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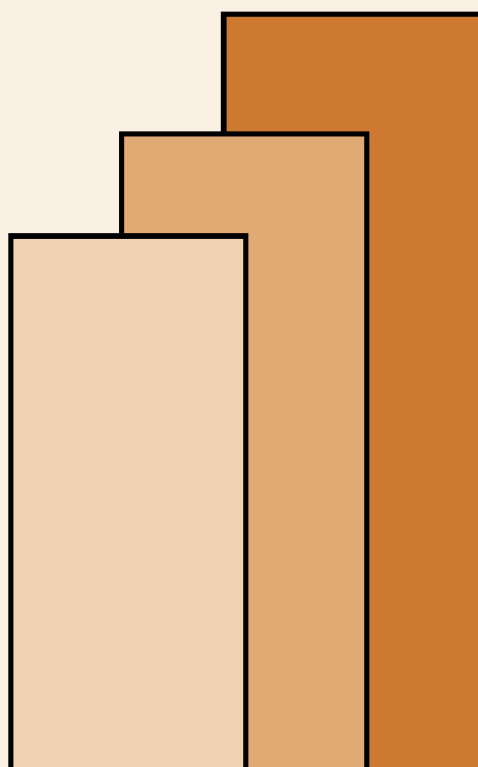
Cristina C. David

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Philippine Agriculture: Its Path to Modernization*

Cristina C. David**

Agriculture continues to be the major source of income and employment in the total economy, employing nearly half of the total labor force and contributing over 20% of gross domestic product. When all economic activities related to agro-processing and supply of non-farm agricultural inputs are included, the agricultural sector broadly defined accounts for about two-thirds of the labor force and 40% of the gross domestic product. Equally important to note is the fact that almost 70% of the poor belong to the rural sector.

The performance of the agricultural sector is, therefore, of economic and political importance. Unfortunately, the agricultural sector has performed quite poorly since the 1980's, as has the total economy. Whereas Philippine agriculture performed well relative to other Asian countries in the 1970's, the country had the lowest growth rate in agricultural gross value added (GVA) and agricultural exports, as well as in the gross domestic product in the 1980's (Table 1). Growth rates of GVA in recent years have been higher, about 2.6% in 1993 and 1994, but these are still comparatively lower than those achieved by neighboring countries. At least with respect to agriculture, there are no strong indications that these modest rates of growth will be sustainable.

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The poor performance of Philippine agriculture in the 1980's has been caused in part by depressed world commodity prices. The fact that the decline in the agricultural growth rates was most pronounced in the Philippines, however, suggests that the country has been losing its competitive advantage in the sector. Indeed, the Philippine shares in the world trade of its major exports -- coconut products, sugar, bananas, pineapples -- all declined in the past decade (Table 2). Moreover, the agriculture sector has ceased to be the major source of foreign exchange as the share of agriculture to total exports dropped from 65% in 1960 down to 12% by 1994. In fact, agriculture has made little net foreign exchange contribution in recent years, because imported agricultural products and inputs constituted about 10% of total imports.

The declining importance of agriculture is a phenomenon consistently observed in the economic history of developed nations and in cross-section comparison between poor and rich countries. This trend is often attributed to Engel's Law (i.e., generally inelastic demand for agricultural products) coupled with rapid technological change in agriculture, and discovery of synthetic substitutes for agricultural products. However, the issue is not so much the declining importance of agriculture, but whether or not government policies and programs (or lack thereof) may have unduly hastened the declining competitive advantage of Philippine agriculture vis a vis other competing countries, hindering the achievement of a sustained overall economic progress.

This paper argues that misguided and inadequate government policies and programs have contributed to the erosion of the country's competitive advantage in agriculture. Policy and institutional reforms as well as the recovery of public expenditures for agriculture in the late 1980's have had limited impact for a number of reasons. Several misguided policies remain on

major crops such as the NFA direct market interventions, sugar pricing and sharing arrangements, import bans on garlic, onions, etc., and banana hectareage limitation. The level of price protection on corn and sugar became excessive, certain provisions of well-intentioned new laws such as the Seed Law and Magna Carta of Small Farmers further promoted protectionism. The weaknesses in the budgetary allocation and institutional structure of the agricultural bureaucracy continue to lower efficiency in the delivery and effectiveness of agricultural support services. The erosion of collateral value of land and increased uncertainties accompanying land reform have not been effectively addressed.

The recent Senate ratification of the GATT-Uruguay Round potentially serves as a means for accelerating trade policy reforms and strengthening agricultural support services. But the high binding tariffs, the current method of administering the minimum access requirements, and the short-term perspective in designing safety nets may reduce, if not negate, the potentially positive impact of GATT in the total economy. Unless the economic fundamentals characterizing Philippine agriculture are clearly understood, sustainable growth (rather than food self-sufficiency) accepted as the sector's overriding objective, the proper role of government pursued, and the proper choice of policy instruments are adopted, agriculture policies and programs will continue to be misguided by narrow political and bureaucratic interests, rather than serving the broader welfare of the country.

Towards Agricultural Modernization

The Philippines has relatively scarce land resources compared to ASEAN neighbors. Our cultivated land per person is less than half those of Thailand and Malaysia. While it is comparable with Indonesia, the latter has vast frontier areas that can still be economically opened

up outside Java. In contrast, the cultivation frontier in the Philippines was already reached by the 1960's as the country is largely mountainous. Moreover unlike those countries, Luzon and many parts of the Visayas region periodically suffer from strong typhoons causing major crop damages in these areas. And having an archipelagic geography, domestic transport cost, a major cost component of bulky and perishable agricultural products, is inherently higher than other countries with contiguous areas.

Given those characteristics and contrary to common belief, sustained agricultural growth will be better achieved by a more open-oriented, rather than a protectionist development strategy. That will induce producers to allocate resources where our comparative advantage lie, which would mostly be in higher valued agricultural commodities, and with rising labor cost, also in tree crops. It will provide consumers lower food prices and agro-processing industries lower raw material prices by promoting greater competition. It will lower cost of tradeable agricultural inputs, and allow greater access to imported technologies, if trade liberalization (low and uniform tariffs) is adopted throughout the total economy. With the use of variable trade levy, it can lower the administrative cost of stabilizing agricultural prices by greater reliance on international trade instead of costly buffer stock operations. And equally important, that strategy will shift government's attention and scarce budgetary resources away from administering trade and market regulations toward policies and expenditure programs that enhance agriculture's competitive advantage.

Trade Regulations

Ratification of the GATT-Uruguay Round is a necessary step towards the open-oriented development strategy. However in a separate paper, I have argued that the agriculture-specific

provisions of the GATT-Uruguay Round may be overly conservative and the manner of implementing the minimum access requirement and safety nets faulty, potentially delaying trade liberalization, optimization of budgetary allocations in agriculture, and streamlining of the bureaucracy necessary for modernizing the agricultural sector.

Table 3 shows the binding tariffs and minimum access provisions on the commodities where quantitative trade restrictions are to be lifted. First of all, there is supposed to be no change in the rice market policies for 10 years. Hence, the very costly subsidies to NFA market operations will continue, diverting scarce government resources that could have been better spent on productivity enhancing support services.

Second, binding tariffs are mostly higher than the implicit tariffs or protection provided by QRs in the early 1990's and the tariffs imposed under EO 470. Although binding tariffs are supposed to decrease over 10 years, at year 2004 these are still much higher than the projected average tariffs of 5% at that time.

Third, importations of minimum access requirements are to be done by NFA, SRA, and other government agencies. Although domestic distribution is supposed to be bidded out to the private sector to extract potential economic rents, considerable inefficiencies (and even corruption) may be encountered in the process and timing of government importations. Furthermore, by maintaining and even creating more work for regulatory agencies, there will be greater resistance to the streamlining of the agricultural bureaucracy necessary for strengthening agricultural support services.

Commitments on binding tariffs are, of course, simply upper limits and minimum access import requirements lower limits. Whether or not those highly protective tariffs are

implemented and how the minimum access requirements are administered are, therefore, entirely within the country's control. Even the quantitative trade restrictions on rice may be lifted anytime.

Setting the tariffs for corn and sugar close to the binding tariffs, rather than to the low targeted average tariff is detrimental not only to the growth objective of the whole economy, but of the agricultural sector itself. Corn is the single most important input in the poultry and hog industry, where potentials for growth are high and whose contribution to gross value added in agriculture is even higher than corn. Rational pricing policy for corn would promote exports of pork, as studies have already indicated the country's comparative advantage in hog production. It will also eliminate the rationale for high tariffs on livestock and poultry.

The very high protection on sugar hurts not only the consuming households, but also the food processing industry which accounts for close to 40% of the manufacturing value added and which has high export potentials. It should also be emphasized that the much higher protection of corn and sugar compared to rice reduce rice hectareage because these are the most important competing crops in production on marginal rice lands.

It is, therefore, critical for sustained agricultural growth to pursue low and uniform tariffs across the board, within agriculture and between agriculture and industry, despite the high binding tariffs. Ideally, that strategy must also be pursued in the case of rice. In fact, tarrification (removing QRs and allowing private rice importation) at variable levels can achieve price stability at lower cost to society. It may also likely increase rice production as corn and sugar are not made artificially profitable and the costly subsidies to NFA marketing operations can be shifted to productivity-enhancing public support services to rice farmers.

It is time to interpret the food security objective as one of achieving food self-reliance, i.e., capability to purchase sufficient food supply regardless of source, rather than rice self sufficiency. The Philippines, as well as Indonesia, cannot compete with Thailand, Vietnam, and Burma which have inherently strong comparative advantage in rice production, because of larger land endowment, and in the case of Vietnam and Burma, also cheaper labor and cost of water control. Despite Malaysia's large land endowment and generally strong comparative advantage in agriculture, it imports about 30% of its rice consumption because labor cost is quite high. The recent rice importation of about 200,000 mt by the Philippine government represents only about 3% of the country's total rice production while the average rice importation from 1992 to 1995 has been less than 2%. The apparently high nominal rice prices observed in recent weeks, in fact are still less than half the price levels in real terms, less that prevailed in the 1960's and 1970's when the ratio of rice imports to production were even higher.

Other Regulations

There are at least three other market/production related policies having significantly adverse effects on agricultural development. The first two (i.e., quedan system and producer - miller sharing arrangement) relate to the sugar industry. The quedan system administered by the Sugar Regulatory Administration (SRA) is a market sharing arrangement for equitably distributing US market premiums among sugar growers. The quedan system design reduces incentives to increase production and invest in yield increasing technology development because higher production will reduce revenues. Furthermore, it does not provide any incentive to improve milling quality for export that will increase net returns because export allocation to the US are fixed.

On the other hand, the sugar sharing arrangement (60 to 70% to growers and 40 to 30% to millers) instituted by law to permit millers to share in the benefits from the US premium market also reduces incentives of both growers and millers to raise productivity. Growers will receive only 60% to 70% of benefits from investments in productivity growth while millers only 40 to 30%. Several major studies have already pointed out the high cost of those misguided policies. But evidently, the sugar industry prefers to lobby for maintaining the high price protection, rather than increasing industry efficiency at the cost of consumer welfare and overall economic growth. And not surprisingly, the loss in competitive advantage in sugar occurred much earlier and was more rapid than other commodities.

The third important counter-productive policy is the banana hectareage limitation which disallows new entrants from establishing banana plantations and let existing banana producers determine among themselves the banana hectareage for export. The policy was adopted on the mistaken belief that the Philippines has a monopoly position in the banana markets of exporting countries, specifically Japan. Consequently, the Philippine share in world banana market has declined. Yet, banana plantation owners continue strongly resisting the abolition of that law despite the obviously high cost to the economy.

Support Services

Because many support services for agriculture are characterized by economies of scale, long gestation period, riskiness, externalities, and public good attributes, the private sector will underinvest in such activities, such as technology development, irrigation, and market infrastructure. Although the public sector should largely leave the domestic and international marketing of agricultural commodities to the private sector, the government must strengthen

agricultural support services to increase market efficiency, raise productivity, and promote sustainability. This involves raising the budgetary support for agriculture, improving the budgetary allocation within agriculture, and restructuring the agricultural bureaucracy. The following discussion will focus on agriculture-specific support services, recognizing that public policies and expenditures related to market infrastructure is of vital importance to agricultural growth.

Raising and Improving Budgetary Allocation

The agricultural sector bore the brunt of the contractionary policies in the early 1980s. Relative to gross value-added in agriculture and to total government expenditures, public expenditures for agriculture in the mid-1980s were only about equal to 1955 levels (Fig. 1). As a result, the institutional structure for delivery of agricultural support services was severely weakened, particularly the agricultural research system. Expenditures for agriculture recovered by the late 1980s, but the Philippines continued to have the lowest ratio of public expenditure for agriculture to total public expenditures and gross domestic product among ASEAN countries (Table 4).

It should be noted that the increases in public expenditures in the late 1980s went mostly to agrarian reform, environmental protection, price support, and other support services rather than to long-term productivity-enhancing investments such as agricultural research and irrigation (Fig. 2). Although about two-thirds of the agrarian reform expenditures were for support services such as credit and extension, the linkage to land reform rather than to technological opportunities reduces the cost-effectiveness of such expenditures. The allocation of funds would be biased towards short-term support projects (e.g. credit subsidies) against institution building

efforts or projects that will have long-term impacts (e.g. agricultural research). The allocation for funds will depend not so much on where these would have the highest economic pay off, but rather on the priority areas of the land reform program which may largely depend on ease of its implementation. And finally, it increases the bureaucracy in the allocation of funds for and implementation of agricultural support services projects.

The misallocation of funds within the agricultural bureaucracy is clearly exemplified by the underinvestment in public agricultural research, despite the fact that in a land scarce economy such as the Philippines, the key to agricultural growth rests on technological change. The country's ratio of expenditure for agricultural research to gross value added in agriculture was above the average among Asian developing countries in the 1960s and early 1970s (Fig. 3). In the 1980's the agricultural research budget declined in real and relative terms. In 1981-85, public expenditure for agricultural research as a ratio to gross value added in agriculture was only 0.16% in the Philippines compared to .46% in Thailand, .34% in Indonesia, .41% in developing countries, and 2% in developed countries. The country has fallen behind even more in the late 1990s. We now have one of the lowest budgets for agricultural research in Asia next only to Nepal.

The relatively weak support to agricultural research explains the decline in the competitive advantage of Philippine agriculture, particularly for traditional crops. The generally high estimated rates of returns of agricultural research reported worldwide, including the Philippines, clearly indicate that the country is underinvesting in the development of agricultural technologies (Table 5). Those rates of returns, even if discounted by half, are higher than estimates for irrigation and market infrastructure investments, which typically range from 15 to

25 percent. Thus, raising public investments for agricultural research must receive equally high priority as public infrastructure. Yet, in the safety net program of DA, agricultural research received only about 2% of the proposed budget.

Increasing the effectiveness of budgetary support for agriculture would realistically come mainly from reorienting agricultural policies away from trade and other regulations as these free significant resources for growth-enhancing investments. The NFA budget alone is about four times the allocation for irrigation and more than the combined allocation for irrigation and total public support (including those allocated to State Colleges and Universities and DOST) for agricultural research. It will also come from the more efficient administration and use of agrarian reform funds for agricultural support services and from the overall efforts at restructuring and streamlining the agricultural bureaucracy.

Weaknesses of the Current Bureaucracy

Government support services to the agricultural sector has been plagued by weaknesses in the institutional structure of governance, stemming from the fragmented, overlapping, and commodity-based nature of the organizational structure. Whereas the Department of Agriculture (DA) assumes the responsibility for accelerating agricultural development, the mandates, authorities, and budgets for performing the various agriculture-related activities are spread over several different agencies belonging to at least four other departments.

The mandates for technology generation in agriculture, fisheries, and natural resources still officially belong to the Philippine Council for Agriculture Resources Research Development (PCARRD) and Philippine Council for Agriculture and Marine Research and Development

(PCAMRD) under the Department of Science and Technology (DOST). State Colleges and University receive direct budgetary allocations for agricultural research. The Department of Agrarian Reform (DAR) allocates about two-thirds of agrarian reform funds and manpower resources for provision of agricultural support services. The Department of Environment and Natural Resources (DENR) also similarly delivers agricultural support services in the upland areas. Provision of rural market infrastructure is the concern of the DPWH and local governments while the regulation of the transport and communications industry the concern of the Department of Transport and Communications. With the devolution, the local government now administer most of the front-line agricultural support services such as extension, animal health, meat inspection, etc.

The problem stems not only from the dispersion of responsibilities across several departments but, equally important, from the defects in the organizational structure of the DA. Although most of the autonomous agriculture-related agencies -- e.g., NFA, Philippine Coconut Authority (PCA), Sugar Regulatory Administration (SRA) -- have been brought under the DA, they have remained largely intact as attached agencies, retaining the weakened controls and accountability in their bureaucracies, and constraining coordination of research within the DA. Moreover, front-line services such as extension continue to be administered by the attached agencies for their respective commodities, rather than devolved to LGUs as the case for the DA proper. Thus, the organizational structure adopted after 1986 is a mixture of attached commodity agencies and a set of bureaus, councils, and offices concerned with other commodity groups and functions outside the purview of attached agencies.

Attached commodity agencies may have solely research functions (Philrice, Naphire, etc.), regulatory functions (NFA, Fertilizer and Pesticides Authority, etc.) or the whole range of research, extension, marketing, and regulatory functions [PCA, SRA, Fiber Industry Development Authority (FIDA), National Tobacco Administration]. Bureaus and other offices similarly perform a single or variety of functions. For regional operations, the attached agencies are separate and independent of the integrated operations of the regional offices of the DA. As a result, there is considerable overlapping of functions and activities. On the other hand, the essential interactions among the various support services throughout the whole process, from planning to delivery, such as between research and extension, is largely missing.

The commodity-based structure of the DA exacerbates the fragmentation of the bureaucracy and the overlapping of functions. It also makes the department prone to greater instability and inflexibility. Historically, the DA has been divided among more and more specific commodities, based mainly on political economy factors rather than on consistent, sound, and logical criteria. Why, for example, is there a commodity agency for fiber or cotton but not for corn? Indeed why is the commodity agency for cotton (Philippine Cotton Corporations) separate from fiber (FIDA) when the combined value of their domestic products is much less than for corn. There are four separate agencies dealing with livestock -- Bureau Animal Industry, National Meat Inspection Commission, Livestock Development Council, and Philippine Dairy Corporation (PDC). Yet, Congress up to now is contemplating on establishing even more of these commodity specific agencies such as the Cattle Industry Marketing Board, Seed Industry Development Board, Department of Fruits and Vegetables, Department of Fisheries, etc.

The commodity-based structure favors regulations against growth-enhancing activities -- research, extension, irrigation -- which have longer-term pay-off. Regulations are easy to implement, have short-term impacts, generate resources for the agency, and rents for the employees allocating import/export permits, issuing licenses, and so forth. In contrast, well-documented justifications and a record of performance are necessary to raise budgetary support for productivity-enhancing activities. Furthermore, heads of commodity agencies are typically non-technical persons who may not fully appreciate the potential contributions of technological change or the scientific skills and different type of management style required for productive research. The multi-functional commodity-based organizational structure has inadvertently lowered the priority of productivity-enhancing activities.

Clearly, strengthening publicly supported agricultural support services is imperative to reap the full advantage of an open-oriented development strategy. And that will require both improvements in budgetary allocations and streamlining of the agricultural bureaucracy. In principle, streamlining of the bureaucracy will involve the a) integration of the responsibility of all key public functions related to agriculture under the DA, except for the redistribution of private agricultural lands; b) limitation of government involvement to provision of basic services that have public good attributes, externalities, increasing returns to scale, long gestation period, and are risky such as agricultural research, extension, and irrigation; allocation of export premium markets, and regulations necessary for the protection of human health and the environment to ensure long-term sustainability of agricultural production; c) uniform implementation of devolution principles across DA and attached agencies; d) reorganization into a consolidated but greatly trimmed DA along a functional rather than a commodity-based

structure, and e) effective structural links between the national and local government in the implementation of the public sector agriculture-specific tasks.

Concluding Remarks

This paper has attempted to provide a broad view of the policy and institutional constraints confronting the country in its quest for modernizing Philippine agriculture. Given the time limitation, it has not been sufficiently intensive nor exhaustive. For example, a major policy dilemma is how the erosion of collateral value of agricultural land and uncertainties due to the Comprehensive Agrarian Reform Program that limit growth of agricultural investments can be effectively addressed. A major effort will be required to undertake a comprehensive and intensive assessment of the current structure of government policies and programs, as well as agriculture's market and technological potentials in order to design the appropriate program of legislative and executive actions necessary for the achievement of rapid and sustainable agricultural growth.

Nonetheless, it is clear that the policy and institutional reforms needed to reverse the agricultural sector's declining competitive advantage have to be bold and far-reaching. And the new development strategy for agriculture will have to involve the following:

- * redefining the government's goals and objectives with respect to the sector, i.e., sustainable growth and food self-reliance rather than food self-sufficiency;
- * reorienting agricultural policies and public expenditures away from short-term trade and market regulations towards promotion of competition and greater

use of long-term policy instruments for raising productivity, protecting the environment, and improving market efficiency, i.e., open-oriented strategy requiring the dismantling of excessive trade protection and government marketing operations and raising public expenditures for agricultural support services;

- * refocusing agricultural support services towards those that the market will not sufficiently provide and in favor of commodities and programs that have the greatest market and technological potentials, e.g., research and development, irrigation instead of subsidies on fertilizers and mechanical dryers; and

- * restructuring and streamlining the agriculture-related bureaucracy, i.e., raising efficiency in the provision and not only increasing public expenditure of agricultural support services.

Table 1. Average growth rates of gross domestic product, agricultural value added, agricultural exports in selected South and Southeast Asian countries, 1970-1992 (%).

	1970-1980			1980-1992		
	Gross domestic product	Agriculture gross value added	Agriculture export	Gross domestic product	Agriculture gross value added	Agriculture export
Indonesia	8.4	4.4	17.5	5.6	2.9	2.6
Malaysia	9.1	6.5	17.5	6.2	3.4	1.8
Thailand	6.7	4.2	20.7	9.9	5.8	5.2
Philippines	6.1	4.9	14.3	1.5	1.1	-3.2
India	3.9	1.8	14.3	5.6 ^a	3.8 ^b	5.1
Pakistan	5.3	3.0	15.5	6.0	4.2	1.6
Sri Lanka	2.0	0.8	-1.8	4.5	4.6	-1.0
Bangladesh	4.7	1.4	0.1	4.0	2.9	-1.5
Sri Lanka	3.7	1.9	7.8	4.1	1.8	-0.4

Data up to 1990 only.

Data up to 1991 only.

Average of 1972-80.

Table 2. Trends in the share of world trade of selected Philippine agricultural exports, 1960-1992.

	Coconut products					Sugar ^b	Bananas	Pineapple
	Total	Copra	Coco oil	D'cated coconut	Copra meal			
1960-64	48	54	31	56	34	9	0	-
1965-69	55	62	47	52	47	7	0	-
1970-74	56	61	53	53	46	7	3	-
1975-79	63	60	65	61	54	4	8	18 ^c
1980-84	65	38 ^d	68	62	59	4	9	20
1985-89	57	34 ^d	59	51	51	1	7	15
1990-92	52	26	59	43	45	1	5	14

^a 4 year average only because of copra export ban in 1984 and 1985.

^b Includes centrifugal and refined sugar.

^c Average of 1978 and 1979 since world export data on pineapple started in 1978 only.

Table 3. The nominal protection rates (NPR), current tariff, and GATT binding tariff and minimum access requirement for 1995 and 2004.

	NPR ¹ 1990/92 (%)	Tariff (%)			Minimum access		
		EO 470 1995	Binding		Tariff (%)	Quantity (mt)	
			1995	2004		1995	2004
Rice	16	50	-no commitment-		50	59,730	238,940
Corn	62	20	100	50	35	130,160	216,940
Sugar	89	50	100	50	50	38,000	64,000
Chicken	94 (50)	30	100	40	35	2,218	3,396
Pork	31	30	100	40	35	826	1,376
Beef	nav	30	60	35	30	15,000	32,000
Wool	500	30	100	40	nap	nap	nap
Wheat	0 ²	30	100	40	30	1,610	2,683
Potatoes	nav	30	100	40	50	1,457	2,429
Cabbage	nav	30	100	40	30	2,105	3,509

NPR is the estimated percentage difference between actual domestic price received by farmers and what it would have been without quantitative trade restrictions.

Exportable

nap - not applicable

nav - not available

Table 4. Measures of government revenue and agricultural expenditures in selected Asian countries, 1988

	Agricultural expenditures as % of Total expenditure		Total revenue as percent of GDP
Philippines	5.2	1.1	13.7
Indonesia	6.8	1.5	18.1
Thailand	10.3 ^a	1.9 ^a	20.6
Malaysia	7.0	2.1	23.9

^a 1987

Source: Adopted from Manasan, R. G. "A Review of Fiscal Policy Reforms in the Asian Countries in the 1980s," PIDS Working Paper No. 14, May 1990.

Table 5. Summary of rates of returns estimates of public agricultural research.

	Percent
Developing Countries (Evenson and David, 1992)	
5 studies	0
8 studies	0 - 20
28 studies	30 - 50
37 studies	50 +
Philippines	
Rice (Flores, Evenson, and Hayami, 1978)	75
Corn (Librero and Perez, 1987)	29 - 48
Sugar (Librero, Perez, and Emlano, 1987)	51 - 71
Poultry (Librero and Emlano, 1990)	100 +

Sources: Evenson, R. E. and David, C. C. "Rice Production and Structural Change." Organization for Economic Cooperation and Development, Paris, 1992.

Flores, P., Evenson, R.E., and Hayami, Y. "Social Returns to Rice Research in the Philippines: Domestic Benefits & Foreign Spill Over." Economic Development and Cultural Change, Vol. 26 No. 3, April 1978.

Librero, A. and Perez, M. "Estimating Returns to Research Investment in Corn in the Philippines." Philippine Council for Agricultural Resources, Research and Development (PCARRD), Laguna, 1987.

Librero, A. and Perez, M. "Estimating Returns to Research Investment in Sugarcane in the Philippines." PCARRD, Laguna, 1987.

Librero, A. and Emlano, N. "Estimating Returns to Research Investment in Poultry and Livestock in the Philippines." PCARRD, Laguna, 1988.

Figure 1
Public Expenditures in Agriculture (Ga) as Percent of
Gross Value Added in Agriculture (GVA) and
Total Expenditures including and excluding
cost of debt service (G and G')

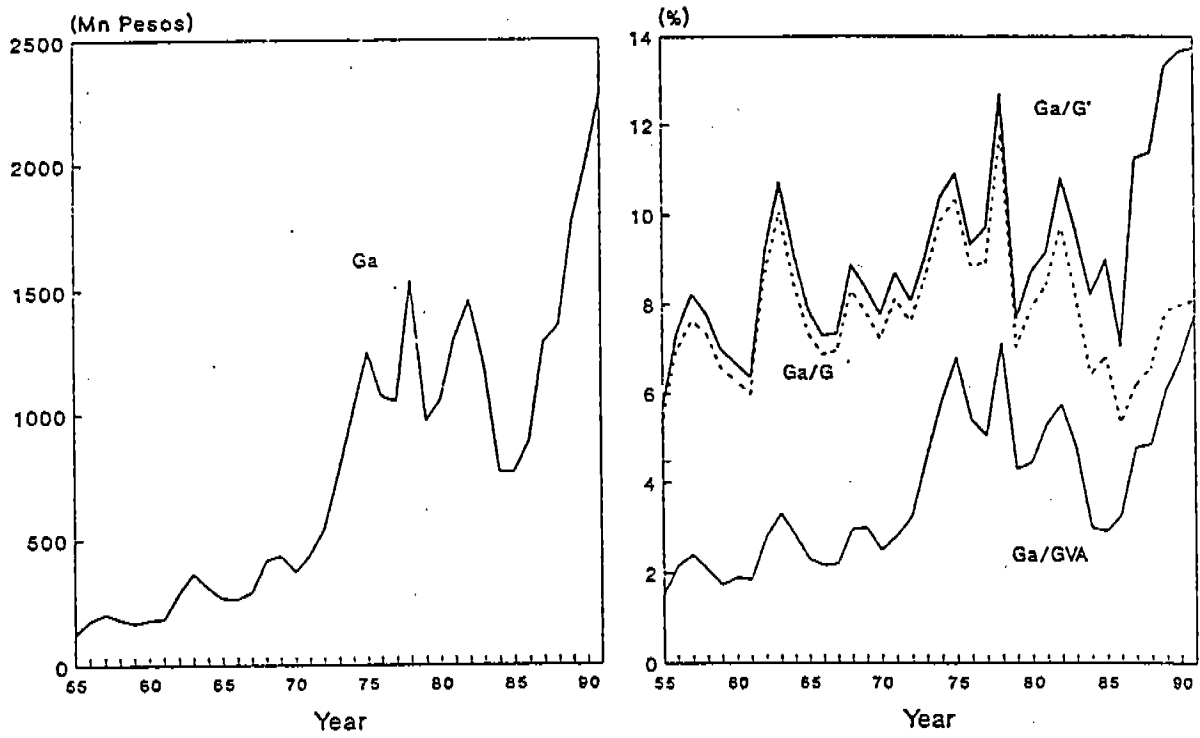
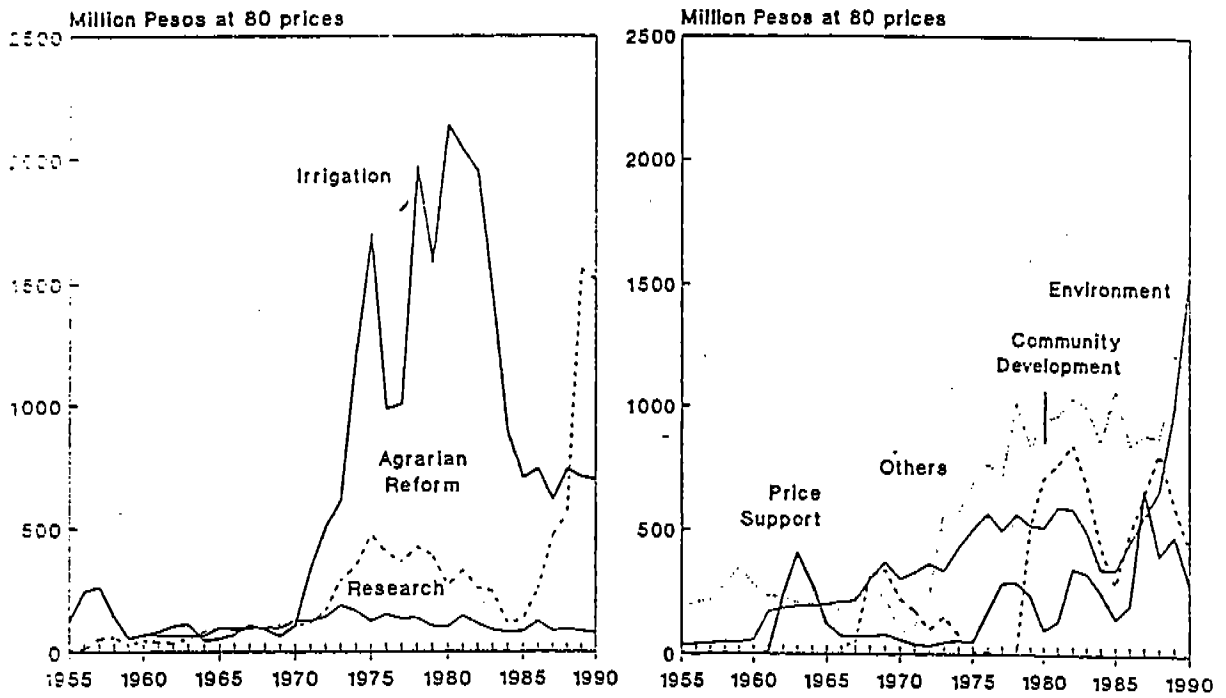


Figure 2
Trends in Public Expenditures in Agriculture
by Policy Instrument, 1955-1990



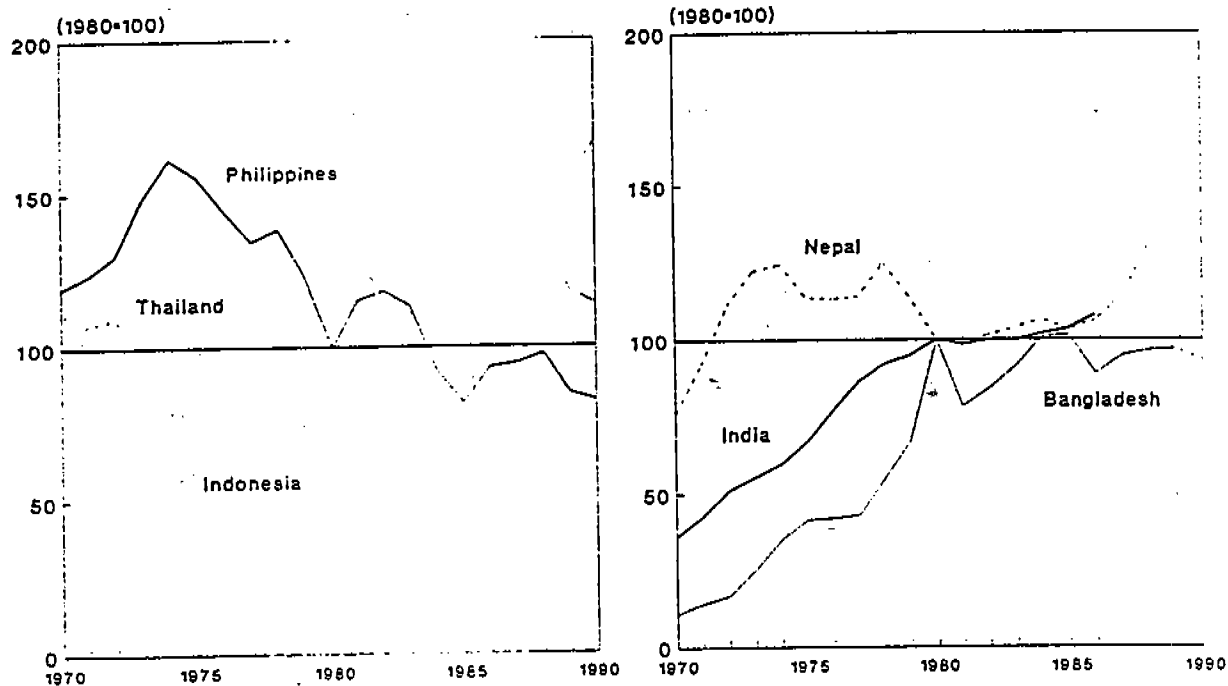


Fig 3a. Trends in agricultural research expenditures in real terms 3-year moving average.

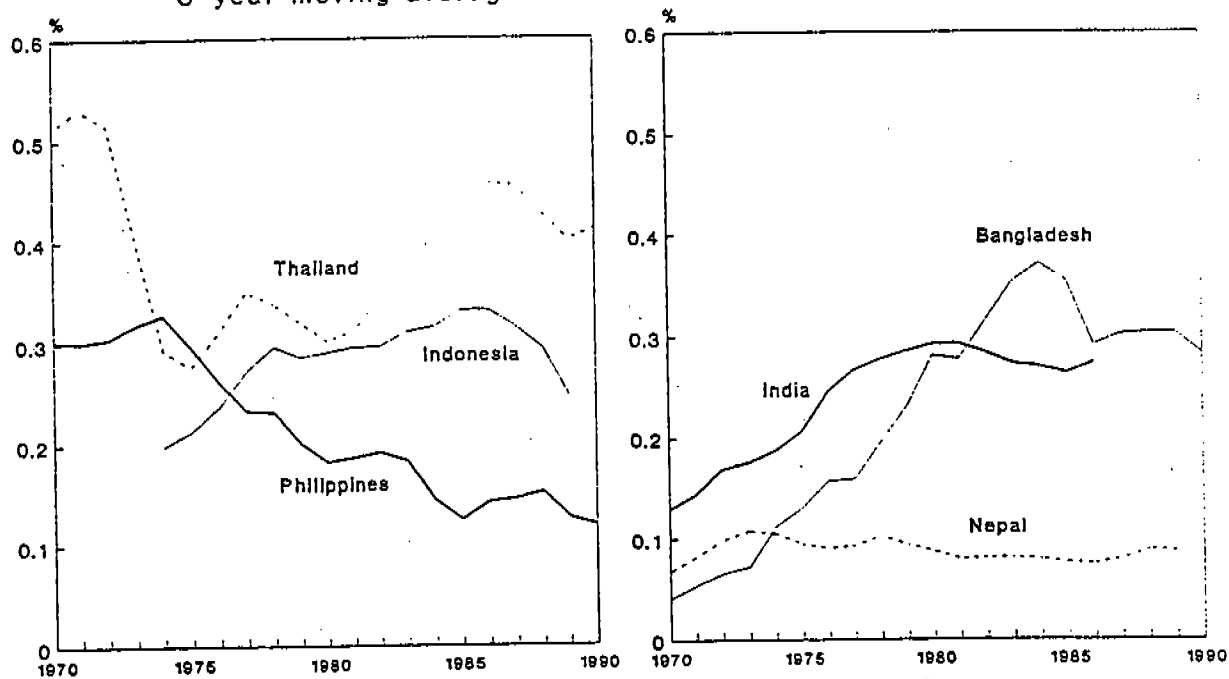


Fig 3b. Trends in agricultural research intensity ratios (% of agricultural research expenditures to gross value added in agriculture) 3-year moving average.