latin America and Kenya and the Ivory Coast in Africa—are also enjoying the fruits of modern technology. Within the next several

[1] *Foreign Policy Briefs,* Vol. XVI, No. 15, Office of Media Service, Bureau of Public Affairs, Washington, D.C., January 6, 1967, p. 6.

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years the agricultural revolution will likely spread to most of the less developed world.

The new era is dynamic, providing new opportunities for farm families, promising to bring into the market place literally hundreds of millions who heretofore have eked out a subsistence living, consuming all they produce. This will broaden the market within individual developing countries, greatly enhancing the prospect for industrial development.[2]

But as hopes and expectations are rising, there is also a mounting awareness of the long-range problems which are cropping up as a result of this breakthrough. Clifton Wharton's article has very well set the question: "The Green Revolution: Cornucopia or Pandora's Box?"

> The application of science and technology to traditional agriculture has begun to produce dramatic results, above all in Asia. The rapid expansion of certain food grains in the developing world is being particularly widely heralded, and justly so, as the "Green Revolution." On the one hand, some observers now believe that the race between food and population is over, that the new agricultural technology constitutes a cornucopia for the developing world, and that victory is in sight in the "War on Hunger." Others see this development as opening a Pandora's Box; its very success will produce a number of new problems which are far more subtle and difficult than those faced during the development of the new technology.[3]

Looking to the impact of the high-response rice varieties on the social structure of countries undergoing the "green revolution," I think it is almost impossible not to see that it will bring about as much political trouble as the Industrial Revolution of the 19th century. The question is whether agricultural innovation in Southeast Asia will bring about political stability or political instability. Who, as between Karl Marx and de Tocqueville, will be right in this case? Is revolution the result of growing poverty or growing prosperity? Will those optimists who hold that economic progress will result in greater satisfaction and increased political stability be right, or will the "green revolution" prove right those who contend that peasants revolt when they are better off?

Reviewing theories of revolution, Lawrence Stone writes:

> Fundamental to all analyses, whether by historians like Brinton and Gottschalk or by political scientists like Johnson and Eckstein, is the recognition of a lack of harmony between the social system on the one hand and the political system on the other . . . the dysfunction is the result of some new and developing process, as a result of which certain social subsystems find them-

[2] Lester R. Brown, *A New Era in World Agriculture,* presented at the first annual Senator Frank Carlson Symposium on World Population and Food Supply, Kansas State University, December 3, 1968.

[3] Clifton R. Wharton, Jr., "The Green Revolution: Cornucopia or Pandora's Box?" *Foreign Affairs,* Vol. 47, No. 3, April, 1969.

selves in a condition of relative deprivation. Rapid economic growth, imperial conquest, new metaphysical beliefs, and important technological changes are the four commonest factors involved, in that order. If the process of change is sufficiently slow and sufficiently moderate, the dysfunction may not rise to dangerous levels. . . . But if the change is both rapid and profound, it may cause the sense of deprivation, alienation, anomie to spread into many sectors of society at once, causing what Johnson calls multiple dysfunction, which may be all but incurable within the existing political system.[4]

Having in mind the developing countries, two economists, Arthur Lewis and M. Olson,[5] have pointed out that pre-industrial and industrial societies are relatively stable and relatively free from revolutionary disturbances, whereas transitional societies undergoing the process of modernization are unstable because of the social stresses generated by the shifts in relative importance and status of the various classes.

While this theory refers mainly to a process of modernization through industrialization, I think it would be applicable also to a society undertaking a rapid change in its agricultural structure. It would then be interesting to determine what changes in status and in the basic interests of different classes the agricultural revolution in Asia is likely to bring about, and which kinds of stresses would result from these changes in the various Asian societies.

One of the remarkable features of the "green revolution" is its rapid rate of adoption by the farmers, at least at the initial stage. Wherever a program to introduce high-yield varieties has been launched in suitable ecological conditions, its pace of development has surpassed the most optimistic expectations. That the rate of expansion has indeed been explosive is illustrated in Table 1. As pointed out by my colleagues, this expansion has been accompanied by a change in the attitude of the people.

TABLE 1. Estimated Acreage in High Yielding Varieties in Asia

Years	Acres
1964/65	200
1965/66	37,000
1966/67	4,800,000
1967/68	20,000,000
1968/69 (goals)	34,000,000

Source: Dana G. Dalrymple, "Estimated Area of High-Yielding Varieties of Grains in Ten Asian Nations," U. S. Department of Agriculture, International Agricultural Development Service, November 1968.

[4] Lawrence Stone, "Theories of Revolution," *World Politics,* Vol. XVII, No. 2, January 1966, p. 165.

[5] W. Arthur Lewis, *Conference Across a Continent* (Toronto, 1963), pp. 46-60; and M. Olson, "Rapid Growth as a Destabilizing Force," *Journal of Economic History,* Vol. XXIII, December 1963, pp. 529-552.

Although I do not underestimate the effects of vigorous campaigns launched by the different Asian governments, they are not in this case sufficient to explain popular participation in the spread of new technology compared with strong resistance to innovation in the past. The success with the high-yielding varieties appears to contradict the favored view that agriculture in developing countries has been stagnant because of the farmers' low "absorption capacity," because of their tradition-bound attitudes and their high degree of illiteracy, or because of cultural and institutional restraints, etc.[6] Restraints of this type do exist, but their effects have been overestimated. The main reason for a stagnant agriculture in the past may be explained by the absence of available technology to provide investment possibilities with high returns to the farmers. We tend to forget that in rural areas of Asia the existing prevailing rate of interest is usurious, more often than not exceeding 100 percent. The new high-yielding varieties, however, are highly responsive to all factors of production, allowing new inputs to double and even triple productivity per acre.

That we have underestimated the rationality of peasant behavior is further corroborated by interviews on the motivation of farmers to adopt the new technology. Surveys conducted by the International Rice Research Institute among Filipino farmers (Tables 2 and 3) show that the change was for the most part a deliberate, well-thought-out decision based on sound observation of the few but essential advantages of the new technology. External inducement (besides price incentives) played a negligible role. Every indication points out that those so-called "unabsorbative, tradition-bound, and illiterate" farmers are more economics- and business-minded than most of their sophisticated observers would have thought a few years ago.

It would be surprising that such an awakening were to be limited to the field of technology, and that there would not be parallel to this change in attitude a greater social and political awareness. In my view, the emergence of a political force in the rural areas undergoing the agricultural revolution is all but ineluctable. The outcome of political stability or instability will depend mainly on the questions of whether the political institutions of the country will evolve fast enough to allow for the peaceful emergence of this force into the national political fabric, and whether governments will be able to design and implement policies that will solve or at least keep under control problems generated by the movement of rapid agricultural change. Those problems facing the decision-makers in developing countries are in-

[6] Sir Alexander Gibb and Partners (International Land Development Consultants), "Programme for the Development of Irrigation and Agriculture in West Pakistan," Indus Special Study (London and Arnheim: N.W. Hunting Technical Services, May 1966).

TABLE 2. Reasons Given for the Adoption of Improved Varieties of Rice, Laguna, Philippines, 1967 Wet Season.

	Number of farmers giving the reasons	Number of farmers indicating the single most important factor
1. Expected high yield	105	97
2. Landlord's decision	55	6
3. Follow advice of extension worker	68	0
4. Expected high price	41	1
5. Followed advice of neighbor	11	0
6. Others	21	6
Total number of adopters 110		
Total number of responding 110		

TABLE 3. Relative Advantages of New Varieties vs. Local Varieties as Reported by 153 Farmers, Laguna, Philippines, 1967 Wet Season.

	Number of farmers reporting		
Item	Better	Worse	Same
1. Price	3	148	2
2. Yield	150	2	1
3. Eating quality	4	144	5
4. Disease resistance	22	119	12
5. Lodging	151	2	0
6. Amount of weeding labor requirement	7	120	26

Source: "Agricultural Economics," Research Progressive Outline, a publication of IRRI, Los Baños.

deed formidable. Among them I will comment only on the discontinuities which are likely to develop and grow in the social structure of a country. There are the gaps between areas where existing water control and other facilities allow the growth of high-yielding rice varieties, and areas where these facilities do not exist. This creates income disparities between those areas, with the likely result that in non-water control regions, production of rice will be eliminated, reducing the employment and income of farmers. Wharton describes the situation very accurately:

> From all this one may deduce that the "first" or "early" adopters of the new technology will be in regions which are already more advanced, literate, responsive and progressive and which have better soil, better water management, closer access to roads and markets—in sum, the wealthier, more modern farmers. For them, it is easier to adopt the new higher-yield varieties since the financial risk is less and they already have better managerial skills. When they do adopt them, the doubling and trebling of yields mean a corresponding increase in their incomes. One indication of this is the large number of new private farm-management consultant firms in the Philippines which are advising large landlords on the use of the new seed varieties and making handsome profits out of their share of the increased output.

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As a result of different rates in the diffusion of the new technology, the richer farmers will become richer. In fact, it may be possible that the more progressive farmers will capture food markets previously served by the smaller semi-subsistence producer. In India, only 20 percent of the total area planted to wheat in 1967-68 consisted of the new dwarf wheats, but they contributed 34 percent of the total production. Such a development could well lead to a net reduction in the income of the smaller, poorer, and less venturesome farmers. This raises massive problems of welfare and equity. If only a small fraction of the rural population moves into the modern century while the bulk remains behind, or perhaps even goes backward, the situation will be highly explosive. For example, Tanjore district in Madras, India, has been one of the prize areas where the new high-yield varieties have been successfully promoted. Yet one day last December, 43 persons were killed in a clash there between the landlords and their landless workers, who felt that they were not receiving their proper share of the increased prosperity brought by the green revolution.[7]

To the consequences listed by Wharton, I would add that in areas where conditions do not at present allow the growth of improved varieties, demands for water control will grow stronger and stronger, and will be made more and more in the name of social justice. One might foresee that the issue of giving priority to developing one area over another will become increasingly a politically loaded matter.

There is also the danger that because of the spectacular payoff of the high-yielding varieties, programs would be conceived exclusively from the point of view of maximizing economic returns to the neglect of social aspects, thus accentuating the economic disease of dualism, the existence of which has long been noted among the developing economics of Southeast Asia.[8] This will result in growth without development which cannot but engender tensions and instability.

As food production grows and nears the level of self-sufficiency and even of surplus, the problem of misery in the midst of plenty will become more acute. Unless developing countries drastically revise their economic development strategies and policies to give first priority to the objective of creating employment, and unless they take measures to reduce income disparities and extend incomes to the poorer classes, many people will still go hungry or remain underfed. At the same time, in view of the worldwide spread of the agricultural revolution, such countries will face greater difficulty exporting surpluses. If internal demand is not enlarged, therefore, measures to

[7] Clifton R. Wharton, Jr., *op. cit.*, pp. 467-68.

[8] J. H. Boeke, *Economics and Economic Policies of Dual Societies* (New York: Institute of Pacific Relations, 1953). For an extensive treatment of this view, see Lauchlin Currie, *Accelerating Development* (New York: Wiley and Sons, 1966).

restrict production will have to be adopted. Personally, I think that the problem of production and supply and of effective demand and income can be met only with an industrial revolution in the wake of the agricultural revolution. This, among other things, implies that the industrialized countries should revise their protectionist policies to allow for a redistribution of labor-intensifying activities among the developing countries.

What will be the impact of the agricultural revolution on the relationship between landlords and tenants and on the problem of agrarian reform? As the high-yielding varieties increase the tenants' income, one of the few useful functions of the landlord—that of crop financing—will progressively disappear (although for the first few years, because of the cash requirements for the purchase of inputs, farmers may have to rely more heavily on the landlords). Another occasional function of the landlord, that of adviser, will also become marginal as the farmer acquires more technical and business knowhow with the adoption of the new technology. Second, the revising of the share of the crop, depending on whether the tenant or the landlord finances the cash inputs, cannot but increase tensions. Third, because the rent is based on a fixed percentage of the crop in most instances, the absolute price of the rent will increase as yields increase, and tenants will find more and more that they are paying too much to their landlords.

Finally, as returns increase and cultivation becomes more profitable, there will be a tendency among landlords to recover for themselves at least part of their lands for direct cultivation with mechanized equipment and/or hired labor. In fact, one must expect that the trend toward concentration of land, elimination of small tenants, and their proletarization, already observed in many irrigated areas,[9] will be accelerated and intensified by the introduction of the higher yielding technology.

Thus it is safe to assume that agricultural innovation will increase tensions between landlords and tenants. As returns increase and ownership of land becomes more profitable, pressure for greater agrarian reform will mount, which will be opposed by vested interests.

Besides the tensions and instabilities resulting from the process of modernization discussed above, I would like also to draw attention to the possible political effect of the momentum of the agricultural revolution itself. According to James C. Davis,[10] so long as the standard of living

[9] See for instance: Robert Hackenberg, *Indian Administration and Social Change,* Doctoral Thesis, Cornell University, 1961; Greisinger, Philip, and Barr, *Agricultural Land Ownership and Operating Tenures in Casa Grande Valley,* Bulletin No. 175, University of Arizona, College of Agriculture, Agricultural Experimental Station, 1941.

[10] James C. Davis, "Towards A Theory of Revolution," *American Sociological Review,* Vol. XVII, February 1962.

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grows relatively fast enough to keep pace with existing expectations, social stresses created by rapid economic growth are not likely to lead to disturbances. The moment of potential political revolution is reached when growth lags behind expectations—that is, when the phase of growth tapers off and some stagnation or decline sets in. As Wharton has suggested, once all existing irrigated lands have been converted to the new varieties, and when the easily irrigable potential has been exhausted, it may be that the spread of the new technology will slow down. Another potential bottleneck will be the limited capacity of supporting facilities in transport, processing, and marketing.

With respect to economic growth, if productivity exceeds demand, and export prospects decline, prices will be depressed, and farmers will experience lower returns for their investment. Then, too, in the initial phase, governments tend to encourage production through a policy of favorable prices or of subsidization of inputs. But as the program grows these policies cannot be maintained indefinitely. The problem, in fact, goes even deeper. Southeast Asian governments are facing a kind of vicious dilemma: in order to keep demand up to the level of increased agricultural production, governments must either accelerate considerably the rate of growth of the economy or else embark on large expenditures for welfare. To do either of these, it must mobilize more and more resources from the agricultural sector; and by so doing it will slow down the rate of increase of farmers' real income.

All the above might appear to be overly pessimistic. It would be tempting to adopt the simple notion that more material wealth and more food is tantamount to economic development and that economic growth will result in orderly social and political development. This would be, in my opinion, unrealistic and dangerous. Southeast Asian governments have no real choice but to face squarely the obstacles ahead.

Does this mean we have to slow down and keep the pace of the agricultural revolution under prudent control? I do not think so. First, even if we wanted to, by now the hopes and expectations aroused by the first spectacular results of "miracle rice" are such that no political leader could slow down today's momentum without risking serious trouble. Second, both on moral grounds and by necessity we have to win the race between food production and population increase. Like Wharton, I believe that the agricultural revolution will allow us to earn only a brief respite in this anguishing race.

I disagree with the view that a 20th-century pre-industrial society, if exposed to technology and submitted to the products and policies of industrialized societies, can be a stable society. Even without an agricultural or industrial revolution, the history of the Third World all over Asia, Africa, and Latin America since the end of World War II was rather tormented. Turmoil and political instability were the rule rather than the exception. My own conviction is that political instability as a result of innovation and modernization will be no greater than that created by stagnation and frustration in the past. In addition, I think it is important to observe that violence and instability in a situation of stagnation are likely to result in *regression* in the modernization of the political structure of the country; while in a situation of rapid growth the chances are enhanced that the final result would be some *progress*.

When broad categories of the population are politically inactive, a change of government through violent competition among the small privileged classes—the military, the politicians, the bureaucrats, the landlords, the merchants, and the intellectual elite—can lead only to a narrowing of the control of power into the categories of the privileged few (usually the military). Whether judged to be good or bad for the country, this change would accentuate the feudal character of government, representing a regression in the process of political modernization.[11] In a few instances those privileged classes frustrated by their elimination from power might attempt to induce the most discontented elements of the destitute masses to launch into guerrilla warfare. The possible outcome would be a long process of endemic violence and generalized guerrilla warfare. Even if a more popularly based regime were to emerge, the result would be a regression in the process of political maturation.

In contrast to the situation envisioned above, violence erupting in a country where the "green revolution" is taking place is more likely to involve the larger groups which have been denied the fruits of this advance. This kind of upheaval will most likely lead to the formation of either new political institutions, allowing for greater participation of the awakened rural classes, or else the emergence of enlightened leadership with policies which will satisfy the aspirations of these groups.

The reasons why I believe that the degree of instability and violence brought about by the "green revolution" might be limited is that, as Stone points out,

> Revolution is never inevitable—or rather the only evidence of its inevitability is that it actually happens. Consequently the only way to prove this point is to indulge in just the kind of hypothetical argument that historians prudently

[11] I consider as political modernization any evolution which leads towards the establishment of socio-political institutions allowing for broader participation of the different categories of the population and resulting in the enlargement and the diversification of the power base of the government.

try to avoid. But it is still just possible that modernization may take place in Morocco and India without revolution. The modernization and industrialization of Germany and Britain took place without revolution in the nineteenth century (though it can be argued that the latter case was slow by twentieth-century standards, and that, as is now becoming all too apparent, the modernization was far from complete). Some think that a potentially revolutionary situation in the United States in the 1930's was avoided by political action.[12]

Furthermore, as Eckstein[13] rightly stresses, in addition to the factors of rapid social change, one must consider a second vital element of great importance in the development of a revolutionary situation: that is, the condition and attitude of the entrenched elite. The elite may lose its manipulative skill, or its military superiority, or its self-confidence; it may be incompetent, or weak, or brutal. A combination of two or more of these features might lead the elite to the fatal course of compounding its errors by intransigence. If the elite fails to anticipate the need for reform, if it blocks all peaceful, constitutional means of social adjustment, then it unites all the discontented elements into violent opposition. But if it rises to the challenge, violence might be avoided. In fact, in addition to Japan, South Korea and Nationalist China are experiencing rapid economic growth and parallel modernization of their rural areas without political turmoil, at least at this stage.

In both countries, an effective agrarian reform program has been undertaken. In Nationalist China the arbitrariness of the regime has been greatly reduced by the emergence of a new elite of technocrats whose share in policy formulation has been increasing with economic success. Since their weight in the power structure depends more on their professional ability than on vested interests, the style of the government has become more and more one of service to the people.

In Korea, a twofold evolution has taken place—of a group of professional bureaucrats on the one hand, and of political institutions allowing for greater popular participation on the other. It is significant that during the last presidential election, President Park's platform was focused mainly on the Economic Development Plan.

In my opinion, one of the best guarantees of a peaceful political development in Southeast Asia will be the leaders' grasp of, and readiness to utilize, the political potential of the agricultural revolution. That President Marcos would stake his political fortune on the "miracle rice" has given a strategic impetus to public and private efforts to expand the new technology and

[12] Lawrence Stone, *op. cit.,* p. 166.

[13] Harry Eckstein, *Internal War* (New York, 1964); and "On the Etiology of Internal War," *History and Theory,* Vol. IV, No. 2, 1965, pp. 133-63.

tackle the problems arising from its development, and has enormously uplifted the political status of the long-neglected peasantry. Reading Dr. Gelia Castillo's delicious account of "miracle rice" as "produced" by the Filipino press,[14] I have the impression that "miracle rice" has produced another miracle, for never has the press of any developing country devoted so many of its columns with such passion to the problems and the lot of its rural population. May this be the first step in bridging the much publicized "gap" between the cities and the countryside.

I am myself confident that most leaders with a progressive or an open-minded, moderate attitude will rise to the challenge and the opportunities of the agricultural revolution. As for those too conservative to readjust to the pressures of modernization of the rural areas, or too authoritarian to allow for the emergence of a new elite more closely related to the expectations of the masses, they will be swept away by the wave of change.

Asia cannot afford to miss the opportunities of the "green revolution" to modernize its political institutions and bring about broader participation of the rural population in the political process. Even at the cost of violence, this will be a moderate price. After all, the industrialized countries paid a high price of revolutions and wars for their process of political modernization.

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[14] Gelia Tagumpay Castillo, " 'Miracle Rice' as 'Produced' by the Press," a paper prepared for the International Seminar on Communications Media and National Development, University of the Philippines, Diliman, Quezon City, November 1963.

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DISCUSSION I

FRED R. VON DER MEHDEN

I am not quite as sanguine as some participants at the conference about the success of the new rice strains in Southeast Asia—not because of a lack of technology, which I am now convinced we have available, and not because of the conventional wisdom that the peasant is traditionally unprepared to accept new ideas. (However, as an "economic man" who recognized costs, the peasant might be quite cautious about expending his resources on the fertilizer or insecticide necessary to maximize yields of "miracle" rice, particularly in areas such as Northeast Thailand where adequate or proper rainfall is not always available.)

The primary reason I tend to be pessimistic about the full realization of the agricultural revolution relates to the administrative capability of many of the governments concerned. Many questions can be raised as to their ability to provide the necessary extension services, subsidization of fertilizer, and other needed agricultural aids, marketing procedures, and expanded water resources. The development of water resources is an excellent example of problems attending agricultural innovation that have brought to light deficiencies in long-term planning, coordination among departments, and analysis of real peasant needs. In all probability, therefore, we can expect the agricultural revolution to achieve its greatest success in areas that already have a high density of administrative personnel, communications, marketing facilities, and a commercial environment.

Setting aside my own views, we might consider the political effects of the so-called "green revolution." The first possibility may be that this innovation will be a "flash in the pan" or more specifically a momentary upsurge that will have only marginal effect on agricultural production. In this case, we may have continued stagnation or the inability of production to keep up with population, which could lead to political stress and rural violence. It has been argued by some political scientists that one of several factors that brought about the high level of rural violence in Indonesia during the 1965-66 anti-communist activities was agricultural tension and its political ramifications.

A more likely possibility will be uneven development of the "green revolution" domestically and internationally. Internally this can mean, as

Ambassador Vu Van Thai has pointed out, great disparity between areas that have developed the new rice strains and those that have not. If there is such an uneven distribution of the fruits of the new technology in Southeast Asia, there is no doubt that the political results could be serious. For example, will it lead to greater difficulties between lowland Burma and the hill tribes that are already separated from the Burmese ethnically and to a degree religiously? Will it mean that there will be greater disparity between the alluvial areas, Central Plains, and Chiengmai regions of Thailand and Northeast Thailand where the difficulties of establishing sufficient water resources are monumental (and political tension is already high)? There are a number of areas where we can see an exacerbation of already acute problems of integration.

The international problem is equally serious. If certain countries achieve self-sufficiency in rice or an exportable surplus, the political ramifications are unending. What will happen to exporting countries that have budgets based upon rice exports? Will there have to be new rural taxes to compensate for declining export taxes? Will this mean a reordering of national priorities so as to emphasize import and export substitutions? Economic dislocation can obviously influence the international and external balance of political forces in the region. Thailand and Burma in particular are vulnerable to a quick expansion of the "green revolution" and a resultant drying-up of markets. Each country has already been faced with different levels of rural dissatisfaction.

To make a final point, I am fascinated by the author's discussion of the proposition that a situation of stagnation is likely to result in a regression in the process of modernization of political institutions. Political scientists are somewhat cautious about the meaning of "political modernization" and have yet to agree on a working definition. I would argue, therefore, that no matter what happens economically, we are probably going to have continued political instability in the area. In the past two decades the developing world has experienced political coups in some thirty-eight countries, mostly by the military. In Southeast Asia there have been successful postwar coups in five of the ten states. I am not optimistic about an end to this process. However, I would not argue that a lack of agricultural development *necessarily* leads to rural violence, because it is rather difficult to assess the direct impact of stagnation on political activity. During the past two years I have attempted to see if there are correlations in the region between various economic and social factors and political situations, and particularly rural violence. Frankly, it must be admitted that very little correlates. For example, in Southeast Asia, an effort was made to correlate some twenty-eight social and economic variables with different levels of rural politically oriented violence. No meaningful correlations using such factors as literacy, land tenure, economic level, etc., could be found on a cross-national basis. Given this lack of knowledge as to the obvious benefits or deficits, politically, of the "green revolution," I would agree entirely that efforts should not be made to hold back this innovation because of feared political ramifications. We do not know the political results anyway, and it is better to have a full belly with unknown side effects than insufficient food for a growing population. This does not mean, on the other hand, that extensive research and analysis should not be made of the political side effects and political bottlenecks connected with the "green revolution."

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DISCUSSION II

SOEDJATMOKO

THE problems that have been raised during the discussion obviously go beyond economic dynamics; they deal with the crucial question of whether—and how—the innovational and developmental potential as a continuing process will be realized in some of the countries of Southeast Asia.

Perhaps it would be best if I told a little story first. Among my friends in Indonesia I count a number of students and student leaders who for some time now have been engaged in village projects, privately and outside the government agricultural extension program, to introduce the new rice strains and the accompanying technology. On one of my visits to Indonesia I had occasion to meet with them. These students were all convinced of the benefits that would accrue from the introduction of the new rice strains. The problem that had started to bother them, however, was the realization that almost inevitably it was the richer peasant who really benefited from those projects. (Given the fracturization of land holdings in Java, the term "richer peasant" should be taken in a very relative sense.) It bothered them especially because in their view most of these richer peasants belonged to what they considered to be the conservative political parties.

To reduce the widening inegalities which they saw developing, and to minimize the cultural shock brought on by the introduction of the new rice strains, the students on their own decided, for instance, to harvest not by the more efficient method—namely by the use of sickles—but to continue the traditional way of picking each stem individually.

I tell this story to demonstrate the strength of the egalitarian element within the village, as well as among the modernizers themselves, in this case the students.

In my reply to them I tried to emphasize that it will not matter greatly if the introduction of new technology temporarily benefits specific groups in the village power structure. More important is the prospect that the students' work will lead to the emergence of a new type of local leadership with a different value system that might be more conducive to economic development; and also that the community as a whole will develop new standards for the selection of leaders and new criteria to judge leadership performance. This will be more decisive in the movement toward modernization than the temporary benefit of new technology for particular political groups within the village.

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This reply of course did not fully answer the question. The emergence of a new type of local leadership on the village level is bound to have consequences for the overall national constellation of forces in the country. The problems with which political parties are chiefly preoccupied are problems of the political power positions of their own groups. While usually no political party openly opposes economic development, if the party leadership feels that a revision of the distribution of power on the national level remains a problem of the first priority, then it may not be too interested in using the political advantages inherent in agricultural innovation for strengthening its own political position. The leadership might say that innovation is very nice but it is irrelevant to immediate problems.

Moreover, if the emergence of new local elements were to adversely affect the strength of a political group, the latter might be disposed to resist a more general application of the new technology—or if not the new technology then the system or method of introduction—to a wider area.

There is another aspect to this. Suppose agricultural innovation and the emergence of the new leadership leads to a strengthening of political elements that are looked upon with suspicion and uncertainty by those at the center of power. They might regard the political consequences of agricultural innovation with great caution and might even refute their own generally developmental orientation. Then, of course, there might be an even different reaction. The political forces which otherwise would not be particularly interested in economic development might ride the wave of agricultural innovation as a means of strengthening their own political position on both a local and national level. And this would be all to the good.

It is conceivable, I think, that a proportional representational system will limit the capacity of a new emerging leadership at the village level to make its presence felt at the national level; whereas a single membership constituency might be much more responsive to the change in outlook at the grass roots level that will inevitably take place in the wake of agricultural innovation. It might also enlarge the chances of direct beneficial effects and a more firm link-up of the political preoccupations at the national level to the course of economic development.

The point I wish to make is that wide application of the new technology will be determined not only by the economic results of the earlier and more limited attempts, but also by its impact on the national balance of political forces. To a great extent, therefore, the success of the attempts to introduce the new agricultural technology will depend on the manner in which these attempts are locked into the power game, the political dynamics of the nation, and by the manner in which these attempts are perceived by the political forces in the country. I do not expect that agricultural innovation will follow the same pattern in the various countries of Southeast Asia. Each nation is bound to develop its own responses to the broader revolutionary potential that is inherent in agricultural innovation. The perception of the implications, the merits and demerits of agricultural innovation, are therefore less important than the calculation of the obvious economic benefits. Agricultural innovation inevitably will lead to serious dislocation at the village level. Nevertheless, given the rate of population increase and the heightened expectations, there is very little choice but to promote it. Unless agricultural productivity increases, no social order at the village level can be maintained.

At the same time, it is becoming increasingly obvious that we should pay a great deal more attention to the social problems resulting from the introduction of new technologies. On the national level this means that our economic development plans should not be too narrowly conceived, but should take into account and try to accommodate the social implications of agricultural innovation. At the same time it should try to harness the potential of the new technology to trigger the succession of social change necessary to being about the modernization and economic development of the rural sector.

Many of us in Southeast Asia have become aware of the traumatic impact of the social and cultural changes that accompany the process of transition, and the violent emotions of utopian hope, of sometimes inhuman hatred and fears, and the violence that occasionally occurs. Nevertheless, we cannot afford to stop or to reduce speed. The only future that is viable lies in the direction of strengthening the developmental impulses in the nations of Southeast Asia. In doing so, we must of course be continuously aware of the human cost modernization involves and try to reduce it as much as possible. Many of us at this conference have worked with the people in Southeast Asia in helping along this process of development and modernization. It certainly is my intention to encourage a continuation of this role, this support, and this spirit.

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DEVELOPING THE AGRICULTURAL SECTOR: A ROLE FOR THE SOCIAL SCIENCES

Nibondh Sasidhorn

SUGGESTED TASKS OF THE SOCIAL SCIENCES

ONE of the errors sometimes committed by developing societies is the failure to distinguish development from modernization or Westernization. Although the two are interrelated, they are not identical. Development in Thailand has depended to a large extent on the importation of Western technology. In the process, development programs have been imposed on our society that do not take into consideration the existing social structure. Disproportionate development as well as misplaced emphasis on modernization or Westernization have given rise to social gaps and frustrations. Technological innovation, better education, easier communication, improved sanitation, and so on, have raised but not fulfilled the expectations of a postwar generation of Thai youth. Urban life today is held to be inferior to that in Western cities. Rural life is regarded as backward and deprived and less promising than life in the city. Population growth has decreased land availability, creating more poverty and driving the people at an alarming rate into the cities, overburdening existing facilities and producing massive social problems. When a new system of water supply was built in Bangkok in 1963, it was anticipated that the service would be adequate for at least ten years. Water shortages occurred in the very first year. Responsible authorities openly admitted they had underestimated the rate of population growth in the city.

It should be the task of the social scientists to try to find the solutions to problems generated by rapid social and economic change. I submit that one way they can do this is by a thorough investigation of the social prerequisites before a development program is launched.

Efficient and continuous growth calls for the mobilization of resources —starting at the community. It must be realized that whereas the Western community desires to evolve from within without interference from outside, quite the opposite pertains for the less developed community. The latter has little propensity to resist outside forces. Indeed, it seeks government intervention and support. The greater the government input, the more honored the people feel. However, the viability of any development pro-

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gram depends not on the government but on the initiative and cooperation of the community itself. The motivations for cooperative community action of course differ in different societies. In Thailand, people think and act in terms of personal relationships. When we greet one another we asked questions like: "Where are you going?" When Mr. X wants to build a house, he receives hearty support from his neighborhood. On the other hand, when the people are asked to build an "impersonal" road, difficulties arise because they cannot identify with the objective. It is notable that our northern community has been motivated to build quite a few public works with the idea of "helping someone you know."

I would suggest that it is the work of the social scientist to discover what it is that motivates people to participate in the development of their community, and beyond that, their country.

A developing nation characteristically has an agricultural economy. Agricultural development, if it evolves gradually, should present no significant problems. In today's world, however, pressures to modernize and catch up to Western industrialized societies, combined with a heightened consciousness of social injustice, will not allow for this gradual evolution. Social imbalances, resulting from an accelerated pace of development, must be corrected if progress is to continue. Of highest priority should be efforts to close the gap between the rural and urban areas, to reverse the flow of workers into the cities, and to curb population growth. To accomplish this, development programs should be oriented toward agriculture. Farm life should be improved and made more attractive for the people. Here is a role for the social sciences.

Of the many problems associated with development in agriculture, none should cause greater concern than the concept of increasing productivity. If productivity increase does not lead to a corresponding increase in per capita income—due to marketing problems or excessive supply over demand, for example—farmers may lose the incentive to participate in the achievement of development goals. This has occurred in Thailand. By placing the emphasis on increasing productivity, the real purpose of increasing incomes has been overlooked. We must discontinue this trend and focus more on income distribution. To execute this plan is a role for the social sciences.

TOWARD A SOLAR SYSTEM OF DEVELOPMENT

The key to effective agricultural development is the market. To develop the market today is far more difficult than in the past. Less developed countries, unable to compete strongly with Western industrialized countries in the overseas agricultural market, must rely on the domestic market. Unfortunately, domestic demand is relatively inelastic. The best way out of the dilemma is to promote industry—as a means of enlarging the home market and reducing unemployment.

This does not mean that agricultural development and industrial development should be pursued independently. In a developing nation, separate programs would be neither feasible nor justifiable. What is needed is a combination of the two—that is, increased efficiency in agricultural production as well as market development. In Thailand, our limited resources compel us to limit our policy alternatives. As a country awaiting the stage of "economic takeoff," we must adopt a device with powerful acceleration. One approach is to rate projects according to priority, undertaking one project at a time and gradually extending to other projects over the long run. The drawback is that the process may lack equilibrium and continuity and may be subject to political and social pressures. A more plausible method is to establish a central core project around which would revolve all other development projects. This particular plan, called the "solar system of development," reaches every corner of the society. The relationships among the projects are threefold: each project is coordinated with the central project; each project is coordinated with other projects; each project is independent. The underlying idea is that a central development program will accelerate as the resources, manpower, the whole capacities of the society, are channeled into one focal point. With the central project progressing at a fast rate, other, related projects will be favorably affected. By the same reasoning, the central project will receive feedback from the subsidiary projects.

In Thailand, agriculture should be the focal point of the development plan, for the following reasons: our natural endowment is favorable to agriculture; agriculture is the largest sector in the economy and the major source of income for the population; agricultural development is the basis of economic takeoff. Finally, world demand for food is rising. If we can make agriculture more productive, the world market may become more dependent on our produce.

In proposing agriculture as the central development project, I am not suggesting that agricultural development be given the highest priority. Present world market and population problems forbid stress in one area to the neglect of others. However, I believe that resources can be mobilized and utilized to their optimum capacity if the development effort in all sectors in the socio-economic system is oriented to agriculture.

Thus, in the solar system of development, industry, although no less important than agriculture, would be geared into the central agricultural program. Industries would be developed to increase agricultural productivity, to widen the market for agricultural produce, to create jobs, and to promote communication and transportation. In the long run, as agriculture becomes more fully developed and capital becomes more available, then industrial development can be pursued more independently from agricultural goals.

Education is crucial to the promotion of efficient agriculture. By tieing education to agricultural development, education will serve not only as a basis for development but as a direct force in the process. The existing educational system in Thailand is outmoded. The emphasis is on classical study—more appropriate for life in the Roman Empire. Literature, admittedly, is necessary for a well-educated man, but it serves no concrete purpose in a society under pressure to modernize. In addition, all levels in the educational system are so linked that no one level is complete in itself. Students are expected to progress to ever higher levels with inadequate provision for what they will do when they leave school. As a result, students are turned out into the streets jobless (it is notable that most of the people committing crimes are of school age and reasonably educated).

In criticizing the present educational system in Thailand I am not suggesting that schools abandon the humanities and other courses that provide students with a broad educational background. Subjects like literature, languages, and mathematics must be included in the curriculum. What I am saying is that some of our social problems would be less severe if educational development were agriculture-oriented. Under the solar system of development, rural schools would be designed to attract people to farm life once they have completed elementary education. The curriculum at this level would include such subjects as agricultural business and elementary cooperative study.

At the secondary level, emphasis would be on education and training in agricultural technology. The development of skills at this level would lessen competition for university entrance.

The university should not be regarded as just a higher professional school but the locus of training in research and methodology.

The concept of the solar system may be applied to various other projects, e.g., youth projects, religion, commerce, community development, communication, etc. The goals of all development projects should be interrelated, although in all instances agricultural development should be the ultimate objective. In this way, the process will be structured and correlated to develop the entire system.

The execution of this operation requires the cooperation of the social scientists.[1] Scholars and experts can supply the necessary information and help to create a sense of mission in the public, beginning with the leaders, then radiating to other levels.

ORGANIZATION AND MANAGEMENT

The next step from the formulation of projects and policies is the execution of the work. Experience has shown that a developing economy relies mainly on the public sector. It is undeniable that administrative inefficiency in the government of a developing country can itself impede the success of a development program. In Thailand, the existing administrative policy tends to undermine rather than strengthen the operation of various government institutions. This shortcoming needs a corrective measure oriented toward agriculture. Effective reorganization and management and programming of the agricultural sector under the government administration is a role of the social sciences.[2]

The private sector, although weak, is indispensable, and must be included in the development program. The instruments to consolidate the private and public sector and the various political parties and interest groups, as they strive to attain their goals, indirectly shape national policy. Interest groups are important because they produce a so-called pluralistic society and provide a solid basis for democracy. If there are only two groups, one will monopolize the power while the other will form the resistance. Such a society invites collapse as the rich become richer and the poor become poorer. In a diversified society, however, a balance among interest groups can be more easily maintained; the private and public sectors can be united through political participation and political parties.

The development of such a socio-political system is one of the responsibilities of the social scientists.

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[1] See David C. McCleland, "The Impulse to Modernization," *American Journal,* Vol. VII, No. 3, December 1967, pp. 371-379; and Peter F. Drucker, "What Have We Learned About Economic and Social Development?" *American Journal,* Vol. VI, No. 4, March 1967, pp. 396-397.

[2] Problems concerning the bureaucracy and administrative system in Thailand are not developed here, as the author believes material of this subject can be found easily elsewhere.

CONCLUDING COMMENT

This paper attempts to account briefly for the role of the social sciences in agricultural development. It is essential that this role be recognized, as its potential effects are immense. Often, I am asked: "Are you a medical doctor?" I usually reply, "No, I am a social doctor. I cure social ills." There are few "social doctors" in Thailand and not enough data on our social ills. This condition has prompted the Faculty of the Social Sciences of Chiengmai University to revise curriculum and establish the Lana Thai Social Science Research Center. It is hoped that such action will help to create the indigenous expertise so badly needed to confront problems of modernization in our country.

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DISCUSSION I

ARTHUR T. MOSHER

DR. Nibondh's paper makes a very refreshing and important contribution to this conference, for two reasons: it is written from experience, and it proposes a positive line of action that is stimulating and helpful. Too frequently such papers do not go much beyond a review of the literature and a few comments on minor points.

In developing his theme, Dr. Nibondh makes several points that are not really central to the main argument on which I wish to comment initially.

First, he maintains that it is the responsibiliy of the social sciences to find the solutions to problems of income redistribution and the development of markets. Undoubtedly, the social sciences have important contributions to make; but it is important for us to realize that with respect to these problems there are physical technologies that are pertinent. Social scientists, as long as they stick to social science, cannot find better ways of storing, protecting, packaging, and selling products. However, the social sciences can help to use them more effectively. "Jeepneys," which play a major role in transportation in the Philippines, are physical technologies for achieving transportation. They do not come out of the social sciences, although social sciences can help to use them more efficiently. The same is true for income distribution. We may talk about desirable distribution of income, but how is it accomplished? There is a technology of distributing and redistributing income that involves administration rather than economics.

Therefore, while the social sciences do have a major role to play with respect to these problems, we need to recognize the contribution of related physical technologies.

When Dr. Nibondh states that a thorough investigation of social prerequisites should be undertaken before any project is attempted, he is taking a position advocated by many social scientists. In most cases, however, this is not going to happen. When people acquire a new technology, they are going to begin to use it without waiting for the social scientist to decide what the long-term results are going to be and whether or not these are advisable. I do think that social scientists have a role in trying to foresee the consequences of new technologies and new projects. But I do not think that we should ask that all projects be held off until we have made a full assessment of what the consequences are likely to be.

Third, Dr. Nibondh states that an agricultural development program should begin by making the rural areas more attractive. I would put it slightly differently: at the same time that projects or programs which try to achieve agricultural growth are undertaken, other projects should be undertaken with respect to the quality of rural living.

Fourth, Dr. Nibondh states that literature serves no concrete purpose in a present-day society that needs development. And yet one of his main points in that it is the task of the social sciences to determine the social prerequisites of development, to understand the society. Are not some types of literature a direct contribution to the knowledge of one's culture? The history of the country, and the history of other countries and their ways of life can make a direct contribution to the tasks that social scientists need to undertake. Plays, novels, and poetry can add to that understanding.

At the end of his paper, Dr. Nibondh states that in Thailand, development relies mainly on the public sector. It is true that the public sector has a major role to play, but it seems to me that for the purposes of development, the public sector should be characterized by enlightened policies for the full utilization of the private sector. There are many people who contend that public policies should make sure that no one gets in the way of private enterprise. This applies to farmers, it applies to businessmen, it applies to manufacturers. The public sector does have a major role to play; but an important part of this role is to unleash the private sector. I believe Thailand demonstrates this very emphatically.

These are details. Dr. Nibondh's main theme of the importance of setting an overall development objective larger than economic growth and of tieing individual projects to that objective is sound.

To return to the title of Dr. Nibondh's paper, I would suggest there are six contributions that social science research might make to the processes of development, whether in Southeast Asia or elsewhere.

(1) Contribution to policy formulation
(2) Contribution toward making better managerial decisions
(3) Contribution to organizational and administrative efficiency
(4) Operational research
(5) Contribution to knowledge
(6) Contribution to the training of professionals

All of these contributions are of course important in themselves; but to undertake programs of social science research without considering which of these contributions is primarily to be served by each project would be wasteful of the very limited resources of trained manpower available to carry it out. A comparison of these contributions with the specific types of social science research normally carried out suggests first, that some kinds of contributions are made automatically through research undertaken to serve other purposes, and second, that certain types of social science research will make direct contributions to development and some will have an impact on development only at a later date. Of the six types listed above, it is clear that the first four make direct contributions, and the last two—contribution to knowledge and contribution to the training of professionals—are indirect.

Some types of social science research, for example, can contribute directly to policy formulation. These would include economic demand projections for farm products and farm inputs; predictions of farmer responses to price changes of farm products; studies of trends in income distribution; research into factors inhibiting the spread of new technology; and predictions of likely limiting factors—sociological, psychological, and cultural—in the near and far future.

Much of this research is also relevant to the making of managerial decisions—in the private as well as the public sector. Social science research can also make *direct* studies of managerial decision-making.

Descriptions of social and attitudinal changes are very useful in operational research and in making changes in programs as they are carried out. Such descriptive research can also contribute directly to organizational and administrative efficiency, as can direct studies of presently prevailing types of organization and administration.

Much of this research will add to knowledge, and all of it will become available source material for the training of professionals, helping in the process to make such professional training more practical.

Now, one of the important questions which developing countries must answer is how much attention should be given to social science research directly related to policy formulation, managerial decisions, and organizational and administrative efficiency, and how much to research carried out primarily for the purpose of increasing knowledge without regard to an early application of the results. I would argue that with the limited research resources available, the purposes of developing countries would be better served with a greater concentration on "action-oriented" research. I think that developing countries should ensure that professionals who are not more than five years away from their training are working on problems directly related to the first three types of research listed. These are action-oriented problems that will automatically contribute something to knowledge. If the object is to contribute new knowledge, some of the efforts of the few people

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who are trained in these subjects will likely be diffused, and developing countries will not obtain results that are directly applicable to development problems.

On the other hand, not *all* research should be related to development. In a developing society there are always certain persons who are so uniquely qualified to undertake research that may not be of direct developmental significance, that they should be encouraged to pursue that work. It is the people who have recently had their training and who are still young, who ought to undertake projects that will have a direct developmental impact. The requirements of developing countries demand a concentration of their talents on action-oriented research. Then, as their experiences develop, they may become qualified to deal with more theoretical problems.

Social science research can make one of its most important contributions in the practical training of these young professionals. The present inefficiency of professional training is a luxury that developing countries simply cannot afford.

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DISCUSSION II

SELOSOEMARDJAN

I fully agree that the solar system as outlined by Dr. Nibondh should be considered as a development strategy for Southeast Asian countries. The difficulty is that this kind of solar system or development strategy may have unexpected implications in its implementation. In programs that are constructed with priorities, there is sometimes a tendency among governments and the agencies of development to place too strong an emphasis on the high priority project without due regard to the supportive or supplemental projects.

We have observed during the last three years in Asia various events which have affected all societies. We have seen, for instance, how economic development in Pakistan has progressed very rapidly and very favorably, so much so that the policy of the government, as I see it from Indonesia, has consistently and almost exclusively emphasized economic development, to the neglect of political and social and other factors. The tensions which have developed in the political spheres either have been written off or have been ignored.

Another instance we can cite is Malaysia. Malaysia also placed such a heavy emphasis on, and was so proud of, its achievement in economic development that it forgot to pay due attention to the race relations between the Malayans and the Chinese. We all read the newspapers about these same developments, and of the riots between the Chinese and the Malayans that cost so many lives.

In my own country we have had developments in the reverse direction. For almost twenty years, Indonesia relied almost exclusively on the development of political programs. We progressed very far in the political field, so much so that President Sukarno wanted to proclaim that Indonesia should be the tower of political development for the whole world. (He also said, as the most political man in Indonesia at that time, that his word was above law—above even the constitution.) Sukarno said that the main objective must be nation-building, and that economic development would follow political development by itself. He was punished for this wrong idea by the students of Bogor, of Djakarta, of Bandung, who revolted against him and pulled him down with his whole cabinet of 100 ministers. Sukarno was so strong that he was able to surround himself with 100 ministers, but even so, the students were stronger than he was.

Now we have a new government that has reversed the whole policy of the nation. From a focus on political development we have now shifted to a focus on economic development. The comment has been made that the five-year plan inaugurated in April 1969 has placed too much emphasis on economic development, and that social development has not been written into the program. This may be true, but it does not mean that the government has not paid attention to the social and political implications of economic development. However, we also do not want to repeat the mistakes of the past by having a development plan that includes everything—political development, social development, economic development, educational development, regional development, religious development, and so on. We have tried that and after three years it did not work. Nobody paid any attention to it and everybody made his own plan according to his own priorities.

But now we have a problem of the role of the social sciences in all the various development plans. As Dr. Nibondh rightly commented, one of the roles of the social sciences is to look at the prerequisites for development. The problem is, how do we identify the problems—not only the economic, but the social, political, and religious problems and their relationship to economic development? Second, how do we make a plan that will realize our goals as successfully as we desire? Last of all, how do we go about analyzing the impact of this development on the future of the society? Because if we do not do that, we will be surprised by the sudden and unexpected events that will arise as a result of this development.

We have to realize that societies in less developed countries are very much dependent on the government, not only for their economic development but for their whole way of life. The government has a very heavy influence on the evolution or stagnation of the country and of the people. In this case, what can the social science do? What role can they be given? And, while asking this question, we invariably have to ask ourselves, what is the role of the social scient*ist*? This is important, whether the social sciences are being used in the universities to analyze social problems or whether they are being used in research to collect data and make reports to be given to government agencies. It is important because this work may be done in such a way that cannot carry the approval of social scientists themselves.

Social scientists in Indonesia have restricted themselves in the past to the pursuance of science separately from the political tendencies and activities of political parties, including the government itself. This was very hard for them, especially during the Sukarno regime, because if one did not

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endorse governmental policies, even if one did not agree with them, there was a very big chance one would end up in jail. The government was then strongly tempted to take over the University of Indonesia that had in it a nucleus of professors and students who at that time were very much opposed to the forces of government. A fight went on below the open level in Indonesia that was very dangerous to the people working at the university. An open disagreement with the government on paper at that time would have had very unfavorable consequences for the professors.

In such a situation, the professors, scientists, and students had no choice other than to try to select certain problems and certain projects that had been established by the government that could at the same time carry the approval of the professors. Otherwise they remained silent.

Now, after the Sukarno government had subsided and was replaced by the Suharto government, those same professors and those same students became involved in the programming and execution of new government policies. This has created a problem, because these same professors and students are now being accused by many members of Indonesian society of intellectual prostitution. This accusation is very real. Early in 1969, newspapers in the capital city of Indonesia engaged in a debate over the achievements, the attitudes, the influence of those professors and scholars who are now helping to draw up economic development plans.

The problem that I wish to submit to this conference is which role should be taken—by the social sciences and especially by the social scientists. Developing countries are by their very nature unstable. Political instability creates changes in the elites, creates changes in the government; and every change in the government of course means a change in politics. What should the social scientist do? Should we go along with whatever government is in power, or should we pursue our own intellectual policies, even if we are against the government, and risk the end of those policies or even our own life?

Many of us have advocated change and risked our safety, and the rest of us have managed to survive through all the changes to the present time. But what if after five or ten years a new government comes into power which has a different philosophy in conflict with the present policy? These are crucial questions that I would like to submit to this conference.

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CLOSING COMMENT

WHAT has impressed me most is the sincere and straightforward way in which the participants as this conference have tried to approach the truth, with no national boundaries, for the sake of the people in the world, and most especially for the people of Southeast Asia. To me, this is the significant thing. We should keep aiming at this, and at keeping peace in the world.

The subject of this conference has been well chosen and The Asia Society should be congratulated. I am pleased that the discussion covered such a wide range of sectors affected by agricultural innovation—namely, rural life, education and manpower resources, patterns of international relations, domestic political patterns, and the social sciences. Many points of view have been expressed and many suggestions made. Whether they are correct or applicable, perhaps time alone will tell.

The point I wish to make is that many problems give us an awareness of the changes and the impact of these changes that, whether we like it or not, we in Southeast Asia will have to face soon. I personally view change as a healthy challenge to the growth of a people.

GENERAL NETR

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SECOND INTERNATIONAL CONFERENCE ON IMPLICATIONS OF AGRICULTURAL INNOVATION FOR DEVELOPMENT IN SOUTHEAST ASIA

Sponsored by the Southeast Asia Development Advisory Group of The Asia Society

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CHAIRMAN

The Honorable Kenneth T. Young
Chairman, SEADAG and
President, The Asia Society
112 East 64th Street
New York, New York 10021

SPEAKERS

Mr. Lester R. Brown
Senior Fellow
Overseas Development Council
1717 Massachusetts Avenue, NW
Washington, D. C. 20036

Dr. Joseph Fischer
Institute of International Studies
University of California
Berkeley, California 94720

Dr. Arthur T. Mosher
President
Agricultural Development Council
630 Fifth Avenue
New York, New York 10020

Professor Manning Nash
Department of Anthropology
University of Chicago
Chicago, Illinois 60637

General Netr Khemayokhin*
Director of the Southeast Asia Ministers of Education
Bangkok, Thailand

Dr. Nibondh Sasidhorn
Dean, Faculty of the Social Sciences
Chiengmai University
Chiengmai, Thailand

Mrs. Nongyao Karnchanachari
Office of the National Education Council
Sukhothai Road
Bangkok, Thailand

Dr. Vernon W. Ruttan
Chairman, Department of Agricultural Economics
University of Minnesota
212 Haecker Hall
St. Paul, Minnesota 55101

Dr. Selosoemardjan*
Djalan Kebumen 5
Djakarta, Indonesia

H. E. Mr. Soedjatmoko*
Embassy of the Republic of Indonesia
2020 Massachusetts Avenue, NW
Washington, D. C. 20036

Dr. Gelia Tagumpay-Castillo
Department of Agricultural Education
University of the Philippines
College of Agriculture
Laguna, The Philippines

H. E. Mr. Vu Van Thai
P.O. Box 14
Hillsdale, New York 10529

* Informal discussants.

Professor Fred R. von der Mehden
Department of Political Science
Rice University
Houston, Texas 77001

PARTICIPANTS

Dr. Virach Arromdee
Faculty of Economics and Business Administration
Kasetsart University
Bangkok, Thailand

Dr. William L. Bradley
The Rockefeller Foundation
111 West 50th Street
New York, New York 10020

Dr. Samuel H. Butterfield
Foreign Service Institute
U.S. Department of State
Washington, D. C. 20520

Dr. Ruben Santos Cuyugan
Quezon Hall
University of The Philippines
Diliman, Quezon City, Philippines

Mr. Don Davis
Chief, Agriculture and Rural Development Division
EA/TECH, Room 3316A NS
Agency for International Development
Washington, D. C. 20523

Mr. Charles S. Dennison
International Minerals and Chemicals Corporation
485 Lexington Avenue
New York, New York 10017

Dr. Joseph D. Drilon, Jr.
Executive Officer
International Rice Research Institute
Los Baños, Laguna, The Philippines

Mr. James P. Grant
President
Overseas Development Council
1717 Massachusetts Avenue, NW
Washington, D. C. 20036

Dr. Sam-Chung Hsieh
Director, Projects Department
Asian Development Bank
Commercial Center
P.O. Box 126
Makati, Rizal D-708, Philippines

Mr. Robert R. Johnson
Director
Office of Technical Services
EA/TECH, Room 3313 NS
Agency for International Development
Washington, D. C. 20523

Mr. Lionel Landry
Executive Director
The Asia Society
112 East 64th Street
New York, New York 10021

Mr. Jack Ling
UNICEF, United Nations
United Nations Plaza
New York, New York 10017

Dr. James Mackie
Center of Southeast Asian Studies
Monash University
Clayton,
Victoria, Australia

Professor Makoto Momoi
National Defense College
Baei Kenshujo
2-2-1, Nakameguro
Meguraku
Tokyo, Japan

Professor Takeshi Motooka
The Center for Southeast Asian Studies
Kyoto University
Kyoto, Japan

Mr. Robert H. Nooter
Assistant Administrator for Vietnam
AA/VN, Room 6313 NS
Agency for International Development
Washington, D. C. 20523

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Mr. John J. Quinn
Coordinator, SEADAG
The Asia Society
112 East 64th Street
New York, New York 10021

Miss Avery B. Russell
Rapporteur, SEADAG
The Asia Society
112 East 64th Street
New York, New York 10021

Mr. Robert Shaw
Overseas Development Council
1717 Massachusetts Avenue, NW
Washington, D. C. 20036

Mr. Paul Sithi-Amnuai
Vice President
Bangkok Bank Ltd.
44 Wall Street
New York, New York 10005

Professor Joseph E. Spencer
Department of Geography
University of California
405 Hilgard Avenue
Los Angeles, California 90024

Dr. Philip E. Sperling
Deputy Director
VN/REIR, Room 609 RP
Agency for International Development
Washington, D. C. 20523

Dr. Buenaventura Villanueva
United Nations
United Nations Plaza
New York, New York 10017

Dr. Clifton R. Wharton, Jr.
President,
Michigan State University
P.O. Box 432
East Lansing, Michigan 48823

Mr. Hans J. Wolflisberg
Agribusiness Council, Inc.
299 Park Avenue
New York, New York 10017

Professor Stephen H. K. Yeh
Assistant Director of Research
Economic Research Center
University of Singapore
Bukit Timah Road
Singapore 10

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