

Policy, Planning, and Research

WORKING PAPERS

Agriculture and Rural Development

Agriculture and Rural Development
Department
The World Bank
October 1988
WPS 98

Diversification in Rural Asia

Agriculture and Rural Development Staff

The challenge to agriculture in East Asia is to sustain rice farming while expanding into a more flexible, diverse agriculture. The task for aid agencies will be to come up with suitable analytical skills and technical knowledge for the switch from commodity-based project lending to broader sectoral support.

As a result of the declining contribution of rice-based farming in East Asia, investment in agriculture must diversify to maintain rural incomes.

In the short term, East Asian countries should (1) diversify toward crops for which there is a promising market (fruits, vegetables, and livestock products rather than sugar, rubber, coconuts, and palm oil) and (2) expand small-scale industry, marketing, and construction in rural areas:

Long-term needs include sustained research on crop and livestock technology with an eye to developing:

- Higher yielding secondary food crops.
- Better integration of livestock and crop production.
- More flexible irrigation and drainage systems (current rice irrigation systems being suited only to rice).
- Improved technology to lower the cost of production.

The policy dialogue should focus on key questions. How do different crops and livestock interact to affect overall output? What are the

costs of various combinations? How can the need for farm and regional specialization and cooperation between small farmers be balanced with the broader need for flexibility?

Rather than focus on narrow issues — such as the costs of protecting rice farmers — or take a “pick-the-winner” approach to diversification, the Bank should help:

- Create an overall policy environment that encourages more flexible and broader cropping systems rather than commodity-support programs.
- Design laws and institutions that facilitate efficient marketing by establishing grades and standards for different commodities and developing and distributing farm inputs.
- Stimulate public investment in physical and social infrastructure, communications, and information systems.
- Develop a rural financial system that mobilizes rural savings, makes credit available to traders, and diversifies the rural economy.
- Assess rural training and education systems and their capacity to prepare rural people for nonagricultural jobs.

This paper is a product of the Agriculture Production and Services Division, Agriculture and Rural Development Department. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Shawki Barghouti, room J2-071, extension 38408.

The PPR Working Paper Series disseminates the findings of work under way in the Bank's Policy, Planning, and Research Complex. An objective of the series is to get these findings out quickly, even if presentations are less than fully polished. The findings, interpretations, and conclusions in these papers do not necessarily represent official policy of the Bank.

The following persons contributed to this publication:

Shawki Barghouti	Guy Le Moigne
Brian Berman	Herve L. Plusquellec
Fateh M. Chaudhri	Richard Reidinger
William Cuddihy	G. Edward Schuh
Hamdy M. Eisa	Paul F. Siegel
John Hayward	Carol F. Timmer
Peter Hazell	C. Peter Timmer
William E. James	Vijay S. Vyas

The overall research project and this publication were coordinated by Shawki Barghouti. Paul B. Siegel, Carol F. Timmer and William E. James assisted in the preparation and editing.

This publication draws heavily from reports prepared for the Agriculture and Rural Development Department by G. Edward Schuh and Shawki Barghouti, Vijay S. Vyas and William E. James, C. Peter Timmer, and Brian Berman.

Other sources of information include presentations at the World Bank's Seventh Agriculture Sector Symposium by John A. Hayward, Herve L. Plusquellec and Guy Le Moigne, Peter Hazell, Hamdy M. Eisa and Richard Reidinger.

Details on rural diversification in Indonesia, Malaysia and Thailand were provided by Fateh M. Chaudhri, William L. Cuddihy and Richard Reidinger from the World Bank's Asia Region.

Table of Contents

Executive Summary.....	i
Chapter 1. An Overview of Diversification.....	1
Issues of Concern to the World Bank.....	6
Chapter 2. Changing Patterns of Agricultural Production and Food Consumption.....	11
Performance of the Agricultural Sector.....	14
Sources of Growth.....	18
Trends in Exports and Commodity Prices.....	23
World Markets for Cereals.....	25
Supply Factors.....	27
Demand Factors.....	29
Price Variability.....	34
The Rice Market.....	35
The Wheat Market.....	37
Diversified Agricultural Production.....	39
Corn.....	40
Root Crops, Legumes and Horticultural Crops.....	41
Livestock Products.....	42
Tree Crops and Export-Oriented Crops.....	44
Thailand	
Malaysia	
Indonesia	
Philippines	
South Asia	
Fisheries.....	51
Forestry Products.....	52
Chapter 3. Agronomic and Technical Factors in Crop Diversification.....	54
Land Types for Crop Cultivation.....	55
Irrigated Rice Land.....	61
Rainfed Rice Land.....	66
Upland Areas.....	67
Inputs for Non-Rice Crops.....	69
Seeds.....	70
Agricultural Chemicals.....	71
Farmer Skills.....	73
Mechanized Equipment.....	74
Labor.....	76
Marketing, Storage and Processing.....	78
Feed Grains and Livestock.....	80
Ruminants.....	81

Poultry.....	83
Swine.....	87
Chapter 4. Economic Factors in Crop Diversification.....	91
Flexibility in Farm-Level Decisionmaking.....	94
Investment at the Farm Level.....	97
Research and Extension	
Availability of Credit and Inputs	
Marketing and Infrastructure	
Regional.....	108
Adjustment in the Agricultural Sector.....	110
The Changing Structure of Agriculture.....	110
Efficient Allocation of Resources.....	113
International Market Signals.....	114
The Dynamic and Macroeconomic Dimensions of Diversification.....	117
Investment and Price Instability.....	117
The Macro Economy and Agriculture.....	120
Chapter 5. Government Policies for Rural Diversification.	124
Farm-Level Issues.....	127
On-Farm Constraints.....	127
The Extension Service.....	128
Opportunities for Contract Farming.....	128
Responsiveness of Farmers.....	129
Agricultural Sector Issues.....	130
The Marketing System.....	130
Agricultural Research Strategy.....	133
Agricultural Investment Strategy.....	136
Price Policy and Diversification.....	138
The Government's Role.....	140
Structural Change in Agriculture.....	145
Chapter 6. An Agenda for the Future.....	148

DIVERSIFICATION IN RURAL ASIA

Executive Summary

i. Rural diversification is a process of broadening and strengthening the income sources of rural households. The process extends from the introduction of new crops and technologies into traditional farming systems to the development of off-farm jobs in small-scale rural industries. Eventually the process involves the exit of a growing proportion of the rural work force from agriculture as part of the structural transformation of the economy. At this level of generality, rural diversification can be viewed as a gradual and inevitable process.

ii. The Problem. The problem arises when the process is forced by deterioration of farm incomes because of sudden and sharp declines in earnings from specific crops or because incomes in farming rapidly decline relative to incomes in other sectors. Declines in agricultural incomes from prior levels and relative to other activities or sectors may lead to widening income disparities, particularly when there is inflexibility in cropping patterns and current non-farm employment opportunities are limited.

iii. The income disparities induce resource movements, including labor, from areas of low returns to those with high returns. In the long run these resource movements contribute to more efficient resource allocation and higher national income; in the short run, pressures to switch crops or to leave farming altogether can cause distress when adjustment costs are large. These adjustment costs depend, to a great extent, on the flexibility of farming systems and on how well rural and urban factor markets are integrated.

iv. Incomes from farming, in the short run, depend on output prices, input prices and yields. When input prices and yields are relatively inflexible, instability in farm incomes is driven primarily by instability

in output prices. Crop failures have traditionally been a focus of concern in relation to farm incomes. However, the emergence of large crop surpluses can, by forcing output prices down sharply, also pressure farm incomes. Large numbers of farmers may be forced to suddenly shift to other crops or to leave agriculture in search of alternative employment. The problem arises when the on-farm process of adjustment does not bring farm incomes back into balance with previous levels quickly and when rural labor is illequipped for non-farm jobs or when such jobs are relatively few.

v. The rice-based rural economies of Asia began to experience new and unexpected problems in the mid-1980s as surpluses emerged forcing down rice prices in domestic and world markets. Sudden declines in incomes for rice farmers occurred in most Southeast Asian countries as governments did not have adequate budgetary resources to keep domestic rice prices above low prices in the world market. These governments sought to diversify their farmers out of rice, but such efforts were stymied by inflexible farming systems and a more general deterioration of agricultural commodity prices in world markets. Donor agencies, especially the World Bank, found their agricultural portfolios heavily invested in rice-specific irrigation systems with very low economic returns. Other projects in export-oriented tree crops also experienced unexpectedly low returns related to collapsed prices.

vi. The commodity price declines in the mid-1980s were, in part, a result of the very successful agricultural production program adopted by countries in Asia. Though the impact of low prices was broadly similar across Asian countries in reducing commodity export earnings and creating distress for farmers primarily growing rice; the ability to respond varied. Moreover, some countries that were net importers of food and other commodities experienced favorable effects from the low prices. Others, like Thailand, that were already more flexible and diversified, were actually able to maintain and even expand agricultural exports while those with less flexibility, like the Philippines and Indonesia, experienced sharp declines. Across Southeast Asia and in parts of South Asia rural diversification has come to be viewed as a vehicle for alleviating the strains and distress caused to farmers, governments and donors by the

collapse of world prices, especially rice, under the pressure of large surpluses in the mid-1980s.

vii. Design and implementation of new policies and investment strategies to foster rural diversification turned out to be a complicated undertaking. Two major trade-offs surfaced almost immediately as governments tried to respond. First, a concern for income distribution conflicted fairly directly with efficiency considerations, at least in the short run, and governments found it difficult to strike an appropriate balance between the two. Attempts to do both led to a second trade-off between incurring large budgetary costs by maintaining farm prices (and in some cases subsidies on inputs) and passing on the costs to consumers. The dilemma for these countries, especially the ASEAN-4 nations of Indonesia, Malaysia, the Philippines and Thailand, as well as some South Asian countries, is in reconciling their concerns to: (1) minimize the adjustment costs to the rural sector of coping with low rice prices; (2) to keep budgetary costs under control; and (3) all the while to be sure that future patterns of resource allocation are not badly distorted by the policies and investments initiated to cope with short-run problems. Ultimately the process of rural diversification must be consistent with longer run patterns of structural transformation. Successful countries will find ways to use the diversification process to stimulate economic transformation within rural Asia by encouraging more efficient allocation of resources. The objectives of reducing rural poverty and improving income distribution can best be pursued when rural incomes are growing and employment is expanding. The task of this report is to find ways for the World Bank to help countries move along this path.

viii. The Approach. Herein diversification is treated as a process rather than as a result. The objective in the near term is to increase the flexibility of cropping systems so that a variety of activities can be undertaken in response to changing market conditions with relatively low adjustment costs. The level at which such flexibility is created is crucial to the costs involved; creating flexibility at the individual farm level is more costly than creating flexibility in cropping patterns for the country as a whole. Regional specialization is possible within an overall

pattern of national diversification, thus drawing on differences in agronomic potential and the economies of scale in marketing that are inherent in well-functioning commodity systems. Unfortunately, regional specialization cannot eliminate the vulnerability of farmers to price changes for the particular commodity they produce.

ix. National diversification through regional specialization is the efficient route to solving the aggregate problem of vulnerability to sharp changes in individual commodity demand and prices, but problems of rural poverty and income distribution remain. In marginal and upland areas of Asia, rice-based cropping systems have low returns. Pulling such land out of rice production would help reduce rice surpluses provided opportunities exist for these farmers to generate income from other crops. Shifting marginal areas out of rice into secondary food crops is seen as one solution, however, commodity-specific approaches are risky and, given the weak infrastructure and marketing base, may not achieve much for limited-resource farmers in rainfed areas. Alternative, flexible farming systems for upland farmers that feature production of more income-elastic goods like livestock and horticultural products are a means of diversifying their income sources. For those without access to adequate land or on-farm employment, diversification out of agriculture altogether is needed. While this is consistent with desired patterns of structural transformation, such shifts in labor allocation may engender numerous problems. In economies burdened with inefficient, inward-looking industrial sectors, job opportunities outside of agriculture are severely limited. If the rural economy is unable to absorb idle or displaced labor from agriculture, there will be an increased inflow of unskilled rural workers into low-wage urban informal sectors. Rural diversification is the main vehicle countries have to increase capacity to absorb this labor. The rural non-farm sector is increasingly becoming an important source of jobs for members of farm households. The process of rural diversification has good potential to increase the role of small- and medium-scale rural industry, marketing, construction and other labor-intensive services. However, there has been little research on development of rural industry and its requirements in terms of infrastructure, credit and characteristics of labor skills it demands. Industrial policy has been biased, particularly in Southeast

Asia, towards urban centers, often primate cities where capacity to absorb further industry or immigration is overstretched already. Governments will need to give more attention to planning for expanded industrialization within rural areas, including policies required to create a favorable environment for private investors to move enterprises to rural communities.

x. Finding ways to cope with these short-run and long-run dimensions of rural diversification is not simple. There are sharp divergences in approaches. In Japan crop diversification was introduced in the 1960s under careful government direction. Thailand has in recent years adopted a free-wheeling market-oriented approach to diversification within agriculture. India tried to promote industrialization in rural and backward areas through a complex set of government interventions under high protection. Taiwan, in contrast, adopted a market-oriented approach and introduced incentives for small rural enterprises to process agricultural goods for export. All these approaches have had their problems and successes, but a common lesson is that the diversification process must be market-led in the sense of pointing farmers and rural entrepreneurs towards activities with better market demand and higher potential for income. Another important policy aspect is the greater success attained by orienting production towards world markets rather than just local demand.

xi. A market-led diversification process depends on several other factors influenced by government actions. Research and extension activities for non-rice crops and livestock operations can alter the technological base faced by farmers and their skills in using it. Government and private investment in education and training in rural areas can enhance flexibility by increasing the ability of farmers and others to adjust to changing market conditions. Research on design and management of irrigation systems to make crop choices more flexible has the potential to broaden the opportunities facing farmers.

xii. Infrastructural investments help reduce marketing costs and so improve the profitability at the farm level of undertaking new ventures. Better roads, communications, information and public market places enhance agricultural diversification. Improved institutional arrangements by

strengthening land tenure and avoiding excessive concentration of land holdings can improve the willingness of farmers to try new crops and their ability to gain access to the inputs such new activities require. One of the strongest possible sources of diversification at the rural economy is agro-forestry. The preservation of remaining forest stands and the future of reforestation, both of which are crucial for a sustainable forestry sector, depend on improved incentives and institutional arrangements. Improved rural financial markets can broaden participation in the formal credit sector, opening up opportunities for traders to receive working capital that will finance short-term investments by farmers in new crops. Improved laws and policies can facilitate a productive role for private firms in seed development and distribution, fertilizer marketing, and processing of products for domestic and foreign markets. The national government is the key actor in setting all of these factors in motion.

xiii. No doubt the most important role for the government in fostering a successful rural diversification process is in creating the overall appropriate policy environment. At all levels of concern--the farm level, the sectoral level, and the macro-economic level--government policy acts to buffer or reinforce pressures and opportunities in world markets. Policies for price stabilization, taxes and subsidies, foreign exchange rates, industrial protection, domestic inflation, export-promotion and budgetary priorities have a direct impact on the profitability of agriculture and rural enterprises. Policy intervention may impede diversification--efforts to stabilize domestic rice prices above world levels certainly seem to have done so. Too much intervention no doubt harms the whole development effort. A more market-oriented approach to development with greater reliance on the private sector will help diversify the rural economy but may do so at the cost of somewhat lower self-sufficiency in staples like rice. The trade-offs between market-determined diversification and government-directed food security objectives need to be considered in designing intervention.

xiv. The approach followed in this report is to organize the discussion by major economic, technical and policy issues in sequence and to treat these issues at various levels by considering their effects on farmers,

regions, the sector as a whole, and the entire macro-economy. Accordingly, there are individual chapters on technical and agronomic factors that affect diversification, economic factors that influence the choices farmers make in the context of the technical environment, and government policy issues that grow out of the interface between the technical and economic factors. The result is a matrix of intersecting levels and issues, that reflects the organizational complexity inherent in analysis of diversification as a process driven by, or at least consistent with, market forces. Diversification is not solely an agronomic issue or an economic one. Effective government policy requires an integration of both dimensions.

xv. The Future Agenda. The report purposely avoids a "pick-the-winner" approach to diversification of Asian agriculture. It argues that creation of a profitable environment for non-rice crops in Asia requires substantial technical research, innovative economic analysis and policy dialogue that focuses on issues for which the Bank's extensive comparative experience offers insights but which remains sensitive to the objectives of government and the views and aspirations of the rural communities. The pervasive theme is the desirability of introducing greater flexibility into farming systems and in broadening the basis of the rural economy in general. A major conceptual problem for research is to determine what optimal flexibility means in different circumstances. In nearly all agricultural systems, flexibility has a cost. Balancing the needs for specialization at the farm and regional levels with the right amount of systems flexibility is no easy task and will almost certainly involve a trial-and-error process.

xvi. Research on crop and livestock technology is essential for any substantial progress to be made in diversifying Asian agriculture. Rice and wheat have benefited from a disproportionate share of research funding. Redressing the technological balance by developing higher-yielding secondary food crops, better-adapted livestock breeds, more cost effective (and less hazardous) forms of disease and pest control, and improved post-harvest techniques come about only through sustained commitment to research programs. Scope for cooperation with private-sector research efforts

exists. These efforts can play a much larger role than in the past if governments adopt appropriate arrangements to protect patent rights and make possible the development of private marketing channels for proprietary information and products. Whatever the mechanisms, an improved technological base is needed to lower the costs and improve the reliability and quality of non-rice crops if farmers are to benefit by diversifying out of rice.

xvii. A better understanding is needed of the synergistic and competitive dimensions of farming systems that stimulate farmers to move away from a rice monoculture towards a more varied cropping pattern. This research faces two complex and related questions: (1) how do different crops and livestock interact agronomically to determine overall output and what are the costs of the various combinations? and (2) how can individual farmers on small plots of land cooperate with their neighbors to capture economies of scale in crop production? Complex systems of intercrops will likely reinforce the small size characteristic of so much of Asia, but improved technology for individual crops such as corn or soybeans may create opportunities for significant gains in yields and efficiency to be achieved from coordinated plantings, irrigation rotations, and harvest times. Research is needed to assess the trade-offs between increased costs of construction and operation on the one hand, and greater capacity of irrigation systems to deliver and drain water on a far more flexible basis than is now characteristic of most flood-type irrigation systems for rice. The introduction of better systems of operation and maintenance together with measures to more economically allocate water could be enabling factors in the development of new cropping patterns.

xviii. The main goals for economic and project analysis center on understanding the linkages between specific farming activities, other agricultural enterprises, the rural economy, the urban economy and the international economy. In particular, determining the extent to which non-rice crops, livestock or other rural activities can substitute for the positive role traditionally played by rice is an area of interest. Traditional techniques of project evaluation may not capture fully the benefits of increased flexibility that new investments can generate.

Alternative methods of valuing flexibility need to be assessed in order to provide the basis for a general approach. Better technology for non-rice crops, livestock and aquaculture, better-managed irrigation systems and improved marketing infrastructure can shift the relative profitability of cropping system. In addition, the expansion of non-farm rural enterprises may create increased off-farm labor-demand raising the opportunity cost of relatively labor-intensive irrigated rice monoculture, thereby favoring somewhat less labor-intensive crops. The importance of the Asian rice economy will not diminish very quickly and, in some countries, the policies that favor rice production and consumption are likely to continue to the detriment of diversification programs.

xix. It should not be the goal of the World Bank to use its policy dialogues with member Asian countries to redress the apparent bias towards rice. Rather, the Bank should be concerned with laying the foundation for a successful transition to a more diversified rural economy. Market forces and the limits of budgetary resources are already leading to adjustments in the direction of diversification of cropping patterns as lands marginal for rice shift to other, more profitable crops. A continuing policy dialogue might best be pursued around several themes governments are becoming more receptive to. Continually building an effective and dynamic private sector role provides the basis for higher growth if several complementary institutions and measures to stimulate competitive forces are established along the way: the legal framework for a market economy, and public investment in a network of physical and social infrastructure, communications and information systems, and established grades and standards appropriate to the stage of development of individual commodity systems. No diversified market economy can function without working capital; an efficient rural financial system that makes credit available to traders, small entrepreneurs and farmers and that mobilizes rural savings has a central role to play in rural diversification.

xx. The diversification of agriculture and the rural economy is a long term process. The economic transformation of rural Asia may occur in a relatively harmonious fashion involving evolution of a sustainable pattern of agricultural production, expansion of the role of rural industry and

services and general upliftment of living standards. On the dark side, it could occur sporadically, with widening income disparities, chronic poverty, and deteriorating environmental conditions. In this context narrow focus on the issue of the costs of protecting rice farmers seems rather trivial. Instead of pushing very hard on this single issue, a more positive approach is possible. Linking short-run problems of adjustment, which all governments need to discuss, with longer-run paths to structural transformation and economic development, offers a time horizon for the diversification process that fits the nature of the problems. Low economic returns from growing rice can be solved eventually by rural diversification, but short-run steps can have only a marginal impact on the momentum of Asia's rice economy. The task for the Bank is to use its investments and opportunities for policy dialogues to point these short-run steps in the right long-run direction.

DIVERSIFICATION IN RURAL ASIA

CHAPTER 1. AN OVERVIEW OF DIVERSIFICATION

1.01 Nearly all Asian agricultural economies have been rice-based. In the early stages of development in Japan, Indonesia, and Bangladesh, for example, more than half of agricultural GDP was generated by rice cultivation. Successful agricultural development meant successful expansion of rice production, and in most Asian resource settings, this meant raising rice yields. Table 1.1 provides a handful of summary statistics on the rice economy in East and Southeast Asia, which reveal the dramatic but uneven increases in yields between 1960 and 1984, as well as the relative decline in the importance of rice in these rapidly growing economies. This decline and its relevance for diversification initiatives are discussed at length in this report.¹

1.02 The techniques for raising yields are now well understood, if not always well implemented. Increasing rice yields through investments in irrigation, use of modern inputs, and incentive prices provided the engine of rural growth for a number of Asian agricultural economies, an engine that provided higher incomes for rural areas as well as food for urban workers. Imports of rice were often reduced or eliminated, thus freeing up foreign exchange for alternative uses. The drive for self-sufficiency in rice in several countries--South Korea, Taiwan, and Malaysia, especially--has been costly in budgetary and efficiency terms relative to average costs of imported rice since the 1960s. But in Indonesia and the Philippines, for example, import substitution was efficient in both social

^{1/} Sections of this report are drawn from C. Peter Timmer, "Crop Diversification in Rice-Based Agricultural Economies: Conceptual and Policy Issues" (Washington, D.C.: World Bank, Agriculture and Rural Development Department, 1987; typescript) and Carol F. Timmer and C. Peter Timmer, "Patterns of Agricultural Diversification in Asia" (Cambridge, Mass.: Harvard Institute for International Development, 1988; typescript).

Table 1.1 Selected Statistics for the Asian Rice Economy

	East Asia			Southeast Asia			
	Japan	Korea	Taiwan	Malaysia	Thailand	Philippines	Indonesia
Population (millions)							
1965	98.9	28.5	12.6	9.5	31.5	32.6	109.5
1985	120.8	42.7	19.2	15.7	52.7	56.8	168.4
Per Capita Income (US dollars)							
1983	10,120	2,010	3,570	1,860	820	760	560
Paddy Yields (tons per hectare)							
1960	4.86	2.79	3.27	2.05	1.39	1.16	1.81
1984	6.35	6.47	5.01	2.66	1.8	2.49	3.87
Share of GDP (percent)							
Agriculture							
1965	9	38	22.6	30	35	26	51 ^a
1983	4	14	7.4	21	23	22	26
Rice							
1965	4.1	18.5	13.2	3.6	11.3	5.2	18.8 ^a
1982	1.4	5.6	1.8	1.7	5.1	3.4	7.8
Rice in Agriculture (percent)							
1965	46	49	58	12	32	20	37 ^a
1982-83	35	40	24	8	22	15	30
Rice Consumption (kilograms per capita per year)							
1964-66	109	112	132	105	162	86	83
1979-81	76	150	125	99	145	91	126
Share of Staple Food Calories from Wheat (percent)							
1961-65	16	7	--	16	0.6	7	0.3
1979-81	24	14	--	18	2	7	3

Sources: International Maize and Wheat Improvement Center, 1985 CIMMYT World Wheat Facts and Trends (Mexico, 1985); The International Rice Research Institute, World Rice Statistics 1985 (Manila, 1986); World Bank, World Development Report 1985 (New York: Oxford University Press for the World Bank, 1985).

^aFigures are for 1968.

and private terms. Only in the mid-1980s has the world price of rice been so low that virtually no investments in increasing rice production in these countries show positive returns.

1.03 As domestic requirements for rice have been met locally and prices in the world market declined in the mid-1980s, the rice sector ceased to be a source of income growth for the majority of the labor force still in rural areas in these countries. In response to low farm incomes caused by low prices for rice--or to high budgetary costs incurred in an effort to support farm prices--most countries in Asia have sought alternative sources of income growth in rural areas. Public works programs, rural industrialization projects, and even rural-urban migration are potential elements of adjustment in response to the problem. The most common response has been the attempt to diversify these agricultural economies away from their heavy reliance on rice and toward other items with more favorable income elasticities of demand--livestock products, fruits, and vegetables, for example.

1.04 Rapid industrialization and urbanization assisted Japan, South Korea, and Taiwan through this process of structural adjustment, but not sufficiently to prevent substantial inefficiencies in resource allocation and large budget expenditures in an effort to cushion farmers from the very pressures induced by the rapid economic growth.² The countries of Southeast Asia that are the primary focus of this report--Malaysia, Thailand, Indonesia, and the Philippines--might be able to pursue similar long-term adjustment mechanisms, but for a variety of reasons agriculture must remain as a major source of growth in the short run even though the era of the rice-based growth has passed. Diversification is essential for agriculture to play this role.

1.05 From the long-term perspective presented above, the diversification of agriculture away from staple cereals toward crops with higher value and greater potential for growth in consumer demand is both

2/ See Kym Anderson, Yujiro Hayami, and others, The Political Economy of Agricultural Protection (Sydney, London and Boston: Allen & Unwin, 1986).

inevitable and non-controversial (except among cereal-raising farmers). It is not this aspect of diversification that is spurring Asian countries to adopt "forced-pace" campaigns to shift cropping patterns. Two short-run factors cause the immediate concern: low farm incomes if low rice prices prevailing in the mid-1980s in world markets are passed on to farmers; and low payoff to past investments by governments in rice-specific infrastructure, especially irrigation facilities (and the inability to make new investments appear attractive in economic terms).

1.06 Both factors stem from a fundamental inability to forecast the price of rice in world markets in either the short run or the long run. Since investment appraisals are based on price forecasts and the costs of price stabilization programs depend on how domestic support prices compare with border prices, the link is very direct. If both farmers and public investment portfolios were not so tightly locked into production of a single commodity whose price fluctuates quite unexpectedly, adjustment to the new price environment would be much less painful. A highly inflexible agricultural system in the context of a highly flexible international price environment is bound to cause problems if those external prices are linked either directly or indirectly to the domestic economy. Price stabilization policies provide the short-run link; investment decisions provide the long-run link.

1.07 Diversification is not merely an agronomic question of what alternative crops can grow on land presently devoted to rice, and it is not merely an economic question of how to make them profitable. The issue is intertwined with broader agricultural development strategies, especially the interplay between short-run policies designed to meet immediate government objectives for the sector and the longer-run relationship of agriculture to the rest of the economy during the process of structural change. Efficient adjustment mechanisms for agriculture must be found in an environment of changing technologies and relative prices. In all countries, however, policy objectives for food and agriculture extend beyond efficiency. A widely accepted set of categories for agricultural policy objectives includes efficient agricultural production, improved income distribution (primarily through job creation for unskilled

laborers), a nutritional floor for the vulnerable poor, and national food security through a degree of short-run price stability for basic food commodities.³

1.08 A major theme of this report is that efforts to diversify Asian rice economies are at the heart of how countries attempt to cope with inherent conflicts among these objectives. An efficient agricultural structure--one that responds to changing signals from world markets about relative scarcities of commodities--conflicts with price stability unless non-price signals and programs are used to increase or decrease rice production when it is in deficit or surplus (at prevailing domestic prices). Both investment policy and price policy thus motivate a focus on diversification. Investment policy requires this focus because of long-run uncertainties about the social opportunity cost of rice and hence payoff to the investment. Price policy is an important ingredient in the diversification analysis because of short-run uncertainties about the border price of rice and the attendant cost to the budget of defending domestic price stability. The alternative to a price stabilization program is to let farmers immediately bear the entire burden of price declines or consumers to bear the burden of price increases. Few countries are prepared to embrace this alternative except under extreme duress precisely because their food systems are not flexible--that is, they are not easily diversified in the short run.

1.09 Governments often frame the issue of diversification in terms of which crops to promote. A significant problem arises, however, when diversification programs are target oriented. Planners simply do not know how demand and prices will change in the future or what impact new technologies will have on relative costs. Consequently, target-oriented diversification programs run the risk of diversifying farmers into crops just as their prices fall (or even worse, the added output causes the prices to fall), with farmers no better off than before. To avoid such

3/ See C. Peter Timmer, Walter P. Falcon, and Scott R. Pearson, Food Policy Analysis (Baltimore: Johns Hopkins University Press for the World Bank, 1983).

short-run traps, it is necessary to think of diversification as a process of adjustment rather than the establishment of targets for cropping patterns. The implications of the process-oriented approach are quite significant for the design of both short-run price stabilization policies and long-run development strategies. The process of rural diversification involves finding efficient short-run adjustment mechanisms for agriculture within the broader context of multiple objectives for agricultural policy, which have inherent trade-offs among them, while not losing sight of the economy-wide objectives for efficient structural transformation.

1.10 All countries are striving for a successful structural transformation--the gradual evolution of an economy from one based primarily on agriculture to one in which the bulk of labor and output is in the industrial and service sectors. Somewhat paradoxically, the structural transformation is stimulated by the rapid growth of the agricultural sector, not by its forced demise. The reason can be seen either analytically or historically. Analytically, the structure of an economy evolves in response to changing patterns of demand, and Engel's Law requires that a decreasing share of consumer expenditures be devoted to food and agricultural products. Historically, all industrial revolutions, not least those in Japan, Taiwan and Korea, have been accompanied by rising productivity in agriculture. This gain in productivity generates the resources that then stimulate expansion of other sectors. Managing this transformation is obviously a delicate process: if agriculture receives too much stimulation, the surplus resources will try to stay in the sector; if it is taxed too heavily, the surplus resources will not be generated at all.

Issues of Concern to the World Bank

1.11 The World Bank is a major participant in the debate over diversification by virtue of its dominant role in lending for agricultural development. From 1974 to 1986, the Bank lent almost \$40 billion, which represented 30 percent of its total lending, in support of adjustment activity and agricultural projects, whose total cost exceeded \$100 billion. An average of \$1.5 billion a year, which was about one-third of Bank loans

for agriculture, was used for investment in irrigation. The recent emphasis on policy-based lending has further increased the Bank's role in agriculture through its effort to improve the economic environment for farmers in countries in which policies have generally penalized agricultural sectors.

1.12 Agricultural lending is such an important component of the World Bank's lending portfolio that is deeply concerned, particularly in the light of low international prices for most agricultural commodities in the mid-1980s, about the profitability of past and future loans for agricultural projects. Many existing commodity-based projects would not have appeared profitable if prices that prevailed in world markets in the mid-1980s had been used in the investment appraisals. Few new investments would be judged profitable on the basis of currently projected price trends.

1.13 Support for existing projects has also become a problem. Lack of a cost recovery mechanism has impeded the development of efficient irrigation systems. The poor record of cost recovery suggests that the full benefits of irrigation investments are far from being realized. The ability to impose betterment levies depends on the actual betterment realized, which depends in turn on the reliability of timely water supplies to farmers, on prices of outputs and inputs, and on the quality of extension services. The problem of cost recovery was compounded in the mid-1980s by falling rice prices. At a time when more efficient irrigation systems were needed, farmers were in less of a position to pay for water. Even in efficient systems, low prices for agricultural products reduce incentives to farmers to use costly water.

1.14 In some countries, existing irrigation systems have been neglected, and rehabilitation projects have become a higher priority than expansion into new areas. Because of poor maintenance and operations, the benefits from irrigation in many cases have been less than they might have been. The revenue generated from water charges and betterment levies is typically not even adequate to pay the operation and maintenance (O & M) costs, which are about 10 to 15 percent of initial investment. O & M costs

should be financed by proceeds from the project in order to connect the needs of farmers for timely water deliveries with the incentives for system managers. Because of revenue shortfalls, the systems' requirements for operation and maintenance tend to be neglected. The degradation of these irrigation systems has both short- and long-run effects, and their rehabilitation is very expensive. The feasibility of upgrading existing irrigation systems for cultivation of non-rice crops is a topic treated in this report.

1.15 The Bank's investments and programs have had a major impact on agricultural production. Projects approved between 1974 and 1986 were expected at the time of appraisal to result in incremental annual production of over 12 million tons each for rice, wheat, and corn and to increase output of other commodities by substantial amounts. This output level for rice was greater than the amount of rice traded in world markets in the mid-1980s, and the projected levels of output of other commodities represent sizable shares of world trade (see Table 1.2).

1.16 The World Bank's funding of irrigation schemes to expand rice output in Asia was largely responsible for surpluses in world markets in the mid-1980s. The Bank can either be credited for increasing rice production and contributing to food security or, alternatively, blamed for a lack of coordination across country projects and for inaccurate price projections used in the investment appraisals. It should be noted however, that the Bank projects also increased demand for commodities in the developing countries of Asia by raising real incomes and supporting the overall process of economic development.

1.17 In response to the reality of commodity surpluses in the mid-1980s, the Bank initiated wide-ranging policy debates with member countries about appropriate forms of intervention in the agricultural sector. It has recently emphasized rural diversification as a main element in agriculture's adjustment to new market conditions. The task of this report is to help keep the policy dialogue focused on the appropriate issues.

Table 1.2: Annual Incremental Production from Bank Financed Projects Over the Period 1974-85 (as estimated at appraisal) for selected Crops

Crop	No. of Projects	Estimate Annual Incremental Output (Thousand Metric Tons)	Volume as % of World Production 1985	Volume as % of World Trade 1985
Rice	304	16,813	3.6	147.0
Wheat	156	12,506	2.6	11.1
Maize	263	12,815	2.6	18.3
Sorghum	121	5,910	8.8	58.5
Sugar	118	4,200	4.3	14.1
Groundnuts	125	1,969	9.7	198.0
Soybeans	70	2,850	2.9	11.6
Cotton Lint	147	2,822	15.8	68.8
Rubber	42	2,179	50.0	59.7
Palm Oil	36	1,832	24.3	38.0
Coffee	55	220	4.3	5.1
Cocoa	44	184	9.8	14.2
Tea	5	36	1.6	3.7
Tobacco	32	118	1.9	8.4

Source: AGR, AGR Data Base for the estimated incremental output at full development.
FAO and USDA for Production and Trade Data.

1.18 A major concern of the Bank is the dependence of the agricultural sectors of Asian countries, particularly the ASEAN-4 (Indonesia, Malaysia, Philippines, and Thailand), on rice and a few export-oriented crops. In the face of low international market prices and the rigidities inherent in tree-crop production and irrigation systems designed to grow rice, these four countries are the focus of this report because of their serious adjustment problems. When using updated price forecasts, most commodity-based projects currently being implemented in these countries face unacceptably low returns to investment. From the perspective of a Bank lending portfolio, an overconcentration of its lending to projects within a very limited range of commodities is highly undesirable.

1.19 The solution to the problems facing these countries is often seen as a matter of creating a broader set of options. This strategy of broadening the range of crops for sale in world markets, or even in domestic markets, is derived from perceiving the problems facing agriculture in terms of supply and demand. The analysis of the problem is limited to consideration of the agronomic potential of the farming systems, the constraints to producing other crops, and an assessment of which crops to promote. Such a target-oriented or "planning" approach, however, is at odds with the essence of rural diversification, which aims to develop an agricultural system that is flexible and responsive to changing market conditions. This increased flexibility cannot be achieved by the type of production planning used in the past for rice or by a search for crop-specific development programs. Little flexibility can be gained by trying to target investments or policies on the basis of short-term price projections. Rural diversification is a process of introducing flexibility in farming systems and market responsiveness. It is a process of structural adjustment to market forces.

**CHAPTER 2. CHANGING PATTERNS OF AGRICULTURAL PRODUCTION
AND FOOD CONSUMPTION**

2.01 With free markets and the absence of government intervention, patterns of agricultural production, trade, and consumption evolve jointly through the influence of market-clearing prices. Patterns of demand change as incomes and tastes change; commodity-specific technical change alters relative cost structures, prices in markets, and hence consumer demand. Engel's Law and technical change are thus the underlying factors causing patterns of agricultural production, trade, and consumption to change over time.

2.02 Additional factors often cause governments to intervene in this process, however. They often take measures to dampen instability in market prices, whether from domestic or international forces, to lessen the burdens of adjustment on consumers and producers. Linkages between output, employment, and secondary income generation can vary significantly from commodity to commodity and between rural and urban sectors. Market values do not necessarily capture the full social value of these linkages, and opportunities thus exist for government interventions to speed the development process and redirect the distribution of its gains.⁴

2.03 High growth of agricultural GDP in Asia (Table 2.2) seems to have been closely related to the rice intensification programs adopted during this period. The conspicuous dynamism of the Asian economies in which the rice sector has been promoted can be partly explained by the positive linkages created when incomes of the many small farm households are expanding. Rapid growth in the rice sector based on land-augmenting, labor using technology created strong labor demand within agriculture. Simultaneously, the growth in incomes of farm households led to increased demand for other farm products and labor-intensive services and consumer

4/ See Albert O. Hirschman, "A Generalized Linkage Approach to Development, with Special Reference to Staples," in Manning Nash (ed.), Essays on Economic Development and Cultural Change (Chicago: University of Chicago Press, 1977), pp. 67-98.

goods. Investment in farm improvements and the savings generated in foreign exchange all contributed to greater capital formation as well.

2.04 The unimodal distribution of rice lands in most of monsoon Asia and the relative scale neutrality of rice intensification technology also meant that income distribution tended to improve as rice production expanded. The question now arises whether or not diversification will lead to similar gains as in the rice-based economy.

2.05 There are some reasons to believe that crops that compete with rice may have fewer positive linkages. Why might this be the case? First, in the countries concerned, rice still tends to be the single largest contributor to agricultural GDP. It remains the wage good, even though its share in workers' expenditure patterns is dropping rapidly in the fastest-growing economies.⁵ The crop itself is extremely labor intensive to produce under all Asian conditions, even in Japan, in comparison with other staple commodities (but not in comparison with fruit, vegetables, and livestock production). Its income-earning potential per hectare of irrigated land far surpasses that of other staple commodities in Asian circumstances (but again, not necessarily that of fruits, vegetables, and livestock).

2.06 The income generated by rice seems to have a very high multiplier effect for two reasons: rice farmers have labor-intensive consumption patterns, and their incomes seem to remain within the village economy for several cycles of expenditure; and rice farmers save and invest heavily when the profits from rice cultivation are large. The investments also tend to spur the rural economy; they focus on labor-intensive marketing and processing activities, including the purchase of small trucks or motorcycles, which offer significantly lower marketing costs from remote villages to larger wholesale market centers. In short, changes in the rice economy, especially through short-run changes in the profitability of

⁵/ The share of rice in urban household expenditures fell from 6 percent, 29 percent, and 17 percent in 1965 in Japan, South Korea, and Taiwan, respectively, to 2 percent, 12 percent, and 5 percent in 1980.

growing rice due to price changes, might well have significant general-equilibrium and dynamic effects on both the rural and urban economies that are not easily captured in the standard analytical models of comparative statistics used to evaluate such changes. Theory is of little use in establishing whether or not this is so; models can be constructed that show results either way. The answer must be sought in several comparative empirical studies of both historical and recent changes in the rice economies of Asian countries.

2.07 From the point of view of the diversification issue, the main goal of such research would be to understand the various aspects of rice-based agricultural systems in contributing to rural and urban growth and the extent to which non-rice commodities with higher income elasticities of demand, or better prospects in the world market, might make similar contributions. The focus of such analysis would necessarily be heavily Asian, but the search for effective rural-urban growth linkages has obvious relevance beyond Asia. If a significant element of Asia's success in overall economic growth can be shown to be due to the structure of its agriculture (including the small average farm size for rice producers), new insights into the growth process and important new degrees of freedom for economic development policy for all countries will have been generated.

2.08 Rice is uniquely important to Asia. Its labor intensity, high productivity, and widespread cultivation on millions of small farms generate positive growth linkages within the rural sector and to the urban sector. The important question is what can be learned from successful agricultural diversification efforts in Asia and elsewhere, not just in terms of direct contribution to farm incomes, but in terms of spillover multipliers that are so critical to the rural dynamism seen in Asian economies.

2.09 A lesson that seems to emerge is that positive linkages from a crop sector to the rural economy and beyond are strengthened when growth occurs broadly across many farms regardless of their size or scale of production. Such a "unimodal" pattern of growth is favorable for expansion of labor-intensive non-farm activities in particular. In contrast, a

growth pattern dominated by a few large-scale farms or plantations, or a bimodal pattern, seems to contribute much less in terms of linkage effects. Another related point is that positive linkages from a specific agricultural sector to the economy in general are best encouraged by a stable macro-economic policy environment and by industrial and trade policies that are relatively neutral--not heavily biased against sectors like agriculture producing tradeable goods.

2.10 In designing diversification programs for agriculture and the rural economy, these points will have to be kept in mind. Failure to do so may mean that overall costs of adjustment to lower rice incomes in rice-based Asian economies will be much higher than most policymakers seem to realize.

Performance of the Agricultural Sector

2.11 The agricultural sectors of developing Asian countries contribute important shares to total GDP and exports, and they provide employment for at least 40 percent of the labor force (see Table 2.1). The ASEAN-4 countries have higher per capita incomes and lower shares of GDP from agriculture than do South Asian countries. During the 1970s, the agricultural sectors experienced relatively high rates of growth, led by the staple foods subsector under the banner of self-sufficiency in basic food production. In terms of production and consumption, rice is by far the most important food crop, and price stabilization policies were geared toward increasing production of affordable rice.

2.12 The prices of export crops during this decade were relatively high, and these high levels also encouraged increased production in this sector. A major emphasis was placed on production of tree crops in the ASEAN-4 countries; the plantings spurred by price signals in the 1970s are coming into bearing in the 1980s. For several tree crops, such as rubber, oil palm, and coconut oil, exports from the ASEAN-4 countries comprise over 75 percent of world exports.

Table 2.1: Share of Agriculture in GDP and Employment, 1970 and 1983, and Per Capita GNP, 1984

Country	Share of Agriculture in GDP (percent)		Labor Force in Agriculture (percent)		Per Capita GNP (US dollars) 1984
	1970	1985	1970	1985	
Southeast Asia					
Malaysia	30 ^a	21	53	36	1,980
Thailand	28	17	80	59	860
Philippines	28	27	54	49	660
Indonesia	47	24	66	55	540
South Asia					
Pakistan	37	26	59	53	380
Sri Lanka	33	24	55	46	360
India	47	31	69	59 ^b	260
Burma	38	48	67	66	180
Nepal	68	57 ^c	94	93 ^b	160
Bangladesh	58	5	86	64	130

Note: Countries are listed in order of decreasing per capita GNP. Figures are rounded.

a 1971

b 1983

c 1984

Sources: World Bank. World Development Report 1985 and World Development Report 1986 (New York: Oxford University Press for the World Bank, 1985, 1986). World Bank, World tables, Third Edition, Volume II Social Indicators. Asian Development Bank Key Indicators, July 1987.

2.13 The perceived scarcities and high commodity prices of the 1970s have given way to the surpluses and low commodity prices of the 1980s. Governments that invested heavily in the attainment of self-sufficiency and increased exports of agricultural commodities have been caught off guard and are faced with large budgetary obligations and decreased sources of revenues. Furthermore, the agricultural systems are quite inflexible because of past investment and incentive policies.

2.14 Inflexible production systems for domestically-consumed commodities (and inflexible patterns of consumer demand) create serious problems of adjustment when world prices for the commodities are highly unstable. In fact, international commodity markets have experienced increased price variability, which is largely a function of price stabilization policies adopted by both importing and exporting countries in the industrialized and developing world. In response, domestic markets in many developing countries have been buffered from world markets by price stabilization policies and restricted (or subsidized) imports of substitute goods. In response to stable prices for rice and subsidized inputs, farmers in the ASEAN-4 countries during the 1970s significantly increased total production of rice. Rice output grew at an annual rate of 3.7 percent. The adoption of high-yielding varieties combined with increased irrigation facilities and higher application rates of fertilizer led to much of the growth in production.

2.15. Most rice farming in the developing countries of Asia is based on a combination of modern and traditional cultivation practices that maximize yields per unit of land. The use of high-yielding varieties has increased the demand for labor in many cases; the multiple cropping made possible by short-season, high-yielding rice varieties has been a very important source of rural employment, especially for absorbing new entrants into the labor force. Average farm sizes in Asia are extremely small, but small farms are particularly suited to the intensive cultivation practices used in rice production. Since alternative crops tend to have lower returns to labor or land, or both, and since rice is the major component of the diet of most Asians (farm households often keep 50 percent or more of the rice harvest for own consumption), rice has managed to maintain its paramount position

in the economies of developing Asian countries. But small farm size limits farm income, and such farms will not be able to absorb additional labor unless unexpected technological improvements take place. Increasingly households of small farmers and landless rural workers have looked to off-farm employment for an increasing source of family income. Expansion of employment opportunities in the rural non-farm economy will be increasingly important for these groups.

2.16 Since the 1970s, the developing countries of Asia have generally increased their production of rice at a rate greater than population growth, traditional rice importers have achieved self-sufficiency and even surpluses, and the international market price of rice dropped to its lowest level of the century. This imbalance between rice supply and demand is of great concern to these countries. Is this situation a cause for alarm?

2.17 The prospects for further sharp increases in domestic production of rice are limited. The high rates of growth since the 1970s are unlikely to be sustained because of the scarcity of additional arable land, the lack of new technological breakthroughs, the expected moderation of government support for increased rice production, and the already widespread adoption of high-yielding varieties and intensive cultivation practices. On the consumption side, population growth will continue to be a major factor influencing total consumption of rice. The latent consumption potential of undernourished portions of the population might effect an increase in rice consumption if incomes of these groups rise significantly. A closing of the gap between rice and wheat prices in the world market might lower the attractiveness of wheat as a substitute good for rice, and low prices of rice might encourage consumers of coarse grains to switch to rice.

2.18 The difficulty of projecting commodity prices is well known, and no attempt will be made here to compete with more ambitious efforts to make projections. But, in brief, the rice surpluses of the mid-1980s and historically low international prices of rice might well be temporary. The leap from scarcity to surplus from the 1970s to the 1980s was based on numerous factors that are reversible--for example, good weather, export dumping by the United States, and costly domestic support prices. The

highly acclaimed turnaround by Indonesia as it switched from being the world's largest importer of rice in the 1970s to being an exporter in 1985 and 1986 changed in 1987 as Indonesia responded to drought-induced shortfalls by drawing down rice stocks. Drought affected many parts of Asia in 1987, and stocks built up from past surpluses prevent Asia from returning to the panic of the 1970s. There is pressure on the United States, the European Community, and Japan to stop export dumping or to lift import restrictions on cereals, or both. The question for developing Asian countries remains one of figuring out how to juggle the interests of farmers and urban consumers to maintain rural incomes and inexpensive food at a minimum cost to the government budget. The task is complicated because no one knows what the international price of rice will be as the opportunity cost of such efforts.

Sources of Growth

2.19 The impressive agricultural performance of the Asian developing countries since the early 1970s in the face of many difficulties must in no small measure be attributed to government policies based on a recognition that the economic fate of their countries depended on the agricultural sector. The policies pursued by these countries have generally had similar objectives, but the main one was increased food production. Governments wanted increased food security through self-sufficiency in staple food production. Apart from its political and social justifications, the objective of self-sufficiency in food production has a sound economic rationale in those countries that produce their staple foods at lower cost to the economy than the average cost of imports. A secondary objective of agricultural development was the promotion of export-oriented commodity crops, primarily agricultural raw materials.

2.20 For the developing countries of Asia during the 1970s (except Nepal), the average annual rates of growth in cereal, food, and total agricultural production were higher than rates of growth in population (see Table 2.2). Despite the higher rate of growth in cereal production relative to population growth, however, the average per capita availability of cereals from the domestic sector increased only marginally in

Table 2.2: Annual Rate of Growth in Agricultural Production and Population and Per Capita Availability of Cereals from Domestic Sources

Country	Average Annual Rate of Growth 1971-1981 (percent)		Average Annual Population Growth 1972-1981 (percent)	Average per Capita Availability of Cereals (tons)	
	Agricultural Production ^a	Production Food Cereals		1970-72	1979-81
Southeast Asia					
Indonesia	3.7	3.8 5.2	2.5	0.18	0.23
Malaysia	4.7	5.9 2.6	2.6	0.17	0.16
Philippines	4.9	4.9 4.6	2.6	0.18	0.22
Thailand	6.0	6.4 4.6	2.2	0.40	0.45
South Asia					
Bangladesh	2.9	3.0 3.4	2.9	0.22	0.24
Burma	3.4	3.4 6.0	2.3	0.29	0.39
India	2.9	3.1 2.8	2.1	0.20	0.21
Nepal	1.2	1.3 0.9	2.0	0.30	0.26
Pakistan	3.2	3.7 4.8	3.0	0.19	0.21
Sri Lanka	3.8	6.0 3.8	1.7	0.12	0.14

^aAgricultural GDP

Source: Food and Agriculture Organization of the United Nations, Production Yearbook, vol. 35 (Rome, 1981).

Bangladesh, India, and Pakistan, whereas more sizable gains were made in Indonesia and the Philippines and in the traditional rice exporters, Burma and Thailand.

2.21 Agricultural growth in the Asian developing countries in the 1970s was propelled on the whole by food production, and in most of the countries the emphasis was on the production of cereals (staple foods). The rate of growth of the food subsector in all the countries equaled or exceeded that of total agricultural production.

2.22 During the decade, the production of export-oriented crops, including rubber, palm oil, coconut, cocoa, sugar cane, pineapple, cotton, and others, also increased significantly. In addition, the livestock, fishery, and forestry subsectors expanded in several countries. The increase in food production and the reduction in imports, together with the increase in exports of agricultural commodities, meant that the agricultural sector in most countries made positive contributions to the balance of payments. Agricultural trade surpluses of increasing size were generated between 1973 and 1980 in all the ASEAN-4 countries and in Burma, India, Pakistan, and Sri Lanka (see Table 2.3). This positive contribution of agriculture to the balance of payments was a major factor in helping the countries adjust to the external economic shocks of the 1970s.

2.23 In contrast to the 1970s, the rate of growth in agricultural production in the early 1980s declined in most of the developing Asian countries. The Philippines' growth rate fell to less than one-half the average of the 1970s (see Table 2.4). Lower or negative growth in agricultural exports was a major cause of reduced overall agricultural growth as the export-oriented subsectors were hard hit by the recession of 1980-1983 and the continued decline of agricultural commodity prices. On the other hand, Indonesia managed to compensate for the lower growth in exports by a very high rate of growth in rice production for domestic consumption. Indonesia's rice production grew by more than 5 percent a year between 1980 and 1984.

Table 2.3: Agricultural Sector Net Exports, 1973-1984
(in US\$ million)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
ASEAN-4												
Indonesia	756	1,132	671	1,216	1,703	1,627	2,974	3,111	1,121	939	1,626	1,562
Malaysia	1,360	1,383	1,499	2,298	2,622	2,837	4,773	4,443	3,434	3,376	4,174	3,114
Philippines	954	1,435	1,091	1,099	1,458	1,342	1,705	1,893	1,719	1,215	1,161	1,146
Thailand	842	1,520	1,337	1,831	1,681	2,120	2,599	2,874	3,537	3,705	3,052	3,653
South Asia												
Bangladesh	(356)	(377)	(429)	(313)	(4)	(243)	(97)	(380)	(240)	(304)	(195)	(222)
Burma	90	124	108	153	152	133	242	311	350	299	330	169
India	255	285	(19)	198	641	683	1,134	1,055	1,150	1,234	760	580
Nepal	64	31	39	58	43	53	48	7	25	5	31	26
Pakistan	12	(53)	(106)	1	(17)	(84)	9	218	469	5	(2)	(336)
Sri Lanka	120	85	61	232	331	376	330	212	265	297	277	708

Notes: Agricultural sector includes forestry and fishery products.
Agricultural trade deficits are shown within parentheses.

Source: FAO, FAO Trade Yearbook, 1984 and earlier editions.

Table 2.4: Growth in Agricultural Production and Agricultural Exports, 1971-1981 and 1980-1984

Country	Average Rate of Growth in Agricultural Production (percent)		Average Rate of Growth in Agricultural Exports (percent)	
	1971-1981	1980-1984	1971-1981	1980-1984
Southeast Asia				
Indonesia	3.7	4.6	24.3	-13.5
Malaysia	4.7	3.4	21.3	- 5.9
Philippines	4.9	2.1	13.2	- 5.4
Thailand	6.0	3.4	24.5	3.9
South Asia				
Bangladesh	2.9	2.5	6.0	3.3
Burma	3.4	6.9	12.9	-14.2
India	3.4	1.7 ^a	15.1	0.2
Nepal	1.2	3.1	-3.1	6.6
Pakistan	3.2	2.3	18.0	- 7.9
Sri Lanka	3.8	2.1	9.1	8.6

^a1976-1983

Source: V.S. Vyas and W.E. James, "Agricultural Development in Asia: Performance, Issues and Policy Options" (Washington, D.C.: World Bank, 1987; typescript).

2.24 Despite the record of high rates of growth within the agricultural sectors of developing Asian countries in the 1970s, employment and the relative importance of agriculture in GDP declined, particularly in the ASEAN-4 countries, which (relative to the other developing Asian countries) have the highest per capita GNP and the lowest shares of G.^o from agriculture (see Table 2.1). It should be emphasized that while the percentage of persons employed in the agricultural sector decreased, the absolute number of persons employed in agriculture increased. The sector is still an important source of economic growth and labor absorption in developing Asian countries, even though its relative importance is declining because of the general structural transformation of the economy. As Table 2.1 shows, the share of GDP from agriculture falls as per capita incomes rise, primarily because patterns of consumer demand gradually shift to non-agricultural expenditures (Engel's Law).

Trends in Exports and Commodity Prices

2.25 Agricultural exports are an important component of total exports from the developing countries of Asia, accounting for a third or more off total goods exports in all countries except Indonesia. These countries are important in world export markets for commodities such as rubber, jute, coconut oil, palm oil, tea, rice, and copra. Some countries dominate particular markets. Bangladesh exports about 71 percent of the jute in the world market. Of palm oil exports, Malaysia's share is about 70 percent. The Philippines has a large share of the coconut oil market--almost 71 percent--and almost 27 percent of copra exports. India's share is almost 27 percent of tea exports. Rubber is dominated by Malaysia, which has almost half the market and Indonesia, which provides about 25 percent of rubber exports. Thailand has a 15 percent share of the rubber market and over 20 percent of the rice market.

2.26 Since a large share of these countries' export earnings are dependent on a few commodities, continuation of the prolonged depression in world prices for agricultural commodities in the 1980s is causing some of them serious difficulty. Some countries will be affected by low commodity prices and limited export markets more than others. For commodities such

as rubber, jute, coconut oil, and palm oil, the competition for limited markets is among neighboring Asian countries.

2.27 A brief review of price trends of important commodities points to the radical changes in real prices from the 1970s to 1985. Prices of sugar, palm oil, coconut oil, copra, rubber, cotton, and others significantly dropped. Because of the "decoupling" of commodities from the industrial economies brought about by technological changes, real prices are not expected to rise in the future. For the ASEAN-4 countries that together produce over 75 percent of the world's exported rubber, palm oil, and coconut oil and that expanded plantings of these three crops based on the high prices of the 1970s, the prospect of low prices and the inherent inflexibility of tree crops are causes of great concern.

2.28 Several factors have influenced the sharp declines in prices in the 1980-1986 period. Exceptionally good weather was widespread over Asia. The low price of fertilizer, especially urea, stimulated greater use of fertilizer and boosted yields. The increase in production was a lagged response by both farmers and governments to several factors: previous scarcities and high prices; to the United States Payment-in-Kind prices of 1983-1984 for grains, fats and oils, and cotton; and to the much longer lagged response of some tree crops to the high prices of the late 1970s. Agricultural policies in industrial countries, including protection of domestic producers from imports and the dumping of subsidized exports, depressed commodity prices.

2.29 What does this mean for future prices? With a reasonable rate of growth in per capita incomes and removal of the temporary factors responsible for the surge in supplies in recent years, an increase in real prices of commodities in the short run is anticipated (indeed it has already happened for rice). Over the longer run, however, real prices of most agricultural commodities are expected to be on a declining trend for the remainder of this century.

2.30 In assessing commodity price trends relative to those of manufactured goods, it is worth noting that quality improvements in manufactured products are often not adequately adjusted for in existing price series. Conceptually this could lead to an exaggeration of the actual decline in the barter terms of trade facing primary goods producers. Nevertheless, primary producers should not count on favorable prices to make their investments profitable. Instead technological improvements, cost reduction and improvements in quality to increase competitiveness are likely to determine profitability and market share.

World Markets for Cereals

2.31 Production of cereals, pulses, and other staple crops is by far the most important agricultural activity in Asia. In most of the Asian developing countries, about 60 to 70 percent of crop land is planted in cereals. Rice is the most important crop in area, number of producers, and contribution to total agricultural production. It is only natural that the drive to attain greater production of cereals in Asia focused on the most important crop--rice. Wheat is grown mainly in the semi-arid South Asian countries; excluding China, India and Pakistan account for more than 90 percent of Asian production. Rice and wheat together account for over 85 percent of all food production. Rice alone accounts for more than 65 percent. Corn is another important cereal crop, which is grown in most developing Asian countries.

2.32 From 1966-1975 to 1976-1980, the average annual rate of growth in rice production in Asia was 2.6 percent (see Table 2.5) About two-thirds of this gain was attributed to yield increases and the remainder to area expansion. There are significant differences among individual countries and geographic areas. Yields per hectare remained highest in East Asia, but the average annual rates of growth in yields were higher in Southeast and South Asia--the highest rate was in Southeast Asia, which also had the highest growth rate in area planted to rice (see Table 2.5). India and China are the dominant rice producers of Asia, accounting for over 60 percent of production.

Table 2.5: Rice Production, Area, and Yields, 1966-1975 to 1976-1980

Country	Average Production of Paddy (thousand metric tons)		Average Annual Rate of Growth 1966-75 to 1976-80 (percent)	Average Area (thousand hectares)		Average Annual Rate of Growth 1966-75 to 1976-80 (percent)	Average Paddy Yield (metric tons per hectares)		Average Annual Rate of Growth 1966-75 to 1976-80 (percent)
	1966-75	1976-80		1966-75	1976-80		1966-75	1976-80	
<u>East Asia</u> ^a	137.946	164.149	2.3	38,022	40,988	1.0	3.63	4.01	1.3
China	110.164	134.400	2.7	32,420	35,640	1.3	3.39	3.77	1.4
Japan	16.090	14.793	-1.1	2,944	2,592	-1.7	5.48	5.71	0.5
South Korea	5.560	7.135	3.4	1,203	1,222	0.2	4.62	5.83	3.2
<u>Southeast Asia</u> ^b	49.391	62.966	3.3	24,935	28,032	1.6	1.98	2.24	1.7
Indonesia	18.738	25.695	4.3	7,979	8,906	1.5	2.34	2.89	2.9
Malaysia	1.679	1.862	1.4	679	709	0.6	2.46	2.62	0.8
Philippines	5.060	7.221	4.9	3,287	3,524	0.9	1.54	2.05	3.9
Thailand	13.182	16.400	3.0	7,478	8,990	2.5	1.76	1.82	0.4
<u>South Asia</u>	90.328	110.900	2.3	55,321	58,375	0.7	1.69	1.90	1.6
Bangladesh	16.700	19.230	1.9	9,793	10,071	0.4	1.71	1.91	1.5
Burma	8.054	9.579	2.3	4,755	4,939	0.5	1.69	1.93	1.8
India	60.773	73.475	2.6	37,404	39,458	0.7	1.62	1.86	1.9
Nepal	2.268	2.306	0.2	1,184	1,264	0.8	1.91	1.82	-0.6
Pakistan	3.212	4.589	4.9	1,527	1,941	3.3	2.09	2.38	1.6
Sri Lanka	1.321	1.721	3.6	658	702	0.9	2.00	2.45	2.7
<u>TOTAL ASIA</u> ^c	279.665	338.015	2.6	118,278	127,375	1.0	2.37	2.66	1.6

^a Includes North Korea and Taiwan.

^b Includes Laos and Vietnam.

^c Includes North Korea, Taiwan, Laos and Vietnam.

Source: Adapted from Randolph Barker and Robert W. Hordt, with Beth Rose, The Rice Economy of Asia (Washington, D.C.: Resources for the Future, 1985), pp. 45-47.

Supply Factors

2.33 Sources of rapid growth in production in the 1970s--the adoption of high-yielding varieties and the expansion of irrigation and areas brought under cultivation--are unlikely to continue to result in large increases in cereal production in the 1980s. Improved technology to increase yields has already been applied in most developing Asian countries. By 1983, the majority of area devoted to rice and wheat was planted to high-yielding varieties, leaving little potential for further expansion. The international agricultural effort that increased the productivity of rice and wheat, including genetic improvements in high-yielding varieties, has seen its results widely adopted. There is no apparent new technological breakthrough just over the horizon that can stimulate a second Green Revolution (Table 2.6).

2.34 The potential expansion of lands under irrigation is limited because sites for constructing new, large-scale irrigation systems are becoming scarce and irrigation technology is becoming more expensive. Most prime sites for irrigation have been exploited in the developing countries of Asia, and future investment would only extend irrigations systems to marginal zones at high cost. But there is considerable scope for improving the efficiency by intensifying the use of existing irrigation systems and thereby contributing to growth in production.

2.35 Most developing Asian countries are unable to continue to expand the area under cultivation. There is severe population pressure on available land and little potential for expanding agricultural land through forest clearance and land settlement. From 1973 to 1983, expanded land area contributed just 25 percent of the increase in cereal production in Asia. Improved yields and multiple cropping accounted for the remaining 75 percent. The proportion of additional production from area expansion is likely to be negligible in the future.

Table 2.6: Average Share of Rice in Agricultural Production and Area in Asia and Rice Yields, 1966-1975 and 1976-1980, by Region

Region Country	Share of Rice in Production (percent)		Share of Rice in Area Planted (percent)		Index of Average Yields (East Asia =100)	
	1966-75	1976-80	1966-75	1976-80	1966-75	1976-80
East Asia						
China	39.4	39.8	27.4	28.0		
Total	49.4	48.5	32.1	32.2	100	100
Southeast Asia	20.5	21.5	25.1	25.8	53	55
South Asia						
India	21.7	21.7	31.6	31.0		
TOTAL	30.1	30.0	42.8	42.0	46	48

2.36 Government policies to stimulate increased cereal production through improvements in infrastructure, subsidized inputs, stable producer prices, and a host of institutional supports have been largely responsible for the rapid rates of growth in production. With budgetary pressures and low international prices of cereals, these policies will probably be rolled back to some degree, thus forcing marginal land out of cereal production. These lands, marginal for cereal cultivation, may be better suited to alternative farming systems.

Demand Factors

2.37 Three main factors determine the level of rice consumption: tastes, incomes and the price of rice relative to the price of substitutes. These three factors are interactive, and they are difficult to separate using aggregate data on consumption. Tastes of urban people are generally distinct from those of rural people because of differences in life-style and level of physical activity. The tastes of one ethnic group within a country may differ from those of other groups. Changes in the price of rice will have an effect on consumption because rice becomes more or less expensive relative to other alternatives. If rice absorbs a large fraction of total expenditures, a change in its price has substantial effects on real incomes. Absolute income levels of consumers also influence consumption patterns.⁶

2.38 In most countries, place of residence, whether rural or urban, is an important factor affecting patterns of consumption. Since rural people usually have lower incomes than those of urbanites, they are more likely to eat meals at home and less likely to purchase prepared foods made from wheat flour if they are more expensive. Preparation of rice in the household tends to be a time-consuming activity. As urbanization proceeds and women enter the labor force, the opportunity cost of time in the household tends to rise, and cooking rice has to compete with the

^{6/} This section is drawn extensively from Chapter 11 of Randolph Barker, Robert W. Herdt, with Beth Rose, The Rice Economy of Asia (Washington, D.C.: Resources for the Future, 1985).

convenience of wheat-based bread. Note, however, that bread must be purchased frequently outside the household, thus adding significantly to transactions costs relative to rice, which can be stored in the home for weeks or months.

2.39 About two-thirds of the energy in the average Asian diet is provided by cereal grains--the share of rice alone is 40 percent, that of wheat 15 percent. Rice and wheat are the preferred cereal grains in all countries of Asia, and, with the exception of Japan, per capita consumption of these grains is either static or rising (see Table 2.7). Rice is by far the most important cereal in all Asian countries (except Pakistan), and wheat is popular in some countries, especially as a substitute for rice in the diets of urban dwellers. Corn, millet, and barley are important in some parts of Asia, in addition to several noncereal staples, primarily cassava and sweet potatoes. A rise in income in rural areas generally lead to a substitution of rice for inferior staples, such as corn, millet, and root crops.

2.40 Patterns of cereal grain consumption differ throughout Asia and have been changing over time. During the 1960s and 1970s, rice provided a much higher proportion of energy per capita than did wheat (except in Pakistan), but the general trend in all countries was for wheat to become a more important part of the Asian diet.⁷ In most countries consumption of wheat increased but not usually at the expense of lowered rice consumption. The general pattern was for energy intake from rice and wheat together to increase.

⁷/ See Barker and Herdt (1985), p. 161, for a more extensive discussion of changes in dietary pattern.

Table 2.7: Share of Coarse Grains, Rice, and Wheat in Total Cereal Consumption, 1960 and 1980

Region Country	Share in Total Cereal Consumption ^a (percent)					
	1960			1984		
	Coarse Grains	Rice	Wheat	Coarse Grains	Rice	Wheat
East Asia	17.8	74.7	7.5	28.1	60.5	11.4
China	30.2	47.6	22.2	29.6	39.8	30.6
Japan	21.9	57.8	20.3	56.1	27.0	16.9
Southeast Asia						
Indonesia	18.0	80.8	1.2	16.7	78.9	4.4
Thailand	0.2	99.1	0.7	14.9	83.2	1.9
South Asia						
India	11.8	72.2	16.0	7.3	64.7	28.0
Pakistan	32.2	48.2	19.6	23.7	44.0	32.3
	14.7	13.0	72.3	10.1	14.6	75.3

^aTotal cereal consumption includes coarse grains, wheat, and rice. Coarse grains includes amounts consumed indirectly from livestock products.

Source: United States Department of Agriculture, Foreign Agriculture Service, Washington, D.C.

2.41 In most Asian countries, increased consumption of rice is positively related to incomes at lower levels of income, whereas there is reduced demand for rice at the highest levels of income. A country's per capita GDP also influences rice consumption. Japan has reached a level of income at which all urban consumers reflected in national statistics eat about the same amount of rice. In Indonesia and rural India, countries with lower national incomes, per capita consumption of rice is positively related to income. Different countries thus have different income elasticities of demand for rice, and these elasticities change over time as income increases.

2.42 From a nutritional standpoint, wheat and corn historically have been less expensive sources of energy and protein than rice. The lower cost of wheat and corn is one reason that food-deficit countries in Asia tend to import wheat to meet the needs of low-income consumers for a basic food staple. It should be noted, however, that the preparation costs (milling and baking) of wheat are higher than those for rice, an important consideration since the gap between rice and wheat prices has narrowed. While governments can save foreign exchange by importing the less-expensive wheat, the price consumers pay for the final product might be quite similar.

2.43 In aggregate terms, rice consumption in Asia has been increasing rapidly as a result of population growth and rising incomes. On a per capita basis, however, consumption has risen in some countries, remained stable in a few, and even declined in others. There is little evidence to suggest that increases in rice production have done much more than keep pace with population growth and achieve modest improvements in per capita consumption. Analyzing food self-sufficiency in terms of aggregate data on production and consumption has little relevance if a significant proportion of the population cannot afford an adequate diet. There is a sizable amount of latent consumption potential that would be realized if incomes rise. Although the income elasticity of demand for wheat is slightly higher than that for rice, rice is the dominant staple in all Asian countries (except Pakistan). If incomes of low-income consumers rise, they would be a major factor in the future growth in demand for rice,

particularly in those countries in which inferior cereal grains and staples make up a substantial portion of the diet; in such cases income growth could compensate for any reduction in demand caused by a decline in the rate of population growth.

2.44 In a large proportion of low-income Asian households levels of food intake are far below the national averages. The proportion of the population that cannot afford an adequate diet is large, by some estimates as high as one-third to one-half of the total in some countries. In absolute terms, the number of malnourished people appears to be rising in many parts of Asia. Although average availability of food per capita in most Asian countries in 1983 was close to the FAO's estimated minimum daily requirement of about 2200 kilocalories a day for Asia, this average does not take into account the skewed distribution of income and hence the ability of low-income consumers to purchase food. Averages such as national food availability per capita obviously underestimate the seriousness of the food problem because actual food consumption is skewed in line with income distribution. For low-income consumers who are net purchasers of rice and other cereals low prices represent a rise in real income.

2.45 When assessing present patterns of cereal consumption in Asia and attempting projections of future consumption, it must be emphasized that despite a growing amount of information on overall patterns of consumption, our knowledge of the nutritional status of the poorer and more vulnerable segments of the population is still very inadequate. In many countries, it is difficult to assess the degree to which the nutritional situation is improving or deteriorating.

2.46 The issue of nutritional deficiencies of large segments of the population is important in the context of policies for food self-sufficiency, food security, and price stabilization for staple cereals. Most Asian governments refuse to abandon the socio-political imperative of providing basic foods to their populations. The specter of scarcity in the 1970s is not an image from the distant past but a cause for unease even during the temporary surpluses of the 1980s.

Price Variability

2.47 The recurrence of scarcity and surplus in the Asian rice economy suggests that governments could store rice from periods of surplus to avoid periodic "rice crises" during shortages. To some extent such storage does happen as a result of market forces and government policy. World stocks of rice rose to historic peaks of more than 26 million metric tons in 1985 and have since fallen to less than 17 million tons as drought and policy changes sharply reduced growth in rice production. But more ambitious storage or buffer stock schemes are extremely costly. Rice has high storage losses in the humid tropics, and interest rates alone imply that real prices would have to rise by 10 to 20 percent per year simply to cover this single component of storage costs.

2.48 Unstable world prices also cause governments to emphasize domestic production rather than imports to assure food security. This logic leads readily to programs for rice self-sufficiency, but several countries have discovered the extremely high costs of such programs. Malaysia has reduced its "self-sufficiency" goal from 85 percent to 50 to 60 percent of consumption requirements as domestic production costs have soared relative to costs from world markets.⁸ Even countries that achieved self-sufficiency or production surpluses have re-evaluated the costs of "success." Subsidizing exports of rice may make sense as a temporary means to adjust stocks but surely not as a long-run strategy. Even for countries determined to maintain rice self-sufficiency, prices in world markets are an important signal about costs and benefits. Temporary surpluses and deficits that must be accommodated by exports or imports of rice translate these signals into actual costs to the government budget if domestic prices deviate substantially from world prices.

^{8/} See Mokhtar Tamin and Sahathavan Meyanathan, "Rice Market Intervention System in Malaysia: Scope, Effects and the Need for Reform" (Manila: Asian Development Bank, June 1987; typescript).

2.49 Unfortunately, variability in world prices of cereals has increased markedly since the 1970s, with great volatility between years. Increased variability in production for both importing and exporting countries has had only a minor effect on prices in international markets. More important are national government policies that have affected market performance by controlling, either directly or indirectly, the volume of imports and exports with the objective of increasing the stability of domestic prices. Most Asian countries determine the volume of rice to be traded (either imported or exported) on the basis of the adequacy of domestic production and supplies; they tend to be unresponsive to changes in the world price, thus shifting a major portion of adjustments to price instability to the world market.

2.50 Since the volume of cereals traded in world markets is only about 12 percent of total production, these policies lead to a leverage effect whereby a relatively small increase in variability of production can induce a much larger increase in variability of world prices. This is especially true for rice; only about 4 percent of total production is traded internationally. In contrast, about 25 percent of total wheat production enters the world market.

The Rice Market

2.51 In the mid-1980s, rice prices reached their lowest level in real terms during this century. In constant U.S. dollars, the official Thai price for rice (5-percent broken) fell over 60 percent from the recent high reached in 1981. Prices of other cereals have also fallen but not sharply as the price of rice. Real prices of rice since 1981 dropped partly because of short-term demand and supply factors for rice (rice surpluses were widespread in Asia, and Indonesia reversed its traditional role as an importer) and partly because of longer-term structural changes between the rice market and other cereal markets. In addition, the United States and the European Community engaged in an export subsidy war, and for rice in particular, the actions of the United States have had a major effect on its price.

2.52 The structural changes in the market stem from the stronger links among markets for cereals in the 1980s and the willingness of consumers to switch among commodities. Developments in the markets for wheat and coarse grains are beginning to affect the level of trade and prices in the rice market, and these trends may influence future movements of relative prices of cereals. Prices in the world rice market have historically been more variable than wheat or corn prices because of the more inelastic nature of demand for rice compared to that for wheat or corn. The sharp increase in rice prices late in 1987 and early 1988 confirmed the continued importance of this pattern. Gradually, the cereal markets are likely to become better connected, however.

2.53 The world rice market itself is well integrated in the sense that price movements of most grades of traded rice are highly correlated. But at any given point in time, there is no market-determined representative world price of rice as there is for other major cereal grains, such as the wheat or corn prices quoted on the Chicago Board of Trade. Over one-half the traded volume is handled through government-to-government contracts. The thinness of the rice market, the volatility in year-to-year demand among importers and supplies from exporters, and the fact that there is no central market-clearing price greatly adds to the cost of sellers locating buyers and to the risk of expanding exports of rice.

2.54 One of the greatest difficulties in the 1980s has been accurately projecting the prices of commodities. Figure 2.1 compares actual and projected prices for rice in constant dollars. Since 1974, when rice prices peaked, attempts to chart future developments have been far off the mark. The dashed lines, labelled with the year the price projection was made, indicate the large magnitude of error in projecting rice prices. The projection made in 1982, for example, was already off by more than \$150 a metric ton by 1985. Projections have been revised downward since 1978 as world prices have declined. The projection made in 1986 shows real prices roughly constant until the year 2000, which reflects the bottoming out of the world rice market in the mid-1980s. The impression is confirmed by the fact that prices in early 1988 were already well above the 1986 projections.

The Wheat Market

2.55 Wheat is the second most important crop in Asia in terms of production and area, though it is grown mainly in South Asia (and China). Between 1972 and 1982 wheat production rose by nearly 60 percent in the main producing countries of India, Pakistan, Bangladesh, and Nepal, which represents an annual rate of increase of over 6 percent. Aggregate output increased primarily because of the introduction of high-yielding varieties of wheat, and a larger area planted because of irrigation and the substitution of wheat for other crops. More rapid increases in production may result from the introduction of new disease-resistant, high yielding seeds.

2.56 In non-wheat producing countries, the major factor encouraging imports of wheat has been the low price of wheat relative to that of rice. From 1950 to 1982, the price of rice increased from 1.9 to 2.2 times that of wheat. The changing relative prices were caused by changes in supply and demand. Technological change led to an earlier and more rapid growth in yield and production of wheat than rice. At the same time, the demand for rice grew more quickly than that for wheat. This was partly because of a more rapid rate of growth in the Asian population, the major rice consumers of the world, and partly because the incomes of rice consumers, including those in OPEC countries, rose quite rapidly. The ratio of rice to wheat prices declined sharply after 1982 as incomes in OPEC countries declined and Indonesia switched from being the world's largest rice importer to being a modest exporter. After the surpluses of the mid-1980s were absorbed, however, the rice-to-wheat price ratio returned to the levels of the previous three decades.

2.57 Historically, the short-run integration of the world wheat and rice markets has been very weak. Relatively few consumers buy significant quantities of both cereals, so the scope for substitution is quite limited. This limited substitution is even more of a problem when government price policies do not pass through to consumers the changes in world prices. Accordingly, most substitution that has taken place was the result of

government decisions. For example, Bangladesh, the Philippines, and Indonesia imported food-aid wheat rather than rice from commercial markets, and China imported wheat for distribution in northern and eastern coastal cities while it exported more valuable rice from southern ports. These decisions eventually reflect changing relative prices in world markets, but only with a considerable lag.

2.58 Even in the late 1980s, the rice and wheat markets are not very well integrated. When prices for both commodities were so low that the lower qualities were being fed to livestock, integration seemed finally to have taken place. But once the rice surpluses of the mid-1980s dried up in late 1987, the traditional independence (in the short run) re-established itself as rice prices nearly doubled, whereas wheat prices barely budged. This independence seems likely to remain as long as Asian governments continue to stabilize the prices of basic cereals for their consumers.

2.59 By the 1980s it was apparent that most Asian countries knew how to encourage their farmers to grow enough wheat or rice to meet domestic goals for food security (which was sometimes, but not always, interpreted to mean self-sufficiency). With the real value of these commodities in world markets at low levels, the economic value of this achievement, especially at the margin, was questionable. Where, then, should governments put their resources? Since the mid-1960s, they went mainly into food production, especially rice and wheat, but production successes alone did not solve the problem of food consumption nor will they raise farm incomes in the future if prices remain low. Other policies that address farm incomes--access to non-cereal markets and off-farm employment--will be needed, and for these, diversification policies will play an important role. What is clear is that production of rice (and wheat in South Asia) can no longer propel growth in the agricultural sector. There will remain a need for sufficient grain for food security, and for large Asian countries this means growing most of it domestically. But policies that generate these grain supplies need also to be consistent with the longer-run process of shifting out of grain production specifically, and out of agriculture more generally, as part of the structural transformation.

Diversified Agricultural Production

2.60 In most developing countries of Asia, the preoccupation with self-sufficiency in cereal production has understandably diverted resources from production of export-oriented crops. A policy of balanced incentives for production for domestic and external markets, coupled with improvements in institutional and technological support, would benefit the agricultural sector in the long run.

2.61 Many countries, especially in Latin America and Africa, have found it difficult to strike the right balance between support for primary food grains such as wheat and rice, secondary foodstuffs such as starchy staples with low or negative income elasticities, higher-value pulses, vegetables, fruits, and livestock products, and crops destined specifically for export. Allowing the market to be the sole determinant of this mix runs the risk of undervaluing foods for the poor and food security in general, whereas high-income consumers and export markets are well served. Concentrating too much on basic foods, however, can lead to rigid production systems that are unable to adjust rapidly to surpluses and discrimination against earning foreign exchange.

2.62 Most Asian countries have done reasonably well in striking this balance. They stressed domestic food security through developing their rice sectors intensively and earning foreign exchange from tree crops and other commodities, which have relatively little interaction with the rice economy. The problem with this strategy emerged only in the mid-1980s, and then only as a problem of success. There was too much rice, at least temporarily. The surpluses did, however, reveal a gap in most agricultural development strategies in Asia: a neglect of the "intermediate" agricultural sector that is neither basic food staple nor traditional export crop. The important policy question is whether diversification into this intermediate sector from both the rice sector and the more traditional export crop sector is technically and economically feasible (see Chapters 3 and 4). Experience with this process varies, both with respect to individual commodities and with respect to countries.

Corn

2.63 Corn, the third most important food crop in Asia, is produced as food for both humans and livestock. Since its agronomic potential in Asian settings has lagged behind that of rice and wheat, growth in output of corn--an increase of about 30 percent between 1973 and 1982--has been less spectacular than that of the other food grains. Indonesia, Thailand, and the Philippines had the most significant gains in output; both yields and area increased. Thailand has become a substantial regional exporter of corn for livestock feed.

2.64 No intensive livestock industry has been built anywhere in the world without two key ingredients: a low-cost energy source, and high-quality protein supplements. Corn and other coarse grains have almost universally supplied the low-cost energy for all types of livestock, and soymeal has been the most cost-effective protein supplement. In any given circumstance, substitutes for both of these commodities are potentially competitive, but they usually face some cost disadvantage. Countries wishing to stimulate a livestock feed industry to use domestically produced crops and by-products of agricultural processing, where corn and soymeal must be imported, should evaluate the technical and cost efficiency of their domestic alternatives against these costs of imports. If corn can be grown domestically, even limited protection against imports of corn can carry a significant cost disadvantage for the country's livestock industry because livestock feed is such a large share of total costs of production. Although the technical efficiency of making greater use of local products in feed rations--use of cassava supplemented with protein or use of by-products of agricultural processing such as rice bran for the energy component--is reasonably well researched, understanding is quite incomplete of how an entire feed system could mobilize regular supplies of these products, gain stable access to complementary protein meals that must be imported, and price the resulting product to be competitive with more traditional ration formulations borrowed from developed countries.

Root Crops, Legumes, and Horticultural Crops

2.65 Unlike basic cereals, the production of other secondary food crops---cassava, sweet potatoes, soybeans, mung beans, peanuts, potatoes and others--has not increased in significance largely because they are not included in the preferential pricing policies and established marketing outlets for rice, wheat, and, increasingly, corn. In addition, secondary crops are generally neglected in agricultural research and extension, and it is unlikely that a "technology package" approach would work for these secondary crops because, compared with rice or wheat, they are grown under much more varied conditions. Demand for several of these commodities, especially the secondary starchy staples, has also lagged as consumers switched to rice and wheat as incomes rose. Demand for these commodities as livestock feed may reverse this picture, however, and cassava and sorghum in particular might find dynamic domestic markets if a modern feed industry emerges.

2.66 There is also potential growth in horticultural crops, as farmers supply fresh fruits and vegetables to domestic markets and possibly for export. This potential is highest in the ASEAN-4 countries because of their agricultural processing industries, higher levels of income, and relatively greater urbanization. Farms located close to urban markets have a distinct comparative advantage in supplying fresh produce when the marketing system is still primitive. More distant areas become competitive as marketing costs are reduced. In the absence of rapid income growth and aggressive efforts to develop new products, the potential of the domestic markets can be quite limited, however, and in such a stagnant environment a relatively small number of producers can provide the necessary supplies. The difficult task, once economic growth stimulates potential consumer demand for higher-quality and a broader array of fruit and vegetable products, is to create the infrastructure for a rapid entrepreneurial response.

Livestock Products

2.67 Traditionally the livestock sector has been neglected because it competes with production of food grains. Many governments have been reluctant to promote livestock production because of the fear that in areas of low incomes and food-grain deficits, a shift from production of domestic food grains to feed grains or the use of food grains for livestock feed would cause an increase in the prices of staple foods to impoverished households. As governments have faced new problems of surplus food grains and downward pressure on prices in the 1980s, livestock production has received more attention. With rising per capita incomes, taste preferences of consumers for livestock products, and the high value added in the production, processing, and manufacture of meat, eggs, and dairy products, more countries may attempt to accelerate domestic livestock production by encouraging research and investment in intensive operations and by introducing trade policies that favor imports of feed grains rather than imports of meat and dairy products.

2.68 In the newly industrializing economies of Taiwan and the South Korea, where income was growing rapidly and per capita incomes were higher than in the ASEAN-4 countries, consumption of livestock products increased rapidly, and domestic production based on imported feed grains rose to meet the demand. In these two countries, the amount of feed used per unit of livestock output rose continuously, largely because farmers raised pigs and poultry, which require intensive grain feeding. The growth in demand for livestock products and feed grains in these economies is indicative of what might happen in ASEAN-4 countries that achieve rapid economic growth. In several of these countries, however, the increased demand for feed grains might be met by increased domestic production rather than imports, as has been the case in Indonesia.⁹

9/ The Indonesian government's concern that imports of feed grains, particularly corn, would rapidly increase prompted a study of the corn economy and the livestock sector. See C. Peter Timmer, editor, The Corn Economy of Indonesia (Ithaca: Cornell University Press, 1987).

2.69 The demand for livestock and dairy products has been rising in all the developing countries of Asia, especially in the ASEAN-4 countries, where per capita income is higher than in South Asia. The supply of livestock and dairy products has been constrained in the mid-1980s by several factors. In densely populated areas, pasture land and fodder are scarce, and production of feed grains has low priority relative to production of food grains for consumption by humans. Marketing facilities and infrastructure are inadequate, disease is a major problem, and the veterinary, technical, and extension services are weak. The requirements for credit for livestock and dairy production are quite significant. Farmers face a long time horizon before they receive a stream of revenues, and current input costs of modern husbandry are substantial.

2.70 Compared with production of large ruminants (cattle), there have been fewer limitations on expanding production of poultry, small ruminants, and (in non-Muslim areas) pigs. Livestock production that generally requires less land and fewer non-land inputs is likely to be more suited to most regions in developing Asian countries than cattle production. Poultry, small ruminants, and swine can be a major source of additional income to smallholders and rural households with small land holdings.¹⁰ Development of livestock production potentially can help meet equity objectives of rural development through its contribution to cash income of small farmers, particularly if a labor-intensive livestock strategy is adopted. Value-adding industries associated with livestock products, including slaughterhouses, transportation, and marketing, generate rural income and employment. With economic growth and improved refrigerated storage, transport, and marketing facilities, constraints on marketing and processing of perishable products may be eased, encouraging more rapid expansion in production and consumption of livestock products.

10/ Integration of village and backyard poultry production with commercial enterprise has been successful in Thailand. Private firms supply inputs, technical advice, marketing services, and credit for smallholders who raise chickens, and they share in the profits. Effective organization and marketing, along with adequate support in technical areas such as quality and disease control, are elements in successful involvement of smallholders.

2.71 Policies in many countries concerning cereals and livestock are in need of review and modification. Countries with surplus rural labor, for example, could investigate the feasibility of labor-intensive livestock production to meet equity objectives of increased employment as well as provide greater supplies of livestock products to meet market demand from higher-income consumers. Historically, most governments created disincentives toward domestic production of feed grains and erected barriers against imports. If gaps between the projected demand and supply of cereals used for livestock feed cannot be met by imports, however, market forces could lead to higher prices for meat and feed grains. This would adversely affect food consumption of the poor if grains such as sorghum and corn play a significant role in their diets. Keeping wheat and rice prices low will not help these low-income consumers very much. Consequently, a price policy that protected producers of feed grains or restricted imports while it transmitted low international prices of more preferred grains into the domestic economy will discriminate against the poor in two ways: it will raise the cost of their basic foodstuff; and it will limit the growth of income opportunities from a more dynamic livestock sector. Only surplus producers of feed grains would benefit. Although some of the rural poor may be in this category, with respect to grain production most are net deficit households.

Tree Crops and Export-Oriented Crops¹¹

2.72 The export-oriented crop subsector is second in size to staple cereal production in most Asian developing countries. The export of coconut, rubber, palm oil, cotton, jute, coffee, tea, sugar, and other tropical products provides a major share of foreign exchange earnings. Many of these crops are processed or used as raw materials by industry and are therefore important for growth in both agriculture and industry.

^{11/} This section is drawn extensively from Vijay S. Vyas and William E. James, "Asian Agriculture" in S. Ichimura, Editor, Development Strategies and Productivity Issues in Asia (Tokyo, Asian Productivity Organization, 1988).

Because of their high labor requirements, they provide rural employment, and their production is widespread among smallholders.

2.73 The high prices of export crops during the commodity boom of the early 1970s encouraged area expansion, which played a major role in increased production of crops for export in Thailand, Malaysia, and Indonesia. In addition, new plantings of improved varieties of rubber, coconut, and palm oil and increased inputs led to higher yields, particularly in Malaysia. Thailand and Malaysia were able to improve productivity and lower costs. They had far better growth performance when prices were depressed in the 1980s than other countries, such as the Philippines, where productivity of major export crops slumped.

2.74 From the standpoint of income distribution and poverty amelioration, improvement in the productivity of smallholders in the developing countries of Asia is of particular importance. Smallholders have been reluctant to adopt the costly approaches to production, including replanting, large amounts of working capital, and intensive management and supervision, used by modern estates. With greater investment comes greater risk of loss if prices decline. The reluctance of smallholders to adopt such technology results from their own calculation of benefits and costs, as well as constraints in access to credit and in levels of knowledge, skills, and management capacity. The performance of rural financial institutions, research, and extension services are of great importance in easing these constraints, as individual country experiences demonstrate.

2.75 Thailand. Agricultural exports from Thailand are the most highly diversified of any of the ASEAN-4 countries. Significant change has occurred since 1970 when four crops--rice, rubber, corn, and cassava products--comprised about 85 percent of agricultural exports. By 1985 this share had declined to 65 percent as Thai producers branched out into production of a wide variety of nontraditional products, such as natural orchids, canned pineapple, coffee, canned fish, and dried cuttlefish (see Table 2.8). A substantial share of the increase came from processed commodities as domestic and foreign firms took advantage of low wages and readily available fresh commodities to build a successful export-oriented

Table 2.8: Principal Exports of Thailand, 1970-1985, in Current Prices

Export Commodity	Share of Exports ^a (percent)				Rate of Growth (percent per year)		
	1970	1975	1980	1985	1970-75	1975-80	1980-85
Traditional Agro-products	55.7	57.5	43.8	34.4	25.8	17.7	2.7
Rice	17.0	13.0	14.6	11.6	18.4	27.2	2.9
Rubber	15.1	7.7	9.3	7.0	9.3	28.9	1.9
Maize	13.3	12.7	5.5	4.0	23.7	5.1	1.1
Tapioca products	8.3	10.2	11.2	7.7	30.3	26.5	0.1
Sugar	0.6	12.7	2.2	3.2	127.2	-12.2	16.0
Tobacco leaves	1.3	1.3	1.0	0.8	23.6	19.2	2.9
Nontraditional Agro-products	7.5	11.2	12.7	18.2	35.6	27.4	15.7
Other Crops, Fruits and Vegetable products							
Mung beans	1.7	1.0	1.1	1.2	12.8	25.5	9.5
Sorghum	0.7	1.1	0.5	0.5	36.2	6.5	9.7
Fresh fruits	0.2	0.2	0.2	0.4	32.0	25.6	20.0
Natural orchids	0.0	0.0	0.3	0.3	n.a.	n.a.	2.9
Raw cotton	0.1	0.0	0.3	0.1	4.3	74.8	-9.3
Coffee	0.0	0.0	0.1	0.5	n.a.	n.a.	38.5
Kapok fiber	0.9	0.4	0.2	0.1	4.8	8.6	-2.0
Canned pineapple	0.4	0.8	1.1	1.7	44.5	32.9	18.1
Molasses	0.3	1.1	0.3	0.4	60.4	-5.3	15.8
Subtotal	<u>4.3</u>	<u>4.6</u>	<u>4.0</u>	<u>5.1</u>	<u>26.4</u>	<u>21.3</u>	<u>13.0</u>
Seafood Products							
Prawns	1.5	2.0	1.5	1.8	31.8	17.1	11.9
Fresh cuttlefish	0.3	1.1	1.0	1.1	68.3	20.5	10.3
Fish meal	0.2	0.3	0.7	0.3	31.2	48.2	-9.0
Fresh fish	0.2	0.3	0.3	0.7	28.4	25.6	29.3
Dried cuttlefish	0.0	0.2	0.3	0.5	n.a.	29.7	22.6
Canned fish	0.0	0.1	0.5	2.7	n.a.	77.7	53.9
Canned crustaceans	0.0	0.1	0.7	1.1	n.a.	89.9	16.8
Subtotal	<u>2.2</u>	<u>4.1</u>	<u>4.9</u>	<u>8.2</u>	<u>40.8</u>	<u>29.1</u>	<u>19.3</u>
Animal Products							
Unworked feathers	0.1	0.0	0.1	0.2	-11.1	68.3	23.8
Frozen poultry	0.0	0.0	0.5	0.8	n.a.	135.8	17.5
Subtotal	<u>0.1</u>	<u>0.0</u>	<u>0.6</u>	<u>1.0</u>	<u>1.1</u>	<u>110.8</u>	<u>18.5</u>
Other Agro-processed Products^b	0.8	2.5	2.0	3.9	58.4	29.8	12.1
Total Agro-products	63.2	68.7	56.5	52.6	27.1	19.5	6.2
Other Manufactured Products^c	14.5	13.8	25.5	26.2	23.7	40.4	8.3
Other Products	22.3	17.5	18.0	21.2	19.0	25.0	11.4
GRAND TOTAL	100.0	100.0	100.0	100.0	25.0	24.2	7.7

^a Totals may not add up due to rounding up errors.

^b Footwear, wood products, jute products, furnitures and parts and leather gloves.

^c Nonagro-industrial manufactured exports.

Source: Table 5, Statistical Annex.

agro-industrial sector. At the same time, the share of non-agriculturally based exports grew even more rapidly, and by 1987 total agro-based exports provided less than half of Thailand's export earnings.

2.76 Thailand's diversification into agro-processing for export is even more remarkable in view of the depressed world market for agricultural commodities. The success is partly due to precisely this factor. Many of the products Thailand is exporting have very small producer constituencies in the OECD countries, and depressed markets for the raw commodities lower the costs of processors. In addition, Thai farmers have proved remarkably flexible in responding to new market opportunities, not so much by switching out of traditional commodities but by opening new land or producing in the off season for rice. Second, a dynamic private sector has been willing to invest in these export opportunities, largely because there is little fear of expensive or disruptive government interventions to benefit farmers, domestic consumers, or the treasury. Lastly, the Thai government has been willing to let the agricultural sector adjust to lower world prices without significant efforts to cushion the burden of the process. Once the rice premium, a de facto export tax on rice, was reduced to zero, major discrimination against the agricultural sector was ended, apart from macroeconomic biases reflected in the exchange rate, interest rates, and level of industrial protection. Thai farmers are among the few exporters in the world who must compete with hardly any subsidies. This fact is likely to spur more rapid structural change in Thailand as rural households shift labor to off-farm employments at an accelerating rate.

2.77 Malaysia. Until the early 1970s, Malaysia's agriculture and virtually its entire economy were based on production of rubber, paddy rice, and coconut. At that time cocoa and oil palm were almost unknown in Malaysia. In the 1970s, Malaysian growers substituted the more profitable palm oil for rubber and as a result achieved high productivity and export earnings. Its export of palm oil represents about 70 percent of world exports. Rubber has been a declining industry in the country because its profitability does not compare favorably with that of oil palm and cocoa. Rubber smallholders remain one of the poorest groups. Since the plantation estates cannot readily increase their total area, many growers have removed

rubber trees to make room for other tree crops. By 1985 over one-third of agricultural land was used to produce oil palm and cocoa. Nevertheless, Malaysia still remains the world's dominant producer and exporter of rubber. Its share is about 50 percent of total exports of rubber, despite gains by Indonesia and Thailand.

2.78 Diversification of exports has been a policy goal since the 1960s, although the food sector remains heavily dominated by rice. Government policy has concentrated on expanding export crops (rubber, coconut, oil palm, and cocoa) while importing food produced relatively cheaply in neighboring Burma and Thailand. But over 70 percent of Malaysia's agricultural land is devoted to rubber and palm oil, which makes it very vulnerable to price swings in international commodity markets. The fall in commodity prices in the 1980s has caused Malaysia to be concerned over its dependence on a small number of agricultural-based exports.

2.79 Indonesia. Like Malaysia, Indonesia embarked on ambitious programs of area expansion for major tree crops, particularly palm oil. As areas planted in past years begin to produce, Indonesia's supply of crops for export will increase, but strong competition with other Asian countries for external markets will require producers to improve quality and take measures to hold down costs. The emphasis on improving yields and quality through expansion of state-managed plantations and nucleus estate schemes for rubber, coconut, and palm oil has been somewhat successful, but costs have been high. The large number of smallholders in rubber and coconut production, who account for larger shares of area and production than do modern estates in Indonesia, have not participated in the productivity gains to a significant degree. Because of sharp declines in petroleum-based revenues in the mid-1980s, it has been difficult for the government to increase efforts to provide technical assistance and credit for improved planting materials and increased use of inputs, but the resulting depreciation of the rupiah has sharply increased profitability of smallholder production of export crops. Both short-run and long-run supply responses are likely.

2.80 Export crops are gaining importance as a means of diversifying Indonesia's economy and exports away from petroleum. Opportunities exist for efficiently increasing production of cocoa, pineapple, bananas, spices, horticultural products, and a few import-replacing crops, such as corn. But Indonesian authorities have often sought to replace imports with domestic production for sugar, dairy products, and soybeans, for example, even at high cost. The domestic supply and demand for sugar have been balanced at a domestic price that was three times the international price in the mid-1980s (but which was only 50 percent higher by early 1988). High-cost sugar displaced other crops, including rice, cassava, corn, or other secondary crops that received little protection.

2.81 The Philippines. The situation in the Philippines contrasts sharply with that of other ASEAN countries and Thailand in particular. While it is true that the major export crops, sugar and coconuts, have suffered from the fall in international prices in the 1980s, ill-advised policies explain much of the poor performance of exports. In previous years, the Philippines relied on these two traditional export crops for sustaining export earnings in the face of oil shocks and recessions. The government imposed export levies on these crops and increased its control over marketing and processing. Coconut production is dominated by smallholders, many of whom have few alternative sources of income or employment. Large-scale sugar estates figure more prominently in production, although there are also numerous smaller production units. Sugar estates are somewhat geographically concentrated on Negros Island, whereas coconut production is more widely dispersed.

2.82 In principle, government policies for sugar and coconuts were to encourage replanting of higher-yielding varieties of coconut and also raise sugar yields, while smoothing out fluctuations in earnings and stabilizing domestic prices of refined sugar and coconut oil. In practice, it created disincentives to producers and stifled investments that would have enhanced productivity. The export levies kept domestic consumer prices down for a time, but revenues garnered during years of favorable external market demand were not plowed back into production. When external markets were weak, agencies created by the government were unable to provide relief to

hard-pressed planters. The collapse of sugar production and exports in the 1980s and the stagnation in coconut exports demonstrated the negative effects of misdirected government intervention.

2.83 Less-important export crops, which were not excessively regulated, showed strong gains in production, but they were not large enough to offset declines in production and exports of the two major crops. Bananas became a significant export crop, and production expanded rapidly during the 1960s and 1970s but declined in the 1980s. Between 1970 and 1986, the Philippines increased the exports of mango, pineapple, coffee, cocoa, rubber, and black pepper. Recovery and rehabilitation of the export crop sector will be a pressing priority for the government for the remainder of the 1980s.

2.84 South Asia. While the ASEAN-4 countries have emerged as the leading exporters of diversified tree and field crops in Asia, export crops in the countries of South Asia performed rather poorly in the 1970s and early 1980s. Plantations producing tea, sugar, rubber, natural fibers, and coconut have been extensively regulated with regard to labor practices, marketing, and pricing. Sri Lanka nationalized tea plantations (and most other plantations as well), and productivity stagnated or declined. Lax management, inadequate budgets for research and investment in new varieties, and greater concern for making political gains than economic ones from control of the plantation sector have contributed to slow growth.

2.85 The range of crops grown in India, Burma, and Sri Lanka is diverse, but major exports from the sector are still largely confined to tea, rubber, jute, and small amounts of coconut. Sri Lanka's expanded production of secondary food crops, fruits, and vegetables is beginning to be reflected in higher export earnings. Together with minor export crops (coffee, pepper, cloves, cocoa, and others), these crops accounted for 5 percent of total exports in 1984. Other South Asian countries have even narrower export bases: Bangladesh exports mainly jute and tea; Pakistan, cotton and rice; Nepal, jute and ghee.

Fisheries

2.86 Asian developing countries have steadily increased their share of the world's total fish catch: from 12 percent in 1965, to 14 percent in the early 1970s, to almost 20 percent by the early 1980s. The volume of production in Asia more than doubled between 1965 and 1982. Marine fisheries account for 80 percent of total production; inland fisheries and aquaculture account for the remainder. In the majority of Asian developing countries, expanded marine production has contributed strongly to growth in agricultural GDP, employment, and foreign exchange earnings.

2.87 Fish are a major source of animal protein in the diets of Asian peoples, and rapid expansion of supply has been necessary to meet domestic demand. In most South Asian countries (except landlocked Nepal), fish production has been adequate to meet this demand and to supply some surplus for export, particularly higher-value products such as shrimp. Bangladesh has rapidly expanded exports of fresh and frozen shrimp products. In the Philippines, fish production grew at a moderate pace, but aquaculture, which is export-oriented, has increased production rapidly in recent years. India has the largest fisheries industry. By the early 1980s, Thailand, Indonesia, and the Philippines produced nearly 2 million tons of fish a year. Between 1973 and 1982, growth in exports of fish products was exceptional in each of these countries, and exports to Japan and the United States increased sharply.

2.88 There is potential for increased fish production. Growth of the industry has been enhanced by the extension of exclusive zones to 200-mile limits; marine production capacity is great in the vast Indo-Pacific oceanic regions. Current production is below maximum sustainable yields in Indonesia, Malaysia, Bangladesh, Pakistan, India, Burma, and Sri Lanka. The development of aquaculture and brackish-water ponds in coastal areas also has potential in large parts of Asia, particularly in Indonesia and East Malaysia.

2.89 Within marine fisheries, the dominant source of supply, the expansion of commercial fishing often involves a direct trade-off between equity and growth. Indonesia in the 1980s instituted a trawling ban in waters traditionally worked by artisanal fisherman, despite subsequent declines in production and exports. Diversification for traditional fishing villages will become an important issue in these countries in the near future as it is unlikely heavily-fished coastal waters can continue to sustain a growing population of small-scale producers.

2.90 Environmental problems and inappropriate fishing practices constrain growth in fish production in the future. In all the Asian countries, overfishing and pollution of coastal waters adjacent to urban centers and densely populated rural areas have further reduced the fish catch of artisanal fishermen. As a result, small fishing villages in these areas have suffered declines in income.

Forestry Products

2.91 Among Asian countries, there are great disparities in the distribution of forestry resources. Southeast Asia, particularly Indonesia and Malaysia, have large expanses of tropical forests, whereas forests in South Asia have been critically depleted where fuel wood has become increasingly scarce. But even in Southeast Asia, the disappearance of natural forests or their degradation is reaching alarming proportions. Thailand, once a major exporter, has become a net importer of tropical hardwood. The Philippines has experienced declining production because of falling timber prices and deforestation of natural stands of timber and it is expected to become a net importer by the end of the 1980s. Despite their relatively rich forest resources, Malaysia and Indonesia are having difficulty supplying wood-processing industries with logs. Forestry plantations based on fast-growing hardwood species are one alternative that is increasingly pursued, but such projects have uncertain economic returns.

2.92 Historically, forestry has provided substantial export earnings and government revenue to the countries of Southeast Asia. But its contribution to growth in agricultural GDP has been declining rather sharply in the 1980s as forests have been cleared for agricultural uses.

In Asian developing countries in 1981, forests covered about one-third of the land area, over 300 million hectares, but it is estimated that 11 million hectares a year are deforested and that the rate is accelerating.

2.93 Agro-forestry is a key sector for rural diversification. Both traditional industries and crafts (wood-carving, folk medicine) and new industries (rattan and wood furniture, pulp and paper, plywood and ready-made housing) depend on a sustainable and reliable supply of forestry output. Other farm activities are also heavily dependent on the forestry sector--fodder and forage for livestock, fuelwood for pottery kilns and cooking. Investment in fast-growing, economic tree species would seem to have high returns if suitable varieties can be developed and problems of property rights and land tenure can be resolved. The ability of forestry to contribute to diversification is currently limited by the excessive depletion of resources.

2.94 The degradation of forests in watershed areas has contributed to severe environmental problems. Soil erosion, flooding, and drought are common results of deforestation. In turn, erosion has led to siltation of irrigation reservoirs and canals, thus limiting crop production, particularly during the dry season, and reducing the net benefit from expensive investments in water control. The need for new and effective approaches to forestry management is urgent. Development of community forestry programs, replanting schemes, and increased protection of remaining forests are required. The severe environmental externalities caused by deforestation justify strong conservation measures.

**CHAPTER 3. THE AGRONOMIC AND TECHNICAL FACTORS IN
CROP DIVERSIFICATION**

3.01 From an agronomic perspective, many environmental factors determine the suitability of areas for specific cropping systems. Among these factors are soil quality and drainage characteristics, elevation and slope, rainfall (annual totals and distribution), minimum and maximum temperatures, humidity, intensity of sunlight, and day length. Various technologies, such as irrigation and fertilizer, have allowed farmers to overcome or mitigate environmental constraints, but in many cases, these constraints make it prohibitively costly to alter patterns of agricultural production. The environmental differences among regions of Asia are quite pronounced. In northern India and Pakistan, wheat can be grown in semi-arid temperate areas, whereas in Malaysia, in the humid tropics, it rains virtually everyday, and oil palm can be grown. No amount of investment in infrastructure, except in a totally controlled artificial environment, will allow Malaysia to grow wheat or Pakistan to grow oil palm. The rubber tree requires about 2,500 to 3,000 millimeters of rainfall a year, with an even distribution, whereas the growing season for sugar cane requires about one-half the total annual rainfall and a dry season for the carbohydrates to convert into sugar. Environmental factors can thus limit the degree of crop diversification and cause regional specialization.

3.02 Despite the extreme environmental constraints that are often related to climatic factors, there is some flexibility in altering soil characteristics and water regimes by means of irrigation and soil amendments. Major problems for increasing the flexibility of Asian agricultural systems, however, have been twofold: the concentration of previous efforts on production of a single crop - rice; and the large emphasis on tree crops. Oil palms, rubber, and coconuts require four to seven years to come into bearing, and the trees are only replanted after 20 to 25 years. The agricultural systems of Asian countries that are based primarily on rice and tree crops are inflexible. In some cases, the limitations are more economic than agronomic. Trees can be uprooted and different crops planted, and soil modification and upgraded irrigation systems can make some rice-growing areas more suitable for other crops. Such investment is dependent on the market potential for alternative crops.

Land Types for Crop Cultivation

3.03 Rice growing has been uniquely suited to the agronomic and economic conditions that prevail in much of Asia: heavy clay soils, abundant rainfall in annual or semi-annual monsoons, tolerance of rice to waterlogging and flooding, availability of abundant labor for transplanting, weeding, and harvesting, and relatively small farms, which can be worked with family labor for most of the growing season. With improved rice varieties and water control, farm households in areas of high population density have been able to grow enough rice for their own consumption and often have a surplus for sale. The main factor in modernizing rice production in Asia has been the adoption of short, stiff-strawed, high-yielding varieties of rice that are responsive to fertilizer and improved water control through irrigation. Farmers have used a combination of traditional and modern practices, emphasizing those that increase yields per hectare, since in most cases land is their most pressing constraint on production.

3.04 Multiple cropping and improved water control have spurred gains in rice production and rural incomes. The development of rice varieties with shorter growing seasons and the reduction in days to maturity from the 150 to 200 days required for traditional varieties to about 130 days for the first IRRI variety released in the mid-1960s to 110 days for IR-36 released in the mid-1970s made it possible for farmers to avoid drought in areas of restricted water supply and to harvest two or even three rice crops a year in areas with more plentiful water.¹² Since the mid-1960s, developing Asian countries, often with financing from foreign donors, undertook numerous irrigation projects for rice production, some devoting over 75 percent of their public spending for agriculture to irrigation projects. About 85 percent of the developing world's irrigation area is located in Asia.¹³

^{12/} See Randolph Barker and Robert W. Herdt, with Beth Rose, The Rice Economy of Asia (Washington, D.C.: Resources for the Future, 1985), pp. 128-129.

^{13/} See "Annual Report, 1984-85" (Colombo, Sri Lanka: International Irrigation Management Institute, 1985).

3.05 With multiple cropping has come increased demand for hired labor. The decrease in demand due to mechanized land preparation and threshing has been more than offset by increased demand for hired labor to weed, harvest, and perform other operations, such as applying fertilizer and pesticides. Increased availability of irrigation water in the dry season has contributed to the hiring of labor for the dry-season crop. Commercial activity and infrastructural support required for high-yielding varieties has had positive effects on rural employment, but because of past high rates of growth in population (in some cases continuing) the need for off-farm employment remains great. In densely-populated areas, succeeding generations of Asians cannot all earn a living from farming, and in the ASEAN-4 countries most now do not.

3.06 Most farms in Asia are small - the size of the vast majority is less than 2 hectares. Bangladesh, India, Indonesia, South Korea, and Japan have an especially large number of holdings below 1 hectare, whereas Thailand and the Philippines have relatively few extremely small holdings (see Table 3.1). There tends to be an inverse relationship between farm size and intensity of land use, and it is common to find higher yields of rice per hectare on smaller farms. Using intensive cultivation practices, a typical family would find it difficult to farm more than 1 to 2 hectares of paddy rice. The scarcity of land encourages the intensive use of labor, particularly family labor, to obtain high yields, but the productivity of labor is reduced. Regardless of their efficiency in terms of output per hectare, many rice farmers earn low incomes because of the inadequate size of their holdings. The traditional, land-scarce, labor-surplus, agricultural economies in most Asian developing countries have made small farms both a necessary condition for and a result of rice production.

3.07 Most gains in rice production have stemmed from increased yields rather than expansion of cultivated area. While there was considerable area expansion between 1966 and 1980 in Indonesia, Malaysia, and Thailand, which resulted mostly from deforestation of tropical forests, in land-scarce South Asia the amount of arable land has increased only marginally, and it is falling in China (see Table 3.2). The productivity of arable land has been increased by irrigation, which for Asia as a whole increased

Table 3.1: Distribution of Farms and Farm Area by Size of Holdings in Asia (percent)

	0-1 ha		1-3 ha		3-5 ha		5-10 ha		over 10 ha	
	Farms	Area	Farms	Area	Farms	Area	Farms	Area	Farms	Area
South Asia										
Bangladesh, 1974	66	24	29	53	3	13	2 ^a	10 ^a	-	-
India, 1971	51	9	29	22	9	16	8	22	4	31
Pakistan, 1972	--	--	44 ^b	12 ^b	25	18	21	27	11	43
Sri Lanka, 1960 ^c	44	15	40	43	16 ^d	42 ^d	--	--	--	--
Southeast Asia										
Indonesia, 1973	70	29	24	38	3	13	2	10	1	10
West Malaysia, 1973	35	15	56	61	8	18	1 ^a	7 ^a		
Philippines 1971 ^c	15	3	54	34	22	28	7	17	3	19
Thailand, 1971 ^c	13	3	36	18	31	32	16	32	4	16
East Asia										
South Korea, 1974	67	58	25	35	8 ^d	7 ^d	-	-	-	-
Japan, 1970	67	33	29	46	2	7	2 ^a	14 ^a	-	-

^aIncludes all farms above 5 ha.

^bIncludes all farms below 3 ha.

^cIncludes only rice farms.

^dIncludes all farms above 3 ha.

^eSize categories for Thailand are 0-0.96, 0.96-2.4, 2.4-4.8, 4.8-9.6, over 9.6

Source: Adelita C. Palacpac, World Rice Statistic (Los Banos: International Rice Research Institute, 1982), p. 61-62/

by 2.4 percent a year since 1966. Bangladesh, Nepal, the Philippines, Malaysia, and Thailand had particularly high rates of irrigation development (see Table 3.2). In terms of area countries with the largest number of hectares of irrigated rice land are India, Pakistan, Indonesia, and Thailand. In some countries, rice is grown primarily on irrigated land-- virtually 100 percent of Pakistan's rice is irrigated--and most of the remainder is grown on rainfed, banded land that does not have permanent irrigation infrastructure. While irrigated area in Thailand, a traditional rice exporter, increased by almost 50 percent between 1966 and 1980 (Table 3.2), almost 75 percent of its rice land in 1979 was still nonirrigated (see Table 3.3). Throughout Asia, a small proportion of rice is grown in upland areas - rainfed, unbanded land, which is used primarily for non-rice crops.

3.08 This chapter looks at all three land types--irrigated and rainfed banded rice land and upland areas--to assess the flexibility farmers have in shifting out of rice production. Farmers within a country are not equally flexible, nor is it necessary for each and every farmer to introduce non-rice crops in the rotation or to expand existing production of such crops. But from one area of farms to another, and province to province, agronomic potential for rice production varies substantially. A country may have considerable flexibility among different farms and regions even when individual farmers specialize; land best suited for rice production can be farmed intensively to meet a country's requirements for food security, while farmers elsewhere can be encouraged to diversify their crops. For such a strategy to succeed, a government has to balance, in addition to agronomic factors, many economic ones, including the attitudes of its farmers toward risk, the profitability of growing different crops, and the adequacy of marketing facilities for non-rice crops.

Table 3.2: Arable Land and Irrigation Development in Asia 1968-1980

Country	Total Arable Land					Irrigated Land					Irrigated to Arable Land	
	1968	1980	Increase	Annual Rate		1968	1980	Increase	Annual Rate		Ratio (%)	
	('000 ha)	('000 ha)	('000 ha)	(%)	(%)	('000 ha)	('000 ha)	('000 ha)	(%)	(%)	1968	1980
South Asia												
Bangladesh	8,850	8,928	78	0.88	0.08	620	1,620	1,000	161.29	7.10	7.01	18.15
Burma	9,920	9,573	-347	3.50	-0.25	773	999	226	29.24	1.85	7.79	10.44
India	158,590	165,200	6,610	4.17	0.29	26,660	39,350	12,690	47.60	2.82	16.81	23.82
Nepal	1,821	2,138	315	17.29	1.15	105	230	125	119.05	5.76	5.77	10.76
Pakistan	19,837	20,030	193	2.52	0.18	12,490	14,300	1,810	14.48	0.97	63.93	71.39
Sri Lanka	792	1,028	233	29.42	1.86	398	525	127	31.91	2.00	50.25	51.22
Subtotal	199,510	206,892	7,382	3.70	0.26	41,048	57,024	15,976	38.72	2.38	20.57	27.56
Southeast Asia												
Indonesia	12,600	14,200	1,600	12.70	0.86	4,175	5,418	1,243	29.77	1.88	33.13	38.15
Malaysia	880	1,000	120	13.64	0.92	238	360	122	51.28	3.00	27.04	36.00
Philippines	7,120	7,050	-70	0.98	-0.07	740	1,269	529	71.49	3.93	10.39	18.00
Thailand	11,418	16,250	4,835	42.36	2.55	1,768	2,630	862	48.78	2.88	15.49	16.18
Subtotal	32,018	38,500	6,485	20.25	1.53	6,921	9,677	2,756	39.82	2.42	21.62	25.13
TOTAL	231,528	245,392	13,867	5.98	0.42	47,967	66,701	18,734	39.05	2.38	20.72	27.18

Source: FAO, Production Year Book, various issues.

Table 3.3a: Share of Rice Area Irrigated and Planted to Modern Varieties in Selected Countries of Asia, 1975-1979

Country	Share of Area Planted to Modern Rice Varieties (percent)	Share of Rice Area Irrigated (percent)
Southeast Asia		
Indonesia	50	84
Malaysia	38	71
Philippines	68	42
Thailand	10	26
South Asia		
Bangladesh	15	12
Burma	6	17
India		
Central India ^a	34	18
East India ^b	21	28
North India ^c	82	89
South India ^d	66	83
West India ^e	50	23
Pakistan	43	100
Sri Lanka	61	64

^aCentral India: Madhya Pradesh, Maharashtra, Uttar Pradesh.

^bEast India: Assam, Bihar, Orissa, West Bengal, Manipur, Tripura, and Nagaland.

^cNorth India: Jammu and Kashmir, Punjab, Haryana, Himachal Pradesh, Delhi.

^dSouth India: Tamil Nadu, Andhra Pradesh, Karnataka, Kerala, Pondicherry.

^eWest India: Gujarat, Maharashtra, Goa, Damon, and Diu.

Source: Randolph Barker, Robert W. Herdt, with Beth Rose, The Rice Economy of Asia (Washington, D.C.: Resources for the Future, 1985), p.218

Irrigated Rice Land

3.09 The main objective of the irrigation projects implemented since the mid-1960s was to provide a steady supply of water during the wet season for the cultivation of rice under traditional wetland conditions. Irrigation during the dry season was of secondary consideration, and in most cases the reduced supply of irrigation water has been used to grow an additional crop of rice on a more limited area.

3.10 Sites for irrigation projects were originally selected because of their suitability for rice, and the systems were planned for rice production. This original purpose does not mean that other crops cannot be grown. But from an agronomic perspective, diversification from rice paddy to non-paddy crops (referred to as upland crops) is limited by existing irrigation facilities, growing season, soil types, drainage capabilities, and land preparation methods for rice. These constraints are highly related to each other and are shaped to a large degree by the geography of Asia and the unique characteristics of the rice plant, which is tolerant of waterlogging and intolerant of water stress.

3.11 Lowland rice, which is essentially an aquatic plant, has been found to perform best if the soil is kept under saturated conditions from the seeding and transplanting stages to about two weeks before harvest. The best water environment for rice seems to be a flooded condition, to a depth of 10 to 15 centimeters, which allows other benefits related to weed control, nitrogen management, temperature control, and chemical application.

3.12 Most areas where irrigated rice is grown in Asia have very heavy clay soils, which is ideal for rice production because the soil's capacity for water retention (poor drainage) helps maintain the high-moisture conditions required for rice. Most other crops are sensitive to poor drainage and continuous conditions of high moisture. The prospects for diversification in the wet season are thus limited in most irrigated areas, particularly those with poor drainage, because the availability of water in the wet season is excessive for upland crops. The potential in the dry

season depends on the soil's having adequate drainage capacity and on other factors discussed below.

3.13 Rice and upland crops differ in their water requirements in terms of volume and schedule. Most upland crops require much less water than rice but greater control over the rate of application. The amount of water adequate for rice in the dry season is about twice the daily water requirement of upland crops, such as soybeans, corn, peanuts, and mung beans. In terms of water consumption, the area of upland crops that could be grown during the dry season is twice that of rice. But upland crops need intermittent, rather than continuous, applications of irrigation water, thus requiring greater water control than most rice-based irrigation systems provide.

3.14 The traditional field-level irrigation method for rice production is basin irrigation. Fields are divided into small units so that each has a level (or nearly level) surface, and dikes are constructed around the areas to form basins, within which the irrigation water can be controlled. Traditionally, land is prepared by ponding a shallow depth of water and puddling it to obtain a perfectly flat surface. The basin irrigation system is well suited to continuous irrigation or flooding. In principle, some upland crops, fruit trees, and plantation-type crops can be grown using basin irrigation by flooding fields to a minimum depth and providing water at variable intervals.

3.15 In contrast to conventional basin irrigation, furrow irrigation is particularly suitable for irrigating crops that are subject to injury if water covers the stems of the plants. Farmers can plant upland crops in raised beds, which are irrigated by furrows placed between the rows of plants. Since the entire soil surface is not covered by water, efficient irrigation depends on lateral movement of water from the furrows. Considerable experience and labor is needed to divide water from the supply ditch into several furrow streams and maintain correct rates of flow until irrigation is complete. Construction of the furrows requires abundant labor (or heavy earth-moving machinery). Furrow irrigation takes place within the confines of the basin, and in some cases farmers intercrop rice

and upland crops. The dikes, or levees, that surround the basin are usually permanent and remodeled as necessary for repeated use.

3.16 There are inherent difficulties in switching between cultivation of irrigated rice and upland crops. The fundamental difference between the two methods of irrigation, basin or furrow, has considerable impact on the necessary degree of water control in the distribution system and the channel network at field level. The furrow method, supplying periodic and measured irrigation, requires greater control than the basin method of continuous irrigation and flooding. In addition, the puddling method of land preparation for rice requires areas of small units (basins) for the water supply to be level when flooding the field. An extremely level field has to be maintained to ensure even distribution of water within the basin. Upland crops usually require some slope to ensure better drainage. The grading of fields can entail considerable expense.

3.17 Since large-scale irrigation projects are planned for production of rice, the system is not geared toward crop diversification at the farm level. In almost all rice-growing areas, the dominant method of irrigation is basin to basin on a continuous basis. The size of irrigation service areas can vary from a few hectares to 50 hectares or more, depending on the topography and spacing between minor canals. Flexibility of individual farmers in cropping and water control is limited by collective irrigation and drainage practices. A practical requirement for diversified cropping may be that rice and upland crops not be planted in the same service units, since seepage of water from neighboring basins is difficult to avoid.

3.18 But such a directive does not solve the problem of providing better water control and drainage for upland crops. The operation of irrigation systems for non-rice crops is not the same as for rice cultivation, and a different orientation of operating staff is required. Non-rice crops require more intensive water management, both for the canal system and on the farm. In particular, such crops need a large delivery flow intermittently rather than the small continuous flow required for rice. Constant attention is needed to rotate supply among canals or outlets, supply water to individual fields for short periods of time,

adjust delivery of water to match the need of the crop for water, and control the delivery of water to ensure suitable stream size and avoid waste. Most irrigation projects lack storage capacity for the dry season - only about 25 percent of the total service area in Thailand has such capacity.

3.19 One cannot expect good irrigated paddy lands to be converted to non-rice production without substantial investment and excellent market opportunities¹⁴

3.20 More attention needs to be given to increasing the flexibility of farmers in the dry season. Improvements can be made in water control at the farm level (tertiary systems), better facilities for storage of water, and conservation of water during the wet season by lining water channels and controlling the general inefficiencies of the water delivery system. Investment in such improvements would increase the flexibility of the present system.

3.21 In areas where farmers have suitable soils and sufficient water control, they have diversified production during the dry season. Rice-growing areas in Malaysia, Sri Lanka, Indonesia, and the Philippines have more dry-season irrigation than do other countries in South and Southeast Asia (see Table 3.3). Whether they plant one rice crop or more depends on the amount of water available for the second crop season - if insufficient for rice, a non-rice crop is grown. The crop seasons for rice vary with the differing climatic conditions of Asia. In some areas farmers can plant a non-rice crop, such as corn, soybeans, or vegetables that fit the crop

^{14/} The specialty fruit and vegetable farms around Bangkok are one of the few examples where high returns seem to have justified large investment in converting land that was highly suited to rice production to other uses. The cost of constructing raised beds, modifying the soil, and upgrading the irrigation delivery systems was about US\$5,000 per hectare for the on-farm works alone. The area is able to take advantage of good markets nearby, and in this case, market-led diversification was sufficiently profitable that constraints could be overcome

calendar, in a third crop season, which is irrigated if there is sufficient water. In Southeast Asia, the introduction of short-season rice varieties allowed farmers to plant the second rice crop with a short-season variety and follow it in the dry season with high-yielding corn or soybeans, which have longer growing seasons (100 days or more) than those of traditional varieties. In north India, farmers were able to follow a short-season rice variety with a short-season wheat variety, thus growing two major grain crops a year.¹⁵ In such instances, new rice varieties have allowed farmers to adopt improved varieties of other crops. Improved facilities for local research and extension could play a major role in adapting crop varieties to fit particular niches in the crop rotation and to develop varieties resistant to local pests and diseases.¹⁶

3.22 Improvement or modernization of irrigation systems to permit diversification into non-rice crops has been complicated by the sharp drop in rice prices in the early 1980s. Until that time, most rice irrigation projects, including those for which all the infrastructure down to the on-farm water delivery works was built, were viable. Under the economic conditions of the 1980s, the only viable investments in rice irrigation projects are those that take advantage of sunk costs in existing infrastructure, and a detailed analysis of each project would be needed because of the sensitivity of the rate of return to low rice prices. Investment in improving the tertiary system and the distribution system may not be justified unless there is, as a result of using the water saved through more efficient operation, either a substantial increase in rice yields or an increase in cropping intensity, or both. Increased production of rice alone may not economically justify such improvements; the land may have to be planted to higher-value crops. Investment required for crop

¹⁵/ See Barker and Herdt, pp. 26-27.

¹⁶/ This section draws on field surveys conducted in Indonesia and reported in Stephen D. Mink, Paul A. Dorosh, and Douglas H. Perry, "Corn Production Systems," and in Stephen D. Mink, "The Economics of Input Use," in C. Peter Timmer, ed., The Corn Economy of Indonesia (Ithaca: Cornell University Press, 1987), pp. 62-104.

diversification would be undertaken only when there is sufficient indication that other preconditions, such as market demand, marketing facilities, extension services, and others, are met.

Rainfed Rice Land

3.23 More than one-half the rice land in Bangladesh, Burma, Thailand, and the Philippines was without permanent irrigation infrastructure in 1979 and in some cases by a substantial margin - 88 percent of Bangladesh's rice land, for example, is rainfed (see Table 3.3). For non-rice crops, rainfed rice systems share many of the same limitations of irrigated systems: growing season, soil quality and drainage capacity, and land that is divided into small, level banded fields. Unlike farmers of irrigated areas, farmers have far less control over water and must therefore carefully adjust the choice of crops and time of planting and harvesting to the weather.

3.24 What crops can be grown depends critically on the amount and timing of rainfall. In deepwater areas or in waterlogged, rainfed lowlands (such as river valleys), only rice can be grown in the wet season. In areas of high rainfall, rice is planted in the second crop season as well, and the crop must sometimes withstand the alternate stresses of excessive water and drought. In other parts of Asia, climatic and soil conditions are more favorable for growing non-rice crops. In the 1970s, 35 percent of the rice area in Asia was classified as shallow rainfed rice land. Farmers plant a rice crop at the time of peak rainfall, and many can follow it with two seasons of non-rice crops a year.

3.25 Timely planting and harvesting of the dry-season crops are particularly important. Farmers must complete the harvest of the second non-rice crop before the onset of the wet season, often hiring additional labor for harvesting and threshing and for preparing the land for the rice crop, all of which must be done in a short time (about two to three weeks). Labor requirements are also high for the first non-rice crop at the beginning of the dry season when the soil is too dry and hard to be plowed by draft animals and crops must be hand irrigated. In such systems,

farmers are restricted to short-season (75 to 85 days) varieties of commodities such as corn rather than higher-yielding varieties of corn or soybeans, which require 100 days or more and run the risk of late-season flooding at the onset of the wet season. With high labor costs and little scope for raising yields, it is difficult for farm households to increase total returns from such crops.

3.26 In the dry season, farmers in some areas of Indonesia have generally found it more profitable to plant an intercrop of corn and soybeans, corn and mung beans, corn and rice, or corn and melons than a monoculture crop. Managing pests, especially those that attack bean crops, is a complicated task in such intercropped systems, but farmers still find the planting system less risky than monocrops in the dry season. Research is needed to develop short-season, high-yielding varieties of commodities with greater resistance to pests and thus increase the flexibility of farmers, lower their risks, and raise total returns.

Upland Areas

3.27 It is important to recognize that much of the arable land in Asia is already planted to crops other than rice. For example, more than 85 percent of Malaysia's agricultural land is used to grow non-rice crops. Rubber, oil palm, cocoa, and coconuts occupy a vast proportion of the land - about 82 percent. With 14 percent of the land planted to paddy rice, only 4 percent is planted to other field crops. While this pattern represents an extreme in Asia, other Southeast Asian countries have somewhat similar patterns. The Philippines has large estates producing sugar and coconuts. The area in Indonesia's estate crop sector, which includes coconut, oil palm, rubber, and smallholder tea, coffee, and sugar cane, slightly exceeds that planted in paddy rice. The area farmed by shifting cultivation is 70 percent greater than that of paddy rice. While producers of tree crops and plantation crops such as sugar cane cannot be as flexible as other farmers in their response to crop diversification initiatives, the land can be devoted to other crops if economic conditions change.

3.28 When governments engage in a crop diversification effort, they are not directing their attention primarily to plantation owners and producers of tree crops but to the millions of small farmers whose land is devoted mostly to production of non-rice field crops. Upland areas encompass a wide range of land types. Marginal rice land with lower clay content is the most readily adapted to growing non-rice crops. Soils of lesser fertility are often a feature of hilly terrains, and eroded or stony soils limit the range of crops that can grow without major investment in soil modification. Dry, sandy limestone soils are often best suited to root crops such as cassava or to corn or sorghum, which are moderately drought tolerant. Farmers of such land are generally poor, and families are dependent on the production of food staples for their own consumption. They cannot plant tree crops such as clove, banana, or coconut, on their small holdings, which might raise their cash income, because they cannot forgo several years of crop production until the trees come into bearing. Farmers in other areas have highly acidic soils that require the addition of agricultural lime to increase crop yields. Problems of soil fertility have surfaced in newly settled agricultural areas that were part of transmigration projects, notably the resettlement of Javanese farmers on Indonesia's islands of Kalimantan and Sulawesi.¹⁷ As forests were cleared, the fragile soils that once supported rain forest have been depleted by crop cultivation. And at the extreme end of the range of land and soil types, slash-and-burn (shifting) agriculture is still a feature of some parts of Asia, and like other areas of former rain forest, the soil quickly loses its fertility after several crop seasons.

3.29 This diversity of land types means that government policies intended to promote crop diversification will not meet with an equal response from all farmers. The ability to respond is very much affected by the agronomic environment of their land. Some farm households cannot respond so flexibly to changes in commodity prices as others who can assume the risks of a new crop, can afford the cost of inputs, and can go into the markets and purchase food for part of their own consumption. Farmers may have land of only moderate productivity, but they do look for opportunities

^{17/} See The Economist, December 19, 1987, p.36.

for more profitable crops, whether smallholder papaya gardens, citrus plantings, peanuts, hot peppers, or cotton. In addition to farmers of rainfed rice land and farmers of irrigated rice land with dry-season irrigation, government efforts should be directed to this group of farmers who have favorable growing conditions for a wide array of non-rice crops and can shift a greater proportion of their production out of rice.

3.30 These farm households must make highly complex agronomic and economic decisions. They must decide what crops to grow, what inputs to purchase, and how to allocate the land for two or three crop seasons a year. They must compare the cost of producing each crop--the cost for seed, for the fertilizer and pesticides they require and for labor to plow, plant, weed and harvest - with their expected returns. The profitability and riskiness of different crops can vary enormously, and farm households must choose a mix of crops that meets their need for food and income and that is also suitable for the land type and growing conditions. For effective policies, governments must understand such farm decisionmaking; it is not simply the price of rice or the price of corn or beans or cotton, or even the price relationships among various commodities, that ultimately determines choice of crops. What farmers calculate is the total return and risks from all crops, which are a function of yields, the time different crops occupy the land, costs of labor and other inputs, and the effective prices offered by private traders or by government purchasing agents.

Inputs for Non-Rice Crops

3.31 The side effect of the heavy attention to rice intensification programs in most Asian countries has been the concomitant development of an input supply industry designed to reach small rice farmers with fertilizer, pesticides, seeds, credit, and machinery. Creating a modern and efficient input production and marketing system has not been as easy as developing the high-yielding seeds themselves or building the irrigation systems that made them productive. Indeed, it is remarkable how often fertilizer distribution is mismanaged by reserving it as a task either for cooperatives, which seldom function effectively, or for monopoly parastatals, which have little incentive to deliver appropriate products to

farmers when they are needed. Seed reproduction and distribution are also often restricted to government agencies, ostensibly to protect the purity of the genetic potential of the specific varieties, and the results have been widespread bottlenecks and failures to deliver quality seed on time. With all the problems, however, input supplies on behalf of increased rice production have generally reached farmers at costs that have permitted profitable use and higher output.

3.32 Non-rice crops have little of this supporting infrastructure to deliver crucial inputs. Wherever inputs for rice production can be diverted to other crops such as corn or soybeans, few problems are encountered unless government agents try to enforce "rice-specificity" of input use. Most governments have learned, usually painfully, that fertilizer, pesticides, credit, and tractors cannot be restricted to growing rice, even when farmers receive these inputs in subsidized packages designed to increase rice production. Only seeds are genuinely crop specific, but even subsidized seeds can be eaten or sold.

Seeds

3.33 Raising productivity of non-rice crops usually involves developing and marketing new seed varieties with higher potential productivity, in conjunction with other productivity-enhancing inputs. Creating and marketing new seeds for non-rice crops has lagged behind seed development efforts in the rice sector for two reasons. First, rice programs have received higher government priority and funding, so more resources, even on a per hectare or crop revenue basis, have been devoted to the rice seed industry. Second, non-rice crops are considerably more complex to develop because of the greater heterogeneity of growing conditions, consumer desire for quality and diversity, and the lack of suitable genetic materials for ready adaptation to tropical conditions. Government breeding programs have not responded very well to this complexity, and their record in seed development of non-rice crops is poor. By contrast, private seed companies have responded quite well to these opportunities when not prohibited from direct participation in research and marketing. Unfortunately, many countries have discriminated heavily against private seed companies,

especially those with multinational parents, and much improvement will be needed in the commercial environment before a dynamic and competitive seed industry emerges in these countries.

3.34 National and international agricultural research stations have a positive role to play in seed development for non-rice crops. High-yielding wheat and corn varieties developed at CIMMYT parallel the success of rice varieties developed at IRRI. Sorghum, millets, cassava, and some legumes are under development in CGIAR centers, although results are still mixed. Even when major improvements are made in basic genetic material, however, successful adaptation to the myriad local environments likely to be encountered at the margins of rice production, where diversification will first take place, still means a complex breeding, reproduction, and distribution effort will remain for each country. There is little evidence that public research programs and distribution mechanisms will be aggressive and efficient in these tasks.

Agricultural Chemicals

3.35 Increased fertilizer use, especially of nitrogen fertilizers such as urea, has provided much of the "fuel" for higher rice yields in Asia. High-yielding rice varieties and the irrigation facilities essential for their high productivity are sometimes described as the "motor" and "body" of an integrated system designed to transport passengers. Without additional nutrients supplied by fertilizer, modern varieties under irrigated conditions do not achieve their maximum potential yields - just as an automobile is limited by fuel availability in its distance traveled. Although farmers have sometimes been slow to learn this or to apply optimal quantities of fertilizer, there are now few Asian farmers growing irrigated paddy who do not purchase at least small quantities of fertilizer. Knowledge, risk, and constraints in obtaining credit may still limit these purchases to socially suboptimal levels, but the initial step of adoption has been taken by most rice farmers. In addition, much research has been carried out showing optimal levels of fertilizer use in varying circumstances, and the researchers' recommendations for applying a balanced set of nutrients to rice crops--the combination of nitrogen, phosphorus,

and potassium appropriate to different soils are commonly part of the message delivered by extension workers.

3.36 Virtually none of this story holds for fertilizer use on non-rice crops. Often the yields of upland crops have been too low and uncertain, the prices for their output too variable, and credit availability to finance inputs for non-rice crops too limited for farmers to use much fertilizer on these crops. In some circumstances, the story has been different. Indonesian farmers, for example, have used sizable quantities of urea on hybrid and improved open-pollinated corn varieties, and many farmers have thrown some fertilizer meant for their rice fields on their vegetable plots. But there is little systematic research into optimal fertilizer (and liming) practices for non-rice crops. The almost complete absence of a private fertilizer production and marketing sector exacerbates this problem. Without at least a few private firms in the fertilizer sector, a country thus fails to benefit from the incentive such firms have to discover formulations that have significant productivity effects for non-rice specialty crops and to market their private brands to farmers by explaining to them the actual benefits of the fertilizer in raising yields.

3.37 In locations where pesticides are widely available for rice farmers, their use tends also to be widespread on other crops grown in rotation or on nearby nonirrigated lands. There are many examples of misuse of pesticides in rice cultivation, including environmental damage caused by pesticide-contaminated water in paddies. A prime example of excessive spraying has been the problems with the brown planthopper in Indonesia and the Philippines, which has led to the destruction of natural predators. Pest management for non-rice crops can be substantially more complicated than for rice because intercropped systems are sometimes more attractive habitats for insects and plant diseases. (The opposite can also be the case, however; monocultures often present ideal breeding grounds for pandemic outbreaks of single pests.) Whatever the situation in a particular setting, developing appropriate pesticides for a wide range of potential crops that farmers might grow in response to a diversification away from rice is a more complex task than delivering two or three formulations that are suitable for controlling a wide spectrum of rice

pests. As control of rice pests moves toward integrated pest management (IPM) techniques, including crop rotations to break breeding cycles of rice insects, non-rice crops may begin to share the attention and approaches to pest control directed at rice.

Farmer Skills

3.38 Farmer skills are the backbone of a productive agriculture, but many are crop specific. One of the main reasons why farmers specialize in growing only a single crop is that it allows them to concentrate on learning a particular set of skills. Requirements for crop husbandry vary significantly, and some farmers are simply better at growing some crops than others. Even in the United States, farmers on adjoining and nearly identical land often routinely specialize in different crops because of these specific skills. Such practices suggest that crop-specific "learning by doing" is a significant factor in raising agricultural productivity. One means of improving responsiveness of farmers is through education and other human capital investments. Still one can make the case that when technology and institutional support for new cropping patterns are neglected price signals alone may not be adequate to induce a change in practices quickly enough.

3.39 The problem facing Asian countries is perhaps unique because of the magnitude of resources that have been put into rice production. Most farmers in Asia have substantial experience in growing rice, which biases their crop choice even when alternative crops offer nominally higher economic returns. To correct for this bias, governments can offer various incentives to diversify or, alternatively, remove incentives already in place. The easiest approach is to penalize rice growers by lowering rice prices. Governments usually control this price already, and it can be easily manipulated using trade instruments. The widespread negative income effects of such an approach, however, are precisely what governments are trying to avoid by stimulating diversification in the first place. Positive incentives for the non-rice crops rather than negative incentives for rice are likely to be more acceptable.

3.40 A program of direct measures to develop farmer skills for non-rice crops is one possible avenue. Extension programs tailored to farmers most likely to switch from rice to another crop are the most obvious substitute for the knowledge that comes from learning by doing. Unfortunately, extension programs have rather poor track records in this regard. Most extension agents have just learned how to teach farmers about the new rice technologies; they lack knowledge about the vary different skills (including market skills) required to make a success of growing vegetables for urban wholesale markets or fruits for processing. Agents for processing firms often have a better success rate. They know the techniques farmers must adopt to be successful contract growers of specialty crops. and they have a straightforward commercial incentive to transmit this information effectively to farmers.

3.41 Without such direct contact between extension agents or processing representatives and farmers, more anonymous market forces will connect farmers with consumers. Fewer opportunities exist to improve farmer skills directly, and even formal education can serve only to improve receptivity of farmers to new information and farming techniques. In circumstances in which "learning by doing" is virtually the only route to acquiring the crop-growing skills needed for efficient diversification, which is the likely case for most of Asia, adoption of non-rice crops will inevitably be slower than optimal as farmers must learn how to grow the new crops by growing them.

Mechanized Equipment

3.42 Rice cultivation in Asia is not heavily mechanized. Even in Japan, Taiwan, and South Korea, where rural wage rates are relatively high labor intensity of paddy culture is far higher than that in the United States or Europe, where much more mechanized equipment is used. In the ASEAN-4 countries, the most common form of mechanical equipment in rice production is in fact not found in the field at all. Small pumps that assist in water control--to supplement canal irrigation schemes, to power tubewells, or to improve drainage during periods of water surplus- are usually the first mechanical devices introduced into Asian rice systems.

3.43 Power threshers and rice mills are next to follow. Threshers speed postharvest processing and permit another crop to be planted more quickly. Mechanical mills save large quantities of household labor and often have higher technical efficiency (larger rendement) as well. As shorter-duration, high-yielding rice varieties extended the possibilities of multiple cropping, land preparation often became a bottleneck to rapid turnaround. Mechanical preparation of land increased in areas where supplies of draft animal and human power were inadequate--that is, where real wages and costs of draft power increased. Either farmer-owned small power tillers were used, or more powerful four-wheeled tractors were supplied through a rental market. Transplanting and harvesting have been the last tasks successfully mechanized. Transplanting rice seedlings requires a level of physical dexterity that has been difficult to duplicate in machines. Outside Asia, where farm wages are higher and land less scarce, direct seeding is used even though yields are not as high as those of transplanted seedlings. Mechanical harvesting has been difficult because of the very small size of most Asian rice fields and the presence of semi-permanent bunds between them. Very small-scale mechanical rice harvesters are used successfully in Japan, but they are unlikely to see much use in the ASEAN-4 countries because of their high investment cost and limited days of operation per year.

3.44 The question is whether substantial mechanization is a prerequisite for successful diversification into non-rice crops, or whether a similar gradual pattern of increased use of mechanical equipment is adequate. Because most non-rice crops are less tolerant of standing water than rice, improved water control through extensive use of drainage pumps may be essential for non-rice crops grown in the rainy season on bunded land. If such crops are to be grown after rice during the dry season, rapid land preparation may be needed to plant crops with longer growing seasons than those of many modern rice varieties. For this task power tillers or contracted four-wheel tractors may be competitive. Requirements for postharvest technology obviously vary with the crop: corn must be dried fairly quickly if it is to be stored for more than several weeks, fresh fruits and vegetables may need refrigerated trucks to assure

freshness in urban markets, and milk supplies must be kept cool until processed in a central facility.

3.45 Each crop has its own marketing and processing requirements, which could call forth a flexible array of rural industries geared to producing the specialty equipment needed. The absence of such equipment may well serve as an impediment to the growing and marketing of the crops in the longer term, however. The immediate concern is how to start the process. Borrowing technology and equipment from outside is a common way to begin; this approach often means an important role for the multinational corporations that have access to such technology and skills in processing and marketing.

3.46 The small-scale rural industries that grow to accompany a diversified rural agriculture are a tempting target for government investment schemes. Sufficient demand for the output of such industries is crucial, however. One had only to observe the problems of small-scale rural industries in China in the mid-1970s to see how serious the problems of effective demand can be. Rows of rusting water pumps outside the factory and tractors pulling goods on the roads rather than plowing fields demonstrated a serious mismatch between what farmers needed and what the rural industries were producing. These industries can be the source of very dynamic employment and income growth if they are demand led; they can be a serious waste of resources if pushed by supply-driven plans.

Labor

3.47 In 1980 more than 50 percent of the labor force in each country of South and Southeast Asia (except Malaysia and the Philippines) was employed in agriculture. The share of the labor force engaged in agriculture has been declining steadily throughout Asia. With the adoption of short-season, high-yielding rice varieties and the increase in cropping intensity in the late 1960s and 1970s, however, demand for labor increased on average about 20 percent, with hired labor showing a greater increase than family labor.¹⁸ The increase in multiple cropping had a greater effect on

^{18/} See Barker and Herdt, p.122.

employment than the intensive cultivation practices required by the new varieties; multiple cropping made use of normally underemployed workers and increased the number of work days per worker per year.¹⁹

3.48 While the adoption of new rice varieties led to a short-term increase in demand for labor, the long-term trend of a declining share of the labor force in agriculture is an expected part of the structural transformation. As the economy of a country shifts from primarily agricultural to industrial, workers migrate to off-farm jobs. Does crop diversification, with its associated marketing and processing industries, accelerate this process by providing new opportunities? Or are there short-run risks that a shift out of rice cultivation would simply throw large numbers of hired laborers out of work? There is some concern among governments that a program of crop diversification would have adverse effects on rural employment in the short run, before the longer-term process of creating jobs in industries, whether urban or rural, is under way.

3.49 The answers to such questions cannot be known without studying the use of labor for different crop systems as well as the indirect demand for labor created by the farm households' consumption and investment that is stimulated by crop incomes. Most of the information about direct labor use comes from farm surveys, and it is difficult to draw general conclusions from them because of the differences among countries, even regions, in use of family labor, hired workers, wage rates, sharecropping arrangements, harvesting contracts, land tenure, and other factors. For rice alone, the number of labor-days per hectare to bring in a crop varies considerably, from a low of 20 days in the Sind, in Pakistan, to more than 340 days in West Java, with no absolute consistency in greater labor requirements for high-yielding varieties compared with traditional varieties. As mentioned previously, however, the large gains in labor use for rice came with increased multiple cropping.

^{19/} See Barker and Herdt, p.129.

3.50 As more labor was needed to grow two, or even three, crops a year, this pattern of intensive labor use can be observed when use of labor for intercropped systems is compared with monoculture systems. While the number of labor-days per hectare required to grow improved varieties of corn ranges from 75 to 142, an intercrop of corn and cassava requires as many as 346 days. An intercrop of corn, cassava, and upland rice in Central Java requires 363 days of labor. Rice grown in the same province requires slightly more than 250 days. No extrapolation of these figures can be made to other locations in Asia, partly because wage rates are low and Javanese farm households tend to put in more time on their crops than do farmers elsewhere, but they emphasize the need to study patterns of labor use in specific locations where meaningful comparisons of labor requirements for rice, monoculture systems for non-rice crops, and intercropped systems can be made.

Marketing, Storage, and Processing

3.51 Rice marketing systems evolved in Asia quite gradually. Decades ago nearly all rice was consumed on the farm where it was produced, and home processing techniques were primitive. Commercial channels funneled fairly small volumes of paddy to large-scale rice mills, which usually stored significant quantities for later sale to urban or export markets. As high-yielding varieties became widespread and rural economies became less dependent on rice production as the sole source of income, a wider network of commercial channels developed, many of which were directed at processing and storing rice that would remain for consumption in the rural areas. Small-scale rice mills often sprang up to cater to this trade and to farmers who wished to have their rice milled for home consumption, thus saving substantial family time in processing. Labor-intensive and competitive small-scale traders emerged as efficient contacts between small farmers and larger wholesalers in urban areas. Especially if government floor prices reduced the risk of such trading, relatively efficient rice marketing systems developed in tandem with the rapid increases in rice production.

3.52 This efficient rice marketing system is now something of a barrier to farmer diversification into alternative crops. No other commodity in Asia has the dense network of market contacts of rice, and farmers are keenly aware of the risks they take in producing a non-traditional crop for which market demand at the level of initial buyer has not been proven. The problem of initial market contact is exacerbated by the characteristics of many crops that might be grown in place of rice. They are often much less storable and thus require extensive investment in seasonal processing facilities, such as canning factories, or in drying and storage facilities that will extend the storage life of the commodity. Corn, for example, is an important non-rice crop with excellent demand potential from growing feed industries, but it stores badly in tropical conditions unless thoroughly dried and protected from insects. Storage is important to the feed industry if it is to have access to regular supplies of its basic energy source throughout the year. Imports are often an efficient source of seasonal supplies, but their ready availability (especially if subsidized) can easily lead to neglect of the local market as a potential source of supply for longer periods of the year.

3.53 Marketing systems that function smoothly, with all commercial contacts, physical infrastructure and stable price expectations in place, have strong elements of public goods. No single investor can hope to capture the economic returns from the entire system, and yet those returns are large when the system is functioning. Laying the groundwork for an efficient marketing system thus requires some government involvement, especially in physical infrastructure and communications systems. But some mechanism for generating reasonable confidence in the reliability of price formation may also be needed, and this role is made difficult by the relatively short storage life of many of the products that might be marketed. Rice may well be unique in the important role it plays in consumer and producer welfare in Asia and in its capacity to be sufficiently storable that government price and buffer stock policies can stimulate the rapid development of private marketing systems.

3.54 How to stimulate effective marketing systems for non-rice crops thus becomes a major dilemma for governments. If direct involvement

similar to the pattern in the rice sector is ruled out because the commodities are too diverse and insufficiently storable for a government agency to avoid large losses, how can the markets for these commodities be made sufficiently widespread and accessible to farmers that risks of producing non-rice crops are not prohibitive? The low risks and financial attractiveness of growing rice have been a conscious result of government policy, and private investments in the rice marketing system will maintain a significant degree of that attractiveness even after the government withdraws. The private sector is not likely to create the entire system for the non-rice crops on its own accord--just as it did not create the rice marketing system by itself. A major role for the government exists, but it will be a much more subtle and difficult task to stimulate efficient marketing systems for corn, cabbages, and pineapples for processing than for rice.

Feed Grains and Livestock

3.55 Income growth in Southeast Asia has caused rapid increases in demand for livestock products. A rapidly growing proportion of the population has emerged from subsistence-level poverty since the mid-1960s and is seeking improved standards of living, especially through a better-quality diet with more animal protein. This demand for livestock products has the effect of multiplying the demand for grain to feed livestock. Some species of livestock are more efficient converters of grain into food for humans than others, but other considerations are also important in expanding livestock enterprises in the developing countries of Asia. The types of livestock that can be produced can be distinguished by several factors: the feedstuffs they consume, the efficiency with which they convert feed to edible protein, and the nutritional value of their products for humans. The income-generating opportunities from producing livestock depend on these factors and the profits from raising livestock, which depend on feed costs, conversion efficiency, and selling price for the product. Choice of technique is also an important consideration: labor-intensive but large-scale enterprises, as exemplified by modern poultry operations, create many productive jobs for semi-skilled workers.

Ruminants

3.56 Ruminants, which include beef and dairy cattle, goats, sheep, and water buffalo, have the unique capability of digesting coarse, fibrous plant products, wastes, and by-products of agricultural processing and converting such cellulosic material into forms that humans can consume.²⁰ Forages are the principal feed for ruminants, and production of such livestock is widespread in those areas that have abundant native or planted forage land. About 60 percent of the world's population of ruminants is in developing countries, primarily in South Asia, Central and Western Asia, Africa, and South America. The productivity of these ruminants in producing food for humans is quite low, however. The amount of food they produce is about equal to that realized from the 8 percent of the world's ruminant population found in the United States. But goats and sheep in particular are an important source of food (and wool, skins, and other products) in those semi-arid regions where land is poorly suited to crop cultivation, and people in these areas are best able to take advantage of the ruminants' capacity to be "walking factories" which can harvest their own feed.

3.57 The countries of Southeast Asia have relatively little pasture land, and where it does exist, it tends to be far from population centers. For example, while 6 percent of Indonesia's forested and agricultural land is classified as pasture, most of it is on the outer islands, but 62 percent of the population in 1983 resided on Java, which has one of the highest population densities in the world.²¹ Costs of transporting fresh meat and dairy products produced by ruminants from Indonesia's outer

^{20/} This section is drawn in part from two sources: Ruminants as Food Producers: Now and for the Future, Special Publication no. 4 (Ames, Ia.: Council for Agricultural Science and Technology, Department of Agronomy, Iowa State University, March 1975) and Stephen D. Mink, "Corn in the Livestock Economy," in C. Peter Timmer, ed., The Corn Economy of Indonesia (Ithaca: Cornell University Press, 1987).

^{21/} Central Bureau of Statistics, Statistical Pocketbook of Indonesia, 1985 (Jakarta, 1986), p.34, pp.164-65.

islands to major population centers would therefore be prohibitively high. Except for those populations producing for their own consumption, for most countries of Southeast Asia production of edible products from ruminants, as opposed to draft animal power for cultivation and transportation, is restricted primarily to dairy cattle. Lack of grazing land means their feed must be brought to them.

3.58 Raising dairy cattle or beef cattle in confined areas entails two areas of potentially high costs: transporting the feed, and disposing of the manure. While the cattle could make use of a wide variety of agricultural wastes, the bulkiness of all of these by-products means high transportation costs. Each dairy cow consumes about 40 to 50 kilograms of fodder a day. Such cellulosic residues could be used as feedstuffs for ruminants if they could be economically collected and processed. Cassava is an efficient producer of carbohydrates on marginal land, and a cassava starch processing facility located near a dairy might be an efficient source of cassava peelings. The productivity of dairy cattle, however, is substantially increased if they are fed higher-quality feeds, such as corn and protein supplements, as part of their rations.

3.59 Under Asian conditions, dairy cattle are far more economical than beef cattle because of their greater efficiency in converting feed to edible protein. However, the high potential efficiency of dairy cows is difficult to realize under tropical conditions. Animals with high genetic potential to produce milk are expensive to acquire and maintain, they need very high-quality feedstuffs to reach their potential productivity, they are prone to tropical diseases, veterinary services are not widespread in rural areas, and a modern dairy industry requires facilities for collecting, pasteurizing, packaging, and refrigerating the milk. These technical considerations mean the economic viability of a modern dairy industry in tropical countries, especially in the ASEAN-4 countries where little grazing space is available, is seriously in question. Imported skim milk powder, butter and cheeses are extremely cheap, due mainly to the export subsidies paid by the Common Agricultural Policy of the European Community. Even without such subsidies, however, New Zealand producers almost certainly have lower costs than all but the most efficient

operations in the ASEAN-4 countries. Without long-term protection of their domestic dairy industries, these countries will import most of their dairy products.

3.60 Another problem is that there is little demand for dairy products in most Asian countries, where lactose intolerance is widespread. For milk there is stronger demand than for other products.

3.61 However, imported skim milk powder can meet the demand for milk products as well as a local dairy industry. If the costs of imports are substantially lower and the storage life of powdered milk in unrefrigerated conditions longer, pouring resources into a domestic dairy industry will have no, or even negative, nutritional consequences.

3.62 It is no accident that livestock production in South and Southeast Asia has meant primarily poultry production. Poultry are well suited to rural conditions where land holdings are small and feed has been readily available from household food wastes and by-products of harvesting and processing, particularly corn husking and shelling. In parts of Asia, ducks are driven into newly harvested rice fields to feed on spilled grain. Village chickens are ubiquitous in rural areas of Asia and have been after fish, the most valuable source of animal protein. The diet of an average Indonesian in 1980, for example, had about 48 grams of protein a day, of which only 5.5 grams was supplied from animal sources, and of that total, more than 3 grams was from fish. The remaining animal protein was supplied mostly by eggs, milk, and chicken.²²

Poultry

3.63 Until fairly recently, virtually all chickens were of the "village" type--low-productivity scavengers. But villagers can feed their flocks surprisingly large amounts of feed grains. In Indonesia, the amount consumed by village chickens accounted for 25 percent of all feed grains fed to livestock. But the intensive-feeding of commercial poultry

^{22/} See Mink, "Corn in the Livestock Economy" (1987), p 143.

operations is by far the largest factor in feed-grain use. In Indonesia, for example, the population of commercial chickens in 1984 was less than one-half the size of that of village chickens, but commercial chickens consumed about 60 percent of total production of corn used for feed.

3.64 Improved commercial chickens are the basis of the growing poultry industry. Their products are relatively expensive because of the need to import breeding stock and the high-quality feeds required for their greater productivity. Their market is the higher-income consumer, who is willing to pay for higher-quality chicken, but demand is somewhat difficult to quantify in terms of price and income elasticities because of taste preferences of some consumers for traditional chicken meat and eggs, which are often thought to be more nutritious. But the market appears to be growing, and modern commercial layers and broilers have become far more productive, producing more eggs and broilers in a shorter time and on less feed than was possible several decades ago in developed countries.

3.65 Chickens and ducks are highly efficient converters of crude protein in their feed into meat and eggs. Of the livestock enterprises that are technically feasible in Southeast Asia, production of poultry offers, in addition to efficient use of feed grains and nutritional benefits, substantial potential in raising incomes in rural areas. But important obstacles, of which disease control is paramount, must be overcome, and many of these are related to the size of operations. Commercial poultry operations are typically part-time, backyard activities of farm households, although many are located close to urban centers. The size of a layer flock is typically fewer than 1000 birds--most often fewer than 300. Productivity of poultry suffers in such operations from poor sanitation, lack of clean water, lack of proper storage for feed, and heat stress in backyard coops. Small producers are unable to invest in equipment for drying corn and thus prevent the fungal growth in damp corn that leads to aflatoxin contamination, which slows weight gain in broilers and decreases production of layers. They also cannot afford the machinery to grind and mix their own feed rations, nor could they run such small milling machinery near its capacity. Investment in storage facilities that would reduce losses of feed to insects represents a large capital cost.

3.66 Small poultry producers are often not able to achieve the economies of scale that are possible for larger producers, who often obtain discounts on their purchases of day-old chicks and feeds, which can significantly lower their costs of production. In an Indonesian study, the effects of size of operation on unit costs of production and the demand for poultry meat and eggs were determined by comparing costs for small producers and large producers--operations with more than 5,000 layers or broiler operations larger than 750 birds a week. The unit costs of small producers of chicken meat were more than 25 percent higher than those of large producers, and it was estimated that, with reduced costs and the savings passed on to consumers, demand would increase by 18 percent if production shifted to larger operations. Similarly, the unit costs of small producers of eggs were 22 percent higher than those of large producers, and a shift to a larger scale of operation would increase demand by 6 percent.

3.67 Small family-run poultry enterprises are able to supplement their incomes, but their scope for increased productivity is limited. In Thailand, large-poultry producers have sub-contracted with small-scale poultry farms to expand their total supply. Large-scale poultry enterprises are important for diversification in two dimensions: in the jobs they create in rural areas, both directly in the poultry operations themselves if they are labor intensive, livestock feed mills, chick hatcheries, feed dealers, and poultry-processing facilities and indirectly through higher incomes of farmers who then spend a large share of their increased incomes on services and locally-produced goods; and in the demand they create for feed grains grown by local farmers.

3.68 Feed rations for commercial poultry can be prepared either by the feed mixing industry, which produce complete feeds, or by poultry producers, who combine feed concentrates and an energy source. Most poultry producers, particularly those near urban centers, buy complete feeds, which are a mixture of a feed base with a high protein content (feed concentrates) and an energy source. most often corn or rice bran. But when corn is expensive, thus raising the cost of complete feeds, poultry

producers, particularly those in rural areas, find it advantageous to mix their own rations, using feed concentrates for 60 percent of the mixture and an energy source, which can be acquired locally for the remainder. While the preferred energy source is usually corn, an alternative feedstuff, most often rice bran, rice brokens, or dried cassava chips or pellets, can be used.

3.69 High-quality rice bran can be used for up to 45 percent of poultry rations. But it has two disadvantages: crude fiber content varies, and it goes rancid in about two weeks because of its high fat content. Crude fiber can vary from 6 to 45 percent in rice bran, and low-quality rice bran (with high fiber content) causes scours in poultry (also in cattle and swine). The energy value of rice is roughly equivalent to corn, but only broken or spoiled rice is fed to poultry. The feed-mixing industry substitutes rice brokens for corn when corn prices are at their seasonal peak. The main disadvantage to the use of rice brokens by feed mixers, or by poultry producers preparing their own rations, is its lack of carotene, which results in pale skins and yolks, thus reducing their appeal to consumers. Carotene can be added, however, as a supplement to the feed, but poultry producers sometimes think it is too expensive.

3.70 Dried cassava chips and pellets are a good energy source, roughly equivalent to corn, but they are low in protein. High levels of crude fiber limit their use in poultry rations to 15 to 20 percent, and a low-fiber protein supplement, most often fishmeal, has to be used instead of soybean meal (which is usually cheaper). Because of cassava's lower protein content, larger amounts of protein supplements must be used than in rations based on corn or rice. This combination is feasible only when protein meals, such as those processed from rapeseed, sunflower seeds, or soybeans, are relatively inexpensive. Since most countries in Southeast Asia must import these protein supplements, they add considerably to the cost of poultry feed. In Thailand and Indonesia, the cassava component itself may be expensive because of their exports of cassava chips and pellets to Western Europe, which keeps the domestic price higher than that of corn.

3.71 Other alternatives for the energy component of poultry feed are less satisfactory. The by-product of wheat-flour milling, wheat pollards, has only half the energy value of corn and more crude fiber but about 60 percent more protein. Use of wheat pollards for poultry often requires the use of liquid fat as the energy source, which tends to be expensive. Sorghum has about 95 percent of the feed value of corn, but its nutritional quality can be quite variable, especially in crude protein. More care must be taken to ensure a balanced ration. While it can be used to replace part or all the corn in poultry rations, it is low in carotene and high in tannin, which is a mild toxin and depresses weight gain in broilers and egg production.

3.72 Corn remains the most widely used feed grain for poultry and is preferred for its balance of nutrients. A diversification effort that encourages production of poultry (and other livestock) thus requires careful attention to government policies that affect the prices of corn and protein meals. As noted in Chapter 2, restrictions on imports of corn, particularly when the imports serve to offset low seasonal supplies of domestically produced corn, can significantly raise costs of production for producers, since the cost of feed is the largest component of the cost of livestock production. Producers may have little scope for substituting other energy sources. Since most poultry producers use complete feeds, whose cost rises if corn prices rise (and if other alternatives are not substituted for corn), they tend to cut back on production rather than begin mixing their own rations from rice bran or other sources, and producers buy fewer day-old chicks. In layer operations, fewer hens are fed through the molting season, and unproductive hens are culled from the flocks. With reduced production comes higher prices and an ensuing cycle of reduced demand, which may be sufficient to stifle poultry production, at least until the cost of feed declines.

Swine

3.73 Like chickens, swine in Southeast Asia are generally of two types: low-productivity, traditional pigs which scavenge for most of their food; and higher-productivity breeds kept in confined systems. Scavenging pigs

are primarily a feature of areas with abundant land that are distant from established markets and of backward agricultural regions, such as areas of shifting cultivation, where pigs feed mostly on tubers (sweet potatoes) and people have long known the advantages of keeping a source of food "on the hoof" until needed.

3.74 While traditional pigs are raised also in areas of higher agricultural productivity, they are usually raised in confined systems, typically no larger than one or two breeding sows, and are fed mostly fodder mixed occasionally with small amounts of complete feeds or with higher-quality feedstuffs, such as corn or wheat pollards. Because swine are not ruminants, such low-quality feed contribute to low productivity and the relatively long time (10 to 12 months) required to reach slaughter weight. One type of traditional pig--the swayback of Chinese origin--continues to be in high demand among ethnic Chinese because of its red meat and distinctive cooking qualities of the fat.

3.75 Production of swine has generally been shifting to large commercial operations of 500 to 2,000 head, which are often operated in conjunction with an agricultural processing facility. These intensive commercial operations import improved breeding stock (Landrace, Duroc, and Yorkshire boars), and although feeding practices vary considerably, each pig's daily ration typically has a small amount of high-quality feed mixed with corn mash prepared from whole grain or bran from processing or such by-products as copra meal, soybean waste, cassava waste, or rice bran. Pigs reach slaughter weight, on average, in 8 to 10 months - figures nearly double those in the United States.

3.76 Swine production is important in the Philippines, areas of Indonesia that are predominantly Christian or Hindu, and in areas of Thailand and Malaysia with a high proportion of ethnic Chinese. The reluctance of many Muslims to grow pigs for Chinese traders has been a factor in keeping growth in swine production well behind that of poultry. Improved productivity in swine production can come from earlier weaning of piglets and through genetic improvements to increase efficiency of

converting feed to meat, reducing carcass fat, reducing the time required to reach slaughter weight, and increasing litter size.

3.77 It is apparent from the foregoing discussion of dairy, poultry, and swine production that the technical feasibility of a livestock operation is only part of the story. An analysis of economic feasibility is also essential. The type of livestock, the organization and size of facilities in which to raise them, the development of the supporting inf. structure and marketing system, and comparison with likely import costs are issues that must be addressed before deciding that a particular investment in livestock is an efficient use of resources in a given location.

3.78 Scale and organizational form are certain to be critical variables. Village poultry projects have been set up to benefit small producers in Thailand and the Philippines; Indonesia has its equivalent in its government-sponsored poultry cooperatives whose members receive subsidized credit and protected markets. In most of these arrangements, the firm or cooperative supplies growers with inputs (chicks, feed, and medicine), and all output returns to the center. This guaranteed market reduces risks to growers but it also limits their scope for increasing profits, provides little incentive to improve productivity, and may not raise rural incomes very much. When producers are essentially contract growers for the poultry firm or cooperative, unequal bargaining strength can reduce their earnings to those of unskilled labor.

3.79 Larger-scale poultry operations tend to buy their inputs with bulk discounts and market their output on long-term contracts to regular buyers who appreciate quality control. Consequently, larger producers usually have lower costs of production, greater incentives for improving management skills and for increasing productivity, and better control of disease among flocks. They are, of course, vulnerable to the market risks livestock producers face in both developed and developing countries--the tendency for "boom and bust" cycles as producers respond quickly to higher margins and profits, only to drive down market prices below costs of production. There is no easy answer to whether small-scale livestock producers should be

avored and protected from severe market fluctuations in order to further goals for employment and income distribution. The sacrifices in efficiency are not trivial, but protecting the livestock industry from market forces has a double cost: it raises costs and lowers growth in demand. Only further analysis can indicate whether these costs are worth incurring.

3.80 Such analysis of the technical feasibility and economic desirability of a livestock operation or a processing facility must identify the constraints to establishing efficient operations--whether scale of operations, lack of input suppliers, an efficient marketing system, management skills, credit, or other factors. Market forces will address these issues directly as private entrepreneurs do their own calculations before investing in livestock operations. If significant barriers to private investment exist, such as government regulations or lack of appropriate technical inputs and knowledge, there may be a positive role for the government in stimulating a domestic livestock sector as one factor in the diversification process. This role is not limited to alleviation of technical constraints, although this may be crucial for the long-run viability of some livestock operations. The economic environment is also significantly affected by government policies and signals. These economic dimensions to diversification are treated in Chapter 4.

CHAPTER 4. ECONOMIC FACTORS IN CROP DIVERSIFICATION

4.01 The process of diversification can be analyzed at various levels: individual fields within a single farm, single farms within a region, region to region, country to country, but diversification is best considered within the overall process of economic transformation as resources are shifted out of agriculture into industry and services. In a context of changing technology and relative prices efficient agricultural adjustment includes, in some contexts, moving resources out of agriculture altogether. At this level, the discussion is about structural change, a large and complex topic dealt with at length in other areas.²³ The problem for analysis of diversification initiatives is to be sure that they are consistent with long-term structural change and an allocation of resources in agriculture that is sustainable in the long run.

4.02 Unless the analysis is conducted within the context of structural change, the issue of diversification is narrowed to a concern over farmers' responses to relatively short-run changes in prices. Flexibility of farmers to make changes in cropping patterns is an important topic, but many concerned with the agricultural sector would be troubled if discussion of diversification were limited to only these short-run issues. Not only are decisions for public investment in agricultural research and infrastructure inherently long run, but policies for short-run price stabilization have implications for the long run via impact on private expectations and investment decisions at the farm level as well as in upstream and downstream industries. Many of these non-farm investments--rice mills, for example--are just as commodity-specific as an irrigation system designed for rice lands. The purpose of short-run price

^{23/} See Kym Anderson, Yujiro Hayami, and others, The Political Economy of Agricultural Protection (Sydney, London and Boston: Allen & Unwin, 1986); Bruce F. Johnston and Peter Kilby, Agriculture and Structural Transformation (London: Oxford University Press, 1975); and C. Peter Timmer, "The Agricultural Transformation," in Hollis B. Chenery and T.N. Srinivasan, eds., Handbook of Development Economics (Amsterdam: North-Holland, 1988), pp.275-331.

stabilization schemes is to cushion the need for farmers and consumers to immediately respond to fluctuating prices in the external economy. Excluding longer-run dimensions of structural change in the analysis of diversification defines the problem in a manner that limits the relevance of the analysis for the donor community and for policymakers.

4.03 At the other end of the spectrum, diversification is a long-run process in response to differential income elasticities of demand for various agricultural products and to crop-specific technical change. In this view, pressures on farm incomes (and consumer welfare) in the short run due to unstable world prices should be buffered with domestic price stabilization schemes, and only the longer-run trends in relative commodity prices should be passed on to domestic producers and consumers. The role of investments in agricultural research and commodity-specific infrastructure is crucial here, because such investments blaze the trail along which gradual adjustments in cropping patterns and resource allocations must follow. Diversification becomes a key component of project selection, which is dependent, when the projects are commodity specific, on projections of relative prices in the long run.

4.04 Diversification needs to be analyzed in both its short-run and long-run dimensions. In the short run, price changes may create the need for rapid adjustment by producers in and out of alternative crops and activities. If price changes in world markets are directly and quickly passed through to domestic producers and consumers, potential for rapid diversification has to be substantial or adjustment costs could be very high. The ability to flexibly respond to price changes, as has been emphasized above, depends on a number of technical and economic factors. There is strong resistance in most developing Asian countries to allowing domestic prices to adjust quickly and fully to fluctuations in the world market because of the adverse impact such changes could have on the welfare of farmers. The consequences of not passing such price changes on to domestic markets can also be serious. Use of protection and large budgetary outlays to insulate the domestic market can prove costly. However, it can also be argued that fully passing through large but temporary declines in world prices of agricultural goods could also create

costs if it leads to displacement of farmers and rural landless workers and their premature exodus from the agricultural sector. To avoid this, other forms of budgetary intervention may be necessary to cushion those adversely affected by low prices (for example, through improved access to credit, or other forms of adjustment assistance).

4.05 These short-run and long-run views, although they emphasize different aspects of diversification issue, are not incompatible. If commodity prices in world markets are highly unstable and cannot be projected reliably, setting the path of the agricultural economy via project selection for long-run investments will not work. Alternatively, if past investments have been largely commodity specific and there is little technological opportunity to change the pattern even in the future, short-run adjustments to changing prices cannot be very flexible. The bias of existing trade, industrial, financial and fiscal policies has been against agriculture in most developing Asian countries. There are only limited offsetting policies (input subsidies, limited price supports) favoring farmers. Reducing the protection to industry would help redress the bias and could improve farmers real incomes. However, such major liberalization measures take time to have a positive effect on employment and incomes. Hence, it is very difficult to dispense with the existing farm support policies in the short-run. Asking farmers, already among the poorer sections of societies in the developing countries, to absorb large losses in income with no alternatives is both politically and economically bad policy. Expectations are fragile, and all countries need the enthusiastic participation of their farmers in rural savings and investment. Destroying the basis for stability in those expectations by passing through all short-run price fluctuations from thin world markets for important food commodities will leave the country worse off in terms of future production possibilities if farmers withdraw from making rural investments. Price stabilization schemes for staple foods are both desirable and inevitable; the issue is what prices, for how long, and at what budgetary cost.²⁴

^{24/} These issues are discussed at some length in C. Peter Timmer, Getting Prices Right: The Scope and Limits of Agricultural Price Policy (Ithaca: Cornell University Press, 1986).

4.06 Because of the difficulties in choosing commodity-specific projects that are economic in the long-run, there is a need for a diversification program that enhances flexibility and that encourages investment in non-farm activities in rural areas. Such investments lead to a gradual shift of resources within agriculture toward more income-elastic products and at the same time a relocation of factors, particularly labor, out of agriculture into rural industry and services. These dimensions of diversification will be considered at three levels of aggregation: the farm level, the regional level, and the national level.

Flexibility in Farm-Level Decisionmaking

4.07 In economics, agricultural diversification is treated from two analytical perspectives: as a problem of determining, given prices, the optimal crop mix on a production possibility frontier; and as a mechanism for incorporating risk aversion into a farmer's decision-making process in which crop specialization may lead to highly unstable income due to variance in yield, production, or price for the particular crop.

4.08 The debate over diversification analyzed in this report has little to do with these two economic dimensions. However, farmers do make crop production choices in the context of their production possibility frontier, their expectations of relative prices, and their sense of risk, from both an agronomic and market perspective, for various alternatives. If governments expect farmers to respond to crop diversification initiatives, they must first determine which farmers are likely to shift their cropping patterns and to what extent.

4.09 If governments face the prospect of rice surpluses, the temptation might be simply to change the price relationships between rice and other commodities. By reducing incentives for farmers to grow rice, whether by lowering the rice price, removing subsidies for fertilizer, credit, or water, or imposing an export tax, governments can reduce the production of rice. Alternatively, governments could increase the incentives to grow non-rice crops. But farmers are not equally flexible in responding to such

measures. As discussed in Chapter 3, existing designs for irrigated rice systems are inherently inflexible. The systems were designed to grow rice, and farmers of irrigated and rainfed paddy have little choice but to grow rice in the wet season. A lower rice price merely lowers the incomes of these farmers. Farmers who might have a great deal of flexibility, those in upland areas, for example, can more easily shift cropping patterns to take advantage of new price relationships.

4.10 Despite the greater flexibility in upland farms, it is important to note these farmers typically have not benefitted directly from new production technologies anywhere near the extent to which farmers in irrigated rice plains have. To the extent upland farmers are net purchasers of rice, they seem to benefit from rice abundance and lower prices. Compared to rice farmers in irrigated areas, upland farmers generally are poorer and have less access to non-farm employment opportunities. Farmers with seasonally flooded rainfed rice land are an intermediate case; they have moderate flexibility to choose different crops in the dry season. The flexibility of upland and rainfed farmers is noticeably greater in areas well-served by marketing infrastructures in Asia. The response of upland farmers in Java in producing income-elastic crops and products as improved transport gave them access to urban markets has been documented as have similar cases elsewhere in Southeast Asia.²⁵

4.11 The issue of flexibility is important for rice farmers, governments, and donors given the predominant role of the rice sector and the enormous investments in irrigation and related activities to increase rice production. Tree crop producers have very little short-run flexibility and also have been adversely affected by sharp price declines for products like rubber, palm oil and coconut. The impact of price changes on the welfare of farmers depends on their flexibility in production and consumption as well as on their position as net sellers or buyers of rice. In general, many Asian rice (or tree crop) farmers are

^{25/} Fred Roche, "Sustainable Farm Development In Java's Critical Lands: Is a 'Green Revolution' Really Necessary?" Mimco, Cornell University, Division of Nutritional Sciences, 1986.

relatively inflexible and produce mainly irrigated rice (with perhaps an alternative dry season crop like corn and possibly some vegetables in a home garden). The crops they grow are produced in almost fixed proportions even when prices change because of technical factors. Such technological rigidity is probably roughly representative of many Asian farms during the wet season for a short- to medium-term planning horizon. If the farms produce a net surplus of rice to sell, then the decline in the price of rice unequivocally leads to a decline in their real incomes from agricultural activities.

4.12 This is the scenario that worries policymakers and donors. What diversification alternatives can be contemplated in this scenario? The provisos that must be made in explaining the construction of the inflexible production possibility frontier also provide insights into how the situation might be made more flexible. First, adjustments in cropping patterns might be much more feasible in the dry season, especially if crop technologies, markets, and investments in infrastructure are pointed in the direction of greater flexibility. Second, not all farmers face such rigidity in use of their land, and their adjustments at the new prices may be adequate to bring market supplies into balance with domestic demand. The problem remains of how to deal with the consequences of the price decline for income for those farmers who do face inflexible production possibility frontiers. But to address this question, the analysis must return to the broader topic of structural change and adjustment. Greater off-farm employment opportunities are the surest way to cope with low incomes from rice farming, even when all the "inflexible" land continues to grow rice. Land consolidation may permit fewer farmers to continue to earn competitive incomes from rice farming even at lower prices, which has been the path of the United States and, to some extent, Western Europe. Alternatively, very small farm size might co-exist with lower rice prices if most farm household members have full- or part-time jobs in rural labor markets. Taiwan and Japan have followed a variant of this path, but the South Korean pattern is significantly different (see Table 4.1). Many farm household members in Taiwan and Japan work in the industrial sector, and average farm size remains miniscule by the standards of other OECD countries partly because of stringent controls on land accumulation enacted

at the time of postwar land reforms. Rice prices in all three countries have been maintained far above those in the world market to provide added income to rice farmers, a politically powerful group, but the divergence has been widest in Japan.²⁶

4.13 The framework for policy analysis of diversification must at least recognize the general-equilibrium dimensions of potential responses of farmers and consumers to price changes. Because of the crucial role that investment decisions, by both government and the private sector, play in the diversification process, the framework must also recognize the inherent dynamic nature of the analysis.

Investment at the Farm Level

4.14 Investment in the farm enterprise takes many forms--new seed varieties, fertilizer and other soil amendments, improved water control through irrigation or pumps, chemicals to control insects, disease, and weeds--but each serves to ease the agronomic constraints of the soil or climate and increase the farmer's net income from the cropping system. Many of these are interactive; the development of high-yielding rice varieties that were highly responsive to fertilizer required better water control for optimal results. While a great deal is known about increasing the productivity of farmers in growing rice (or wheat), less is known about improving yields of corn in the tropics and even less about other secondary food crops. For farmers to risk introducing a high-value vegetable crop in the crop rotation, to grow corn for a nearby livestock feed mill, or to plant part of the land in cashew trees, for example, requires information on cultivation practices, a source of inputs, income or credit to buy them, and a marketing channel to sell the output. Agronomic research for nontraditional crops; seed development, upgraded irrigation systems and other types of investment in infrastructure, and extension workers to pass along new information thus all serve to increase the flexibility of farmers

^{26/} See Michael R. Reich, Yasuo Endo, and C. Peter Timmer, "The Political Economy of Structural Change: Agriculture," in Thomas K. McCraw, ed., America versus Japan (Boston: Harvard Business School Press, 1986). pp.151-192.

Table 4.1: Share of Farm Household Income from Nonfarm Sources, 1962 and 1980

Country	Total Income from Nonfarm Sources (percent)		Wage Income ^a	
	1962	1980	1962	1980
Japan	49	80	36	69
Taiwan	34 ^b	74	20 ^b	52
South Korea	20	35	9	14

^a Share of farm household income earned as wages from non farm sources. This share is included in the total.

^b Figures for Taiwan are for 1965.

Source: Kym Anderson, Yujiro Hayami, and others. The Political Economy of Agricultural Protection (Sydney, London, and Boston: Allen and Unwin, 1986), p. 13.

in adjusting to new economic conditions. They help change the shape of the production possibility frontier facing individual farmers.

4.15 Research and Extension. The work on the international research centers, IRRI in the Philippines and CIMMYT in Mexico, spawned the Green Revolution in the 1960s. In the 1970s, these centers developed complementary links to national and local research centers in Asia, which facilitated the adaptation of high-yielding varieties to local environments. The second generation varieties adapted to local conditions allowed farmers greater flexibility in planting dates. Research centers, many of whom coordinated their activities through CGIAR, extended genetic research to crops other than wheat and rice--corn, cassava, pulses, tubers, and legumes--and developed new varieties of coconut, tea, and rubber. Research efforts have also promoted adoption of new cash crops, such as palm oil, cocoa, and horticultural products, and research has expanded into such new areas as aquaculture, dairying, and fast-growing hardwood species for tree plantations.

4.16 Despite initiatives in these broader directions, international and national agricultural research has focused heavily on raising productivity in rice and wheat, which benefits areas that are relatively prosperous and favorably endowed with capita, infrastructure, land, and water resources. Investment by Asian countries in agricultural research has been concentrated on lowland, irrigated rice and on major export crops, such as sugar and rubber. But as Chapter 3 points out, much agricultural land is in rainfed and upland area where yields are low and poverty is widespread. Increasing population pressures in upland areas have led cultivators to encroach onto steeper terrain, a practice associated with deforestation and degradation of watershed areas and serious environmental, economic, and social consequences. Many governments have recognized the increasing importance of research that focuses on developing sustainable patterns of agro-forestry and intercropping in upland areas.

4.17 A combination of public and private research has contributed to greater flexibility at the farm level, but with differing approaches.

Public-sector research has as its underlying goal the general well being of populations. Its comparative advantage has been long-term commodity-specific research, which has led to a steady upgrading of the basic staples. Scientists generally focus on a commodity strategy; technology is optimized for an agricultural enterprise and is offered to farmers in the expectation that they will graft the innovation onto their farming systems. Rarely are technology packages geared to heterogeneous or changing circumstances, however. Technical messages often assume optimal conditions and aim for maximum production. Prepackaged technology does not cater to variability and flexibility in farming systems and does not easily fit into the process of diversification, particularly in the nonmechanized systems of small farmers.

4.18 Commercial research is profit motivated and tends to be on short-term projects, which are evaluated and funded according to their potential payoff. Scientific teams are built up and broken down with an eye on the bottom line. They assess the potential for technology relative to the system for which it is designed. If there are weaknesses in the system--in produce marketing, seed supply, credit, or extension services, for example--the cost of rectifying the weakness must be taken into account in assessing the value of innovation. Technology developed by private firms tends to be targeted at a specific agricultural system and packaged accordingly. They promote new ventures among farmers who are capable of taking risks and committing themselves to specific crop technology. This commitment may be induced through offers of guaranteed markets, credit availability, and low-cost inputs until confidence in the system is established. The ultimate profitability to the firm must be very large, however, for this approach to be worthwhile.

4.19 This difference in approach has implications for the technology that is adopted by farmers. Technology derived from international research centers tend to be broad-based and unspecific, and whether the innovation is new genetic material, a variety with greater resistance to pest and disease or with higher yield or shorter growing season, it often needs to be incorporated in location-specific varieties to achieve full potential. This process requires support from national and regional research centers.

Private research tends to be narrowly focussed, and the innovation is embodied in a new pesticide, implement, or a specific hybrid. There is considerable overlap, however. Virtually all the new rice varieties were developed in public-sector research centers, but private research by chemical companies produced most of the pesticides for use on rice. Their widespread use, especially when chemical companies have waged aggressive marketing campaigns, has often led to significant negative externalities, however. Even in those locations where the private sector has been innovative in product development, the role of public policy and regulation should not be neglected.

4.20 The dissemination of new technology or a new cultivation practice that can increase the flexibility of farmers in diversification places new professional burdens on the extension service. Training programs for extension workers have been based on simple repetitive messages. This disciplined approach, with its prescribed schedules and activities and rigid administrative procedures, is appropriate for promoting technology packages of a single crop, but it is not responsive to the needs of diversification at the farm level. Agents need to be trained to deliver multiple messages, advise on a large variety of crops, and provide market information, all in the same regular visits. With broader approaches and responsibilities, extension workers can use more initiative and respond more flexibly in spreading the word of new crop combinations, cultivation practices, and market opportunities.²⁷

4.21 Availability of Credit and Inputs. For farmers to have flexibility in crop choice, they need access to production inputs and sufficient income or credit to acquire them. Efficient credit and input supply markets are essential for crop diversification. Traditionally, farmers have relied on moneylenders or private traders to advance them funds until the crop was sold. But capital is scarce in developing

^{27/} The extension agents with all these skills are very likely to find higher salaries in the private sector. It will be difficult for a government extension service to attract, train, and retain adequate staff to respond to the wide range of issues in a diversification program.

countries, and high interest rates reflect its scarcity. It is also very costly and risky to lend to small farmers. To provide incentives to adopt new technology, many governments established rural banking systems or special credit programs, usually subsidizing the interest rate on the loans. The subsidy for credit, along with subsidies for fertilizer, seeds, or pesticides, were seen as essential in the mid-1960s for inducing farmers, especially small ones, to adopt new agricultural technology and increase output. The cost of the subsidies to the government budget was regarded as an investment in the agricultural sector, but a temporary one. As farmers adopted the new technology and as output and incomes increased, such subsidies could be phased out, particularly as private financial markets in the countryside were better developed. With increased rural incomes, the greater rate of rural savings and investment would eventually eliminate the need for subsidies. It was a variant of the "infant industry" approach applied to agriculture.

4.22 With a new round of investment, this time in diversified cropping systems, and the need of farmers to purchase inputs for potentially risky crops, governments have to find ways to improve the access of farmers to credit and to assess the social profitability of subsidies for inputs. Credit programs have had very mixed results. The availability of subsidized credit, usury laws, and central bank regulations affected the interest rate paid on savings, thus discouraging rural savings and the establishment of efficient credit markets. Rigidities and inefficiencies in the dispersion of credit, including rationing, quotas, excessive paperwork, delays in disbursement of funds, made it difficult to attract participation of many small farmers. Many who did participate in borrowing did not repay. The cost to specialized institutions of administering such programs were so high they were hard pressed to compete with informal lenders in rural areas. In some cases, farm lending programs placed undue emphasis on reaching targets for loan disbursements, which had several adverse consequences. Financial institutions that failed to monitor and enforce repayments were faced with severe difficulties caused by loan arrears and outright defaults. Many of those that neglected savings deposits and loan repayments became increasingly dependent on injections of government funds. In the worst cases, as in the Philippines, specialized

financial institutions and rural banks ceased to be viable, and formal credit programs collapsed or contracted.

4.23 Input and credit subsidy programs have been widely criticized for failing to reach small farmers. Larger farmers do have better access to credit, often for reasons of land tenure, provision of collateral, and lower administrative costs of servicing larger loans. In Malaysia, larger farmers benefit from the fertilizer subsidy more than small farmers do, because the amount the farmer receives is predicated directly or indirectly on asset holding--that is, the size of farm. Each farmer is allowed a subsidy of 100 percent up to 2.4 hectares.²⁸ While large rice farmers in Asia may have benefited disproportionately from input and credit subsidies, their rice yields were not higher than those of small farmers, and their rates of adoption of new technology were about the same or only a couple of seasons faster than small farmers.²⁹ The issue is not always clear-cut, however. The fertilizer subsidy in Indonesia was widely accessible to all farmers who bought fertilizer in village markets. The subsidy stimulated rapid learning about the productivity of fertilizer use, served as a substitute for limited access on the part of small farmers to credit, and more than repaid its costs to the government by reducing the need to import rice.³⁰

^{28/} See Mokhtar Tamin and Sahathavan Meyanathan, "Rice Market Intervention System in Malaysia: Scope, Effects and the Need for Reform" (Manila: Asian Development Bank, June 1987; typescript).

^{29/} Randolf Barker, Robert W. Herdt, with Beth Rose, The Rice Economy of Asia (Washington, D.C.: Resources for the Future, 1985), pp.147-148 and pp. 152-153.

^{30/} See C. Peter Timmer, "The Role of Price Policy in Increasing Rice Production in Indonesia, 1968-1982," in Ray A. Goldberg, ed., Research in Domestic and International Agribusiness Management, Vol. 6 (Greenwich, CT.: JAI Press, 1986), pp.168-241.

4.24 With the benefit of hindsight, policymakers trying to facilitate crop diversification can learn from these earlier experiences and can foresee that some types of programs are likely to be ineffective. Government-administered delivery systems tend to be high cost and are unlikely to reach small farmers. In most countries, administered credit has usually taken the form of the provision of credit-in-kind through prescribed input packages and controlled supply channels. The input packages have been allocated on the basis of participation in a crop-specific cultivation program. The direct results have been twofold: rural supplies are distributed according to plan and allocated to specific credit programs by projected demand for credit; and supply channels where farming inputs are available for cash purchase fail to develop - either through private traders or government agencies. Such packages are inappropriate to a crop diversification effort that seeks to increase the flexibility of farmers to respond to market opportunities.

4.25 Input subsidies may make sense if farmers face new risks from different crops and must invest in the inputs for production to be economic. Subsidies delivered through prices are usually more effective than attempts at administrative allocations. In either case, subsidies often develop a political life of their own and can be difficult to remove even when the underlying rationale for their instigation has passed. In the long run, improvements in private input supply and distribution systems help ensure that inputs required for different crops are available to farmers when they need them.

4.26 Marketing and Infrastructure. Central to any discussion of rural diversification is marketing. While the flexibility of farmers can be increased by investments that reduce their agronomic and technical constraints, that increased flexibility in choosing crops or other farming enterprises is realized only if the farmer can sell the output at a profit. For that, farmers need markets or a system of private traders who transmit market signals and buy the output to be truly flexible and responsive, there must be an efficient transmission of market signals throughout the length of various marketing chains: from exporters to wholesalers to private traders to farmers and back again; from retailers in urban areas to

wholesalers to farmers; and from retailers or exporters of agricultural products to processing facilities to growers.

4.27 Many factors can interrupt the efficient transmission of market signals. Lack of roads, or telephone lines are obvious cases in which lack of public investment in infrastructure impedes the development of markets. Local and regional markets remain isolated from each other, and this lack of market integration interrupts the flow of information about surpluses and scarcities, which is what prices formed in competitive markets indicate. Regulatory environments in which a system of licenses restricts who may trade in a commodity can dry up the market for that commodity. Removing such obstacles to the flow of market signals is the essence of helping farmers to diversify. In some cases there are in fact few obstacles, and markets have sprung up.

4.28 Improving a marketing system is more than a matter of removing obstacles, however. There are positive steps that governments can take, and to design effective policies that facilitate that process, policymakers need to understand the nature of markets and the decisionmaking process of participants in the system--farmers, traders, wholesalers, processors, exporters, and retailers. For general trade in commodities, a free flow of market signals needs a sufficient number of private traders--enough to create real competition--and a volume of marketed output from farmers great enough to make it worthwhile for traders to handle the commodity. Trading by a public marketing agency, depending on how it is done, can discourage private traders from dealing in the commodity. Subsidized imports of corn to a livestock feed mill, for example, can make it impossible for private traders to compete, thus dampening the price incentives to farmers to grow corn and discouraging the investment in drying and storage facilities by the private trade.

4.29 For commodity exporters to respond to external market opportunities, they also need a sufficient volume of marketed output to justify costs of shipping and handling. They also need access to credit to finance their operations. Meeting quality standards of foreign buyers makes it necessary for price differentials to be transmitted to wholesalers

and on down the chain to provide incentives for drying commodities to required moisture levels and ensuring against contamination by dirt, insects, and molds. Exporters need flexibility in responding to opportunities. Bureaucratic delays in issuing export licenses can result in a lost sale or a flourishing of corruption as exporters attempt to facilitate the process, either of which serves to prevent competitive numbers of exporters from participating.

4.30 Processing facilities have special requirements in order to be efficient and profitable. They too need a sufficient volume of output from farmers to justify a facility. Whatever commodity they require--whether it is a soybean-crushing plant, a dairy, or facilities to can pineapple, to manufacture shrimp and cassava chips, to package mango or lychee juice into cans or aseptic containers, or to process mung beans into noodles--such processing facilities need a lot of it, and they generally need it year round or for extended seasons--not sporadically now and then. Facilities may require inputs from many sources. Livestock feed mills might need imported protein meals to combine with energy sources readily available from local farmers. A distinguishing feature of processing facilities is their need for an assured supply of inputs, and the supply of those inputs requires a marketing system. Agricultural production is inherently seasonal, and someone must take on the task of purchasing a commodity from farmers at harvest, storing it, and making it available to consumers or processing facilities when needed.

4.31 It costs money for marketing agents to buy, store, process, and transport agricultural commodities. They have to pay interest on their operating loans, trucks, and warehouses. They have losses in storage, as a portion of the stored commodity is inevitably lost to rot, mold, insects, and rodents. There has to be an adequate margin between the price they offer farmers and the price they sell to cover their storage losses and their costs of marketing. Subsidies to a public marketing agency trading in a commodity can trim this margin to levels that drive out the private sector. By doing so, the public marketing agency must then take on the task of virtually all the marketing functions of storing, processing, and transporting, which is not something government agencies do particularly

well. There is a role for public marketing agencies to play in price stabilization of important food staples, but in performing this function, agencies must be sure to allow adequate marketing margins to permit private traders to operate as well.

4.32 Private trading is a risky business, and high risks mean high marketing costs. Public intervention can lower the risk dimension of marketing costs in two ways: by not raising them artificially in the first place, and then by actually lowering real risks facing private traders. Public food agencies and intervention policies often raise the risks to private traders of participating in food marketing. Suddenly declaring private trade to be illegal during a food shortage is the most drastic (but still common) example, but unexpectedly importing additional supplies or dumping stocks on the market can bankrupt traders overnight. More subtle forms of squeezing margins through differential interest rate subsidies or licensing arrangements can alter the cost structure of competitors--favored traders win, others lose. It is no wonder that so much effort is expended by private traders to maintain good relations with the government officials whose decisions and actions dictate the profitability of their firms. These efforts take time and, often, money.

4.33 When governments turn their attention to lowering marketing costs, a wide array of possibilities exists. Better communications and information systems almost always improve the efficiency of marketing activities and serve to lower risks to smaller traders of participating. Maintaining stability in basic policy directions, especially with respect to price and trade policy, helps generate confidence for longer-term investments by the private sector in marketing infrastructure. Sometimes offering to be a buyer of last resort at remunerative prices helps establish a market where surpluses have been sporadic. By lowering risks to private traders of establishing initial operations in such areas, the government may stimulate sufficient marketed volume for private trade to be self-sustaining.

4.34 There is an obvious danger facing government efforts to lower risks and costs of private operators in agricultural marketing and

processing. Subsidizing foreign or large-scale domestic processors with low-cost capital, for example, will distort market signals and squeeze truly "private" operators out of business. "Cooperation" between the public and private sector in marketing often takes the form of special privileges and subsidies for a few favored firms. Although their risks and costs may well be lowered, such an approach does little to create a dynamic and efficient agro-industrial sector. Indeed, by raising costs of important inputs for downstream industries--high-cost soybean meal for the livestock feed industry, for example--such special deals often are significant impediment to both vertical and horizontal diversification.

Regional Specialization

4.35 There are two reasons why regional specialization might be a crucial feature of any diversification policy. First, agronomic and climatic factors favor some crops over others. In the relatively large and diverse countries of Asia, soil types, temperatures, and rainfall patterns can vary radically from one part of a country to another and at different altitudes in hilly or mountainous regions. Volcanic soils support intensive crop cultivation; the acidic soils underlying much of Asia's rain forests are much thinner and more difficult to manage in terms of sustained fertility. Tree crops such as rubber or oil palm probably have substantial technical advantages relative to corn or soybeans, for example, on such soils. Only if relative prices shifted sharply in favor of food crops would it make economic sense to invest in restructuring the acid soils of the humid rain forest areas to support annual cultivation of rice, corn, root crops, or legumes.

4.36 The second reason for regional specialization is more easily overlooked, but it may be as important as climatic factors. Efficient development of entire commodity systems, from input production and marketing through to downstream processing and consumption of the final product, requires the formation of extensive backward and forward linkages from the producer level. These linkages can be both technological, depending on engineering relationships and quality requirements, for example, and financial, depending on investment patterns from profits

generated by commodity production and consumption patterns from the incomes earned in the sector. Many of these linkages exhibit economies of scale and can be developed to optimal levels only if the commodity is produced in a relatively cohesive spatial pattern. This process is a natural result of regional specialization and one of the major factors that gradually but persistently produces such specialization. Well-developed, low-cost marketing systems require sufficient supplies of the specific commodities being marketed to justify the full investments needed to capture any economies of scale to the system. As specialized production grows in a region, the marketing system expands to serve it but also creates the demand for further expansion by offering lower marketing costs than those in regions that would otherwise be competitive on climatic and agronomic grounds. The lower costs generated by specialization can convey significant competitive advantages on regions that are both low-cost producers of a commodity and have an efficient marketing system with adequate volume to capture the economies of scale.

4.37 Regional specialization in a range of agricultural products would thus seem to be the answer to the problem of diversification. Such specialization permits the cost economies of scale (and learning) to be captured, while diversifying the country's agricultural output. A problem remains, however. Although the country may be well diversified, individual farmers and regions are not. Significant price instability, whether generated strictly in domestic markets or transmitted from international markets, would have substantial income-distribution consequences for the farmers and regions concerned--unless their output is sufficiently negatively correlated with prices that net revenue is stabilized by unstable prices. When large regions depend heavily on a single crop for their economic base, the vulnerability from specialization is similar to that at the national level when rice or wheat cultivation is widespread. When rubber producers, coffee growers, or corn farmers specialize in production, each can face problems of income stabilization in the face of unstable prices or yields. Compared with national specialization in a single commodity, the macroeconomic consequences of regional vulnerability are not as great--unless all prices and yields move together. But the individual and regional problems should command the attention of

policymakers. Especially in countries with diverse regional interests, appearing to ignore the economic plight of distressed regions can have devastating consequences for the political stability of the country as a whole.

Adjustment in the Agricultural Sector

4.36 A debate over the appropriate degree of regional specialization in agricultural production for a country inevitably addresses the entire commodity portfolio. Agriculture is usually an important source of foreign exchange earnings as well as the domestic supplier of food and industrial inputs. The policy framework must therefore weigh the relative merits of production for domestic or foreign markets. Expected prices in both markets are the key variables. Price expectations may be relatively easy to defend in the short run, when the time horizon is within contracting periods on established futures markets or when forward arrangements can be made, but in the long run the basis for price formation is much more difficult to justify. No projection models have better credibility than simply extending current prices into the future, and simple trends are particularly sensitive to the periods chosen for analysis. And yet the agricultural economy must evolve in the directions signaled by these market prices if it is to remain an efficient source of growth. The major goal of a diversification policy is to create a flexible agriculture capable of responding quickly, and with few welfare losses, to changing market prices. Such a policy can be formulated only from the perspective of the entire agricultural sector and its relationship to the rest of the economy.

The Changing Structure of Agriculture

4.39 It has become increasingly recognized since the 1960s that growth in the agricultural sector is essential for growth in the rest of the economy. When agricultural growth rates have been extraordinarily high--rates of 5 to 7 percent a year in parts of India, Pakistan, Thailand, and Indonesia, for example--the benefits percolate to a wide spectrum of society. Rising rural incomes increase demand for manufactured goods and services outside the agricultural sector and help create jobs and increase

urban incomes. While per capita incomes are higher in towns than in the countryside, the absolute size of the market for manufactured goods is often larger in rural areas. Moreover, villagers spend much of any extra income on manufactures, and an increase in agricultural income generates substantial demand for industrial goods.

4.40 The pace of economic development is affected not only by the overall rate of growth in agriculture but also in composition. Reasonably broad-based growth with rising rural incomes of large numbers of producers, including small or marginal ones, contributes to growth in demand for rural goods and services that are labor intensive and that utilize a sizable share of local resources. In a study of Nueva Ecija province in the Philippines, an increase of 1 percent in agricultural output resulted in an increase of 1.5 percent in value added in most sectors of the nonfarm economy. In Malaysia's Muda district, its largest "rice bowl," every \$1.00 increase in agricultural output indirectly added 80 cents in value added to the rest of the village economy. Unfortunately, these multipliers also work in reverse. In the Philippines, a reduction of 1 percent in agricultural output resulted in a reduction of 1 to 1.5 percent in rural nonfarm employment, most of which is in local towns. In Malaysia, each dollar's decline in agricultural income contributed to a decline of 80 cents in nonfarm rural income.

4.41 While the agricultural sector contributes to overall economic growth, it is dependent on growth in the rest of the economy to generate jobs for workers who migrate from agriculture and to create demand for agricultural products. In countries of Southeast Asia, rising per capita incomes increase the demand for agricultural products with a high income elasticity of demand, particularly livestock products and high-value fruits and vegetables. Where domestic demand is limited by overall low average incomes and the internal distribution of income is significantly skewed, as in most part of South Asia, only high-income consumers can afford to have more varied diets.

4.42 These patterns of rural incomes and employment are an expected part of the structural transformation, as a country's economy becomes

increasingly industrialized. Low-income farmers leave agriculture in search of better opportunities elsewhere. The share of agriculture in GDP declines as industry's share of national income increases. Agriculture remains important--as the source of the country's food and agricultural commodities--but fewer farmers are engaged in agricultural production. These structural shifts create burdens of adjustment as agricultural workers can no longer earn a living from farming.

4.43 The production of non-rice commodities, discussed in Chapter 3, may well have high labor requirements because of multiple cropping and inter-cropped systems. If this is not the case, the additional amount of labor likely to be employed in expanding production of non-rice commodities would be small--and smaller than the number of rice farmers who decide to change activities in view of the low return to rice cultivation. In addition, since the most promising commodities are items requiring capital investment, such as fisheries, aquaculture, and livestock products, farmers who could possibly benefit from an expansion of these activities, those who face flexible production possibility frontiers, may not be the same ones who are affected by the fall in the prices of traditional commodities. In the long run, the process of crop diversification requires technological progress in agriculture and lower production costs.

4.44 Industrial enterprises in Southeast Asia have been concentrated in and around the primate cities of Jakarta, Bangkok, and Manila. None of the countries have succeeded yet in the industrialization of rural areas despite the growing diseconomies of locating activities in the existing urban centers. In contrast, Taiwan was able to promote a more balanced regional pattern of industrial development. Provision of infrastructure and a policy environment that does not discriminate against rural-based, small- and medium-scale enterprises can facilitate a more dispersed pattern of industrial growth. This reduces the costs of adjustment as rural workers shift away from agriculture.

Efficient Allocation of Resources

4.45 Farmers may diversify their cropping systems in response to their own assessment of household food reserves, highly variable weather conditions, or risk of financial loss associated with use of inputs. Decisions of farmers to use fertilizer, improved seeds, hired labor, and machinery and to shift from growing one commodity to another are largely shaped by their perception of profit. The complex process of choice of technique in production and choice of crop mix is often not appreciated by policymakers or planners. If national policy dictates diversification into export crops, such shifts might be achieved only at the expense of higher-value food crops. Governments should not attempt to influence decisionmaking at the farm level without having a thorough understanding of production technology, prices, inputs, and labor requirements of competitive crops.

4.46 Central to any policy framework is pricing policy. Whether determined in free markets, established by a central planning agency, or modified by government trade policy, prices strongly affect a country's rate and pattern of development. "Getting prices right" is important. The basic pricing rule for obtaining the most efficient use of an economy's resources is to set the price of each good or service at its marginal social cost, which is a result that perfectly competitive (and complete) markets would achieve and that public pricing policy should, in principle, emulate. In the real world, of course, actual market conditions always diverge from the competitive ideal. In pricing public-sector goods and services, for example, public agencies must take into account not only the objective of economic efficiency but also other national objectives. These considerations may justify departure from marginal pricing rules and call for carefully designed interventions in the market to achieve both social and economic objectives. Both efficiency and equity are often served, however if such interventions can make use of market forces rather than supplant them.

International Market Signals

4.47 In theory, the economic gains from trade mean that a country should exploit its comparative advantage by specializing in those commodities for which it is a low-cost producer by world standards. Where resource allocation is efficient, market signals reflect these relative costs, and by following international market prices a country would know what to produce.

4.48 In practice, of course, international market signals are badly distorted. Trade barriers and other forms of protection, particularly by industrialized countries that shield their farmers from costs of adjustment to changing prices, mean that there is often little resemblance between world market prices and underlying marginal costs of production in the countries supplying the market. Developing countries often use this fact to withdraw from the international market altogether or to use their own trade policies for short-run political purposes. They thus fail to capture many of the benefits still available from international trade.

4.49 Countries fail to capture the potential gains from trade for other reasons as well. First, countries may not be able to import at prices that reflect marginal economic costs of production in low-cost exporting countries. Exports of rice from Burma, for instance, are a state monopoly, and the export price is well above the economic costs of production, processing, and marketing. Thailand has often raised its export tax on rice in periods of high prices in world markets, such as 1973-1975. Such policies have encouraged import substitution in countries with trade deficits. Second, and conversely, import restrictions in importing countries discourage investments in rice by exporters. Subsidies on rice exports by industrial countries also discourage higher production in low-cost countries. Third, the high cost of self-sufficiency has often been underwritten by grants or concessionary loans from donors. Taken in isolation, many components of each country's policies may have been logical. Taken together, however, they add up to a bias against a well integrated world agriculture capable of capturing the full benefits from trade. Lacking an international agreement with enforcement powers,

however, it is unlikely that individual countries will sacrifice their own short-run welfare for the longer-run welfare of the world trading system as a whole. Although the current round of GATT negotiations is addressing this issue directly, the response of Japan and Western Europe in particular, does not provide much hope for significant progress. Domestic agricultural policies are too important politically to turn over crucial degrees of freedom to an international body.

4.50 What is a developing country supposed to do? Two extreme courses of action are possible. The first is to treat prices in international markets as the short-run opportunity costs and benefits that they are and to pass these prices directly into the domestic economy without interference. In other words, practice free trade. The benefits of this approach have been widely extolled, and the merits are obvious. No complicated government schemes are needed to implement free trade, incentives are completely transparent, and neither producers nor consumers are discriminated against on a systematic basis. For commodities in international markets whose prices are depressed because of policies in rich countries, free trade rewards consumers in importing countries and penalizes producers. If these producers are able to switch to other commodities, however, free trade can benefit both producers and consumers and improve welfare for the country as a whole. Where diversification policies create flexible agricultural systems, free trade is an appealing strategy for maximizing the economic benefits to the country as a whole.

4.51 If significant rigidities in patterns of agricultural production persist, however, free trade can exacerbate economic pressures on farmers to change crops or professions. In such circumstances, countries usually intervene in domestic price formation by severing any direct links with world commodity markets. At the extreme, such autarky means setting all domestic commodity prices independently of world prices, at least in the short run. To do so, countries must build institutions capable of designing and implementing independent price policies. But in those circumstances in which international trade remains a factor in the domestic balance between supply and demand, these institutions inevitably must make predictions about the future course of world prices. These predictions are crucial to

the success of an independent price policy; no country can long afford to subsidize producers of major export commodities by paying them more than the country receives in the world market. Equally, it cannot continue forever to subsidize consumers of important imported goods by paying its domestic producers less than it pays in the world market. These realities on both the export and import sides are not altered by the extent of distortions in world prices. Budgetary realities in poor countries mean that "fairness" of competition against rich, subsidized producers in developed countries is not much of an issue. Even when the costs of protecting producers in poor countries can be moved "off-budget" by imposing import restrictions, thus placing the burden on domestic consumers, the welfare loss can be substantial in the long run. Resources are diverted from their most productive use, and countries may fail to invest in sectors with long-run comparative advantage.

4.52 The existence of significant "learning by doing" effects and economies of scale complicates the choice between the two pricing strategies. Agriculture is an industry with large fixed costs--in research, infrastructure, and knowledge--and many of these costs are specific to the commodity. Serious inefficiencies in resource allocation are generated in economies in which all fluctuations in world commodity markets are immediately passed through to producers and consumers. But equally serious inefficiencies are generated in those economies that fail to pass on any of these international price signals. The dilemma is how much international price instability should be allowed into domestic commodity markets.

4.53 The goal is to find government investments that increase the flexibility of the entire agricultural system without incurring heavy costs that are crop specific. Calculating such costs requires the government to forecast future returns to alternative crops, and these returns depend on their prices. Since there is no satisfactory way to make projections of future prices independently of current prices, the economic basis for large investments by the government in commodity-specific projects is shaky. Some such investments are essential, especially in agricultural research. For these investments, current market prices in world markets are as good

an indicator as any about the future payoff to increased commodity production. The risks of betting otherwise, that future prices will be sharply higher or lower than current prices, are best left to a private sector that is free to balance such risks against other commercial undertakings.

The Dynamic and Macroeconomic Dimensions of Diversification

4.54 No diversification policy works for long unless it is consistent with trends in the macro economy. Budgetary resources need to be generated to fund many of the initiatives discussed in this report. More important, the most crucial part of agricultural diversification is the movement of resources out of agriculture altogether. This process is far less painful when opportunities are readily available in the industrial and service sectors than when rural migrants must squeeze out an existence in urban slums because it remains the relative better life. But successful diversification policies can help the macroeconomic situation as well. A dynamic rural economy based on a diversified commodity base can increase rural wages, thus slowing migration to the city. An active search for new export markets can help generate additional foreign exchange. And higher rural incomes with extra purchasing power can stimulate the industrial sector. These dynamic dimensions of a successful rural diversification effort are difficult to spell out with any confidence, but existing models and field evidence suggest they are substantial.

Investment and Price Instability

4.55 Most economic analyses find the economic benefits from price stability to be marginal at best; simple models can show that producers gain from price instability if the demand curve becomes increasingly inelastic at higher prices, as seems to be the case for basic cereals in poor countries (and in international markets). Consumers have fewer options for substitution after the price of their basic staple has already risen significantly. In such circumstances producers actually derive higher average revenues if prices fluctuate than if they are stable. The purely economic (and static) benefits from commodity price stabilization

thus tend to be quite small.³¹ If the benefits to stabilization are small, the costs of adjusting to price instability by producers and consumers must also be small. The obvious conclusion is that only limited investment resources should be devoted to creating more flexible agricultural adjustment potential in order to reduce these adjustment costs.³²

4.56 These models fail to capture the immense popularity of successful price support and stabilization schemes among producers and consumers (even in their role as taxpayers). It is not clear whether price instability induces psychic costs of adjustment that do not show up in producer's and consumer's surplus measures of welfare change or whether there is a strong negative impact of price instability on expectations and investment behavior. Price stabilization schemes are prevalent in rice-based societies, including all of the countries of East Asia. In these countries, and in similar circumstances in which some degree of rice price stabilization is a political imperative, investment in diversification programs as rice surpluses emerge is inevitable.

4.57 Determining the optimal shape of the production possibility frontier for individual farmers as well as for the national aggregate thus

^{31/} In generalizing their results, this is a conclusion reached in David M.G. Newbery and Joseph E. Stiglitz, The Theory of Commodity Price Stabilization: A Study in the Economics of Risk (Oxford: Clarendon Press, 1981).

^{32/} This logic fails if the adjustment costs to low incomes on the part of farmers are substantial but price stabilization schemes are not successful in preventing these low incomes. If much of the instability in incomes stems from yield variance rather than price variance, price stabilization schemes will destabilize farm incomes. Most of the current concern over diversification, however, derives from surplus rice production and low world prices. In this situation the trade-off between additional investment costs to create short-run adjustment flexibility in cropping patterns and costs of maintaining some degree of domestic price stability relative to world markets remains the key analytical issue.

becomes a matter of high priority. The optimum cannot be defined independently of the degree of price instability faced externally and tolerated internally. The adjustment mechanisms used to cope with this price instability often spill over into world markets, affecting commercial and political interests outside the country's borders. This spillover is as true for the crops involved in diversification as it is for the basic cereals themselves.

4.58 A more diversified, flexible agriculture has smaller adjustment costs as prices change. For the same assumed level of stability in farmer incomes, both stabilization costs and adjustment costs are smaller if the agricultural system is more diversified. The difficult empirical question is determining the functional relationship between stabilization costs and adjustment costs, and then determining the size of investments needed to shift the cost frontier inward. The relationship between stabilization costs and costs of adjustment has received elegant conceptual treatment.³³ Relatively little is known in principle or in fact about the amount of investment required to lower the costs of achieving price stability.³⁴

4.59 Governments vary in the weights they place on stabilization costs incurred by the treasury relative to adjustment costs incurred by producers and consumers. There are certainly some environments in which governments seem to behave as if no adjustment costs must be borne by farmers. The rice economy of Japan is the clearest example, but much of the Common Agricultural Policy (CAP) of the European Community has a similar intent.

4.60 Lower adjustment costs are desirable even if no expensive stabilization program exists, but large budgetary costs incurred to prevent farmers from having to adjust do focus the issue in an acute fashion. As the Economist put it in a recent lead editorial:

^{33/} See Newbery and Stiglitz (1981).

^{34/} See World Bank, "Thailand Irrigation Subsector Review." Report No. 5847-TH. (Washington, D.C., Projects Department, East Asia and Pacific Regional Office, April 25, 1986), for a discussion of the costs of making irrigation systems more flexible in the dry season.

In the rich and mainly industrial countries farmers are paid too much, so they produce too much. In the poor and mainly agricultural countries farmers are paid too little, so they produce too little. Europeans trample Cognac grapes into industrial alcohol; Americans fill Rocky Mountain caverns with butter; Japanese pay eight to ten times the world price for their bowl of rice. Meanwhile, many million Asians and African live in rural poverty and go hungry to bed. Do not despair. The mistakes are so large that these contrary policies will soon collapse. Properly staged and handled, that collapse will leave the whole world better off.³⁵

4.61 The point is not that free trade is the better answer, which is the Economist's preferred solution, but that very large budgetary expenditures on behalf of stabilizing agricultural prices to keep farmers from having to adjust to external market realities are unsustainable in the long run. A more flexible agricultural system in the short run can alleviate much of the political and economic need for such large budgetary expenditures. Consequently, the time horizon for analysis of diversification must include the potential for such short-run flexibility and evaluate the investment costs of creating it against the costs to the budget of stabilizing domestic prices instead. While it is easy to say that there has been "too much" stability in Japanese rice prices, for example, most American farmers would argue (and seem to have convinced their Congressional representatives) that their prices have not been stable enough (at high enough levels of stability). A more diversified agriculture offers the potential to change the nature of this debate in rich countries and poor alike, but only if the diversification policy is able to focus long-run investments and research on the short-run flexibility of the system and to compare such costs with those of price stabilization programs.

The Macro Economy and Agriculture

4.62 Macroeconomic policies have a significant impact on agriculture, and their effects can often overshadow those of sector-specific policies. Trade, exchange rate, fiscal, and moneta., policies are leading determinants of the movement of capital and labor between agriculture and

^{35/} The Economist (November 15, 1986), p.13.

the rest of the economy, the growth and composition of agricultural output, and the volume and composition of trade in agricultural products. Macroeconomic policies thus affect crop diversification both within the agricultural sector and outside it.

4.63 The most important mechanism through which macroeconomic policies affect agriculture is the real exchange rate. Overvaluation of the domestic currency can result from import barriers entailed in inward-looking or "development-through-protection" industrialization. An overvalued domestic currency is detrimental to agriculture because, relative to industrial products, import substitutes and exports are undervalued. Imported food for domestic consumption is thus artificially cheap and exported agricultural goods artificially expensive. Industries producing agricultural inputs inefficiently under the protection of tariff barriers hinder agriculture by increasing the costs of inputs. While these policies have their effects on employment and income within the agriculture sector, by reducing the competitiveness of agricultural goods, they also affect the flow of resources between agriculture and the rest of the economy. The protectionist policies tend to accelerate the shift of resources out of agriculture by lowering its profitability compared with that of industry--the terms of trade shift toward industry (but employment in industry tend to grow slowly because capital is undervalued in such protectionist regimes).

4.64 In addition to import barriers, other macroeconomic policies affect the real exchange rate. When expansionary monetary and fiscal policies lead to higher inflation at home than that of its trading partners, a government often fails to adjust the exchange rate. It relies instead on increasing protection against imports by employing such devices as quotas, controls on exchange rates, and licensing. As the currency becomes progressively more overvalued, the agricultural sector suffers. Food imports are typically excluded from restrictive import measures to keep urban food prices low, and food imports are therefore implicitly subsidized. In trying to reduce fiscal deficits, countries usually increase sectoral taxes on agricultural exports and curtail subsidy programs for agricultural inputs. As a result of both implicit and

explicit taxation, the agricultural sector tends to bear the brunt of the adjustment programs that ensue from destabilizing macroeconomic policies.³⁶

4.65 From colonial times commodity export crops have been exploited as sources of government revenue, and an export tax is an explicit tax on agricultural goods. Apart from its purpose of raising revenue, the export tax has been used for other reasons. Developing countries have imposed export taxes to take advantage of the monopoly power they believe they have in world markets. Many developing countries have also sought to encourage agriculture-related industries by taxing, or restricting by quota, the exports of the agricultural raw materials used in domestic processing or manufacturing. In striving for self-sufficiency in food production, governments have used taxes on export-oriented crops to induce farmers to grow basic food staples. Export taxation for these purposes has been very costly, however, in terms of national income and agricultural performance.

4.66 Perhaps the most striking evidence of the cost of export taxation can be found in the reduced shares of many developing countries in international trade. Several developing countries have had large enough market shares to exercise some monopoly power, and they imposed export taxes to reap its benefits. But gains from exploiting monopoly power have usually been limited in the long run: foreign consumers found alternative supplies or substitutes; domestic producers had lower incentives to invest in new technology; and high prices encouraged investment and production in other countries. Countries that instituted heavy export taxes have seen their market shares usurped by others with more favorable policies toward producers. In the early 1960s, exports of palm oil from Nigeria and Zaire were greater than those of the main Asian producers, but by the early 1980s, the Asian exporters had captured more than 90 percent of the world market. Agricultural export taxes are often a fiscal necessity in many countries, but tax rates should be set with the consideration of the long-run, dynamic impact along with short-run tax revenues.

^{36/} See Chapter 5 of C. Peter Timmer, Walter P. Falcon, and Scott R. Pearson, Food Policy Analysis (Baltimore, Md.: Johns Hopkins University Press for the World Bank, 1983) for a more complete discussion of these macro issues.

4.67 The strong growth performance of agriculture in Thailand, Indonesia and Malaysia between 1970 and the present was facilitated by the macro-economic stability of these countries.³⁷ These countries kept inflation rates under control (Indonesia more recently than Malaysia and Thailand); and made other efforts to keep farm export prices competitive. Internally there were efforts to improve price incentives to farmers, offsetting some of the bias in industrial and trade policies.

4.68 Just as macroeconomic policy can be the dominant factor influencing agricultural development, so too is its impact pervasive on the process of rural diversification. Evolving patterns of demand are the prime driving force behind the diversification process; the speed at which these patterns shift and thus support rapid diversification is largely a function of macroeconomic performance. Links to patterns of foreign demand are efficient only if the exchange rate correctly reflects the real opportunity costs of domestic resources in producing for export. A repressed financial system always discriminates against the rural sector, and, as stressed already, diversification efforts are highly sensitive to credit availability for private traders if flexible marketing arrangements are to be created. And rural infrastructure is mostly a public good, not easily supplied in optimal amounts by the private sector. Unless government budget priorities and spending procedures support investments and maintenance of this infrastructure, rural diversification can make little progress.

^{37/} See William E. James, Seiji Naya and Gerald M. Meier, Asian Development Economic Success and Policy Lesson (Madison, University of Wisconsin Press, 1988), Chapter 5.

Chapter 5. GOVERNMENT POLICIES FOR RURAL DIVERSIFICATION

5.01 An important lesson learned from postwar development experience is that economic growth depends on rising agricultural productivity. Economies that have invested financial, human, and policy resources in agriculture in the postwar era have grown faster than those that neglected or discriminated against their rural economies. Wherever rapid agricultural growth stimulated rapid overall economic growth, however, societies have had to pay a heavy price for their success in the form of severe cases of structural lag. Human and financial resources have not been able to move out of the agricultural sector fast enough to prevent low economic returns to their utilization. As a result, low incomes, even widespread poverty, are seen in some rural areas. Those countries that have supported farm incomes through price supports have paid very high budgetary costs, and these burdens have been exacerbated in the 1980s by the collapse of commodity prices in world markets. Diversification of agricultural production patterns is a potential response to both problems--structural transformation and low commodity prices--but the relationship between the two problems is not one-to-one, nor will the potential solutions necessarily correspond.

5.02 A successful structural transformation is painful for the agricultural sector in all societies.³⁸ Agriculture declines in relative importance as societies become richer; eventually agricultural labor must find work in other sectors. The process of selling the family farm and uprooting households to look for jobs in the city is painful, especially when the family members have few skills applicable to modern urban life. It is not surprising that societies cushion this process whenever they

^{38/} For a review of the process of agricultural development in the context of structural transformation see C. Peter Timmer "The Agricultural Transformation," in Hollis B. Chenery and T.N. Srinivasan, eds., Handbook of Development Economics (Amsterdam: North-Holland, 1988), pp. 275-331, which deals specifically with the changing structure of the economy and the role of labor flows out of agriculture, as well as the changing structure of the agricultural sector itself due to differential Engel elasticities.

become rich enough to afford it. The only puzzle is why all industrial countries seem to use the same mechanism: protection of domestic farmers from foreign competition for commodities that were imported historically. Protectionism is thought to stem from the changing political "market," as food declines in importance in real wage rates and urban household budgets, and from the capacity to "hide" support costs in higher consumer prices rather than direct budgetary outlays.³⁹ Governments appear reluctant to "decouple" support for farmers' incomes from inefficient interventions in commodity markets for this reason.

5.03 Despite policy efforts to slow the structural transformation and preserve the viability of family farms, the exit of agricultural labor to other sectors is inevitable and the only mechanism for coping with inexorable shifts in demand and supply conditions for agricultural output. Discussions of agricultural diversification, including the discussion in this report, must accept the fact that in the long run rural incomes will be depressed relative to urban incomes unless labor leaves agriculture. High commodity prices can temporarily slow this process, as in the mid-1970s, and low commodity prices can accelerate it, as in the mid-1980s. But all existing historical experience argues that transferring labor out of agriculture is inevitable if the economy is growing. The policy issue is whether efficient ways can be found to ease the cost of adjustment, perhaps through better educational programs in rural areas, more flexible land and credit markets so that farmers can avoid sales during hard times, and rural industrialization programs to create a better market for off-farm employment for members of farm families. This pattern was followed in Japan and Taiwan, but this has not been the case in most of Southeast Asia.

5.04 Agriculture itself undergoes considerable restructuring within the general process of structural transformation. Differential income elasticities of demand for starchy staples, livestock products, and fruits and vegetables induce farmers to switch from producing grain for direct

^{39/} This viewpoint is expressed in Kym Anderson, Yujiro Hayami, and others, The Political Economy of Agricultural Protection (Sidney, London and Boston: Allen & Unwin, 1986).

consumption by humans to producing grain to feed to livestock, as well as higher-value horticultural crops suitable for processing or fresh distribution. Different technologies and suitable ecological settings restrict the crop substitutions to a substantial degree, especially in tropical conditions, but research efforts and changed economic conditions can affect the degree of substitutability.

5.05 The collapse of the world price of rice is the proximate cause for the current interest in agricultural diversification, and the special circumstances of the Asian rice economy have been an important element in the attempt in this report to understand the problem and scope for policy initiatives to deal with it. In particular, a wide spectrum of personal and institutional interests are affected by diversification programs.

5.06 At the broadest level, the entire society has important stakes in diversification programs when they are designed and implemented within a policy framework that incorporates the changing structure of the economy during the process of economic growth. The impact can be positive or negative. Policies that attempt to freeze the allocation of resources and distribution of incomes to farmers growing particular commodities (especially rice) can gradually create serious distortions in the allocation of economic resources, and these distortions can imperil overall economic health unless the country is rich enough to afford them. There are also positive adjustment policies, however, that attempt to make the agricultural system more flexible, that train agricultural workers for off-farm jobs, and that cushion the transition from a rice-based agricultural economy to an industrial and service-based economy. These policies include diversification programs at the level of research, investment in infrastructure, improvement in marketing communication and information, and pricing interventions that build stable expectations and lessen the risk of adopting new technologies and products. To be successful, positive adjustment policies must be consistent across all three levels discussed in this report: the farm level, the agricultural sector level, and the macroeconomic level.

Farm-Level Issues

5.07 Any crop diversification program depends on farmers' adopting new cropping patterns. The technology and incentives necessary for them to do so have been extensively discussed already; the remaining issue is the set of farm-level factors to be addressed by diversification policy. The nature of on-farm constraints, role of the extension service, opportunities for contract farming and mechanisms for organizing farmers, and the responsiveness of farmers to the various types of signals they receive are raised in this section.

On-Farm Constraints

5.08 It is illuminating to contrast the homogeneity of irrigated paddy in an extensive river basin is sufficiently different from the constraints facing upland farmers that decisionmaking models based on farmer behavior in rice systems might provide poor guidance to their behavior when encouraged to grow alternative crops.⁴⁰ The uniformity of the environment provided by standing water, coupled with the stability of the market environment provided by a successful price stabilization policy, mean that success in raising rice yields through adoption of new varieties and heavy fertilizer applications does not translate directly into similar behavior if corn, soybeans, peppers, or papayas are introduced into the cropping system. The relatively homogeneity of rice research and extension activities must then give way to the messy diversity of on-farm research on cropping systems. The implied corollary is that far more regional and local research would be needed, not just work within the CGIAR system and national research stations in each country.

^{40/} For an Indonesian example see Heriyanto, and others, "The On-Farm Research Program for Palawija based farming systems in Malang District, East Java, Indonesia, 1984-1986." Paper presented at the Farming Systems Research Symposium, Kansas State University, Manhattan, Kansas, October 1986.

The Extension Service

5.09 The implications for extension activities are equally strong. In very few Asian settings can extension workers establish a one-to-one relationship with individual farmers. There are simply too many farmers and too few extension workers. This is not a serious constraint if the new technology and cropping practices being extended are relatively homogeneous for extensive areas, as in an irrigated river basin devoted to rice. Messages transmitted directly to village leaders or respected farmers can be spread fairly accurately and effectively by word-of-mouth and demonstration. But when each farmer might be trying a unique combination of crops, timing, and cultivation techniques, the problems that arise will also be unique. Extension agents who cannot help when problems come up, or who do not know how to grow the crops the farmers want to try, quickly lose their credibility and usefulness. Close interaction between local research stations and the extension agents is the obvious solution, but not one that can be established quickly except on a pilot basis.

Opportunities for Contract Farming

5.10 One mechanism for providing appropriate technology, extension advice, and stable markets for the output is through contract farming for a central processing unit or marketing firm. Many countries are now trying to find the right set of incentives and local institutional arrangements to attract foreign and domestic investors to participate in schemes. For certain products in some locations--for example, pineapple in Thailand and the Philippines and oil palm in Malaysia--contract farming has been mutually profitable for farmers and processors. But for a variety of reasons, integrating farmers into agro-processing activities has been difficult. The recent World Bank Agricultural Assessment for Indonesia points out that licensing, restrictions on foreign investors, short-term land leases, quality control, and other problems in marketing and transportation have inhibited the development of secondary food crops and horticultural products.⁴¹

⁴¹/ World Bank, "Indonesia: Agriculture Assessment" (Washington, D.C., July 1986; typescript), pp. 67-68).

Responsiveness of Farmers

5.11 A central concern is how to get farmers to respond to crop diversification initiatives. Information channels for prices, availability of new crop technology, and cultivation practices have to be established and expanded in order to elicit an appropriate response from farmers. Any crop diversification program has to deal with this reality. Several approaches would seem to be open. One, discussed previously, is to package the entire deal into a contract with a central processing facility. In some countries, especially Indonesia, cooperatives are used as a semi-autonomous arm of the government to direct farmers toward new, profitable activities. The cooperative promises to market and process the resulting output at profitable prices for its members, but frequently in such undertakings, it incurs losses that must be covered by the government if the cooperative is not to go bankrupt. A more vigorous role for private-sector marketing activities is possible, especially for the non-rice crops that may not be as storable as rice or that have specialized quality or processing dimensions that government agencies are not skilled in meeting. However, there is a widespread distrust of the private trader throughout much of Southeast Asia, not alleviated by often inflammatory rhetoric by government officials and the popular press. Working out new arrangements for a much more active involvement of private traders and marketing agents in rural areas requires that the rhetoric be shelved and that effective competition policies be developed and enforced. One major factor keeping effective market signals from reaching farmers has been governments' attempts to limit competition in marketing, both domestic and foreign, ostensibly in the interests of domestic consumers and producers. More often than not, the result has been badly fragmented and high-cost marketing systems, which work to the disadvantage of both.⁴²

^{42/} This lesson is especially clear from the analysis of corn marketing in Indonesia, but it holds much more generally. See C. Peter Timmer, "Corn Marketing," in C. Peter Timmer, ed., The Corn Economy of Indonesia (Ithaca: Cornell University Press, 1987).

5.12 Farmers are the ones who must implement crop diversification schemes. They will do so only if the new cropping patterns fit into the portfolio of choices that each farm household must make. Thinking about adoption of new crops in place of rice as replacing one element with another in an investment portfolio helps to clarify the farm-level issues with respect to crop diversification. If the government does not intervene, farmers adjust their cropping patterns when surpluses of rice develop, but the adjustments may involve substantially lower farm incomes, potentially severe welfare effects for those farmers with few technological options, and the possibility of inefficient investment levels and patterns for the long run. Can government intervention make things better for farmers in the short run and for the entire economy in the long run? The answer depends on the role the government plays in the diversification process and on the forms of intervention it uses.

Agricultural Sector Issues

5.13 Most of the day-to-day policy issues facing diversification efforts are addressed within the context of agricultural policy by the agriculture-related ministries. The framework for this policy must incorporate several important farm-level issues, as noted previously, and macroeconomic linkages, to be discussed below, but the agriculture sector provides the main focus for design and implementation of diversification programs. Four main topics arise: the role of the marketing sector; potential changes in the strategy and funding for agricultural research; switches in patterns of agricultural investment; and the role of agricultural price policy in stimulating (or impeding) the diversification effort.

The Marketing System

5.14 A fundamental principle of all successful diversification programs is that they are driven by market demand. In the rice-based systems in Southeast Asia, the marketing system for rice is nearly always better developed, often with the help of direct marketing agencies or substantial

government subsidies, than the marketing system for alternative crops that rice farmers might grow.⁴³ Markets for new crops are very thin; significant increases in output are heavily discounted by traders who are uncertain of potential wholesale market demand; farmers who lose money on the new crop revert to concentrating on rice, a crop for which there is a guaranteed market.

5.15 The government can take several steps to overcome the marketing bottleneck. Without doubt, the most important for the long-run efficiency of the agricultural sector is to invest in the basic infrastructure that permits low-cost marketing to take place. Marketing involves the transformation of the farmer's commodity in time, place, and form by storing, transporting, and processing it. Implicit in these tasks is the exchange of ownership, as farmers sell their crops to traders, who sell to wholesalers, who sell to retailers, who sell to household consumers. Each sale involves a potential risk, as the price paid may be too high relative to the price ultimately received at the next sale. For the entire marketing system to work efficiently, and consumers' preferences and willingness to pay to be transmitted accurately back down the entire chain of transactions, there must be low-cost transportation, communications, access to credit, and institutional arrangements for sharing risks of price fluctuations. When the system is highly developed, patterns of urban and foreign demand are quickly transmitted back to the rural economy. Traders and farmers respond as quickly as their resources and technology permit.

5.16 Marketing infrastructure includes roads, railroads, and ports, but often investments are made in these facilities without conscious objectives

^{43/} The picture is clearest for cassava and corn in Indonesia, but the pattern is likely to be general. For details of cassava marketing, see Laurian J. Unnevehr, "Marketing and Price Formation," in Walter P. Falcon, William O. Jones, Scott R. Pearson, and others, The Cassava Economy of Java (Stanford, Calif.: Stanford University Press, 1984); and for corn marketing see C. Peter Timmer, "Corn Marketing," in C. Peter Timmer, ed., The Corn Economy of Indonesia (Ithaca: Cornell University Press, 1987).

for agricultural marketing. Highways opened for defense purposes offer export outlets previously unavailable; railroads built to carry minerals also move coffee and cocoa; port facilities built to import wheat can export corn or cassava chips. The policy issue is whether the potential increases in agricultural marketing are adequate to justify substantial additional investments in this type of infrastructure. The mirror question is whether any significant diversification can take place without such infrastructure in place. Only specific project analysis can answer these questions, but it is important to set the analysis in the appropriate context. Potential gains in flexibility of the agricultural economy made possible by diversification do not show up automatically in the cost-benefit appraisal of such investments in infrastructure. Planners must find innovative techniques for incorporating such potential gains in efficiency (and income distribution).

5.17 Several nitty-gritty initiatives in agricultural marketing can help create a more conducive environment for agricultural diversification. For example, government agencies can set up rural buying stations where growers can meet regularly with traders. Daily radio broadcasts can provide information on wholesale and rural market prices for non-traditional commodities as well as the staples sold by farmers. Governments can facilitate the industry's development of appropriate grades and standards to lower transactions costs, and it can provide effective institutional arrangements to make contract farming less risky for both farmer and processor.

5.18 A focus on quality standards and processing opportunities broadens the concept of diversification to include vertical diversification--that is, adding value to the staple commodity itself through more attention to consumer demand for more attractive rice and more convenient forms in which to use it. Vertical diversification in fruits and vegetables has only limited potential for the domestic market, and world markets are highly competitive.⁴⁴ But innovations in processing techniques, especially aseptic

^{44/} This point is emphasized in World Bank, "Indonesia: Agriculture Assessment" (1986).

packing of fruit juices, and development of more convenient forms of traditional products might offer significant opportunities if domestic demand can be stimulated through higher incomes and lower prices. Higher incomes are a function of macroeconomic policy and the state of the world economy, but lower processing costs and scale economies offer the potential to reduce retail prices for many processed foodstuffs, with a subsequent stimulus to demand.

5.19 Quality standards for exports and improvements in quality control would increase competitiveness in world markets. Export markets have been lost for lack of effective mechanisms for enforcing trade contracts and the resulting failure of domestic markets to transmit existing price differentials for quality products all the way down the marketing chain--from exporters to processors to farmers. A commodity exchange could forge stronger links among farmers, processors, and exporters and help transmit incentives to invest in postharvest technology and adequate warehouses to maintain quality standards. In the case of nontraditional high-value commodities, contract farming would increase incentives to farmers to meet the quality standards required by processors, and modernization of the domestic produce marketing chain would also be beneficial. If foreign investors with needed marketing, managerial, and technical expertise were encouraged to invest in food retailing, exporters would have access to well packaged and good-quality produce that met foreign standards.

Agricultural Research Strategy

5.20 Without productive agricultural technologies for crops and livestock, no diversification program can succeed for long. With the important exception of Malaysia, most Southeast Asian systems for agricultural research have focused heavily on rice. This bias needs to be redressed in such a way that the continuing progress made in raising productivity in rice cultivation is not jeopardized. There are two problems. First, most agricultural scientists in these countries are "crop-specific." They were trained as rice breeders or as specialists in the diseases of rice, the pests that attack rice, or the types of soil in which rice is grown. They are so-called, "putty-clay" human capital, and

their retraining is expensive and time-consuming. Second, many of the potential crops involved in a diversification program are not grown as specialty crops in monocultures, but will be integrated into a complicated multi-product farming system. Relatively few scientists are trained in techniques for research on such complicated systems, and the methodologies for evaluation are not well developed.⁴⁵ It is unrealistic to expect substantial breakthroughs on new crop technologies from these research efforts before the end of the century.

5.21 Even with a more flexible and broader agricultural research program under way, the question of which crops to work on is difficult to answer. There are dozens of potential tree crops producing fruits, nuts, spices, and beverage products. Like the kiwi fruit, any one of them might take off.⁴⁶ There might be numerous unresearched vegetables that are produced and consumed in Southeast Asia, each with an unknown potential.

^{45/} See Derek Byerlee, Larry Harrington, and Donald Winkelmann, "Farming Systems Research: Issues in Research Strategy and Technology Design," American Journal of Agricultural Economics, vol. 64, no. 5 (1982); and Heriyanto, and others, 1986.

^{46/} The seed of the kiwi fruit (*actinidia deliciosa*) was introduced into New Zealand from China in 1906 and was promoted under the name "Chinese gooseberry." Its commercial potential took off slowly, and in 1953 only 31 hectares were planted. Small quantities were exported in the 1950s; exports gradually started to pick up by the 1960s. This initial success is attributed mainly to its new name "kiwi fruit" and the establishment of the Kiwifruit Marketing Authority, which is controlled by producers and exporters. Aggressive international marketing campaigns paved the way for its introduction to European and North American consumers. Research, extension, and market links were strengthened to resolve problems in the fruit's development. The United States and other countries have begun production, but New Zealand still has a great share of the market--total plantings are projected to exceed 24,000 hectares by 1990. The success of kiwi fruit paved the way for development of other horticultural activities in New Zealand.

Even staple crops such as corn, cassava, and a wide variety of legumes have received little research attention in the tropics; they offer opportunities for highly profitable diversification if cost-reducing and yield-increasing technologies can be made applicable to the constraints on farmers' cropping systems. Coordination of regional research centers by the CGIAR has helped establish some priorities for crop research, but only for the handful of most important food staples. Much more local attention to local crops and environments is needed to create more flexible production possibility frontiers in agriculture.

5.22 In attempting to make these frontiers more flexible, should government efforts focus on individual farmers, a region, or the entire country? Although the results for aggregate production might look the same no matter which target is chosen, the consequences for income distribution, as relative prices of commodities rise and fall, are vastly different. If each farmer has a flexible production possibility frontier and can adjust easily as prices change, the burden of adjustment is widely shared. If individual farmers specialize in particular crops, however, and diversification occurs through different regions specializing in different crops, according to regional comparative advantage, then sharp differentials in income are generated as prices move up and down. The research task is almost certainly much more difficult if flexibility is sought for each farmer, and the costs of maintaining a diversified marketing system are probably higher. But the costs of stabilizing prices in the face of pressure from specialized farmers who face low prices, however temporary, might make the broader flexibility approach more cost-effective in the long run.

5.23 A final agricultural research issue is the potential impact of new approaches made possible by techniques that manipulate basic genetic material and by the new biotechnology industry that the techniques have spawned. Research capacity in most developing countries in these techniques is very limited, as are the venture capital and entrepreneurship that have sparked the biotechnology revolution in the United States (and to some extent in Europe). Fruitful opportunities might exist for forming joint ventures with foreign laboratories to pursue research on products or

processes that would directly contribute to both horizontal and vertical diversification in Southeast Asian agricultural economies.

Agricultural Investment Strategy

5.24 Agricultural research is one dimension of agricultural investment, and many of the points discussed previously hold more generally. In particular, the location of crop-specific investments is a difficult issue. Should regional comparative advantage be developed through specialization, with all the attendant consequences for income distribution noted previously? Or should such investments be spread more broadly in order to diversify the geographical risks from crop specialization?

5.25 One solution to this problem is to make crop-specific investments more flexible, primarily with respect to the flexibility of irrigation investments. Irrigation projects have taken the largest investment of both domestic funds and those borrowed from donors. The Thailand Irrigation Study by the World Bank attempts to assess the costs of upgrading irrigation systems and the potential market demand for non-rice crops.⁴⁷ It notes that most upland crops require better water control and drainage than paddy and this implies substantial investment costs as systems design and on-farm development of land infrastructure are often necessary to permit switching to non-paddy crops.

5.26 Whether such large investment costs are worth paying is both a market and a marketing problem. Wherever demand for high-value crops such as peppers and onions exists and the marketing system is effective in linking that demand to farmers, many of the necessary on-farm investments are made by farmers themselves as they seek to capture new profit opportunities. With sufficient incentives, ridges have been built up in the middle of paddy fields, and horticultural crops have been grown surrounded by irrigated rice. The emphasis on the economics of the

^{47/} World Bank, "Thailand Irrigation Subsector Review." Report No. 5847-TH. (Washington, D.C., Projects Department, East Asia and Pacific Regional Office, April 25, 1986), p. 52.

situation, rather than narrower agronomic assessment of soil characteristics, is appropriate.

5.27 At the margin, investment allocation can shift from irrigation works to more general, and less crop-specific, rural and marketing infrastructure. The Thai Irrigation Study notes the importance of marketing as a constraint on diversification, even when the irrigation system is designed to permit growing upland crops in the dry season. The same point holds in Indonesia, Malaysia, and the Philippines. When there is substantial uncertainty about which crop to invest in or how flexible to make an irrigation investment, some of the investment resources can be devoted to roads, telephones, rural electrification, market centers and rural credit programs, ports, and rail facilities.

5.28 Sometimes design of programs is more critical than funding levels, although the two often go together. Schemes to improve the access of small farmers to rural credit systems are an obvious example. Subsidies on interest rates and bureaucratic restrictions on who may participate in the program can be very costly to the budget but provide few benefits in terms of increased agricultural production or improved flexibility of crop choice. By contrast, charging interest rates that cover the costs of servicing small loans as well as the opportunity costs of the money opens the potential to reach a far broader clientele. In fact, if diversification is a major governmental goal, restricting credit programs to farmers will be nearly self-defeating. The primary bottleneck, as stressed often in this report, is usually in marketing the output, not in getting farmers to grow the crop when profitable. Credit programs that make it much easier for small-scale traders to obtain working capital, much of which they will on-loan to small farmers, are likely to be a highly efficient mechanism for speeding the diversification process. Traditionally, project evaluations for a broad range of investments in rural infrastructure, credit programs, and marketing development have not included two potential benefits gained from diversification: increased flexibility of the agricultural system; and the possibility that price fluctuations would have less severe consequences for income distribution.

Price Policy and Diversification

5.29 The impact of price policy on the diversification process has been stressed throughout and there is no need to repeat the discussion here. But two very different dimensions to agricultural price policy must be emphasized: the impact of rice price policy on the potential to diversify into non-rice crops; and the potential to use price policy for the non-rice crops themselves in an effort to enhance their profitability and adoption.

5.30 The importance of price stabilization schemes for basic food staples, for rice in Southeast Asia, has been the key theme stressed here. The links to diversification programs are through the following mechanisms: the enhanced profitability of rice production made possible by the stabilization (and support) of rice prices, and therefore the relative discouragement of non-rice crops; the trade-offs between the budgetary costs of rice price stabilization programs and the costs of adjustment for farmers and consumers if rice prices are allowed to fall (or rise); and the enhanced efficiency of the rice marketing system made possible by government investments on behalf of stable procurement and distribution capacity. Successful rice price stabilization programs greatly enhance the profitability of growing rice, an outcome once desired by most governments until the onset of gluts in the mid-1980s.

5.31 The policy issue for diversification concerns redressing the increased profitability of growing rice made possible by rice price stabilization programs.

5.32 One cannot simply promote non-traditional crops through price support schemes. For a number of reasons non-traditional farm activities differ from rice in ways that make price stabilization schemes impractical.

5.33 Many of alternatives to rice must reach export markets as well as domestic markets, and they must be price competitive on a day-to-day basis to establish a reputation of reliable supply. Many of the nontraditional crops have very short shelf life--fresh fruits and vegetables, live fish, and livestock products, for example--or require relatively sophisticated and timely processing.

5.34 Price stabilization schemes work only when the commodity is reasonably storable, without wide variations in quality that are difficult to define in terms of standard price discounts and premiums. Few of the nontraditional crops meet these criteria, though corn and soybeans come closest. For countries that operate an import-substituting schemes for these crops, a price stabilization scheme organized around rural buying stations to prevent a collapse in local market prices as increased production comes on stream might make sense. But if the nontraditional crops must be exported, the most effective way to stabilize prices is to ensure that the f.o.b. price at the port is transmitted efficiently back to farmers, after conversion at a competitive exchange rate.

5.35 This perspective reemphasizes the importance of a competitive and responsive domestic marketing system as a key to enhancing the profitability of diversification schemes. The contribution is threefold: an efficient private marketing system can relieve the government of much of the burden of price support schemes if regular exports can be generated; lower marketing costs increase average returns to farmers by garnering them a larger share of the consumer price; and the lower costs provide more stable prices to farmers because of smaller divergence between the f.o.b. export price and the farm-gate price.

5.36 The importance of price policy to diversification efforts is thus somewhat contradictory. Rice price policy actually tends to be part of the problem rather than part of the solution, but there are likely to be tangible benefits that justify imposing these added barriers to diversification. Price policies for non-rice crops might also be part of the problem, however, if they have the effect of causing farmers to produce crops for sale to government procurement agents at a guaranteed floor price and the government is then unable to turn around and sell them at a profit. The different technical and market characteristics of each crop must be examined before a uniform judgment can be made in this regard, but many nontraditional crops proposed as suitable candidates for rice diversification programs have either too complicated a set of marketing and processing requirements for government agencies to handle them efficiently

or, at market prices, too low a production value to be adopted by farmers. Pilot projects to demonstrate technical feasibility of particular crops in a particular region are obvious exceptions to this general rule, but they illustrate the nature of the problem. Diversification crops must create more value added for the economy than that created by the rice they displace, and enough of the increment must be garnered by the farmer to make it profitable to adopt the crop in the first place.

5.37 For farmers to have flexibility in crop choice depends on market prices. Incomes derived from a given set of crop choices and prices depend on the technology itself because the technology partly determines the cost of production. The relationship between technology and market demand means that diversification can never be solely an agronomic or an economic question; the two must always be considered simultaneously.

The Government's Role

5.38 By the very nature of agricultural production in Southeast Asia, most of the adoption of diversified cropping patterns will be by millions of small-scale farmers acting in accord with their private interests. State-owned plantations can be diversified by command. But by and large, diversification is an activity of the private sector. At the other extreme, relatively few resources from the private sector will be invested in large-scale irrigation projects, roads, electric power and communications networks, or even agricultural research on alternative crops to rice that can be grown by smallholders. These activities fall almost entirely in the domain of the public sector, at least in the countries of concern.

5.39 A basic premise of current diversification efforts is that further, large increases in rice production will not find a market at remunerative prices. Unless prices actually facing farmers communicate this signal, they will try to continue expanding rice production. If the lower prices are passed on to farmers, they will actively seek alternative crops with better market prospects or better income-earning prospects off the farm or outside of agriculture. Such changes are desirable as a long-

run response but can be quite tumultuous in the short run. Poor farmers and rural landless laborers might crowd into urban labor markets seeking jobs and create unrest if they do not find them. Attempts to grow alternative crops may flounder because of untried technology or markets that are too thin to absorb profitably substantial increments in supply. Government extension workers are blamed when soybeans are wiped out by pests and disease; middlemen are blamed for falling prices for cabbages and onions. Confidence in the effectiveness of government development programs is shaken; willingness to trust the marketplace as an arena for easy and fair exchange of commodities is lost--by both farmers and policymakers. To avoid such problems, it is desirable to search for alternatives to such a short-run market free-for-all.

5.40 The key to this search is a better understanding by public policymakers of the actual decisionmaking environment of private-sector participants - farmers, traders and processors, and consumers. With this understanding comes the capacity to design more sensitive and effective policies that draw on, rather than scare away, the initiative and investment resources of the private sector. Commensurate with this effort by public policymakers is the similar responsibility of private interests to cooperate in the development program by becoming informed about government objectives and plans. Participation in a public debate about these objectives is healthy, as is constructive criticism in response to drafts of government plans and programs. Large-scale private interests--corporations, unions, cooperatives, and consumer-interest groups--have the resources to conduct their own analysis of these issues and to lay them before public policymakers. Unfortunately, important classes of citizens are left out of the policy process if it ends there. Public policy analysts have a responsibility to examine proposed policies and programs for their impact on these disenfranchised elements of society: small farmers, the rural landless, and the urban poor. Public-private cooperation should not evolve into a cozy relationship between large corporations and a handful of government officials responsible for policymaking in the very arena of their corporate interests.

5.41 The issue is particularly clear in the diversification debate. If the process is to be market driven, knowledge of and access to those markets for nontraditional commodities are crucial. When the markets are external, the easiest way to gain such knowledge and access is to tap the expertise, and possibly the capital, of a multinational enterprise. With many countries now bidding for this expertise, there is a significant risk that more incentives will be offered, either publicly or privately, than is justifiable on the basis of benefits to the country. A certain responsibility on both sides of the bargaining table is essential to keep the process within bounds. Most countries do not have well-developed mechanisms for conducting such a public-private interchange, and the analytical tools for understanding the process are blunt at best.⁴⁸

5.42 The government has a key role in stimulating diversification away from rice. The government's role is potentially positive, but often good intentions do not lead to good policy design, implementation, or impact. Some areas of policy intervention are obvious and noncontroversial; the debate is over what to do, not whether something should be done at all. Investments in agricultural research, rural infrastructure such as irrigation, roads, and communications, and extension programs to facilitate the flow of information to small-scale and widely dispersed farmers fall in this category. Controversies do arise when these investments and programs are commodity specific and the government guesses wrong, as might happen if it invested in rice intensification programs that turned out to have low financial payoff because the opportunity cost of rice dropped well below its expected price when the investments were made and the programs designed.

5.43 One lesson might be that it is not a very appropriate role for the government to be in the business of speculating on future commodity prices. There is no a priori reason to think that it is very good at such a task, and much empirical evidence has surfaced to suggest that governments are very bad at it. However, there is very little the government can do to foster a more efficient agricultural adjustment process without

^{48/} See C. Peter Timmer, "Private Decisions and Public Policy" (Boston, Mass.: Harvard Business School, 1984; typescript).

incorporating future commodity prices either directly or indirectly into its planning. Even allocating money to basic agricultural research involves some judgment about future relative scarcities. The accumulating evidence suggests that this dilemma can be resolved if the government simply does not try to outguess the market - that is, anticipate the direction of future prices independently of current market prices. Whether these guesses are based on complicated econometric models of individual commodity systems or on attempts to discern underlying trends in historical price data, the record suggest they will be wrong in a very important way. Price forecasts based on either of these two techniques do not provide as good an estimate of future prices, even when the time horizon is as long as a decade, as the current price at the time the forecast price must be used in determining government investment and program priorities.⁴⁹

5.44 The implication for the role of government in price stabilization schemes is stark. Unless a strong case can be made for reasons of efficiency and income distribution to attempt short-run price stabilization, the government should probably find other instruments to reach its policy objectives. Stabilizing rice prices clearly makes sense for these reasons if the levels do not deviate too much from border prices for too long a time, where "too much" and "too long" can be determined only relative to budgetary flexibility and the seriousness of any spillovers from rice price stabilization to other commodities or other countries.

5.45 The dilemma here has been stressed before. Policy that stabilizes rice prices is important for political and economic reasons, but distortions caused by too much stabilization create rigidities in the whole agricultural economy. Long-run economic policy must promote efficient allocation of resources; otherwise there will be too little output to worry about distribution or food security. But granting this long-run goal, how much premium can a poor country pay in the short run to achieve food

^{49/} See Robert J. Schwartz, "Optimal Trends for Forecasting Prices: An Empirical Assessment of Three Grains," Ph.D. Dissertation, Economics Department and Harvard Business School, Harvard University, Cambridge, Mass., 1987.

security, and what degree of distortions induced by stabilization policies is desirable to maintain that achievement?

5.46 The answer depends on whether the stabilization policies have a positive net social payoff. Some stabilization schemes, especially buffer stock, have low social returns in relation to their costs. Their distortionary effects on cropping patterns are thus also costly to society. But where risks are high, farmers are risk averse, and administrative costs are low, some stabilization schemes may provide a net social gain. In this case, the distortionary impact on production can be desirable, provided that the average price level is not distorted too. In essence, the government is efficiently spreading the risk burden across taxpayers, thereby relieving farmers of part of their price risks and enabling them to use their resources more efficiently. Rather than being a market distortion, they are filling in for risk contingency markets (for example, futures markets or capital markets) that are either inadequately developed or nonexistent.

5.47 For a government to use price policy to favor the production of particular non-rice crops or livestock requires it to choose which commodities have export potential or sufficient domestic demand. This is a very risky business for a government to be in, given the need for timely and usually proprietary market information. Given the limited domestic market for several nontraditional commodities, the extent to which output can rise will be determined by the growth of exports. Government measures may be needed to improve competitiveness in international markets and access to these markets. In its response to the reality of protectionism and the market distortions it imposes, a government has a legitimate role in trying to increase access to limited international markets and formulating a strategy to improve their bargaining position on agricultural protectionism with their trading partners. There are several key measures that would be important in upcoming GATT negotiations: development of an "early-warning" information system to protect countries from being caught unaware by new protectionist measures; promulgation of clear-cut regulations for counter-trade transactions and state trading (because of its lack of experience, a government should not play a direct role in

trading; in cooperation with the private sector, it could develop a strategy for selling to countries who prefer to buy through monopoly state trading companies); and review of import prohibitions affecting agro-industrial products.

5.48 Competitiveness of a country's agricultural sector can be heavily influenced by government investments in research and infrastructure, willingness to protect individual crops long enough for farmers and the marketing sector to move up a learning curve, "infant industry" protection, institutional arrangements that convey implicit or explicit subsidies, and foreign or domestic investors who transfer improved technology or specialized access to markets. Implicit or explicit promotion of certain crops by government policy is unavoidable and in some cases desirable.

5.49 A crucial aspect of the success of a promotional program is its continued financial and economic viability after the initial period of years so that public assistance can be withdrawn or substantially reduced. This viability requires that farmers, traders, and others involved with program activities not only start off with the right practices but also have the incentive to revise their decisions as circumstances change. For long-term viability, the special incentives initially introduced need to be gradually withdrawn. If a government agency remains involved for a long period of time, it must emphasize flexibility in decisionmaking and take account of the broader ramifications of the various measures taken to assist program participants. These broader ramifications mean that short-run measures must be consistent with long-run goals. In particular, short-term policies should point consistently toward long-run efficiency goals and the process of structural transformation.

Structural Change, Diversification and Rural Poverty

5.50 The incidence of poverty remains substantial in most countries of Southeast and South Asia. In the 1980, World Development Report, it was estimated that of the total number of poor people in developing countries (excluding China), 520 million were in Asia, mainly in rural areas. By the mid-1980s, the number of poor Asians outside of China increased to

somewhere between 550 to 600 million, one-third of which are in India. In low-income South Asia, 40 percent or more of the rural population fall below official poverty lines. The numbers of poor in Indonesia (60 million), the Philippines (33 million), and Thailand (12 million) are still substantial, and these people tend to be living in rural communities.

5.51 The acute scarcity of new farm land and the limited capacity of farming to absorb labor implies that the growth of non-farm rural employment will be a crucial determinant in poverty alleviation. Though structural change is of increasing importance in determining how fast and to what extent poverty can be overcome, what happens in agriculture is also extremely important.

5.52 The success of Thailand has had in diversifying agriculture and sustaining growth in the rural economy is in large part explained by the relative flexibility of the agricultural sector there. Diversification has been facilitated by relatively open and competitive marketing, infrastructural improvements, stable macro-economic policies and an effective land use policy. Thai farmers were able to expand production of non-rice crops by opening up new land and by shifting farm land between crops in response to market signals. The open land policy and the pattern of smallholder, owner-operated farms appears to have been conducive to flexibility. A similar pattern of farm holdings prevails in Indonesia, particularly in Java. However, in the Philippines, despite potential land reform efforts in the 1970s, security of tenure and concentration of land holdings remain serious problems. Rapid growth of off-farm employment, accompanied by improved transport and communication as well as increasing human capital investment has led to income gains for landless and small farmers in Java. The gains have been documented in villages that are irrigated and that are advanced in use of high-yielding rice varieties and other inputs. Rice intensification has continued based on greater specialization and rural labor has found employment in non-rice and non-farm activities. Real wages have increased as a result.⁵⁰

⁵⁰/ "Employment Trends in Lowland Javanese Villages" by William L. Collier, et al, April 1988, mimeo prepared for USAID.

5.53 Institutional conditions may block diversification efforts and worsen poverty and income distribution. For example in the main sugar-growing island of the Philippines, Negros, large sugar plantation owners in the face of the collapsing export markets have refused to allow diversification into food crops. Neither have they invested in order to improve yields or lower costs in the past. Landowners have resisted changing crops when sugar became unprofitable for fear they would face land reform. Indeed, the partial and incomplete land reform may have impeded diversification in the Philippines. It is now obvious that a comprehensive program of agrarian reform and appropriate support measures will be essential to reinvigorate the Philippine rural economy.

5.54 The experiences of the Southeast Asian countries demonstrate that diversification of the rural economy involves both need for expansion in off-farm employment and, simultaneously, diversification of on-farm activities in response market opportunities. Appropriate government policies are of paramount importance in facilitating a more harmonious, less painful process of rural transformation.

Chapter 6. An Agenda for the Future

6.01 Rural diversification is a process that evolves over time through the adjustment of the number and scale of agricultural enterprises, including crops and livestock, grown at the same time on each individual farm, in each agricultural region, or in each country. In developed countries, this adjustment took the same of specialization, substitution, or the introduction of new crops in an attempt to simplify the structure of farming, increase its profitability, reduce its risks, and adjust to fluctuating forces of supply and demand. The agronomic potential of the physical resource base is the essential ingredient in this process, which is supported by technological know-how in making efficient use of these resources. A series of economic and market factors provides the dynamic force that puts this process in motion; these factors shape the decisions of individual farmers regarding what crops to grow, at what scale, and for what purpose.

6.02 In industrialized countries, the economic forces behind the process of rural diversification are relatively well known. Diversification is perceived as a long-term process of crop substitution through stages of economic growth. As countries undergo industrialization, shifts in demand, labor migration, and structural change, the scale of production of agricultural crops and innovations in farming enterprises change mainly through substitution among existing crops. Rather than introduce new crops, farmers use their resources to increase the output of particular crops or livestock in response to changing markets. Diversification is a long-term, market-driven process of agricultural adjustment, influenced by the objectives of government policy for income distribution and short-term price stability. This agricultural adjustment process is itself set in the context of structural change, and hence involves government investments and price policies as well as farmer decisions with respect to land, labor, and entrepreneurial resources.

6.03 The interaction between the private and public sectors of the economy is vital in shaping the process of rural diversification. The

public sector has an important role in providing public goods, including infrastructure, research, extension and education (as well as an appropriate set of institution and policies. Governments should be cautious in using price policies to direct the allocation of resources in directions different from those indicated by long-run market trends. To speed the process of rural diversification, the developing countries of Asia need to avoid isolating their economies from international market forces and to face domestic producers and consumers with long-run opportunity costs reflected by trends in border prices. With this assumption, and assuming that the agricultural sectors in most of these countries will continue to be characterized by abundant labor, segmented capital markets, small land holdings, and large numbers of rural landless laborers, the events outlined below indicate the general direction the process of rural diversification might take.

6.04 Relatively fewer resources will be devoted to rice production as farmers shift to producing commodities with a higher income elasticity of demand, which include livestock products and high-value fruits and vegetables, and to growing feed grains for the livestock sector. Imports of wheat can be expected to increase, and there will be relative growth in export-oriented crops. In general, the agricultural sectors of these countries will become more extensively integrated into the international economy.

6.05 Growth in production of commodities with greater market demand will occur in regions with lower relative cost structures. While the agricultural sector as a whole will become more diversified, there will be greater regional specialization. Whether this specialization is driven by international specialization depends on underlying resource endowments, the development of efficient production technologies for these commodities, and the extent to which efficient marketing and distribution systems emerge. If transportation costs can be reduced, the forces of increased trade and international specialization should be significant.

6.06 Diversification has important regional dimensions. Farmers in upland areas can have a considerable degree of flexibility in changing their cropping patterns. But farmers in uplands have not received sufficient support in terms of agricultural research and extension, infrastructure and marketing, access to credit and non-farm employment opportunities. Diversification can and should involve limited resource farmers in rainfed and upland areas that have not directly participated in the green revolution in irrigated rice lands. Their participation would significantly contribute to poverty alleviation and facilitate structural transformation.

6.07 Research faces the challenge of reaching farmers in marginal areas in a manner that allows such farmers to evolve sustainable farming systems according to long-term comparative advantage. An approach that attempts to force such farmers into growing specific crops designated by planners is unlikely to succeed. Research and investment needs to be geared to both on-farm and off-farm dimensions, in a manner that promotes vertical development of production, marketing and processing for a variety of secondary food crops, livestock and horticultural products. The shift from one crop of low value to another will not be sufficient. An approach that generates higher value - added and economies of scale and that upgrades quality according to market standards is needed but will be difficult to achieve.

6.08 Diversification at the farm level on paddy land will be primarily into a non-rice crop in the dry season, especially where there is irrigation, and into livestock enterprises. The livestock products with the most rapidly growing demand are likely to be poultry meat and eggs. Because of economies of scale in production, poultry operations will develop into large, highly specialized farms. With higher yields made possible by new rice varieties, small subsistence farm households may diversify their cropping systems either to have a more varied diet or to increase cash income by growing more profitable crops for sale in the market. While such farms are an important part of Asian agriculture, they

tend to be too small for extensive diversification, and the goal of policy should be to help these farmers consolidate their holdings into larger farms or to move to more remunerative off-farm activities.

6.09 Movement of resources out of agriculture is likely to be a major part of rural diversification. Because small farms cannot generate household incomes large enough to compete with other alternatives, the pressures for consolidation into larger farms will be great. Labor requirements for non-rice crops, with the exception of fruits and vegetables and intercropped systems, will be significantly less than for rice. This reorganization of farms into larger units and the migration of labor to off-farm employment will be a major challenge to policymakers. That the absolute size of the labor force in agriculture is still growing in most of the developing countries of Asia only points to the seriousness of the problem of creating jobs outside of agriculture. How effectively government handle these adjustments will to a large extent determine the pace of the diversification process and the contribution of agriculture to general economic growth.

6.10 In the developing countries of Asia, this process of rural diversification is likely to follow a path similar to that of other Asian countries that have already undergone the agricultural transformation. Much has been learned from these countries, and the experiences of those based on a rice economy--Japan, South Korea, and Taiwan--are especially relevant to South and Southeast Asia. In particular, the role of small farm size in conditioning the path of diversification and structural change cannot be ignored. Widely dispersed small farms were a crucial factor in the adoption of high-yielding rice technology and the equitable distribution of its benefits. The pricing and marketing policies of countries that encouraged the small farmer to invest heavily in rice production, however, also gave them a strong vested interest in the continued use of price policy as an instrument for maintaining rural incomes relative to rapidly rising industrial wages. The large numbers of small farmers lent political importance to these concerns, and all successfully industrializing Asian countries have protected their rice farmers from foreign competition as they lost comparative advantage in rice production.

6.11 Diversification strategies have been used in Japan, South Korea, and Taiwan to cope with the budgetary costs and inefficiencies in resource allocation that accompany protection of rice farmers. But the unique role played by rice in the agricultural economies of all these countries has been difficult to replace. The adjustment has gone more smoothly where the rural economy had important nonagricultural activities for support, as in Taiwan. This role of a dynamic rural economy, as opposed to a dynamic agricultural economy, stresses the importance of nonagricultural policies in the diversification process. In particular, policies that help integrate urban and rural labor markets and facilitate the establishment of small-scale rural industries speed diversification and structural change by pulling resources out of agriculture. In most countries, however, pressures remain that exert a strong push. Part of any agenda to foster rural diversification must cope with the short-run problems generated by these pressures. The lessons from the already industrialized countries in Asia are not promising in this regard. Heavy protection of rice farmers was an essential ingredient in coping with the short-run pressures on income distribution in all three countries.

6.12 An agenda for the future includes measures that would have an impact in the short run or the long run on various levels of the economy--from farm level to the macro economy. At the farm level, diversification requires research and investment, of the types described below, to create more flexible agricultural systems.

6.13 There should be no slackening in the effort to raise productivity in rice production. Within the foreseeable future rice will continue to be the main agricultural activity in Asian developing countries and the chief wage good. Lowering the cost of its production can thus contribute significantly to economic growth, and as the analysis of the rice market in Chapter 2 indicates, lower costs might enable it to become a more important traded commodity.

6.14 Support or public-sector research is important for the continued development of rice varieties that can be adapted to local agronomic

conditions, can be resistant to pests and disease, and can fit into the crop calendar in multiple-cropping systems. As noted in Chapter 3, greater choice of rice varieties has allowed farmers to introduce new high-yielding varieties of other crops.

6.15 Expanded research for upland crops, especially at regional and local levels, is essential for adapting varieties to tropical conditions and local agronomic environments and to fit multiple and intercropped systems. Both upland and paddy farmers would benefit from the continued development of short-term, higher-yielding, pest-resistant varieties of field crops. Research is needed to improve the tolerance of non-rice crops to wet soils on irrigated land. Improved tolerance of crops to drought and soil salinity would increase the productivity of crop cultivation on marginal land. High-value horticultural crops are likely to be an important component of crop diversification. Systematic research into optimal application of fertilizer and agricultural lime for upland crops is needed. All such improvements that would result in higher and more stable yields serve to reduce risks for farmers and enable them to diversify their cropping systems.

6.16 Commodity research programs need to be strengthened for both field crops and tree crops that appear to have a potential comparative advantage in regional or world markets. Work on cost structures should help determine which commodities these would be, but the most likely ones are those with higher income elasticities of demand or with export potential outside the regions of South and Southeast Asia. As noted in Chapter 2, raising the productivity of smallholder tree-and estate-crop production is of particular importance in improving the distribution of income and alleviating poverty. The improved management of forest resources and expanded efforts at reforestation are important not only for the growth of agro-forestry industries but also for sustainability of agriculture itself.

6.17 Research is needed on design and management of group farming systems, whereby farmers consolidate their holdings and coordinate planting

seasons, irrigation, and drainage. Such systems may allow farmers to realize economies of scale otherwise not possible because of small land holdings.

6.18 Constraints research, as implemented so well in the past by IRRI, should be expanded, with special attention to the constraints to land consolidation and increased labor productivity.

6.19 An expanded program of research on water management and drainage is of high priority for enabling farmers of paddy to diversify either by a shift out of rice or, more likely, multiple cropping with rice. Work on the design of irrigation and drainage systems is as important as work on management. Irrigated areas provide special opportunities and unique problems. As noted in Chapter 3, with favorable climatic conditions and good drainage, irrigated areas could be suitable for growing a wide range of crops. The research strategy should attempt to bridge the gap between agronomy and irrigation engineering. These fields, while strongly related, have usually been researched with limited or no integration.

6.20 Research and development of feed technology would benefit livestock production. Improvements in yields of feed grains would allow more intensive use of land as demand for feed grains and fodder increases competition for land. Research should also focus on improved feed efficiency, development of new sources of feed, and greater use of by-products and agricultural waste.

6.21 Research in improving the productivity of livestock and controlling disease in tropical conditions is essential for expanded livestock production. This research is particularly important for commercial poultry production because it appears to have greater potential in the ASEAN-4 countries than cattle and swine.

6.22 The flow of resources into agricultural research centers will ultimately have little payoff in developing more flexible farming systems,

however, if government policies are not facilitative in the diversification effort. A host of government policies, including those seemingly far removed from agriculture, can thwart any attempt to increase the responsiveness of farmers to changed economic conditions. In a more positive light, the right combination of policies can help promote efficient allocations of resources within the agricultural sector, making it more flexible in responding to changing conditions in world markets, and can alter the flow of resources between agriculture and the rest of the economy in ways consistent with the long-term structural transformation of the economy. Investments in rural infrastructure and agricultural marketing are at the core of developing a flexible and responsive agricultural sector.

6.23 The efficiency of existing irrigation system, along with their maintenance, needs to be improved. As noted in Chapter 1, betterment levies need to be linked to actual performance of system managers for them to respond to incentives to deliver water in a timely fashion.

6.24 The feasibility of upgrading existing irrigation system for cultivation of upland crops needs to be studied in view of the likely value of output, the adequacy of the marketing system (including transportation), and the potential for regional specialization. While the agronomic conditions may be favorable for growing non-rice crops on irrigated land, the economic feasibility of upgrading irrigation systems needs to be studied. Costs of improving drainage and water control for existing irrigation systems, building storage capacity, and lining water channels have to be compared with the value of non-rice crops grown on the land, which is a matter of market demand. Any study of upgraded irrigation systems has to consider other investments in infrastructure, including roads and communications, and in marketing, particularly in drying and storage facilities, trucks, and refrigeration, which may be complementary.

6.25 Development of efficient marketing systems is essential to a diversification effort. Various measures can reduce the risks and costs of

marketing: improved roads and communications, rural buying stations, daily radio broadcasts, increased access of private traders and exporters to credit, and construction of wholesale market' that are equipped with such amenities as water and a certified public weighing scale to accommodate truckloads of agricultural commodities. Refrigerated trucks and supplies of clean water are needed in the marketing of horticultural crops or their delivery to a processing facility. As noted in Chapter 4, improved road links between regional markets improved spatial price integration, lower the costs of marketing, and promote regional specialization as supplies of basic food staples can move more freely to deficit food-producing regions and output of agricultural processing facilities can be transported to urban centers or ports.

6.26 Improved access by farmers, private traders, small entrepreneurs, and exporters to credit is important for increasing the number of participants in the marketing system and associated small industries and promoting competitive price formation. The feasibility of various initiatives that would ultimately help develop rural financial institutions and promote rural savings and investment need to be determined. Rural credit programs that offer small loans at market rate of interest could be established for small farmers and extended to tenant farmers and private traders, who have limited access to credit because they own no land.

6.27 Rural lending institutions should not be limited to making agricultural loans. Loans for rural cottage industry should also be encouraged, since they are likely to provide opportunities for off-farm employment.

6.28 The establishment of local branches of overseas banks may improve the access of exporters to credit to finance their trading, help them obtain international letters of credit, and expand activities into new markets.

6.29 Seed development and distribution for non-rice crops needs to be improved. Private seed companies need to be encouraged to develop improved

seeds, adapt them to local conditions, and develop a distribution network through private input suppliers.

6.30 The system of developing and marketing of fertilizer for non-rice crops needs attention. The establishment of private fertilizer companies can help improve the distribution of fertilizer, and marketing efforts of these firms can help convey information to farmers about cultivation and management practices for upland crops.

6.31 Involvement of the private sector in ventures that are not only privately profitable but also socially profitable is needed. Research is needed to identify commodity-based projects, particularly for horticultural crops and livestock, that appear to have had desirable results in creating jobs and raising income in rural areas. An evaluation needs to be made of the equipment, technology, and managerial skills that domestic and foreign firms can provide in building up processing facilities, marketing systems, and small-scale manufacturing industries (for irrigation pumps, milling and processing equipment, fertilizer, and the like) in rural areas. As noted in Chapter 5, attention needs to be paid to the legal and institutional barriers, such as licensing, land leasing, and financing, to such ventures.

6.32 The dynamic effects of crop diversification, rather than merely the static substitution effects, need to be determined. Rising incomes of farmers from intensive rice cultivation have roundabout effects on incomes and employment in rural areas as farm households spend their incremental income on services and locally produced goods. As noted in Chapter 4, a better understanding of the unique aspects of rice-based agricultural systems would indicate whether cultivation of non-rice crop is likely to make similar contributions to economic growth. The number of rural dwellers whose incomes are linked directly or indirectly to rice production and marketing and the effects of shifts to non-rice crop cultivation and regional specialization, particularly on income distribution, are not well known.

6.33 A careful analysis of the cost structure of alternative crop and livestock systems, with a focus on commodities with higher income elasticities of demand, is needed. So long as trade can be kept relatively open, this analysis needs to be done for the region as a whole rather than for individual countries. Agricultural production in the regions of South Asia and Southeast Asia, and regions within individual countries, are likely to become increasingly specialized. Biological and physical scientists need to collaborate with economists and sociologists and shed light on the potential for new production technology for altering cost structures. Because of the dynamic aspect of cost structures, the research needs to be on-going, not a single snapshot, and needs to take into account the extent to which macroeconomic policies, particularly trade and exchange rate policies, create distortions that mask underlying comparative advantage.

6.34 Government trade and exchange rate policies and its price stabilization activities fundamentally affect the country's food security. Research is needed into the design of effective policies for rural diversification that are consistent with price stabilization policies for the basic food staple, namely rice or wheat.

6.35 An assessment of rural institutions and educational programs should be made to determine if they are adequate for the long-run structural adjustment required in agriculture. As noted in Chapter 5, flexible land and credit markets will reduce the burden on farmers who must sell their land and will permit land consolidation. Adequate educational programs may be needed to prepare agricultural workers for jobs outside of agriculture.

6.36 Special attention needs to be given to adjustment policies - and to agricultural policies more generally. Research is needed to understand the interaction between government trade policy, exchange rate policy, and development of efficient agricultural enterprise. A proper policy framework can greatly facilitate the needed resource adjustments and, in turn, the rural diversification process. Ways need to be found to help governments cope with the short-term problems of adjustment as they adopt policies designed to attain efficient allocation of resources in the long run.

Sources of information contained in this publication and not specifically cited are:

"Meeting the Challenge of Diversification Out of Rice Production in Asia: Towards a Research Agenda", by G. Edward Schuh and Shawki Barghouti. Agriculture and Rural Development Department, the World Bank. July 1987. (Based on paper presented at meetings of Consultative Group for International Agricultural Research, Montpellier, France, during May, 1987).

"The World Bank Experience with Rural Diversification - A Review of Sector Work", by Brian Berman. Agriculture and Rural Development Department, the World Bank. 1987 (internal document).

The following presentations from "Sustainability Issues in Agricultural Development - Proceedings of the Seventh Agriculture Sector Symposium", edited by Ted J. David and Isabelle A. Schirmer. The World Bank. 1987.

- (a) "Issues in Research and Extension"
by John A. Hayward
- (b) "Crop Diversification in Irrigated Agriculture: Water Management Constraints"
by Herve L. Plusquellec and Guy Le Moigne
- (c) "Economic Policy for Diversification"
by Peter Hazell
- (d) "Upstream Needs (Information, Inputs and Credits)"
by Handy M. Eisa
- (e) "Diversification from Rice"
by Richard Reidinger

PPR Working Paper Series

	<u>Title</u>	<u>Author</u>	<u>Date</u>	<u>Contact</u>
WPS77	Incentive Policies and Agricultural Performance in Sub-Saharan Africa	Bela Balassa	August 1988	N. Campbell 33769
WPS78	Economists, Institutions and Trade Restrictions: A Review Article	J. Michael Finger	September 1988	N. Artis 33731
WPS79	Quantitative Appraisal of Adjustment Lending	Bela Balassa	August 1988	N. Campbell 33769
WPS80	Emerging Issues of Privatization and the Public Sector	Samuel Paul	September 1988	E. Madrona 61711
WPS81	Reaching People at the Periphery: Can the World Bank's Population, Health, and Nutrition Operations Do Better?	Richard Heaver	September 1988	S. Ainsworth 31091
WPS82	Microeconomic Theory of the Household and Nutrition Programs	Dov Chernichovsky Linda Zangwill	September 1988	S. Ainsworth 31091
WPS83	Welfare Costs of U.S. Quotas in Textiles, Steel, and Autos	Jaime de Melo David Tarr	September 1988	C. Cabana 61539
WPS84	Black Markets for Foreign Exchange, Real Exchange Rates and Inflation: Overnight vs. Gradual Reform in Sub-Saharan Africa	Brian Pinto	September 1988	S. Fallon 61680
WPS85	Wage Responsiveness and Labor Market Disequilibrium	Ramon E. Lopez Luis A. Riveros	September 1988	L. Riveros 61762
WPS86	External Balance, Fiscal Policy and Growth in Turkey	Ritu Anand Ajay Chhibber Sweder van Wijnbergen	September 1988	A. Chhibber 60102
WPS87	Vocational and Technical Education in Peru	Peter Mook Rosemary Bellew	October 1988	C. Cristobal 33648

PPR Working Paper Series

	<u>Title</u>	<u>Author</u>	<u>Date</u>	<u>Contact</u>
WPS88	Costs, Payments, and Incentives in Family Planning Programs	John A. Ross Stephen L. Isaacs	September 1988	S. Ainsworth 31091
WPS89	Export Quota Allocations, Export Earnings and Market Diversifications	Taeho Bark Jaime de Melo	September 1988	C. Cabana 61539
WPS90	A Framework for Analysis of Mineral Tax Policy in Sub-Saharan Africa	Robert F. Conrad Zmarak M. Shalizi	September 1988	A. Bhalla 60359
WPS91	Israel's Stabilization Program	Nissan Liviatan	September 1988	N. Liviatan 61763
WPS92	A Model of Cocoa Replanting and New Planting in Bahia, Brazil: 1966-1985	Pravin K. Trivedi	September 1988	D. Gustafson 33714
WPS93	The Effects of Education, Health and Social Security on Fertility in Developing Countries	Susan H. Cochrane	September 1988	S. Ainsworth 31091
WPS94	The World Bank's Population Lending and Sector Review	George B. Simmons Rushikesh Maru	September 1988	S. Ainsworth 31091
WPS95	International Trade and Imperfect Competition: Theory and Application to the Automobile Trade	Junichi Goto	September 1988	J. Epps 33710
WPS96	The Private Sector and Family Planning in Developing Countries	Maureen A. Lewis Genevieve Kenney	September 1988	S. Ainsworth 31091
WPS97	Export-Promoting Subsidies and What to Do About Them	Richard H. Snape	September 1988	J. Sweeney 31021
WPS98	Diversification in Rural Asia	Agriculture and Rural Development Staff	October 1988	S. Barghout 38408