COMPREHENSIVE Assessment of water management in agriculture

Research Report 6

Macro Policies and Investment Priorities for Irrigated Agriculture in Vietnam

Randolph Barker, Claudia Ringler, Nguyen Minh Tien and Mark Rosegrant

IWMI International Water Management Institute

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Comprehensive Assessment of Water Management in Agriculture

The Comprehensive Assessment is organized through the CGIAR's System-Wide Initiative on Water Management (SWIM), which is convened by the International Water Management Institute. The Assessment is carried out with inputs from over 90 national and international development and research organizations—including CGIAR Centers and FAO. Financial support for the Assessment comes from a range of donors, including the Governments of the Netherlands, Switzerland, Japan, Taiwan and Austria, the OPEC Fund, FAO, and the Rockefeller Foundation.

The authors: Randolph Barker is Professor Emeritus, Cornell University and formerly Principal Researcher, International Water Management Institute; Claudia Ringler is a Research Fellow at the International Food Policy Research Institute (IFPRI); Nguyen Minh Tien is Head of Planning Division, the Department of Cooperatives and Rural Development of the Ministry of Agriculture and Rural Development (MARD), Vietnam; and Mark Rosegrant is Division Director of the Environment and Production Technology Division at IFPRI.

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Cover photo by François Molle showing some paddy fields in the Chau Doc region in the Northern part of the Mekong delta.

Please send inquiries and comments to: comp.assessment@cgiar.org

Contents

Abbreviations and Acronyms

ADB	Asian Development Bank
AFTA	ASEAN Free Trade Area
BCM	Billion Cubic Meters
CIE	Center for International Economics, Canberra, Australia
CPC	Commune Peoples Committee
DAP	Diammonium Phosphate
DPC	District Peoples Committee
DWRHWM Management	Department of Water Resources and Hydraulics Works
DWRM	Department of Water Resources Management
EADN	East Asian Development Network
ERP	Effective Rate of Protection
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GE	Government Expenditures
GOV	Government of Vietnam
GVA	Gross Value Added
ICOR	Incremental Capital Output Ratio
IFC	International Finance Corporation
IMC	Irrigation and Drainage Management Company
IME	Irrigation Management Enterprise
IMF	International Monetary Fund
IMT	Irrigation Management Transfer
ISF	Irrigation Service Fees
MARD	Ministry of Agriculture and Rural Development
MLI	Multilateral Lending Institutions
MONRE	Ministry of Natural Resources and the Environment
MPDF	Mekong Project Development Facility
NPC	Nominal Protection Coefficient
NPK	Nitrogen, Phosphorus and Potassium
NTB	Nontariff Barriers
NWRC	National Water Resources Council
O&M	Operation and Maintenance
PARDS	Provincial Agriculture and Rural Development Service
PPC	Provincial People's Committee
R&D	Research and Development
SME	Small and Medium-Scale Private Enterprise
SOE	State-Owned Enterprise
UNDP	United Nations Development Programme
VBARD	Vietnam Bank for Agriculture and Rural Development
WTO	World Trade Organization
WUG	Water User Group

Summary

Following a series of reforms, the Vietnamese economy grew rapidly during the 1990s. The agriculture sector grew at approximately 4 percent. Despite what can be considered a creditable performance, questions are being raised as to whether this rapid growth can be sustained in the decade ahead. Export earnings in rice, coffee and pepper have fallen sharply due to a decline in world prices fostered in part by the rapid expansion of Vietnam's own exports. Policy measures are being taken to protect farm incomes. A well-formulated strategy for agricultural and rural development and for poverty alleviation has been agreed upon by the Government of Vietnam (GOV) and the donor community. Yet doubt lingers as to what steps are needed to provide the incentives for sustained agricultural growth.

This report discusses the experience of the recent past and future prospects of the agriculture sector. We examine the trends and changes in agricultural taxation and expenditures noting the constraints to agricultural growth related to policies in the nonagriculture as well as the agriculture sector. We focus, in particular, on irrigation, which has accounted for over half of agricultural expenditure over the past decade and which has been a major contributor to both rapid growth in exports and agricultural employment. Where possible, we relate the recent experience of Vietnam to that of neighboring Asian economies. These countries are facing, or have faced in the past, many of the same problems that Vietnam is now encountering. We conclude with a summary of policies and investment priorities needed to sustain rapid agricultural growth.

Taxation

During the 1980s and early 1990s the overvalued exchange rate was a disincentive to both agricultural and nonagricultural exports. However, today, indirect taxation in the form of industrial protection places the greatest burden on the agriculture sector. The effect of industrial protection is to lower the domestic terms of trade of agriculture below the international level. Studies have shown that the stronger the industrial protection the lower the annual GDP growth rate—not just for agriculture but for the economy as a whole. In the case of Vietnam, industrial protection places a further burden on the rural economy. The industries being protected tend to be capital-intensive, state-owned enterprises (SOEs). This penalizes not only agriculture but also the unprotected industrial sector. As a result, the nonagriculture sector cannot absorb the surplus labor from the agriculture sector.

Currently, sugar is the most heavily subsidized sector in agriculture with the benefits going largely to the industry but not to the farmers. One also must be concerned about the recent decision to construct two large urea plants. Fertilizer is the most important purchased input for farmers. During the 1990s the decline in the fertilizer/rice price ratio was an enormous benefit to farmers. The experience of other developing Asian economies suggests that fertilizer cannot be produced in Vietnam at competitive world-market prices. The need to protect this capital-intensive industry could, in the future, prove very costly for the agriculture sector.

Expenditures

Vietnam's "green revolution" occurred a decade or two later than in most other Asian developing countries. However, the pattern of expenditures has been similar. More than half of the expenditure of the agriculture sector has been for irrigation. Investment in agricultural research,

even by Asian developing country standards, has been extremely low. The rapid growth in the agriculture sector has been fostered by institutional changes and by the introduction of new technologies. Biophysical and socioeconomic factors have favored the South. But as the slack opened by institutional changes and the adoption of new technologies has been taken up, world-market prices have declined and agricultural growth is slowing. The issue at hand is not only how much to invest, but where to invest, and how to ensure a high return for the investment. In this latter context we must emphasize the importance of complementary investments in rural infrastructure and markets—roads, electricity, communications—and in human capital development—schools and health facilities—which will enable Vietnam to continue to pursue export-driven growth.

Government expenditure in real terms quadrupled during the 1990s, and expenditure in agriculture as a share of the total government expenditure averaged around 10 percent. Computation of the "bias index" shows public expenditure on agriculture to be about one-third of agricultural contributions to GDP, not out of line with that of other developing Asian economies. The incremental capital output ratio (ICOR) is a measure of the efficiency of investments in agriculture, both public and private. There are already signs that the capital-output ratio is increasing—not surprising given the fact that the advantages of the institutional reforms and new technologies have been almost fully exploited. The relatively high ICOR, around 5, is a reflection of the heavy investments in irrigation and water resources, which appear in many instances not to have been very productive. To maintain a strong agriculture-sector growth, we must be concerned with the quality of the investments and with the policies and institutional reforms that will enable Vietnam agriculture to maintain a reasonably favorable capital-output ratio.

Numerous studies show extremely high worldwide returns to investment in agricultural research. Yet there is a widening gap between the developed and the developing countries, the former investing 5 percent of agricultural GDP in research and development (R&D) and the latter only 0.5 percent. Vietnam's investment in research, 0.1 percent of agricultural GDP, is low even by developing-country standards. However, this ratio includes only the institutions directly under the Ministry of Agriculture and Rural Development (MARD) and does not include international support.

With the assistance of UNDP and FAO, MARD has developed a comprehensive master plan for agricultural research in Vietnam calling for a major overhaul of the institutional structure and increased financial support for research. However, the report places too much emphasis on the structuring of the national agricultural research system and too little on the variety of organizations, public and private, national and international, that can participate in the research-extension area. Research-extension needs will vary by commodity and region and the national research-extension system must be flexible in accommodating this diversity.

The need for greater attention to quality in both production and processing of commodities is essential if Vietnam is to compete effectively in export markets. Great strides have been made in improving the quality of milled rice. Current plans call for the development of high-quality rice varieties similar to those of Thailand and to target specific areas for their production. A similar emphasis on quality is planned for coffee, pepper and other export crops.

Irrigation

Vietnam is characterized by a wide variety of water-resource and cropping situations. The Mekong and Red river deltas are largely devoted to rice production based on surface irrigation. There are seasonal floods and droughts. Thus, expenditures for irrigation include drainage and flood control. Large pumping systems in the North and small private pumps in the South are important for water control. In the Central Highlands and the Northeast South region, coffee

and other export crops are irrigated by tube wells. In the Dong Nai basin agriculture competes with urban and industrial demands for water.

The crop area irrigated grew rapidly in the 1980s and 1990s, particularly in the Mekong delta, where improved water control permitted the shift from a single crop to two or three crops per year. The expansion of public-sector irrigation opened up the way for private-sector investment in irrigation needed to facilitate crop diversification. Rapid adoption of small private pumps for both irrigation and drainage, particularly in the Mekong delta, has greatly facilitated crop diversification.

Our analysis shows the important contribution that irrigation development, both public and private, has made to growth in income, labor productivity and employment generation. Yet the irrigation sector is generally regarded as being poorly managed. Inadequate cost recovery and deteriorating infrastructure are major concerns, and ways are being sought to involve greater water-user participation in operation and maintenance (O&M).

In Vietnam, the recent focus has been on the construction of new facilities. Less than 5 percent of expenditure for irrigation and drainage has been devoted to O&M. Although water-fee charges are higher than in most other Asian countries, fee collections cover only half of O&M requirements.

To improve water use efficiency, the current strategy includes an emphasis on canal lining, cost recovery and greater farmer participation in O&M. While such projects have reduced government expenditure, there is little evidence that they have led to an increase in water savings or water productivity. However, rapid dissemination of small private pumps has provided many farmers with an alternative for improving management and water control and increasing water productivity. In these situations, reducing canal losses by canal lining may simply reduce groundwater recharge and the associated recycling of water through pumping. There is an urgent need for integrating the management of groundwater and surface water.

As the decade of the 1990s came to an end, Vietnam initiated a series of reforms in the country's water sector. These included the enactment of the Vietnamese Water Law in 1999, the Decision on the Establishment of a National Water Resources Council in June 2000, the establishment of basin-level committees to oversee the management and allocation of water in the Red river delta, Mekong delta, and Dong Nai basins; and the creation, in November 2002, of the Ministry of Natural Resources and the Environment (MONRE).

Investments for Agricultural Growth

Based on the econometric analysis carried out for this study, the single most important source of growth in agricultural output in Vietnam during 1991–99 was public investment in irrigation, accounting for 28 percent of growth. Moreover, the number of (mostly private) irrigation pumps accounted for a further 6 percent of total output growth. Investments in agricultural research closely follow irrigation investment in importance, accounting for 27 percent of total growth. Investment in roads accounted for 11 percent of agricultural output, and education for 8 percent. Thus, although, irrigation investments are considered to have become less productive in recent years, they have been a major driving force in agricultural growth in the past.

Conclusions

There are strong complementarities between the agriculture and the nonagriculture sectors. The rate of growth in industry defines the limits of the rate of growth in agriculture. Sixty percent of the Vietnamese population is employed in agriculture, which now provides about 20 percent of GDP.

At present, the high level of industrial protection and slow divestiture of SOEs are the major constraints to agricultural growth and to the growth of the economy as a whole. As the

agriculture sector continues its relative decline, surplus agricultural labor should be absorbed by the nonagriculture sector. The benefits of lower industrial protection would be felt in increased employment, higher incomes and reduced poverty. A healthy agriculture sector is able to consume more of the industrial products that are home-grown. To maintain a reasonably low capital-output ratio quality investments will be needed in irrigation, drainage and rural infrastructure coupled with a more effective research and extension service and rural credit programs.

A reorganized research and extension system must be pluralistic in the institutional structure and be able to accommodate a variety of organizations—domestic and international, public and private—that can potentially participate in both the funding and the execution. The research-extension system must be able to address needs that will differ by commodity and by region of the country. Strong links with public and private international research centers are extremely important.

The strategy for improved irrigation management must be reexamined taking into account the impact of the recent adoption of small private pumps. Meanwhile, as water becomes scarce, either seasonally or due to growing nonagricultural demand, the newly created river- basin authorities will play an increasingly important role in allocating water equitably among sectors.

Finally, although not the focus of this paper, one should emphasize the importance of investments in rural infrastructure and human capital and the development of markets and of sound macro-economic policies as necessary complements for sustaining rapid growth in the agriculture sector. Investment in these areas increases the *multiplier effect* or the impact of investments in the agriculture sector on employment and income in the rural nonfarm sector. By extension this has a significant impact on poverty reduction. In short, there must be a steady focus on all the nonagricultural investments needed to sustain rural development.

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Introduction

Much has been written about the performance of the Vietnamese economy over the decade of the 1990s. GDP grew at over 7 percent and agricultural GDP at approximately 4 percent aided by a rapid growth in exports. Agriculture's share of GDP fell from 33 percent to less than 25 percent, but agriculture's share of export earnings (including seafood) remains above 30 percent. Rural incomes have grown and there has been a corresponding decline in the number of people living below the poverty line.

Despite what can be regarded as a credible performance for the agriculture sector, serious problems have been emerging by the end of the decade leaving doubts as to whether the 4 percent targeted growth rate in agricultural GDP could be maintained in the decade ahead. Export growth has been confined mainly to the South, widening the disparity in incomes among regions. Due in part to the rapid expansion of Vietnamese exports, world prices of rice and coffee fell sharply. Moreover, because of the emphasis on capital-intensive state-owned industries and the slow growth in private industry, the nonfarm sector could not absorb surplus agricultural labor. Over 60 percent of the labor force remains in agriculture. Thus, the ratio of labor force in agriculture to agricultural GDP has been rising, indicating a decline in labor productivity. The number of landless has increased and migration to the urban areas has resulted in a decline in labor productivity of the service sector (O'Connor 1998).

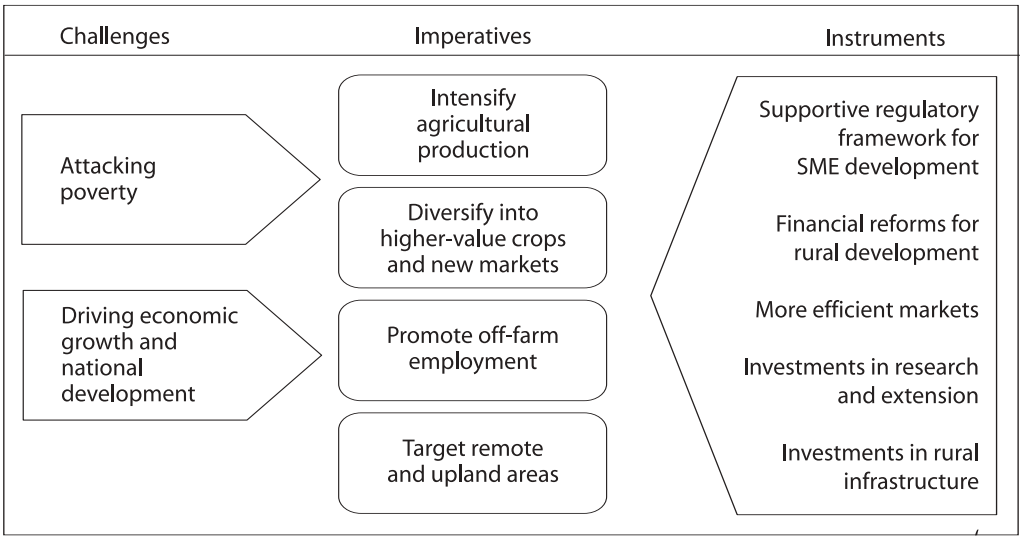
The Government of Vietnam (GOV) has put the rural sector at the heart of the development strategy for the coming decade (World Bank 2000). There is a general consensus between the GOV and the Donor Agencies that compose the Consultative Group regarding the strategy for agriculture and rural development in the decade ahead. This strategy set forth in figure 1 focuses on economic growth and poverty alleviation, two closely linked goals. Intensifying and diversifying agricultural production, promoting off-farm employment and targeting remote and upland areas are seen as the means to achieve these goals.

Similarly, the issuance by the Central Cultural and Spirit Committee and the Ministry of Agriculture and Rural Development (MARD 2002) of "The Way of Rural, Agricultural Industrial and Modernization in Viet Nam" lays out an important future for Vietnam's agriculture sector. In this report, the 2000–2004 period was to be focused on in-depth development of the various sectors associated with agriculture, including agro-industries, cooperatives, farm businesses, private enterprises and foreign investment. The challenge is whether the chosen instruments to achieve these goals, some of which indicate the need for substantial institutional reforms, can be successfully implemented.

This report examines the trends in investments and taxation, both direct and indirect, and related policy changes over the past decade, with a focus for implications on growth in the agriculture and, particularly, the irrigation sector. The report consists of five sections: a) background providing an overview of the agricultural performance during the 1980s and 1990s, b) trends in taxation of agriculture, c) trends in government expenditure on agriculture, d) the development of irrigated agriculture and impact of irrigation on agricultural output, and e) priorities for investments and policy implications.

The analysis in this study is based largely on data obtained from the MARD and the Ministry of Finance. Additional data have been obtained from the World Bank, the Asian Development Bank (ADB), and other agencies. The quality of data in Vietnam is highly mixed. Great efforts were undertaken to sort among various sources to determine the best-quality data. Nevertheless, one must interpret the results with some caution. Having said that, we believe the data to be sufficiently reliable to provide an accurate picture of development and change during the 1990s.

FIGURE 1.
MARD's strategy suggests two critical challenges for the rural sector.



Source: World Bank 2000, figure 3.1, chap. 3, p.40.

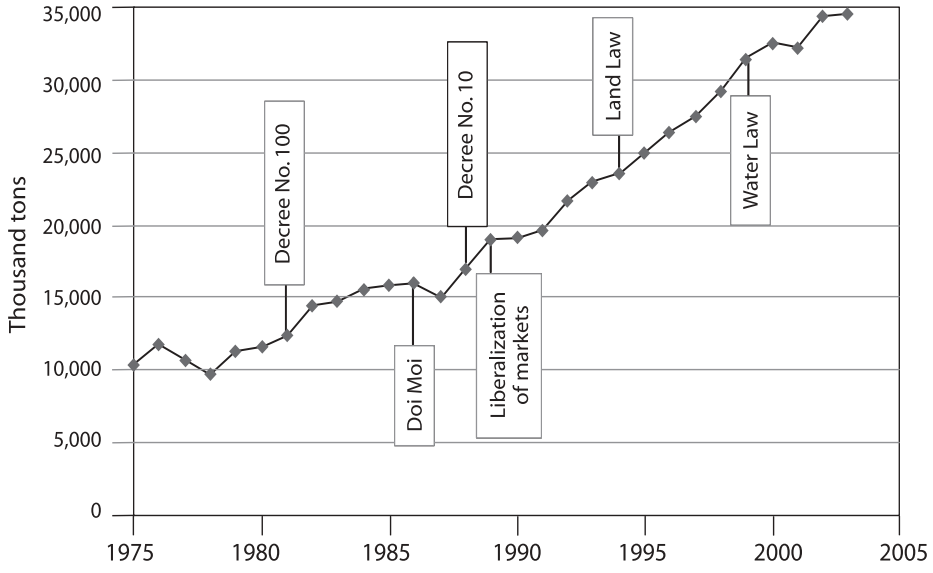
Background

The story of the recent rapid growth in Vietnamese agriculture can be explained initially by understanding the impact of internal and external events on policy changes. Rice is the most widely grown crop with the level of domestic production and price affecting the livelihoods of both producers and consumers alike. Thus early reforms were targeted on increasing rice production.

Policy Reforms Affecting Farm Household Production

Figure 2 shows the trend in rice production from 1975 to 2003. Also shown on the graph are the dates of major policy reforms in agriculture and in the economy as a whole. Policy reforms in agriculture were induced initially by poor performance in the rice sector threatening Vietnamese food security. The slow growth in rice production in the late 1970s led to the abandonment of collectivization efforts in the South and to the adoption of the *household contract system* (Decree No. 100) in 1981. Households were expected to deliver a specified amount of rice to the state and could keep or sell the surplus farm production. National rice output increased, but by the mid-1980s excessive taxes discouraged farm production and in some instances led to the abandonment of rice fields. A combination of bad weather and low production incentives resulted in a serious shortfall in the 1987 harvest. This led in 1988 to the decision to *decollectivize* agriculture (Decree No. 10). The household became the primary producing unit with freedom to sell to the market. The 1994 Land Law gave farm households title to paddy land for 20 years and to other lands from 30 to 50 years. Subsequent amendments to the law have facilitated the mortgaging and the transfer (sale) of land. Although the ceiling on paddy landownership per household remains 3 hectares in the Mekong and 2 hectares in the Red river delta there has been a tendency for the farm size to increase along with an increase in the number of landless laborers.

FIGURE 2.
Trend in output of paddy, 1975–2001.



Source: FAO 2004. FAOSTAT database (update May/2004).

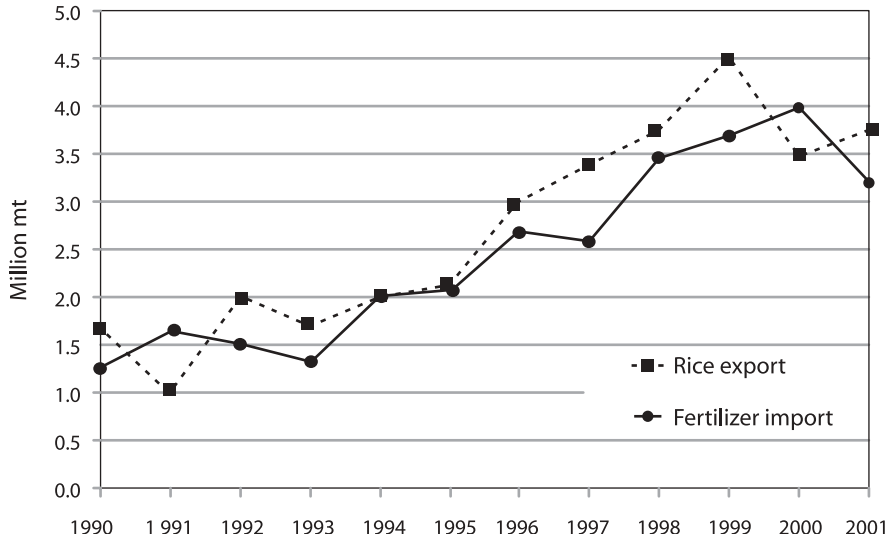
Market Liberalization and Export Growth in the 1990s

The second part of the story, and the one that is the focus of this report, begins with the move to *liberalize markets* in 1989. On the trade side, more state-owned enterprises (SOEs), including at the provincial level, obtained the right to export and import rice and fertilizers. Private dealers bought paddy from farmers and sold fertilizer. In 1997, private companies were allowed to trade internationally in rice and fertilizers; however, their role thus far has been minor (below 10% in 2000).

The combination of *household land use rights* and *market liberalization* provided incentives for adoption of improved varieties with increased application of fertilizer. But the rice production increases were most dramatic in the Mekong delta where improved *water control* permitted a shift in much of the area from one crop of *floating* rice (2 t/ha) to two crops using *high-yielding varieties* (5 t/ha each)—one before and one after the floods. This shift in cropping pattern was accompanied by the use of dikes, dam control and the development of pumping capacity both to provide irrigation water when needed and to drain excess water (Molle and Tuan 2001).

Figure 3 shows the parallel growth in rice exports and fertilizer imports from 1990 to 2000. Rice exports rose to a peak of 4.5 million metric tons in 1999. Only a small portion (roughly 15%) of fertilizer is produced domestically although there are plans for major expansion in domestic production. Fertilizer imports have tripled between 1990 and 1999 and the application of approximately 250 kg of NPK per hectare is among the highest rates in Asia. Fertilizer is the major cash input for farmers and thus the relationship between the price of fertilizer and rice can affect farm production decisions. Table 1 shows a gradual downward trend in the nitrogen (based on urea) to paddy price ratio. As exports grew, attention turned to improving the quality of rice. The variety grown, how it is harvested and dried, and how it is milled determine the quality. In the international market, the percentage *broken* is the major determinant of price. Figure 4 comparing the price of Vietnamese rice exported with *Thai 5 percent broken* shows

FIGURE 3.
Rice exports and fertilizer imports in Vietnam.



Source: MARD 2002.

how quality has improved over time. There are now efforts to devote some areas in the Mekong to the production of high-quality Thai rice varieties.

Market liberalization stimulated the growth in other agricultural exports as well, including rubber, cashew nut, coffee, tea, black pepper and seafood. In addition to rice, coffee and seafood have been the other major export earners. Coffee production is concentrated in the southeastern Region and the Central Highlands (principally Dac Lac province). Irrigation played a central role with the emphasis on private tube wells. By the end of the decade, Vietnam was the second largest producer of coffee in the world. But here again quality has been a problem due to the improper harvesting and processing of inferior *robusta* coffee with the result that Vietnamese coffee is traded at a substantial discount on the world market.

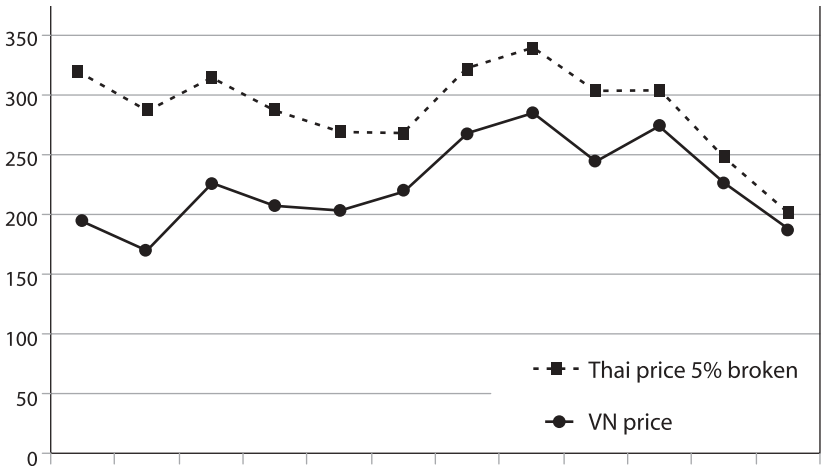
TABLE 1.
Nitrogen (from urea)/paddy price ratio.

Year	Nitrogen (VND/kg)	Paddy (VND/kg)	Ratio (N/R)
1990	4,159	690	6.7
1991	4,783	1,035	4.6
1992	5,109	1,113	4.6
1993	3,696	1,119	3.3
1994	4,870	1,179	4.1
1995	6,239	1,603	3.9
1996	6,043	1,692	3.6
1997	5,124	1,501	3.4
1998	4,433	1,928	2.3
1999	4,230	1,790	2.4
2000	4,783	1,430	3.3

US$1.00 ~ VND 14,000 (1999/2000).

Source: Government Price Committee, Vietnam.

FIGURE 4.
Price of Vietnam rice and Thai 5% in US$/ton.



Source: for Vietnam Rice Price: MARD (Policy Department); for Thai 5%: World Bank Commodity Prices (Pink Sheet).

Success in the expansion of Vietnamese rice, coffee and pepper exports was marred by the decline in world prices of these commodities. The sharp drop in rice prices beginning in 1999 can be largely explained by stock buildups in Thailand and India, heavy producer-cum-export subsidies by the main exporting nations and gains in productivity and production in Vietnam and Burma. The drop in world prices of coffee and pepper appears to be more directly connected to the rapid increase in Vietnamese exports.

Table 2 shows the value and unit price for selected Vietnamese export products. The decline in export earnings from rice and coffee in 2000 and 2001 was largely offset by the gain in export earnings from seafood. Approximately half of Vietnamese seafood earnings are from shrimp and prawns, a very high-risk commodity due to often devastating losses from disease, as other countries have discovered. But with very high profits and relatively fast recovery of investments, growth remains high despite the high risk. Vietnam ranks fifth in world shrimp/prawn production.

There are conflicting demands over water and water quality for shrimp and rice, with shrimp preferring brackish water. Over the period 1994–2000, the GOV constructed a series of sluices and embankments in the lower Mekong delta to block the tidal inflow of seawater. Now land use maps are being developed to mark out specific areas for shrimp production and for rice culture and some of the barriers are being removed (Hoanh et al. 2001). Related to the above, in order to encourage diversification, in 2001, the GOV declared that it was no longer necessary to devote paddy land strictly to rice production.

Finally, irrigation has played a central role in the rapid growth of Vietnamese agriculture. But within both agriculture and nonagriculture sectors the use and demand for water are changing rapidly. In agriculture there are an increasing number of private pumps to exploit groundwater resources, to facilitate the shift from rice to higher-valued crops in the deltas, and to drain excess floodwater. Moreover, in the Highlands, groundwater development has been vital for the development of cash crops, particularly coffee and pepper. In the nonagriculture sector, water resources need to be improved and expanded for domestic uses, industry and hydropower. In 1999, the GOV enacted a Water Law that provides for a water allocation system through licensing and permits. In 2000, a National Water Resources Council (NWRC) was established.

TABLE 2.
Value and unit price of selected export commodities in Vietnam.

	1994	1998	1999	2000	2001
Value of exports in US$ million					
Rice	429	1,024	1,025	638	588
Coffee	328	594	585	440	385
Seafood	551	858	971	1,475	1,800
Petroleum	866	1,232	2,092	3,500	3,175
Total exports	4,054	9,365	11,540	14,500	15,100
Average Freight-on-Board export price in US$ per ton					
Rice	220	273	227	184	166
Coffee	1,853	1,555	1,215	600	423
Petroleum	125	101	141	205	187

Source: Data obtained from Ministry of Finance, GOV 2001.

Subsequently, river basin committees have been established for the Red river, the Mekong delta and the Dong Nai river basin with the long-term objective of facilitating water allocation among sectors. Irrigation cooperatives are operating in some provinces, and irrigation management transfers are planned in other areas. These measures, notwithstanding the coordination and improvement in management of a fragmented and decentralized provincial, community and private system, present a major challenge.

Forms, Levels and Trends in Taxation and Subsidies in Agriculture

Taxation and subsidies in agriculture take on many forms. There are direct national and local taxes imposed on farmers. There are subsidies for commodities such as sugar, for inputs such as fertilizer and irrigation water, and for commodity price stabilization schemes such as rice and coffee. Taxes resulting in trade distortions include direct taxes in the form of agricultural export tariffs and quotas and indirect or "hidden" taxes in the form of overvalued exchange rates and tariffs and quotas for industrial protection. Until the mid-1980s most analysts of agricultural policies were preoccupied with direct effects of sectoral pricing and trade policies on output, resource use and income distribution (Schiff and Valdes 1998). Now it is generally recognized that the indirect effects of economy-wide policies may have a more significant impact on agriculture than policies directed specifically toward agriculture.

It is extremely difficult to identify and quantify all the forms of taxation and subsidies. With changes in the political economy in Vietnam, the taxation system and the roles and responsibilities of different actors are in constant redefinition. However, it is possible to observe the general levels and trends. Over the past decade, two major events have shaped the direction and change in Vietnamese agriculture: first, the opening of the market and adoption of trade liberalization policies, and second, the decline in world agricultural commodity prices. While direct taxes on land, import duties and tariffs have been reduced, and indirect taxation due to overvalued exchange rates has declined, high levels of industrial protection, particularly for capital-intensive SOEs continues to penalize agriculture. The following sections describe the trends or changes in taxes and subsidies that impact agriculture either directly or indirectly.

Direct Taxes on Agriculture—The Relative Tax Burden

The high taxation level of crop production in Vietnam in the 1980s (6–14% for paddy, 10–30% for fruit trees, and 12% for industrial and other crops) contributed to a major production crisis in 1987 and the decollectivization of agriculture (Decree No. 10) in 1988. In January 1989, the agricultural production tax was adjusted to 10 percent of production for all annual crops. In 1993, it was moreover converted to a land-based tax (see Hayami 1994 for a discussion) with land classified into six classes based on the relative conditions of land quality, location, terrain, climate and condition of irrigation and drainage. As a source of total national tax revenue, the land tax is small. Since 1994 it has ranged from 4 to 5 percent of overall national revenues (table 3). In 2001, the land use tax was exempted for more than 2000 poor communes and was reduced by half for rice and coffee growers.

TABLE 3.
Trends in agriculture and total taxes (1994 constant VND billion).

Year	Land use tax	Ag. import duty	Ag. export tax	Other revenues	Ag. revenue	Total revenue	Ag. as % of total revenue
1991	1,287	180	13	16,728	1,480	18,842	7.9
1992	1,777	272	26	25,832	2,075	28,865	7.2
1993	1,579	637	51	35,459	2,267	35,884	6.3
1994	1,127	866	65	36,695	2,057	42,126	4.9
1995	1,326	964	73	39,613	2,363	45,578	5.2
1996	1,495	899	93	42,643	2,487	49,036	5.1
1997	1,251	790	57	42,781	2,098	48,164	4.4
1998	1,326	989	35	42,967	2,349	49,470	4.7
1999	1,265	873	28	44,154	2,165	50,311	4.3

Source: Data obtained from MARD (Policy Department), 2001.

In addition to the land tax, farmers pay a series of other "local" fees levied by the provincial, district, or village authorities. The high level of fees is apparently a more pressing problem in the Red river delta, and the north central and central regions than elsewhere in the country. A study in Ha Tay, Quang Binh and Ha Tinh provinces identified 32 different rates of fees and contributions levied in six communes including school fees. A survey by MARD in Thai Binh province showed that farmers had to pay 14 kinds of fees in addition to those "officially regulated," amounting to 439 kg of paddy/household/year. Based on a 1994 study in the Red river delta, Fontenelle and Molle (2002) report that annual taxes paid by farmers (including water fees) were equal to about 20–25 percent of agricultural production. In Can Tho and Soc Trang, each farm household has to pay 12 additional kinds of fees or around 213 kg of paddy/year. In Thanh Hoa, farmers have to pay 26 kinds of fees (MARD 2002). To address this issue, in late 2001, the National Assembly issued a Law on Fees (No. 38/2001/PL-UBTVQH10) to regulate how to, and who can, collect fees, and to distinguish between fees for the national budget and fees for social purposes.

Irrigating farmers who have a contract with the irrigation management companies (IMC) or irrigation stations pay irrigation service fees (ISF), which can differ by province, district, season, and crop (see section under Irrigation Sector, p.24). Fees are computed in paddy rice to adjust for inflation. In the Red river delta, where pumping costs are high, water fees range from 6 to 8 percent of annual paddy production (Fontenelle and Molle, 2002). Elsewhere the fees range from 2 to 5 percent of paddy production.

The GOV also collects duties on imports and taxes on exports. Relative to total government revenue collections, these are small and, in recent years, are about equivalent to the land tax. The total of land plus import/export taxes has been around 4 to 5 percent of total government revenues since 1994 (table 3).

Is the Vietnamese agriculture sector being taxed more heavily or more lightly than the rest of the economy? Following the methodology in a Philippine study by Habito and Manasan (1992), we have computed the *relative tax burden.* The computations are shown in table 4. The agricultural tax share (agricultural tax as a share of total taxes), shown in column (3),

TABLE 4.
Computation of relative agricultural tax burden.

Year (1)	Agriculture share in total GVA (2)	Agriculture tax share in total taxes (3)	Relative tax burden (4) = (3/2)
1991	37.5	9.7	25.9
1992	31.1	10.0	32.1
1993	26.9	8.0	29.7
1994	25.9	6.1	23.6
1995	24.3	6.3	25.9
1996	24.2	6.1	25.2
1997	22.5	5.0	22.2
1998	22.6	5.2	23.0
1999	22.3	5.1	22.9

Notes: GVA = Gross value added; Agricultural taxes include land tax, and agricultural import and export taxes. Water fees, local taxes and taxes on state-owned enterprises in agriculture are not included.

Source: Data obtained from MARD, Policy Department, 2001.

has declined over the decade, first sharply and then more gradually. The share of gross value added of agriculture, shown is column (2), is also declining. The relative tax burden calculated as the agricultural tax share divided by the share of total gross value added in agriculture shows that relative to its share of gross value added the tax burden of agriculture only averaged 24 percent during 1995–99. The agricultural tax ratio for other Asian countries during the 1970s and 1980s ranged from a high of 27 percent for Korea and Japan to a low of 2 percent for the Philippines. With an agricultural tax ratio of 4–5 percent since 1995 the tax rate in Vietnam is comparable to other lightly taxed agriculture sectors—Thailand and the Philippines (data adapted from Habito and Manasan 1992).

Local taxes, estimated at US$60–100 million annually and thus possibly as large as half of total agricultural taxes, are not reported in these calculations. However, they might be missing in calculations for other countries as well. Thus, although one cannot conclude from this analysis that the Vietnamese agriculture sector is lightly taxed, agricultural taxation is certainly not excessive in the country.

Agricultural Quotas, Tariffs and Subsidies

In keeping with the move toward free trade, there was a general reduction in agricultural tariffs and quotas in the 1990s. Moreover, the GOV has responded to the recent decline in export prices with a number of policies, including the removal of the rice export quotas and the reduction or elimination of export taxes. Table 5 presents changes in the NPC for a number of major agricultural commodities in Vietnam, including two of the largest foreign exchange earners, coffee and rice. The NPC is calculated as the domestic wholesale price minus the border price and the difference divided by the latter. Sugar stands out as the most heavily subsidized commodity. A study of the impact of current sugar polices by the Center for International Economics, Australia (CIE 2001) concluded that liberalization of sugar imports would increase the real income of the country by some US$82 million each year. Sugarcane production would fall. However, trade liberalization would not destroy sugarcane production in the industry, but would generate incentives for reallocation of the structure of production. In the future, the protection of the fertilizer industry may prove to be more costly than sugar as fertilizer is the major farm cash input (Goletti 1998). Protection levels are low at present but appear to be rising (see table 5). Government policy fluctuates depending on the success of domestic producers in arguing for restrictions. However, there is a danger that the subsidy could increase substantially. The recent decision to build two urea plants will move Vietnam toward self-sufficiency. But many observers believe that urea cannot be produced domestically at the price at which it can be imported. Their reservation is supported by the recent experience of the fertilizer industry in Asia (Tomich et al. 1995).

TABLE 5.
Nominal protection coefficients (NPC), Vietnam 1990–2000.

Year	Rice	Rubber	Coffee	Black pepper	Cotton	Tobacco	Sugar	Urea
1990	-15	-3	-21	-2	-2	8	na	-8
1991	-17	-12	-26	-8	-89	26	na	12
1992	-25	-9	-22	-1	-6	19	na	-2
1993	-19	-7	-12	-6	-3	16	na	-4
1994	-17	-2	-12	-3	10	7	na	-4
1995	-10	-3	-10	-12	-9	18	110	-6
1996	-14	-8	0	-9	4	12	111	-2
1997	-16	-10	-4	-9	-5	8	134	4
1998	-15	-4	-16	-10	-4	22	103	13
1999	-7	-1	-8	-6	-10	19	121	21
2000	-7	-5	-7	-20	-7	-4	na	12

Notes: NPC = (domestic wholesale price - border price)/border price. Where domestic wholesale prices were not available the wholesale price was assumed to be 10 percent lower than the retail price. The domestic wholesale price for rice is taken from the Mekong delta, and the domestic wholesale price for coffee is for the *robusta* variety.

Source: Calculated by the authors from data provided by MARD (Policy Department), 2001.

Moreover, the GOV carries out public stockholding for food-security purposes, and hands out transportation subsidies for remote and mountainous areas. Construction of irrigation facilities is paid largely from public funds and approximately half of irrigation O&M costs is subsidized. Moreover, there is a range of large programs to support specific crops, husbandry and fishery products, including free or subsidized seed, credit and extension programs. Many of these programs are carried out at the provincial level and are difficult to quantify.

Trade liberalization is a two-sided coin implying the reduction of both tariffs and subsidies. To the degree that the support programs are successful, they might be justified on the grounds of food security or export promotion. However, protection of crops such as sugarcane or inputs such as fertilizer represent a major cost to the government.

Impact of the Move toward Free Trade

As a result of recent changes in GOV policies, the trade regime and Vietnam's trade have undergone a significant transformation. The government has acted to codify practices in law and supported greatly increased transparency of the trade regime. Only 10 years ago, as most trade activities were centrally determined, incentives, taxes, and conditions for trade, such as licenses and quotas, were largely irrelevant in shaping trade outcomes because individuals and firms had no capacity to respond to them. Since then, the transition to a market economy with decentralized, commercially oriented decision making with respect to production, consumption and investment has been accompanied by the development of market-oriented trade policies. According to some measures (such as the ratio of trade to GDP),

Vietnam appears to be a fairly open economy. Since 1998, the trade regime has been opened up further, allowing for trading rights (direct exports and imports of goods) for firms registered in Vietnam. Export taxes were reduced on a number of products and quotas on rice exports were removed. On the import side, quantitative restrictions were removed on seven commodity groups and the maximum tariff was reduced to 50 percent with exceptions for six items: a) bicycles and other cycles (including delivery tricycles), not motorized; b) beverages, wines and spirits; c) petrol and gasoline; d) automobiles; e) motorcycles; and f) tobacco.

The opening up of Vietnam's economy, including the agriculture sector, to world-market forces and the progressive withdrawal of the government from direct intervention in pricing and marketing have also meant that farmers are now much more exposed to international price instability. In 1996, Vietnam joined the ASEAN Free Trade Area (AFTA). The US trade embargo was lifted in 1994, and a bilateral trade agreement was signed in 2000. The GOV has also plans to join the World Trade Organization (WTO) by 2005. All these agreements will lead to a further reduction in trade restrictions. As a result, farmers face selling prices that are both less-stable and less-predictable than before.

In addition to the greater exposition of Vietnamese farmers to international price instability, trends in international prices for these two agricultural commodities indicate continuing gradual declines (table 2). Together, these factors have seriously affected the incomes of most Vietnamese farmers, particularly rice and coffee farmers, whose livelihoods depend heavily on the sales of a few major agricultural commodities. As a result, the GOV has implemented a series of actions to help farmers cope with price fluctuations for these crops. Unfortunately, however, *ad hoc* measures, such as minimum price arrangements, and stock-withholding programs, such as those attempted in Vietnam in 2000/2001, have done little to benefit producers. The question of how to shape the government interventions in a depressed market remains unanswered. There is an urgent need for a program of market development that gives domestic producers and exporters of crops, such as rice and coffee, the financial capacity to hold stocks without undertaking undue price risks.

Exchange Rates

During the 1980s, the official fixed exchange rate for the Vietnam Dong (VND) was consistently lower than that prevailing in the market. In 1989, a Convertible Currency Rate was introduced, at a devaluation of 22 percent. During the 1990s, the VND was effectively pegged to the US dollar through a series of discrete realignments and it was only in 1994 that the currency control was relaxed. In 1999, the GOV moved to a Market Average Exchange Rate System. However, there is room for further relaxation of exchange rates (Chinese University of Hong Kong 2000; EADN 2000). This system was introduced to gradually move toward a greater role for market forces in the exchange rate determination. Since the introduction of the new exchange rate regime, movements in the exchange rate have been small (IMF 2000).

Whereas the initial sharp devaluation of the unified currency boosted export growth, the nominal exchange rate during 1993–1996 remained relatively stable, causing concerns of an overvalued VND, as inflation declined. According to EADN (2000), it has been estimated that over this period the real exchange rate and the real effective exchange rate appreciated by about 20 percent and 15 percent, respectively. As a result, in the early 1990s, agriculture was severely penalized by overvalued exchange rates and tariff and quota policies, all of which tended to restrict exports and lower domestic prices (Bautista 1999). Following the East Asian economic and financial crisis, worries of overvaluation of the VND have become more acute, as currencies

in countries in crises devalued reducing the competitiveness of Vietnamese commodities (EADN 2000; Dong et al. 2000). However, in the latter part of the 1990s, external factors (falling export prices) and protection of industrial products rather than overvalued exchange rates have been the major deterrents to growth in export earnings (see also the following section).

Industrial Protection

In spite of the economic reforms and the impressive export growth recorded during the 1990s, it is still appropriate to characterize Vietnam's development strategy as an import substitution. Rapid industrialization and a high degree of self-sufficiency are among the main policy objectives, and these ambitions imply that imports should be limited to those products that Vietnam is not able to produce domestically. As the Vietnamese authorities fear that much of the country's import-substituting industry would be too weak to survive in direct competition with more-efficient foreign producers at the stage of development, a restrictive trade regime has been established to protect domestic companies—as well as foreign multinationals operating in the country—and to facilitate a rapid and broad industrialization process.

Many kinds of nontariff barriers (NTBs) are used in Vietnam to pursue a wide range of objectives. While some reflect a continued concern to "manage" or "balance" demand and supply for goods that are considered to be of strategic importance to the economy, others are designed to conserve the use of foreign exchange or to deter imports of goods considered to be of low priority, or to protect local producers, and yet others, to reflect concerns over public safety and public morals. In nearly all cases, however, the NTBs have the effect—intended or not—of protecting local production.

Additionally, the import tariff system provides high levels of protection to a range of local production, and is subject to frequent changes and inconsistent implementation; examples are tariff rates imposed on petroleum and fertilizers. In addition to the large variation and considerable volatility of tariff rates over time, tariffs are unnecessarily complex, with many exemptions and end-use distinctions. While the average tariff rates are relatively low, the large and selective dispersion around this average means that protection accorded by the tariff can be very high, leaving large room for inefficiencies. The escalation of the tariff structure, with low rates for most inputs and high rates for outputs, guarantees that protection is high for many goods with a high proportion of processing or manufacturing.

In addition, the interests of SOEs play a disproportionate role in the determination of trade policy, a situation facilitated by the continued close links between certain enterprises and policymaking ministries. At the same time, it appears that trade policies are shaped with a view to controlling SOEs in the absence of full fiscal and financial disciplines, as well as to restraining competition and maintaining SOE revenue. But despite the government rhetoric the share of total investment in the public sector (including SOEs) has been rising relative to the share in the domestic private sector and foreign direct investments (table 6).

The *effective rate of protection* (ERP) measure provides a guide to the net impact on producers of trade (and other government) policies. The ERP is defined as the percentage change in firm or sector value-added, as a result of government policies, over the level of value-added that would have prevailed in the absence of those policies. A positive ERP indicates that the returns to capital and labor are higher than they would have been in the absence of the government policies. A negative ERP could mean that a

TABLE 6.
Investment (total and percent) by source, Vietnam, 1995–2001 in VND billion.

	1995	1996	1997	1998	1999	2000	2001
Total investment	72,447	87,394	108,370	117,134	131,171	145,333	163,500
Public sector	30,447	42,894	53,570	65,034	76,958	83,568	95,000
	(42)	(49)	(49)	(56)	(59)	(58)	(58)
Budget	13,575	19,544	23,570	26,300	31,763	34,506	40,400
	(19)	(22)	(22)	(23)	(24)	(24)	(25)
State-directed credit	6,064	8,280	12,700	18,400	24,693	26,934	28,000
	(8)	(10)	(12)	(16)	(19)	(19)	(17)
SOEs	3,700	6,329	8,996	11,522	13,362	14,087	17,000
	(5)	(7)	(8)	(10)	(10)	(10)	(10)
Others	7,108	8,741	8,304	8,812	7,141	8,040	9,600
	(10)	(10)	(8)	(8)	(5)	(6)	(6)
Domestic private sector	20,000	21,800	24,500	27,800	31,542	34,594	38,500
	(28)	(25)	(23)	(24)	(24)	(24)	(24)
Foreign Direct Investment (FDI)	22,000	22,700	30,300	24,300	22,671	27,172	30,000
	(30)	(26)	(28)	(21)	(17)	(19)	(18)

Note: Percents of investment are given in parantheses.

Source: Ministry of Finance, GOV, various years.

firm or sector is worse-off than under free trade. Table 7 presents results from a recent study of ERPs in Vietnam (CIE 1999). The study clearly indicated that ERPs vary greatly between sectors, and certain industries are being supported at a very high economic cost. Note that the EPRs for sugar and fertilizer are very much in line with the nominal protection coefficients for these two commodities shown in table 5. Significant spikes in protection, including for tobacco, alcohol and beverages, and the manufacture of ferrous metals with ERPs in excess of 200 percent, contrast with other sectors that enjoy low or negative rates of protection, including forestry, mining, wood processing and products, chemical products, pharmaceuticals, other nonmetallic minerals, and the manufacture of nonferrous metals. Results from the CIE (1999) study also showed that both domestic and foreign investment in Vietnam is being directed toward sectors with relatively high levels of protection and not toward sectors that are viable with low levels of protection. Specifically, around 50 percent of investment is in sectors with effective rates of protection of more than 90 percent, and a quarter is in sectors with effective rates of more than 120 percent. Agriculture, in general, received a much lower share of foreign investment in Vietnam than in several other countries, including China.

The effect of industrial protection on the agriculture sector is felt in several ways. The protected industries receive a larger share of total investments. The agriculture sector must pay more for protected items. The surplus agricultural laborers cannot find employment in the capital-intensive industrial sector. In short, the terms of trade move against agriculture. Another dimension of the costs of current policies is their effect on exports. All exports are disadvantaged by the extensive system of import taxes and controls. These raise the price of imports and locally

TABLE 7.
Effective rate of protection for selected industries and commodities.

No.	Industries	Effective rate of protection (ERP) (%)
1	Agriculture	17.0
2	Forestry	3.1
3	Fishing	43.3
4	Mining	-1.2
5	Vegetables and fruit canning	100.4
6	Tea and coffee processing	90.1
7	Sugar	107.0
8	Wood processing and products	7.0
9	Paper products	117.5
10	Fertilizers and pesticides	22.0
11	Rubber products	160.0
12	Plastic products	185.2
13	Ceramic, glass and porcelain	127.0
14	Cement	89.9
15	Manufacture of ferrous metals	256.5

Source: CIE 1999.

produced substitutes relative to all other goods and services and so reduce the real returns from exporting. Or, to put it another way, every US dollar spent on import substitution as a result of these controls is one US dollar taken away from export-oriented investment. Thus, Vietnam should focus on efficient import substitution (that is, import substitution that is low-cost and makes efficient use of the nation's resources and factors of production) as much as it welcomes efficient exporting.

The trade restrictions, which are applied in some key sectors, have flow-on effects on a wide range of industries. For example, all sales of fertilizer are considered as intermediate products, the vast majority of which goes to agricultural products such as paddy, coffee and other crops. Refined sugar is sold to a number of food processing sectors, such as confectionary and nonalcoholic beverages.

Thus, the structure of Vietnam's economy is such that protection hurts sectors, which are important in terms of rural development (agriculture), exports (food processing), and investment (construction).

The costs of industrial protection for agriculture arise because of the direct effects of protection on inputs used in agriculture and also through the broader effects of protection throughout the economy. Nguyen (1999) estimated that removal of all nonagricultural protection would lead to real farm income being over 10 percent higher than it is in the presence of this protection. The study also projected that total GDP would be higher by around 2.5 percent if industrial protection is removed. CIE (2001) showed that liberalizing sugar imports would increase the real income of the country by some US$82 million each year.

In summary, interventions which protect industry and even some sections of agriculture reduce agriculture's share of gross national product, resulting in slower growth in agricultural production and exports and hence slower economic growth overall. As a result, millions of Vietnamese farmers are enduring indirect taxes, which further weaken their already low incomes.

Government Expenditures in Agriculture

Public spending in agriculture is essential for increasing agricultural growth and productivity. Expenditure in research/extension and irrigation, and complementary expenditure in rural infrastructure and human capital have paved the way for rapid growth in Asian agriculture and poverty decline in country after country. There have been a number of studies of government expenditure and investment in agriculture in Vietnam in particular (e.g., GOV-Donor Working Group 2000; Kherallah and Goletti 2000) and Asia, in general (e.g., Fan and Pardey 1998). The general consensus is that the benefits of public expenditures in agriculture could be greatly improved if governments would increase expenditures on research and extension, improve the efficiency of investments in irrigation and flood control, avoid subsidies to certain sectors such as sugar, and avoid expenditures in areas where the private sector has a comparative advantage.

In this section, we examine government expenditure patterns in the 1990s, comparing Vietnam's experience with those of other Asian countries from the 1970s to the 1990s with the objective a) to compare agriculture's share of total expenditures with agriculture's share of GDP for Vietnam and for neighboring Asian countries; b) to estimate the incremental capital output ratio (ICOR) and the agricultural share of total expenditures needed to sustain agricultural growth; and c) to examine in more detail the investments in research-extension and credit.[1]

Trends in Government Expenditures in Agriculture

Total government expenditure increased almost fourfold over the 1990s (table 8). Agriculture's share of total government expenditure fluctuated from year to year around an average level of 10 percent. The largest item of expenditure was for irrigation and flood control, ranging from 50 to 70 percent of total expenditure, of which less than 5 percent was for current expenditures.

TABLE 8.
Trends in government expenditures (GE), in billion VND (constant 1994 prices).

Year	Total GE	GEA	% GEA	Water resources	% Water resources
(1)	(2)	(3)	(4) = (3)/(2)	(5)	(6) = (5)/(3)
1990	9,584	1,455	15.2	943	64.8
1991	9,309	1,283	13.8	737	57.5
1992	11,928	1,316	11.0	799	60.7
1993	21,710	1,739	8.0	1,003	57.7
1994	20,796	1,981	9.5	1,092	55.1
1995	22,268	2,264	10.2	1,655	73.1
1996	28,213	2,265	8.0	1,366	60.3
1997	34,322	2,556	7.4	1,803	70.5
1998	35,619	3,023	8.5	1,795	59.4
1999	41,024	4,318	10.5	2,638	61.1

Note: GE = Government expenditures; GEA = Government expenditures in agriculture.

Source: MARD (Policy Department) 2001.

[1]Irrigation investments are dealt with in the section under Irrigation Sector (p.24).

TABLE 9.
Agricultural expenditures (GEA) as percent of total government expenditures (GE).

Country	1975	1980	1985	1990	1993	1998
China	12.1	12.4	8.3	8.9	8.3	10.6
India	9.7	14.6	12.6	11.5	9.6	14.5
Indonesia	9.8	9.6	6.8	7.6	6.6	7.2
Philippines	9.0	5.3	5.7	6.0	7.3	6.0
Thailand	5.9	8.1	11.7	10.4	10.4	7.5
Vietnam	-	-	-	15.2	8.0	8.5

Source: Fan and Pardey 1998 and for Vietnam from table 8.

Table 9 compares the share of government expenditures for agriculture in Vietnam in the 1990s with other Asian countries over a much longer period of time. For most countries the share has remained reasonably constant over time, even as agriculture has shown a relative decline and total government expenditures have increased. That is to say, in absolute terms, both the GDP in agriculture and the government expenditures in agriculture have grown. Vietnam's percentage of expenditures of around 10 percent compares well with other Asian economies.

The Bias Index for Government Expenditures in Agriculture

A bias index for government expenditures in agriculture was estimated as the ratio of the sector's share to *total government expenditures* (GE) divided by the sector's share to total *gross value added* (GVA). The bias index is shown in table 10 as values in column (2) are divided by those in column (3) or (GEA/GE)/(AgGVA/GVA). The index ranged from 30 to 47 percent during the 1990s. That is to say, the agriculture sector is receiving government expenditure that is proportionally much less than its contribution to the economy.

The bias index for selected Asian countries is shown in table 11. With the exception of Thailand in certain years, the share of expenditures in agriculture is well below half of the agriculture-sector contribution to GVA. The bias index for Vietnam is well in line with those in Asian countries. This does not mean that the governments are underinvesting in agriculture. The performance of the agriculture sector depends on a range of complementary investments in rural infrastructure, such as

TABLE 10.
Bias index for government expenditures in agriculture.

Year (1)	GEA/GE (2)	AgGVA/GVA (3)	Bias Index (4) = (2/3)
1990	15.2	43.8	34.7
1991	13.8	37.5	36.8
1992	11.0	31.1	35.4
1993	8.0	26.9	29.7
1994	9.5	25.9	36.7
1995	10.2	24.3	42.0
1996	8.0	24.2	33.0
1997	7.4	22.5	33.3
1998	8.5	22.6	37.4
1999	10.5	22.3	47.0

Note: Agricultural bias index = Government investment in agriculture as a share of total investment divided by the value added in agriculture as a share of total value added expressed in percent. GE = Total government expenditures; GEA = Government expenditures in agriculture; AgGVA = Gross value added in agriculture; GVA = Total gross value added.

Source: Author calculations, based on General Statistical Office. Statistical yearbooks. Various issues.

TABLE 11.
Agricultural bias index for selected Asian countries.

Country	1975	1980	1985	1990	1993	1998
China	—	—	—	18.4	30.1	40.1
India	11.6	19.4	23.9	28.3	19.6	18.6
Indonesia	31.1	35.4	27.2	35.7	35.4	36.6
Philippines	43.0	25.7	25.9	30.3	34.9	31.5
Thailand	29.5	6.2	59.0	74.2	84.4	49.3
Vietnam	—	—	—	34.7	29.7	37.4

Note: Agricultural bias index = Government investment in agriculture as share of total investment divided by the value added in agriculture as a share of total value added expressed in percent.

Source: Data from World Bank World Development Indicators for GVA and Fan and Pardey 1998 for agricultural expenditure; for Vietnam, see table 10.

roads, electricity and communications, and in human resources development including schools and health services. Furthermore, it has to be shown that the marginal return on investments in agriculture is higher than in other sectors. The next two sections address the issue of the marginal returns to investment in agriculture or the incremental capital-output ratio.

Incremental Capital-Output Ratio (ICOR)

The incremental capital-output ratio (ICOR) is an important indicator of the efficiency of public and private capital investment. ICOR for the agriculture sector can be computed for a specified period of time (say 5 years) as the average government expenditure in agriculture as a share of agricultural GDP divided by the average growth in agricultural GDP.

The experience of Japan and Taiwan suggests that ICOR for agriculture may be quite high in the early stages of development due to heavy investments in irrigation, drainage and land development. It may also be high much later when mechanization becomes necessary (Krishna 1982). However, during the green revolution, the development of irrigation coincided with the spread of powerful yield-increasing technologies in many Asian countries. In the case of Vietnam, the institutional reforms in the 1980s and 1990s led to a similar growth in agricultural GDP based on investments in irrigation and adoption of yield-increasing technologies. In these situations an opportunity is created for very rapid growth in agricultural GDP over a period of a decade or more. But eventually as the slack is taken up one can expect a somewhat slower growth in GDP and a less-favorable capital-output ratio.

For Vietnam, table 12 shows the upward trend in public expenditure for agriculture (AgGE) as a share of agricultural GDP (AgGDP), with the ratio doubling between 1990 and 1999 from 3.5 percent to 7.1 percent. The trend in public investments and agriculture-sector growth rates suggests that agriculture is becoming less efficient in the use of capital. To examine this issue for both public and private investments in Vietnam, we have calculated the ICOR for the 5-year periods 1995–99 and 1997–2001 (table 13). In the short span between the former and the latter periods the ICOR rose from 4.2 to 5.0. As irrigation accounts for half of public investment in agriculture, some observers attribute the high and rising ICOR to increasingly unproductive irrigation investments. But there are few if any ex-post studies of irrigation investments to confirm or deny this allegation.

TABLE 12.
Trends in public agricultural expenditures (GEA) and GEA as a share of AgGDP.

Year	GEA	AgGDP	GEA as share of AgGDP
	(1994 billion VND)	(1994 billion VND)	(%)
1989	1,338	41,589	3.2
1990	1,455	42,003	3.5
1991	1,283	42,917	3.0
1992	1,316	45,869	2.9
1993	1,736	47,373	3.7
1994	1,981	48,968	4.1
1995	2,264	51,319	4.4
1996	2,265	53,577	4.2
1997	2,556	55,895	4.6
1998	3,023	57,866	5.2
1999	4,318	60,895	7.1

Note: GEA = Government expenditures in agriculture; AgGDP = Agricultural GDP.

Source: MARD 2001.

TABLE 13.
Incremental capital output ratio (ICOR), 1995–99 and 1997–2001.

a. Total public and private agricultural investment as share of AgGDP billion VND in constant 1994 prices.

Year	Agricultural investment	AgGDP	Ag. investment/ AgGDP (ratio)
1995	8,109	51,319	15.8
1996	9,159	53,577	17.1
1997	10,762	55,895	19.3
1998	10,268	57,866	17.7
1999	11,908	60,895	19.6
2000	13,108	63,717	20.6
2001	15,186	65,497	23.1

b. Five-year average AgInvestment/AgGDP (ratio) divided by 5-year average GDP growth rate.

Period	Aginvestment/ AgGDP(ratio)	GDP growth rate	ICOR
1995–1999	17.9	4.3	4.2
1997–2002	20.1	4	5

Note: AgGDP = Agricultural GDP.

Source: Author calculation based on data provided by MARD 2001.

Investment Allocations between Agriculture and Nonagriculture

What percentage of the government's budget should be invested in agriculture? Ideally, we would like to invest an amount that insures a contribution from agriculture that will stimulate the highest overall growth rate for the economy. It is generally recognized that in developing economies such as Vietnam, with a substantial agriculture sector, there is a strong complementarity between agricultural and nonagricultural growth (Johnston and Mellor 1961; Krishna 1982). That is to say, satisfactory growth in either sector depends on adequate deliveries of input requirements from the other sector. The historical role of agriculture in the development transition has been to accelerate its own growth rate while at the same time shrinking in size relative to the rest of the economy, thereby facilitating nonagricultural growth at a rate that is at least twice the growth rate of agriculture. Vietnam fits this pattern very well. For the decade of the 1990s the World Bank reports an annual growth in agriculture of 4.9 percent, in industry of 12.5 percent and in services of 8.1 percent. Meanwhile, the share of GDP in agriculture has shrunk from 44 percent in 1990 to 22 in 1999, an extremely rapid decline. But over 60 percent of the labor force remains in agriculture. In assessing the appropriateness of investment levels in the 1990s and future investment needs for agriculture, we adopt a formula presented by Krishna (1982). The required share of agricultural investment to total investment depends on:

- the growth rate in agricultural GDP or AgGDP growth
- agricultural share of GDP or AgGDP/ GDP
- the agricultural incremental capital/ output ratio
- ICOR = (AgInv/AgGDP)/AgGDP growth

- the savings or aggregate investment/ income ratio or TotalInv/GDP.

The share of agriculture in total investment (AgInv/TotalInv) is given as:

$$\text{AgInv/TotalInv} = \frac{\text{AgGDP growth} \times \text{AgGDP/GDP} \times (\text{AgInv/AgGDP/AgGDP growth})}{\text{TotalInv/GDP}}$$

This formula can be interpreted as follows. You have to invest proportionally more in agriculture if: a) you target a high growth rate, b) your capital efficiency is low, c) agriculture continues to be a big part of the economy, and d) the national investment rate is low. For Vietnam, the picture is mixed: the targeted growth rate for agriculture (4.0–4.5%/year; [MARD 2000]) is high; the capital efficiency (ICOR) is declining; the agricultural share of GDP is approaching 20 percent; and the national investment rate is high.

In table 14 we show agriculture's share of total investment using the above formula for two time periods, 1995–99 and 1997–2001. Agriculture as a share of total investments has remained constant at about 12 percent. Projecting to the time period 2001–2005, much will depend upon how fast the ICOR rises. Based on the assumed ICOR of 7, to meet the targeted growth rate of 4 percent in agricultural GDP would require an increase in the share of agriculture in total investment to 14 percent. A more likely scenario is reflected in a lower growth in agricultural GDP (3.5%) with the share of total investment of agriculture maintained at about 12 percent.

TABLE 14.
Agricultural investments as a share of total investments, 1995–99, 1997–2001, and projected to 2001–2005.

a. Agricultural investment as a share of total investment and AgGDP as a share of total GDP

Year	Total investments	GDP	Investments as % GDP	AgGDP as % GDP
		(Billion VND in constant 1994 prices)		*(5)*
1995	64,685	195,567	33.1	26.2
1996	74,315	213,833	34.8	25.1
1997	88,607	231,624	38.3	24.1
1998	90,952	244,596	37.2	23.7
1999	99,855	256,272	39.0	23.8
2000	110,636	273,666	40.4	23.3
2001	124,143	292,376	42.5	22.4

b. Agricultural share of total investments

Period	AgGDP growth (see table 13)	AgICOR (see table 13)	AgGDP/ GDP	Investment/ GDP	Agriculture/ Total investment (2x3x4)/5
(1)	(2)	(3)	(4)	(5)	(6)
1995–1999	4.3	4.2	24.6	36.5	12.2
1997–2001	4	5	23.5	39.5	11.9
2001–2005*	4	7	20	40	14
2001–2005*	3.5	7	20	40	12.3

**Note:* Alternative estimates.

Source: General Statistical Office, Statistical yearbooks, various years.

The most important conclusion from this exercise is the need to maintain as low an ICOR as possible. This can be achieved principally by improving the quality of the investments in agriculture. This is particularly true in the area of research and extension, credit institutions and irrigation, subjects to which we turn in the next sections.

Research and Extension

A recent summary of studies indicates that rates of return to research and extension often exceed 50 percent and have remained high over time (Alston et al. 2000). One needs to be cautious in interpreting these results, since the evaluation typically relates to specific projects rather than programs or research systems. Nevertheless, there is a general consensus that despite high rates of return, there is a major underinvestment in agricultural research and extension in most developing countries. R&D investment, both public and private, as a portion of agricultural GDP in developing countries is only 0.6 percent as compared to 5 percent in developed countries (Byerlee 1998).

Public research provided basic technologies for the Green Revolution, and has also been very important as a source for scientists for private research. As table 15 shows, in general, more liberalized economies have higher private research intensities. The private sector plays a more important role in the Philippines, Malaysia (where also the private R&D intensity is highest) and India. The most important policy that helped induce this growth was liberalization of industrial policy that allowed private and foreign firms to operate and expand in agricultural input industries (Pray and Fuglie 2001).

There are no reliable figures to show the level of expenditure for research in Vietnam. The MARD research budget, the major source of funding, is currently less than 2 percent of the total expenditure for agriculture. In addition, there are expenditures at the provincial level and on agriculture-related research from other agencies; there is also funding from foreign sources. However, even by Asian standards, the level of financial support for research in Vietnam is low.

Reforming research. There are about 30 agricultural research institutions, 18 of which are under MARD control (GOV-Donor Working Group 2000). The rest are a part of commodity SOEs (rubber, tea, coffee, sugar, etc.) or are semiindependent institutions. In 1996, the GOV decided to reorganize the national agricultural research system as follows (GOV-Donor Working Group 2000): a) keep or merge some

TABLE 15.
Private and public research and research intensity, selected Asian countries, 1995.

Country	Private R&D	Public R&D	Private R&D as share of total R&D	Private R&D intensity (%)	Public R&D intensity
	(US$1995 million)				
China	16.0	479.5	3	0.009	0.327
India	55.5	347.9	14	0.059	0.370
Malaysia	16.6	64.0	21	0.150	0.577
Thailand	17.4	127.0	12	0.095	0.691
Indonesia	6.1	81.0	12	0.018	0.241
Pakistan	5.7	25.0	19	0.036	0.159
Philippines	10.5	37.5	22	0.064	0.230

Notes: R&D intensity represents R&D as a share of agricultural value added.

Source: Pray and Fuglie 2001.

TABLE 16.
Comparative advantage of different actors in agricultural research.

Research tasks	Products	Current situation	Future comparative advantage
1. Genetic improvement	Self-pollinating crops	Public research system	Public research system
2. Genetic improvement	Cross-pollinating crops and small animals	Public research system plus private firms	Private firms
3. Genetic improvement	Local fruit trees and large animals	Farmers	Public system or private firms (with biotechnology)
4. Genetic improvement	Introduced species	Public research system	Public system or private firms (with biotechnology)
5. Crop protection by chemicals	All crops	Private firms, public extension system and farmers	Same, with greater regulation by public agencies
6. Crop protection by host-plant resistance	All crops	Same as 1–4 (depending on crop type)	Same as 1–4
7. Crop protection by Integrated Pest Management (IPM)	All crops	Public extension system, farmers and NGOs	Same
8. Resource management (soils, cropping patterns)	All crops in unfavorable areas	Local public research, farmers and NGOs	Local public research and extension system, farmers and NGOs
9. Mechanization	All crops	Private firms	Private firms

Source: Siamwalla 2001.

institutions, b) move some institutions or centers to SOEs and gradually reduce their funding, and c) spin off some centers to become self-financing. However, the process of reform has moved slowly with difficulty in reaching agreement on these measures.

With the assistance of UNDP and FAO, MARD has developed a *Master Plan for Agricultural Research in Vietnam* (GOV-UNDP-FAO 2001). It calls for a substantial reform of the existing institutional structure of research and decentralization of the system with a move away from the heavy concentration of research centers in the north. Funding would be increased to the "average level for Asia," roughly 6 percent of expenditures for agriculture or two to three times the current level.

The reform is timely as Vietnam faces a major challenge to promote rapid agricultural growth and compete in world markets. This challenge is further heightened by the increasing demands being placed on research systems everywhere, with an original focus on cash crops for export during the colonial period, followed by a heavy emphasis on rice for food-security purposes.

Byerlee (1998) describes an emerging new paradigm for national agricultural research and extension systems. This new model involves: a) a pluralistic research structure with a variety of research/extension organizations participating in both funding and execution, including farmer organizations, NGOs and universities, b) the growing role of the private sector, particularly in the areas of commercial agriculture, c) new mechanisms for research funding, such as competitive grants and contractual arrangements, d) a new form of research organization, which involves the consolidation and rationalization of the existing network or research stations and devolution of decision-making authority to center directors, and e) global scientific linkages to allow agricultural research organizations to capture the spillovers of technologies and knowledge.

The planned reorganization of agricultural research under MARD described in the Master Plan for Agricultural Research in Vietnam

(GOV-UNDP-FAO 2001, Part III) appears to incorporate all of the above elements. However, such a transformation is not easily achieved. How will the priorities be set not only for research but also for the manpower training essential for strengthening research capacity? Which organizations will do the research? Who should pay for the research? Siamwalla (2001) addresses these last two questions. Table 16 identifies the research products, who currently conducts the research, and who has the comparative advantage in the future. The research involves a combination of public and private entities. While the public sector will be dominant for the foreseeable future, the research system in countries such as Vietnam should be in a position to capture and adapt new technologies from research centers and laboratories in the developed world (table 15). Through global scientific linkages, a core of the research staff must be trained to take advantage of advances in biotechnology and information technology.

Table 17 shows the share of the total research budget by sub-sector for the period 1997–99. Frequently mentioned throughout the Master Plan (GOV-UNDP-FAO 2001) is the need for more research on post-harvest and processing activities and on increasing the quality of export crops. For Vietnam to continue rapid export growth and to be competitive in world export markets, the reformed research system will have to give special attention to these two areas. Also needed is economic research to assess the potential of export markets and avoid the overexpansion that has driven down export prices in the past. Research to increase agricultural productivity should focus less on rice, which now receives about 30 percent of the budget, and more on the feed-livestock sector to meet growing consumer demand for livestock products and strengthen agricultural growth in the north.

Extension. The national agricultural extension service was only established in 1993.

TABLE 17.
Share of government funds for research operations by subsector/thematic area in 1997–2000 (%).

Subsector/thematic area	1997	2000
Food crops	22.4	25.1
Industrial crops	6.4	6.6
Fruits and vegetables	4.2	7.0
Animal husbandry and veterinary	13.9	18.5
Forestry	7.9	13.0
Plant protection and soil/land	7.2	4.6
Post-harvest technology	3.7	3.2
Water resources and water management	23.9	14.8
Other	10.4	7.2
Total	100.0	100.0

Source: MARD-DSTPQ 2001 in GOV/UNDP/FAO 2001.

Expenditure for extension is about one-third of that for research. Only about 70 percent of the districts and 30 percent of the communes have access to extension services (GOV-Donor Working Group 2000). Apart from government extension services at the central and local level, there are many organizations and institutions, including NGOs, which perform extension work, but coordination among agencies is weak (GOV-UNDP-FAO 2001). The linkage between research and extension is also weak. In addition, there is lack of a proper curriculum and facilities for educating and training extension agents.

There are three potential avenues for strengthening extension: a) contract farming, b) closer cooperation with NGOs, and c) expansion and devolution of the existing extension services (Siamwalla 2001). The GOV will have to adopt some combination of these. Some state farms and SOEs are currently practicing contract farming and there may be limited scope for expansion. For most countries, the relationship between NGOs and the government has been more adversarial than cooperative. But even with the proper functioning of these first two areas, the GOV will have to expand its extension and technology transfer capacity.

Credit for the Agricultural and Rural Sector

The structure of credit is not unlike that of other developing countries with a formal sector and a significantly more important informal sector. Over 60 percent of the formal lending is carried out by four state-owned commercial banks, the largest of which is the Vietnam Bank for Agriculture and Rural Development (VBARD) with access to most of the communes in Vietnam.

Expanding formal credit. In the late 1990s, the GOV took steps to expand formal credit in rural areas through VBARD, which was identified as the leading commercial bank in lending to farm households. Loans are of three types: a) normal loans for purchase of equipment and crop and animal production, b) directive loans for special government programs, and c) loans to the poor for disaster relief and special projects and programs. Under Decision 67/1999, the GOV liberalized credit allowing VBARD to adjust interest rates to reflect market conditions. Every farm household could borrow up to VND 10 million without collateral. Both state-owned and private enterprises and individual households that need more than VND 10 million must provide collateral. Under the new provisions, loans to households rose from almost none to 68 percent of the total outstanding loans of the VBARD in 2000, loans to private and non-state enterprises rose from zero to 8 percent, while loans to SOEs shrank from 85 to 29 percent. In order to meet the demands for larger loans on commercial farms, Decree No. 11 was issued in 2000 allowing farm households to borrow up to VND 20 million without collateral.

The informal sector. The informal financial system still plays an essential role in the agriculture sector. Money lenders usually provide short-term loans at very high interest rates, which are two to fourfold the average charged by the formal financial sector. However, due to their in-depth knowledge about borrowers, in most cases, money lenders do not require collateral from their customers but instead rely on their “effective” debt collectors. On the other hand, farm households also can get loans at very low interest rates or even free-of-charge from their friends and relatives. Together, the unofficial credit providers are very active in lending to agricultural traders due to some comparative advantages over the formal sector, namely a) easier lending procedures, b) better and easier access for borrowers, c) flexible lending and repayment schedules, and d) no or reduced requirements for collateral.

Problems in rural credit. Despite recent changes in the financial system, farm households and enterprises still face a number of credit-access constraints. This applies in particular to households in rural areas without banking coverage and also to low- and middle-income households who need medium- or long-term credit for investing in medium-scale processing and marketing facilities, and to farm traders who need quick loans to finance purchase of stocks. The issue of insufficient collateral is often involved since the banks take land use right collateral, but at their official price, which is only a fraction of the market price. Additionally, if the borrower cannot repay the debt, banks find themselves in a very difficult position to auction the land since the GOV has not recognized a formal market for land as all land still belongs to the state. In fact, banks rarely sell the land directly. This situation greatly limits the link between credit and land markets and slows down the expansion of agricultural credit. VBARD reaches about 43 percent of total households, and average loans are limited to VND 6.17 million and mostly short-term (less than a year).

Other countries face similar problems. A recent ADB study (Meyer and Nagarajan 2000) on rural financial markets in Asia identifies three Asian institutions that have been studied extensively because their performance has been far superior to that of most rural financial institutions in the developing world. These are

the BAAC in Thailand, the BRI unit desa system (BRI-UD) in Indonesia and the Grameen Bank (GB) in Bangladesh. The latter two in particular focus on low-income farmers. These are models that Vietnam might wish to consider in its own mix of rural financial institutions.

The lack of credit is much more serious to private farm and market traders in Vietnam who have identified it as the main obstacle to their growth. In a recent study by the Mekong Project Development Facility funded by the IFC, it was acknowledged by private enterprises that ambiguities about property rights, restrictions on international trade, irrationality in the tax system, and excessive bureaucracy and red tape complicate business and carry costs, but virtually every one of the traders interviewed identified these problems as secondary to the general lack of credit. A similar finding is reported in every other survey of private firms in Vietnam. In general, the share of the private sector in domestic credit is still well below its share in GDP at about 60 percent. Most of the credit extended to the private sector is of short maturity.

There appears to be a strong lending bias in favor of SOEs, based on directives from the central level, which could lead to serious loan recovery problems, and further restrict private traders and enterprises in their access to credit. In general, allocation of credit toward agro-food processing SOEs crowds out capital to small- and medium-scale rural enterprises. A common argument in defense of SOEs is that they help generate employment. However, SOEs in the rural sectors do not seem to alleviate rural unemployment to a significant extent. Small and medium-scale private enterprises (SMEs) are usually more successful in absorbing rural labor and reducing rural-urban migration. According the World Bank, the labor to capital ratio of a private firm is 10 times that of an SOE. In addition, a job created in an SME requires a capital investment of about US$800, compared to US$18,000 in an SOE. Despite the healthy growth of the agriculture sector during the last 15 years, the failure to increase off-farm employment through SMEs will surely block rural areas from sustainable development in the coming years.

Irrigation Sector

Throughout Asia the past decade has seen increasing concerns about the sustainability of the costly physical infrastructure for water's control and about the emerging scarcity of water due to the growing demand and competing uses. These concerns have led to a rethinking and retooling of the roles of the state in irrigation development and management (Siamwalla 2001).

Siamwalla (2001) goes on to note that two somewhat contrary thrusts have emerged. On the one hand, concerns about the capacity of the state to continue subsidizing irrigation has led to a variety of approaches to devolve or privatize the O&M of various schemes. On the other hand, at the macro level of the water basin, enhanced state regulatory roles are needed to achieve equitable allocation and improved water quality and to resolve conflicts. Closely linked to the public efforts at devolution has been the rapid diffusion of privately owned pumps and tube wells to facilitate the delivery of irrigation water on demand.

The issues identified above are relevant to the current situation in Vietnam. One should add, however, that drainage and flood control (too often ignored in discussions on irrigation) are extremely important in the flood plains of

Vietnam and account for approximately one quarter of the irrigation-sector budget. Thus, when not otherwise specified, the term *irrigation* used in this section should be construed to include irrigation, drainage and flood control.

This section deals with the irrigation sector, which consumes the lion's share of government expenditure in agriculture. It consists of four parts: a) a brief description of irrigation in Vietnam, b) the legal and institutional framework, c) investments in irrigation and current priorities, and d) the impact of irrigation investments.

Irrigation in Vietnam

Irrigation in Vietnam is highly diverse due to a variety of reasons, including topography, climate, history and infrastructural development. Irrigation has, and continues to play, many roles in the agricultural and economic development of the country. It is a major contributor to food security and agricultural exports, as well as to rural employment and related agricultural activities, like aquaculture and rural water supply. Expansion of irrigated area and improvement in water control have made it possible for Vietnam to greatly increase agricultural exports and foreign exchange earnings. This has occurred with rice and now occurring with shrimp, coffee, pepper and other high-valued crops in the uplands in the Mekong delta.

The two largest irrigated areas in Vietnam are located in the Mekong and Red river deltas, with 3.1 and 1 million-hectare gross irrigated areas, respectively. Approximately 0.5 million hectares each are located in the Northeast, North Central Coast, Northeast-South and South Central Coast regions (see table 18).

Three major irrigation types can be distinguished as follows: In the Red river delta, irrigation systems are characterized by large pumping systems that cover several hundred hectares, combined with an intricate system of dikes and upstream reservoirs for flood control. All in all, pumping stations supply about 700,000 hectares in the Red river delta and gravity supplies about 250,000 hectares. The total installed pumping capacity has been estimated at 261,000 kilowatts, guzzling large amounts of energy, which typically accounts for about one-third of the total operating costs of the management companies (Malano 1994). Due to the prevailing climate, double-cropping

TABLE 18.
Gross irrigated area.

	1991	2000	2000	1991–2000	1991–2000 Regional share/growth
	('000 ha)	('000 ha)	(%)	(%/yr.)	(%)
Red river delta	1,083	1,136	16.5	0.41	4.2
Northeast	697	743	10.8	0.52	3.6
Northwest	89	102	1.5	1.54	1.0
North Central Coast	606	682	9.9	1.07	6.0
South Central Coast	368	443	6.4	1.70	5.9
Central Highlands	40	179	2.6	16.73	10.9
Northeast-South	280	543	7.9	6.08	20.6
Mekong river delta	2,455	3,065	44.4	1.42	47.8
Total	5,619	6,894	100.0	1.63	100.0

Source: DWRHWM, MARD 2002.

is prevalent in most of the area. In the Mekong delta, on the other hand, individual pumping for both drainage and irrigation is prevalent. However, there are also several pumping stations or mobile pumps that service groups of farmers, sometimes in the form of cooperatives. The Mekong delta irrigated agriculture has developed very rapidly in the last two decades, and the subtropical climate allows cropping throughout the year, subject only to saltwater intrusion during the dry season in parts of the lower delta, and flooding in the upper delta during the monsoonal season. In fact, approximately two- thirds of the increase in irrigated area during the 1990s occurred in the Mekong delta (table 18), largely due to the shift in the cropping pattern made possible by improvements in water control. Much of the delta, particularly the floodplains near the Cambodian border, had been planted to deepwater rice followed by a field crop such as groundnuts. Beginning in the 1970s, this area gradually gave way to double cropping of rice, one crop before and one after the floods (Molle and Tuan 2001). Elsewhere in the Mekong delta the introduction of small pumps has permitted farmers to continue to intensify irrigated crop production. In 2001, the GOV, in the face of declining rice prices, officially announced that the irrigated paddy lands needed no longer be devoted strictly to rice production. This has given a further impetus to crop diversification including the production of shrimp in the coastal areas.

In the Central Highlands and the so-called Northeast-South region (equal to the southeastern region), tube-well irrigation is practiced for coffee and other perennial irrigated crops, but other forms of irrigation, including surface pumping and small-scale canal irrigation can also be found. In the Central Highlands, irrigation projects have been used to support settlement of the ethnic minority population and to accommodate the in-migration of the Kinh population, as pressure on the available land resources continues to increase. Between 1991 and 2000, the irrigated area increased at an annual rate of 17 and 6 percent in the Central Highlands and the Northeast South region, respectively, much of which was planted with coffee. A study in the Central Highland province of Dak Lak by Muller and Zeller (2002) showed that investments in irrigation and supporting infrastructure, combined with improved access to roads, markets and services, were successful in intensifying agricultural production in the Central Highlands. Higher agricultural productivity on existing land reduced the need for shifting cultivation, thus preserving forest cover while sustaining a much greater population on virtually the same agricultural land area. However, the expansion of irrigated area in the Highlands and part of the Northeast-South region, for example, for pepper in the Binh Phuoc province, was at the cost of forestland. The Dong Nai river basin dominates the Northeast-South region. Here a mixture of irrigation practices can be found with tube-well pumping dominating the upper catchment areas, and gravity surface irrigation in the extensive downstream area, with a large share of irrigation water from Dau Tieng, the largest irrigation reservoir in Vietnam. However, in the last decade or so, rapid economic development in the economic focal zone of HCMC, Bien Hoa and Ba Ria-Vung Tau and, more recently, Binh Duong has increased the scope for inter-sectoral competition and water transfers out of irrigation to fulfill rapidly growing domestic-industrial demands.

Legal and Institutional Framework

In this section we discuss water laws and water rights and the institutional framework for operating and maintaining irrigation systems.

Water legislation. In recent years, Vietnam initiated a series of major reforms in the country's water sector—including the enactment of the Vietnamese Framework Water Law in 1999, the establishment of the National Water Resources Council in 2000, the establishment

of Basin Planning Management Councils for the Red river delta, the Mekong delta and the Dong Nai river basin in 2001, and the establishment of MONRE in 2002.

The Vietnamese Water Resources Law was adopted on May 20 1998, and went into force in January 1999. According to the law, water resources belong to the people under the management of the state, and organizations and individuals have a right to exploit and use the resources. Water allocation is carried out from a river-basin perspective adhering to the principles of fairness and reasonability. Priority in use is accorded to drinking water in both quality and quantity (Art. 20). According to the Water Law, MARD is in charge of overall management of the country's water resources, but the government can delegate authority for specific water uses to other ministries. Water management is to be carried out based on river-basin plans that follow the hydrologic catchment (and not administrative) boundaries. MARD, together with provincial governments, is in charge of establishing both flood and drought plans for the country's river basins. Moreover, both water uses and wastewater discharge will be licensed by the provincial government authorities (People's Committees) (Official Gazette 1998). Decree 179/1999/ND-CP of December 30 1999 spells out details on water-resources management for MARD and other agencies. The state management function of water has since been reassigned to MONRE, established in 2002 (MONRE 2003). MARD remains in charge of service deliveries and investments, including for a) rural water supply, b) irrigation and drainage, c) flood control, and d) disaster management. Other legislation important for water includes the Environmental Protection Law (27 December1993) and the Ministerial Instruction for Guiding Environmental Impact Assessment for Operating Units by the Ministry of Science, Technology, and Environment (MOSTE) (Instruction No. 1420/ QD-MTg). Thus, management of water resources has been separated from the provision of irrigation and drainage services, and other construction and investment activities.

In June 2000, an umbrella organization for the water sector at the national level—called the National Water Resource Council (NWRC)—was established, based on Art. 63 of the Water Resources Law (Government Decision No. 67/2000/QD-TTg). Since 2003, the NWRC has an office at the Department of Water Resources Management (DWRM) of MONRE. Permanent members of the Council include a Vice Prime Minister, the Minister of MONRE, as well as Deputy Ministers from MARD, MOSTE, the Ministry of Fisheries, the Ministry of Planning and Investment, the Ministry of Finance, the Ministry of National Defense, the Ministry of Construction, the Ministry of Transportation and Communication, the Ministry of Industry and the Ministry of Public Health.

In April 2001, basin-planning management councils were established for the Red river delta, the Mekong delta and the Dong Nai river basin. The River Basin Organizations consist of a Council and three Secretariats, one secretariat being placed in the Institute for Water Resources Planning in Hanoi (Red river delta) and two in HCMC (Mekong delta and the Dong Nai basin), respectively. Operating regulations for the councils are still being worked out.

Administration of irrigation services in Vietnam. At the central government level, the Department of Water Resources and Hydraulic Works Management (DWRHWM) of MARD is responsible for the service-delivery function for irrigation, including the planning and prioritization of new development, while the overall policy framework has been taken on recently by the DRWM of MONRE, including the allocation of interprovincial water resources. Funding of large capital projects, including investment for main canals of large irrigation and flood-control projects, is largely carried out by the central government. The Provincial People's Committees (PPC) are responsible for the public irrigation systems within their boundaries. Their functions include managing the systems, setting ISF based on national

guidelines, determining subsidies for the irrigation sector and investments in the local infrastructure, and overseeing the work of the Provincial Agriculture and Rural Development Service (PARDS). The PARDS, through its Irrigation Department, is the provincial government's arm with the overall responsibility for operating, maintaining and repairing public irrigation, drainage and flood-control systems, and for survey, design and construction of minor new works (MARD/ADB No date; Ringler et al. 2002).

In 1984, Irrigation Management Enterprises (IME) at the district or subprovincial level were established to operate and maintain the irrigation systems. They are responsible for managing the irrigation headworks and the main and secondary canals. IMEs have been supplemented, beginning in 1991, with state-owned provincial-level Irrigation Management Companies (IMCs), which oversee the IMEs and substations.[2] Their general functions are a) provision of water, b) collection of ISF and c) maintenance of irrigation facilities. They are accountable to their respective PPC through the PARDS. IMCs are expected to be run as autonomous, self-financing enterprises (Decree No. 388 of 20 November 1991). However, in practice, only part of their income is derived from the collection of water fees; the remainder is allocated from the provincial budget. Below the IME or station are substations, which have the task to collect information about the following year's cropping plan (established by cooperatives or *water user groups* [WUGs]) to draw up water-delivery contracts (Small 1996; MARD/ADB No date). They typically contract with the commune-based agricultural cooperatives and, in some cases, with Village Administrative Boards to provide irrigation water to the tertiary canals via the WUGs/ organizations at the village level. Figure 5. provides a schematic overview of the administration of irrigation systems.

The O&M of public irrigation systems should be covered through the ISF. To this end, the Council of Ministers issued Decree No. 112-HDBT[3] setting the fee as a share of paddy output (4–8%) as a guideline for the PPC. The ISF is area-based and typically differentiated by crop and by season. Fees are typically collected by WUGs, which retain a part of the fee for their collection efforts. The remainder is forwarded to the IMC. However, fees cover typically not more than half of the O&M expenditure of the IMCs. The fee is set in terms of kilograms of paddy to maintain its real value in the face of inflation and can vary substantially by province and even within provinces. Costs and equity factors as well as province-specific policies are taken into account in considering the fee schedule. Compared to other (Southeast) Asian countries, ISF in Vietnam are considered high (Small 1996) at an average of US$30/ha/year. According to MARD (1998), the total annual fee collection is estimated at about half of the actual water fees assessed or VND500–600 billion (US$34–41 million).[4] Water fees thus cover just under half of the total annual O&M costs, estimated at VND1,200–1,500 billion (US$82–103 million). If natural disaster mitigation and large-scale rehabilitation are included, the fees only cover about a quarter of total O&M costs (Ringler et al. 2002; MARD 1998).

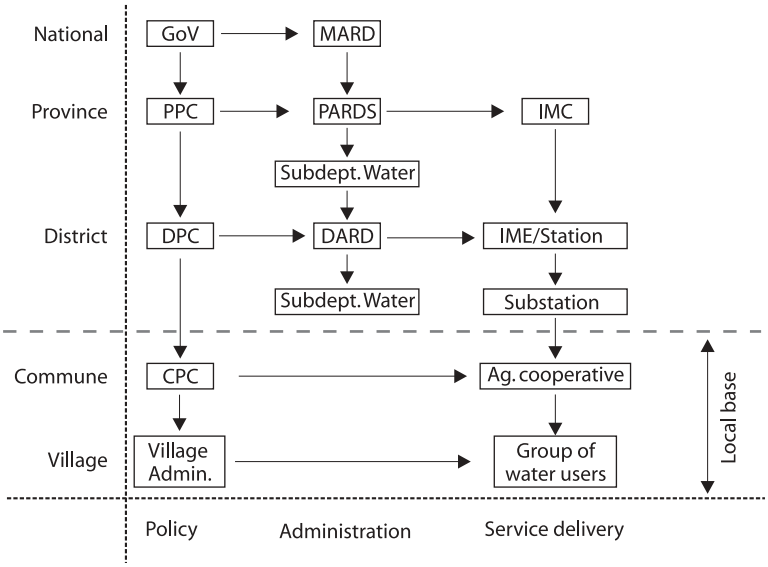
According to MARD (1998), several factors indicate that Decree No. 112-HDBT on ISF has not been implemented successfully. First, water fee collection rates vary substantially across provinces and, whereas some provinces are able to fully cover O&M, others barely collect 20–30 percent of the fees. Second, the water fees set by the PPC are typically below the MARD guidelines, at about 2–5 percent of

[2]Following the introduction of IMCs, IMEs were sometimes renamed as stations.

[3]Decree No. 112-HDBT replaced Decree No. 66/CP of 1962 that stipulated a lower ISF, also in terms of paddy.

[4]An exchange rate of US$1 = VND 14,600 is assumed.

FIGURE 5.
Administration of irrigation systems at different levels.



Source: Adapted from Ringler, Cong and Huy 2002.

Note: A large number of agricultural cooperatives have been abolished since responsibility for agricultural production was returned to individual households. Some have been replaced by other organizations that also provide some irrigation services, including agricultural service cooperatives, water user cooperatives and inter-commune water user cooperatives (Tiep and Chinh 1999).

paddy output. Third, water fees are often employed for purposes other than O&M. Fourth, in areas frequented by extreme events, flooding and drought, farmers cannot afford to pay any ISF. Fifth, nonpayment of ISF by farmers does not lead to a discontinuation of service provision; instead, debts accumulate over the years. Sixth, with the ISF often being the major direct income source of the IMC, their financial situation has remained precarious. Seventh, nonagricultural water users of irrigation systems, including power generation, fish breeding, tourism and domestic and industrial uses, receive irrigation water free of charge or at very low fees. Eighth, the budget gap caused by the low collection of ISF has led to declines in maintenance and rehabilitation leading to degradation of infrastructure, which MARD cannot fill through its annual contribution of about VND100 billion (US$6.85 million), which is allocated chiefly to disaster mitigation and large-scale repairs. Finally, the existing service relationships are not considered conducive to farmers to protect the hydraulic structures and to conserve water.

The problems identified above are encountered in most Asian countries. The deterioration of systems, the result of inadequate or deferred maintenance, is encouraged in part by the willingness of the development banks to provide loans for rehabilitation. Dissatisfaction with the performance of public irrigation systems emerged in the 1980s although their performance has not been as bad as indicated by the widely accepted but faulty method of calculating irrigation efficiency based on water diverted rather than water consumed (Perry 1999).

MARD (1998) has proposed future changes in the ISF which should include the following: a) increase in the ISF rate and in the share of the ISF collected through an increase in paddy collection from the annual 0.3–0.4 million tons to 0.8–1.05 million tons with regional differentiation according to system performance and value of hydraulic works in order to cover about 20–25 percent of large-scale repair and maintenance costs in addition to O&M; b) increase in the price for nonagricultural uses of

irrigation water from VND50–60/m^3 (US$0.004/$m^3$) to VND500–800/$m^3$ (US$0.04/$m^3$); c) improved coordination between central and provincial investments and local investments; d) turnover of irrigation infrastructure at secondary and tertiary levels to farmers, where appropriate; and e) increased volumetric fee charges in order to conserve on water use.

In order to decrease the budgetary burden of irrigation systems, the GOV has been supporting the transfer of small- and medium-scale irrigation systems to farmers at the commune or district level on a pilot basis. This is commonly referred to in the literature as irrigation management transfer (IMT) and has been widely promoted in developing countries by the World Bank and other agencies. Tiep and Chinh (1999) report on the results of the establishment of water user cooperatives to manage the O&M of previously company-managed secondary or tertiary inter-commune canals. The joint management by the water users has led to more reliable water supply, a higher ISF collection rate, a quicker fee remittance, reduced cost and time spent on maintenance, a more equitable water distribution between upstream and downstream portions of the canals, expanded production areas (100% of designed area up from 60–70 percent), higher yields at the tail end (by 8–20%), as well as inter-commune unity along the canals. Dinh (1999) reports on the results of the turnover of both the management and the collection and use of the irrigation service to cooperatives and communes in the Tuyen Quang province in northern Vietnam. After the turnover of a total of 13,000 hectares of largely small irrigation systems, water fee collection increased from 750 tons of paddy in 1996 to 2,740 tons in 1997, and to 3,000 tons of paddy in 1998. A pilot study by the ADB involving the establishment of water user associations in North Nge An and Son Chu has received very high performance ratings (GOV-Donor Working Group 2000).

As results have been largely positive, the participation of end users in irrigation management is being widened to include additional schemes and provinces. However, one needs to be cautious in judging how widely IMT can be successfully applied in Vietnam. The record is mixed. Irrigation management transfer has led to a reduction in government outlays and, in some instances, to improved maintenance. But there is no evidence elsewhere to indicate that it has increased crop and water productivity. Furthermore, a study by Kurian et al. (2004) in India suggests that under widespread use of private pumps and tube wells, such as in the Mekong delta or in the Central Highlands, it may be more difficult than in the past to organize farmers for O&M of public or transferred systems.

Investments in Irrigation

As noted earlier, expenditures for irrigation represent the largest share of the agricultural budget and over 90 percent represents capital investments.

Evolution of investments in irrigation. According to DWRHWM (2001), the total value of fixed government assets in water and hydraulic works amounted to VND60,000 billion (at 1998 prices), excluding fixed assets for dikes, hydropower and O&M. This infrastructure irrigates about 3 million hectares in the country, drains about 1.4 million hectares, protects about 0.7 million hectares of saline soils; it also helped improve 1.6 million hectares of acid sulphate soils in the Mekong delta.

Investments in irrigation in Vietnam are, as noted earlier, usually combined with investments in drainage and flood control. Data on investments in irrigation are difficult to obtain. Table 19 is based on Table D-9 in GOV-Donor Working Group 2000.[5] It indicates that typically about 50–55 percent of the state

TABLE 19.
Public expenditure for irrigation (in 1994 billion VND prices).

Year	Current	Capital	Total	Share of irrigation in total agricultural expenditure
	(in 1994 billion VND prices)			(%)
1992	123	551	674	51.2
1993	220	719	939	54.0
1994	302	1,240	1,542	77.8
1995	238	1,251	1,488	65.7
1996	173[a]	962	1,135	50.1
1997	107	1,142	1,249	48.9
1998	101	1,435	1,536	50.8

[a] Data missing, average of 1995 and 1997.

Source: Adapted from GOV – Donor Working Group 2000.

agricultural budget is spent for irrigation of which approximately 80–90 percent is for capital expenditure. We have only partial information on how much additional funding is supplied by the provinces. We assume from planning documents that approximately 25 percent of the expenditure is for drainage and flood control.

During the 1980s, investments in irrigation and water control in Vietnam have largely focused on large-scale projects. One example is the World Bank-supported construction of the Dau Tieng irrigation reservoir in the early 1980s. In its first version, the reservoir was expected to support an irrigated area of about 172,000 hectares. At the same time, large amounts of public investments went into flood-control structures in the Red river delta. Over the last few years, the focus of investment has shifted toward increasing support of smaller schemes and reservoirs in the drier coastal provinces of the South, the construction of sluices and dikes in the Mekong delta, the rehabilitation of irrigation schemes in the Red river delta, and increased attention to the poorer provinces in the central and highland areas of the country. At the same time, private investments in irrigation accelerated as evidenced, for example, by the rapid increase in the number of pumps (table 20).

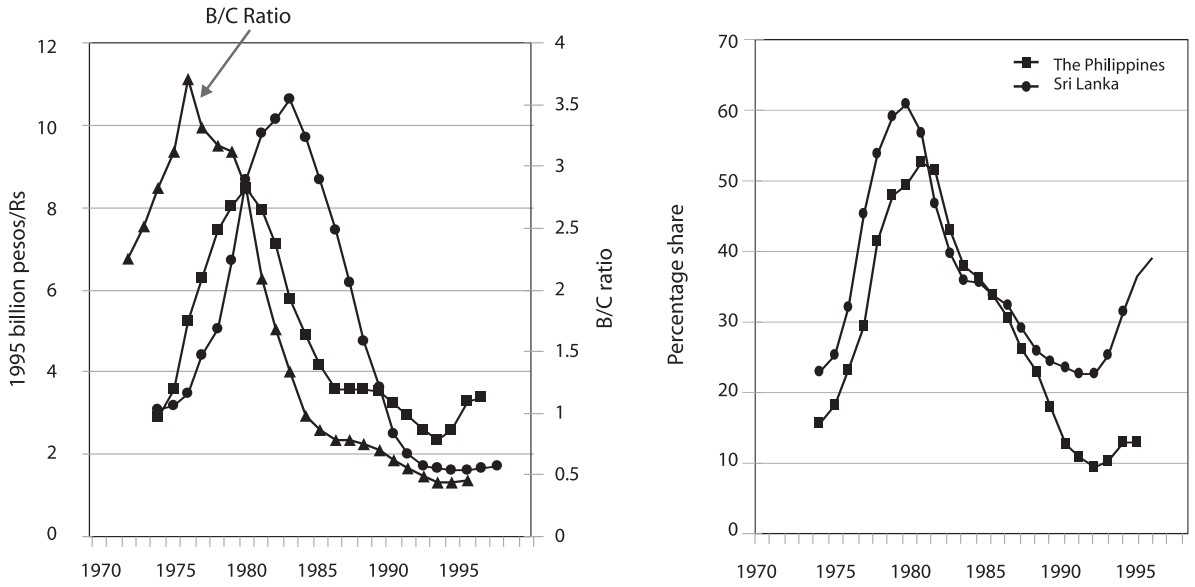
The role of private pumps largely depends on local characteristics (for example, topography, fields and farming size), and while it is of high importance in the Mekong delta, it might not constitute an optimal solution for other localities. Pumps are also important for private groundwater extraction in the Central Highlands where basalt strata contain rich groundwater sources and coffee is the key crop, which produces high revenues to fully cover groundwater pumping costs. However, groundwater expansion in other areas is less likely due to high surface water availability, limited groundwater sources, and limited options for high-value crop production to recover well investments and pumping costs.

Investments in public-sector irrigation carried out during the 1980s and early 1990s have thus opened up the way for investment in private-sector irrigation needed for crop diversification. For example, although many of the secondary and tertiary canals of the Dau Tieng irrigation system have never been built on the command area, leakage from the reservoir and unlined canals has led to a flurry of well irrigation for peanut, tobacco and other crops. Another example is the Mekong river delta, where the construction of dikes to protect (crop) areas from inundation to allow a second or third crop per year has led to a revolution in private-canal pumping.

Investment comparison with other Asian countries. The trends in irrigation investments and in expenditure as a share of total expenditure in agriculture are shown for the Philippines and Sri Lanka in figure 6. Irrigation investments reached a peak, exceeding 50

[5]The figures differ somewhat from those reported by MARD in table 4.1.

FIGURE 6.
Trends in and real value of irrigation investments and the share of irrigation expenditures in government expenditures in agriculture in the Philippines and Sri Lanka (1972–1999).



Source: Based on information from Kikuchi et al. 2002.

percent of total investments in agriculture, in the late 1970s and early 1980s. This represented a lag of several years after the peak in the benefit cost ratio. The sharply falling level of investments in both countries was due principally to both falling rice prices and higher construction costs for new projects. Will Vietnam follow the same trend? Tables 8 and 19 show little, if any, upward or downward trend in investments since 1994 with expenditure remaining at or above 50 percent of total agricultural expenditure. One may expect some decline in the future, but perhaps not as sharp as in the Philippines and Sri Lanka due to the continuing need for investments in drainage and flood control, rehabilitation, particularly in the Red river delta, and the potential for some new projects.

TABLE 20.
Number of pumps by region.

Region	1991	1999	1991–1999
	(in '000)		(%/yr.)
Red river delta	12.11	25.99	10.02
Northeast	4.68	57.88	36.96
Northwest	0.08	0.49	25.23
North Central Coast	4.11	9.66	11.29
South Central Coast	8.83	38.41	20.17
Central Highlands	4.50	44.96	33.34
Northeast South	76.16	258.22	16.49
Mekong river delta	92.83	357.72	18.37
Whole country	203.29	793.33	18.55

Source: Statistical Data of Vietnam Agriculture, Forestry and Fishery 1975–2000. Statistical Publishing House.

Government of Vietnam: Priorities for Investment

Canal lining project. In 1999, MARD started to implement an investment project to line the canal system in various stages during 1999–2005 for canals all over the country. The objectives of this project are to improve upon the irrigation capacity of all existing irrigation systems in Vietnam. At present, most irrigation systems do not irrigate at the level of the designed command area. According to MARD, one major reason of this development is the high water-loss rate in unlined canals. In the central region, water losses are particularly high, as canals are built from sandy soils. MARD expects that following canal lining the distribution/conveyance efficiencies in the main canals will increase from 0.5–0.6 at present to 0.7–0.8 so that the tail ends of canals can also be irrigated. Other expected advantages of the canal lining include the reduction of annual O&M costs and the stabilization and increased effectiveness of irrigation structures.

However, costly structural measures, such as the canal-lining projects, can also have considerable, sometimes unwanted, side effects. In some areas, leakage from canals (and reservoirs) recharges shallow aquifers that are often productively used by farmers through shallow wells. In particular, in the Central Highlands recharge from canal water is important. Other water "losses" from canals join rivers and streams downstream for irrigation and other uses. Joint canal cleaning by farmers has been conceived as an important means for collective action and cooperation among farmers for sharing water. Following canal lining, O&M costs will decrease, but so will the need for farmers to cooperate to clean canals and save water resources. Moreover, IMCs are often not aware of conveyance and distribution efficiencies prior to canal lining, as water is not considered scarce in many of the canals slated for lining—in fact, some canals are being lined due to excessive waterlogging. This situation calls for demand management tools—particularly, improved management of water allocation and distribution—rather than for costly infrastructural interventions.

The total investment proposed for this undertaking is VND11,363 billion (US$758 million) over 6 years. By March 2001, VND3,411 billion (US$227 million) or 30 percent of the total budget had been spent, with farmers providing 38 percent of the funding, MARD providing 31 percent, and the remainder being contributed by ISF, land taxes and from funds related to Decision 66 (DWRHWM 2001). Thus, the canal-lining project can be considered MARD's major irrigation-investment project, as the annual combined provincial and central investment for irrigation and flood control averaged US$211 million over the 1996–2000 period.

Priorities in the central region of Vietnam. The ADB recently supported a project to determine an investment strategy for irrigation and other water-related projects in the central region of Vietnam (TA 3528, Subproject 2). The project surveyed 497 subprojects with an estimated capital cost of US$3.5 billion in the North Central Coast, South Central Coast, and the Central Highlands (totaling 18 provinces). Only 19 of these projects were considered to fulfill both economic efficiency and poverty-alleviation criteria, 16 of which are located in the South Central Coast zone. At the same time, the North Central Coast was identified as the geographic region, where water-related investments are particularly needed, due to highly seasonal flow variability and severe flooding, especially in Ha Tinh, Quang Binh, Quang Tri and Thua Thien Hue.

As for the size of the project, economies of scale could not be identified, although according to the surveyors, small projects tended to perform slightly better. Among the surveyed irrigation and drainage systems, 57 percent were for new projects, and the remainder for rehabilitation and extension of existing systems. The project report concluded that improvement of existing irrigation systems tended to alleviate poverty more effectively,

whereas new subprojects perform better from an economic-efficiency point of view, possibly because rehabilitation is usually linked with extensive canal lining. Further analysis is warranted in this area.

Irrigation and flood control. As noted previously, in the 1990s, about 60 percent of the agricultural state budget was used for irrigation and flood control (table 8). About 80 percent of the 7 million hectares of cultivated land, including 4 million hectares in paddy, receive some sort of irrigation although the quality of this irrigation is highly varied. During the decade, the area irrigated grew at about 1.63 percent per annum from 5.619 million hectares to 6.894 million hectares. Growth was largely concentrated in three regions, the Mekong delta, the Northeast-South and the Central Highlands. Even more significant has been the growth in pumps during the decade at 19 percent per annum from about 200,000 to 800,000 units. But here again the growth has been concentrated in the same three regions, with the Mekong delta accounting for about half of the pumps in the country.

For 2001–2010, MARD has set a target of 124.3 BCM of which, water used for agriculture is 100 BCM, for daily use, 3.1 BCM and for industry and services, 28 BCM (MARD 2000). The strategy suggests to continue the development of comprehensive water-control systems in the Mekong delta; to rehabilitate and upgrade irrigation structures in the Red river delta, including the lining of canals; to build large-scale reservoirs in the central regions to supply water and control floods; and to increase small-scale schemes, possibly connected to agroforestry-production areas, in the poor upland provinces.

In addition to the hard investments, additional activities in the areas of basin-water management and water pricing are being envisaged, albeit implemented only slowly. The water-sector reforms detailed in the section under Legal and Institutional Framework form part of the strategy to achieve this target.

What is perhaps not fully accounted for in this strategy is the rapid private investment in pumps to exploit (and in some cases overexploit) groundwater in the uplands or for timely access of water from canals to facilitate crop diversification in the deltas. The integration of private and public water-resources investment and management activities presents a major challenge.

Impact of Irrigation Investments

Irrigation is recognized as an engine of economic growth. Investments in irrigation have both a *direct effect* on agricultural productivity, farm incomes and employment, and a *multiplier effect* in terms of employment and incomes generated in the nonfarm sector. In this section, given the available data, we are able to assess only the direct impacts. We do this using a regression analysis to assess the impact of irrigation and other investments on the gross value of agricultural output; and then through GIS mapping we show the differential impact of irrigation by province.

Regression analysis. To capture the direct impact of irrigation and other inputs and investment on the value of agricultural output, we have estimated the following equation:

$$O_{it} = \propto_i (A)^{\beta_1 it} (L)^{\beta_2 it} (RS)^{\beta_3 it} (RDS)^{\beta_4 it} (IRS)^{\beta_5 it} (ES)^{\beta_6 it} (T)^{\beta_7 it} (P)_{it}^{\beta_8} \quad (1)$$

where,

i	=	provinces in Vietnam (53)
t	=	year; 1991 to 1999
$\propto_o$	=	intercept term (dummy) for each of 53 provinces
O_{it}	=	gross value of agricultural output (constant VND 1994 billion)
A_{it}	=	agricultural land ('000 hectares)
L_{it}	=	agricultural labor ('000 persons)
RS_{it}	=	research stock (1994 constant VND million)
RDS_{it}	=	transportation (road) stock (1994

constant VND million)

IRS_{it} = irrigation stock (1994 constant VND million)

ES_{it} = education stock (1994 constant VND million)

T_{it} = number of tractors

P_{it} = number of pumps ('000)

β = elasticities

The variables are defined in more detail in the appendix table. The data used to fit the regressions is a cross-section time-series panel with observations from 53 provinces over the period 1991–1999. Eight of these were split to form 16 provinces during the 1990s. Thus today there are 61 provinces. However, in our panel data set we combined the data from each of the split pair of provinces. Investments are public investments at the provincial level. All values are expressed in logs and hence all coefficients of variables are *elasticities.* The equation is given as a fixed effects model using a generalized least squares (GLS) estimator with correction for heteroskedasticity.

The number of tractors is representative of other agricultural inputs, including fertilizer consumption, for which no data are collected at the provincial level in Vietnam. For public investment in technology, including irrigation, roads, education and agricultural research, it is the stock of capital or knowledge, not the annual investment flow, that affects output (Huffman and Evenson 1989). The technology variables are therefore defined as stocks of investment in agricultural research, irrigation, roads and education. Data on annual expenditures on irrigation have been obtained from Vietnam's Ministry of Finance (2001). Data on expenditure on transportation (90% for roads), research and education have been obtained from MARD 2001. Expenditure flows on irrigation, roads and education were converted to investment stocks $Z_i(t)$ by applying the formula:

$$Z_i(t) = \dot{Z}_i(t) + (1-d)\, Z_i(t-1) \qquad (2)$$

where $\dot{Z}_i$, is annual expenditures on irrigation, roads and education and d is the rate of depreciation. The average life of irrigation systems and roads is assumed to be 40 years, so d is set equal to 0.025. For education, where a much larger share of expenditures is current (such as teachers' salaries), the depreciation rate is set equal to 0.75. To test the sensitivity of this assumption, a number of alternative depreciation schemes were tried and the results were robust to the different definitions. Expenditure data for research and extension are from MARD 2001. These expenditures are assumed to apply across provinces, implying that research advances generated by the research system spill over into each of the provinces, but are weighted by the area devoted in each province to those commodities with the highest share of research expenditures (here: rice). Given the national base of the research system and relatively broad geographic diffusion of varieties generated by the system, this appears to be an appropriate assumption.

Conversion of research expenditure to stocks must take into account a number of factors. Research takes time to complete and research knowledge depreciates, so there are lags between research expenditure and production impacts (Alston et al. 1995, 349). In order to account for these longer lags and for depreciation of research and extension stocks, the research and extension variables are estimated as:

$$Z_r(t) = \sum_{t=0}^{n} \alpha(t)\, \dot{Z}_r(t) \qquad (3)$$

where, $Z_r(t)$ is the research stock in period t, $\dot{Z}_r(t)$ is the current expenditures from the national budget on research, and $\alpha(t)$ is the timing weight for accumulation of new research expenditure to the stock of research. Research stocks are estimated using a set of research development lags and timing weights estimated by Pardey et al. (1992). The timing weights are

0 for the first 4 years, followed by 0.01, 0.061, 0.086, 0.112, 0.142, 0.137, 0.12, 0.091, 0.079, 0.071, 0.051, 0.03, 0.01, and 0.00 (see also Rosegrant et al. 1998).

The results from the estimation of the aggregate agricultural supply function are shown in table 21. The equation shows an excellent fit to the data, with all the independent variables statistically significant at the 5 percent level or better and approximately 99 percent of the variance in the dependent variable explained. The agricultural output elasticities can be combined with the growth rates in inputs and investments over time to estimate the contribution of changes in inputs and investment to national agricultural output growth. The contribution to annual growth in agricultural output of each explanatory variable is the estimated coefficient from the agricultural output function (table 21) times the annual rate of growth of the explanatory variable. The results of the sources of growth computation are shown in table 22, which shows the contribution of research, education, irrigation, tractors, pumps, labor and agricultural area to output growth during 1991–99. The model is quite successful in explaining actual output growth over this time period, accounting for 93 percent of agricultural output growth during this period.

TABLE 21.
Parameter estimates and significance level.

Variable	Parameter estimate	t-Statistic
A_{it}	0.118609**	4.18
L_{it}	0.104856**	2.94
RS_{it}	0.630116**	3.05
RDS_{it}	0.056333*	1.88
IRS_{it}	0.228359**	3.63
Es_{it}	0.019759**	3.38
P_{it}	0.015924**	2.55
T_{it}	0.026482**	3.31

Note: *Significant at 5%; **Significant at 1%.

Source: Author calculation based on data from MARD and MOF.

TABLE 22.
Contribution to output growth, 1991–99.

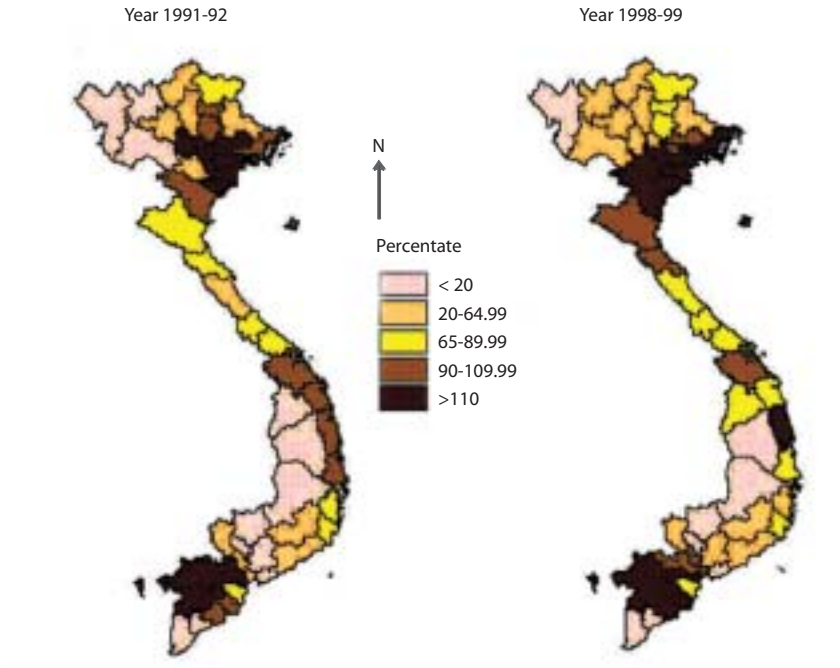
Variable	Source of growth	Share in total growth
A_{it}	0.25	4.33
L_{it}	0.41	7.04
RS_{it}	1.56	26.66
RDS_{it}	0.66	11.22
IRS_{it}	1.66	28.33
Es_{it}	0.49	8.35
P_{it}	0.31	5.37
T_{it}	0.51	8.70
Total growth explained	5.85	100.00
Total agricultural output growth	6.33	

Source: Author calculation based on data from MARD and MOF.

Expansion in agricultural area accounted for 4 percent of agricultural output growth, and expansion in agricultural labor for 7 percent. The single most important source of growth in agricultural output in Viet Nam during 1991–99 was public investment in irrigation, accounting for 28 percent of growth. Moreover, the number of (mostly private) irrigation pumps accounted for a further 6 percent of total output growth. Investments in agricultural research closely follow irrigation investment in importance, accounting for 27 percent of total growth. Investment in roads accounted for 11 percent of agricultural output, and education for 8 percent (table 22).

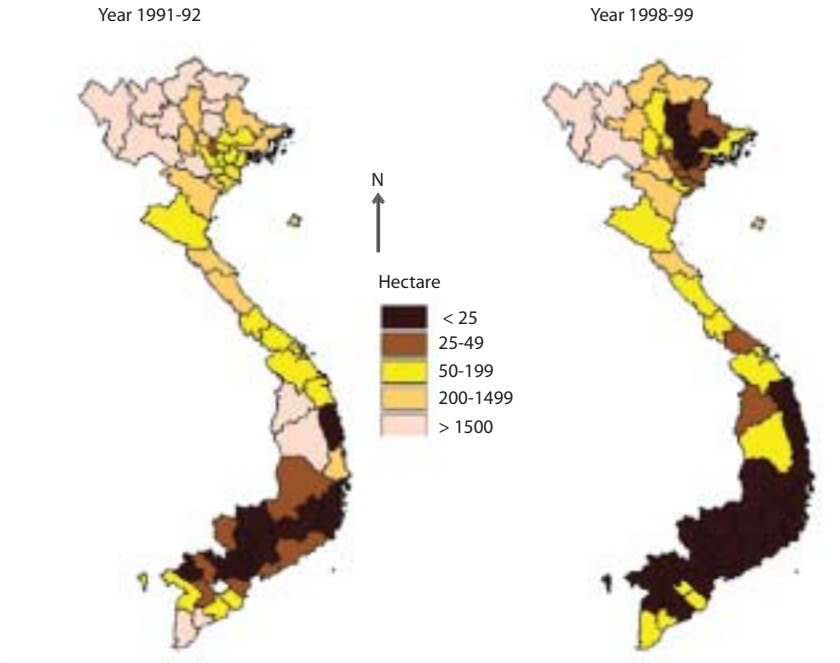
Regional and provincial variation. To obtain a better understanding of the impact of irrigation investments, we examine the wide diversity in irrigation development across regions and provinces. The regional and provincial-level impacts of irrigation vary considerably. Table 18 indicates that, in 2000, approximately 45 percent of the irrigated area was in the Mekong delta, and between 1991 and 2000 the irrigated area increased by almost 50 percent, for example. Although the irrigated area grew at 16 percent per annum in the Central Highlands, this region accounted for less than 3 percent of the country's irrigation. By contrast, with the

FIGURE 7.
Vietnam: Irrigated area as a percentage of agricultural land 1991–1992 and 1998–1999.



Sources: Statistical yearbooks, various years, and data provided from DWRHWM 2001.

FIGURE 8.
Vietnam: Area served by one pump 1991–1992 and 1998–1999.



Source: Statistical Data of Vietnam Agriculture, Forestry and Fishery 1975–2000.

exception of the Northeast-South region, there has been little expansion in irrigation in other regions of the country.

Using GIS, we next developed a series of provincial maps for four variables to illustrate the impact of irrigation across 53 provinces and over time from 1991–92 to 1998–99. The four variables mapped are: a) irrigated area as a percent of agricultural land, b) area served by one pump, c) gross value of output per hectare, and d) gross value of output per worker.

The irrigated areas are concentrated in the Mekong and Red river deltas (figure 7). The pumps are also concentrated in the deltas but have spread into the Central Highlands and South Central Coast in the 1990s (figure 8). Gross output per hectare is highest in the northern and southern deltaic provinces (figure 9). But gross output per worker is highest in the Mekong, North East South, and Central Highlands (figure 10). This reflects, in part, the impact of pumps used in the Mekong delta to manage surface irrigation and drainage and in the uplands to lift groundwater to irrigated perennial crops—coffee, pepper, etc.

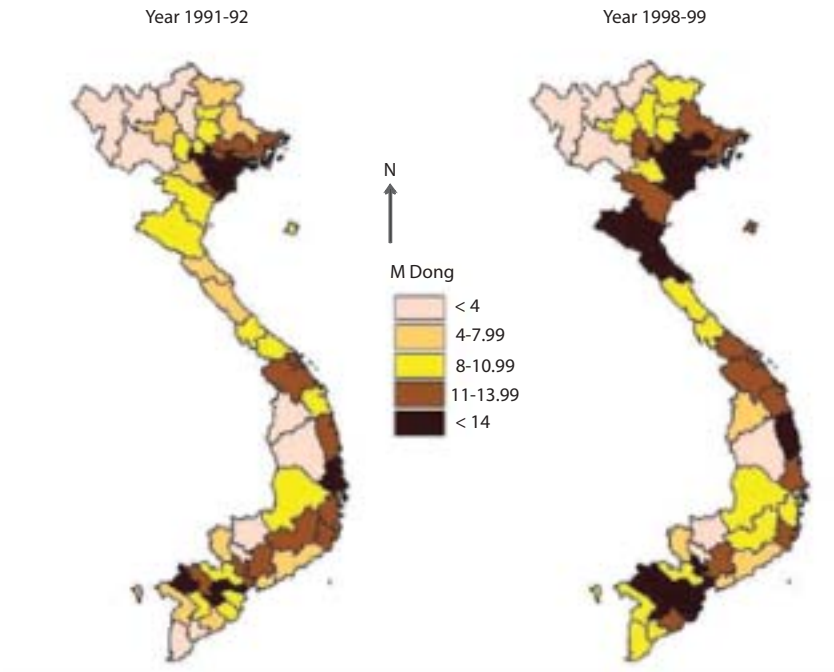
It can be argued that next to the *green-revolution* technology, the spread of relatively inexpensive pumps and tube wells has had the most dramatic impact on Asian agriculture in the last quarter century (Siamwalla 2001). With respect to this technology, the same case can be made for Vietnam. Pumps and tube wells have facilitated the shift to higher-valued crops, particularly coffee and pepper, but also fruit trees and shrimp.

Indirect impacts. The previous section has shown the direct impacts of irrigation investment on income and employment. Another direct, short-term impact is in the employment generated by construction. In addition to these direct impacts there are significant indirect impacts both positive and negative, which we discuss below, but which cannot be documented for Vietnam, given the lack of data and the limited scope of this study. Nevertheless, recognition of these indirect impacts is extremely important when it comes to setting investment priorities and considering cost recovery (who benefits and who should pay).

Price effect. An increase in farm production generated by irrigation investment and the use of other inputs has led to a fall in prices of food grains. Because of the relatively inelastic demand for food grains, consumers, and not producers, are the major beneficiaries of irrigation. Falling food grain prices have had a significant impact on poverty alleviation, the greatest benefit going to the rural landless laborers and low-income urban consumers There is a well-documented illustration of this for India by Datt and Ravallion (1998b). However, the continuing heavy subsidization of food grains by the developed countries has resulted in an artificially low rice price threatening the income security of rice producers in Vietnam and elsewhere and encouraging the shift to higher-valued crops.

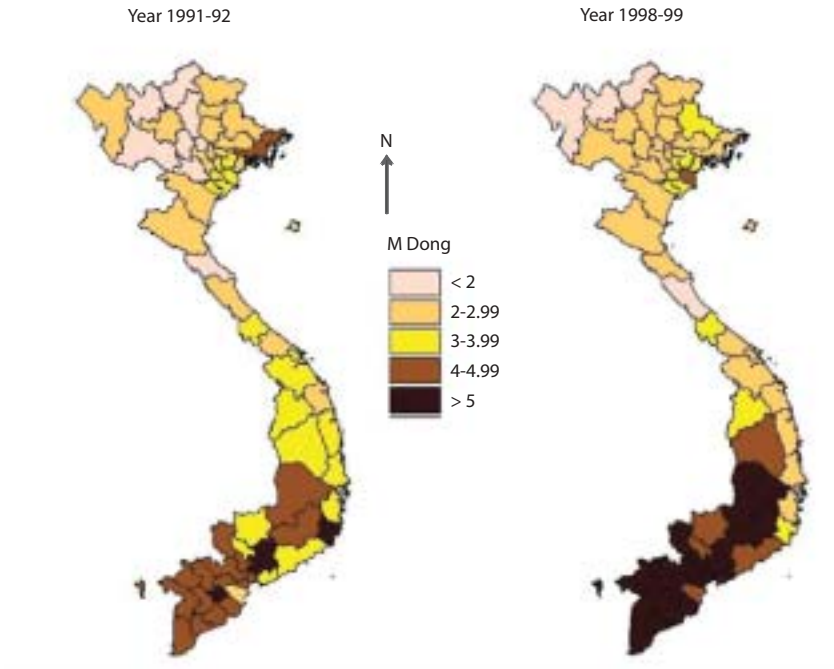
Employment effect. The increase in farm income generates demand for both agricultural and nonagricultural goods and services and hence creates employment opportunities in the nonfarm sector. This is frequently referred to as the *multiplier effect.* Mellor (2001) indicates that the additions to employment in the rural nonfarm sector stimulated by agricultural growth can be as much as twice that for agriculture. In keeping with this observation Bhattarai et al. (2003) analyzing a panel of state-level Indian data found that the direct and indirect income benefits to society exceeded the direct benefits to the farming community by more than 3 to 1. The degree to which the rural economy can reap these benefits, however, depends on preconditions. Datt and Ravallion (1998a) have shown why some Indian States have done better than others at reducing rural poverty. The distribution of assets—human capital, financial capital and social capital—across farms and regions is important (Timmer 1997). Farmers with better access to irrigation and market infrastructure

FIGURE 9.
Vietnam: Gross value output per hectare 1991–92 and 1998–99.



Source: Statistical yearbooks, various years.

FIGURE 10.
Vietnam: Gross value output per agricultural worker 1991–92 and 1998–99.



Source: Statistical yearbooks, various years.

are more responsive to price changes (Bhattarai and Pandey 1997).

Negative externalities. The negative impacts of irrigation include damage to both environment and human health. In Vietnam, the major concerns are in overexploitation of groundwater in the uplands and water pollution, particularly in industrial areas such as the Dong Nai basin. Lipton and Litchfield (2003, see also Lipton et al. 2003.) summarize the discussion of externalities as follows. There is a mixture of short- and long-run socioeconomic, environmental and political effects of irrigation that may have adverse or positive effects and may affect different types of poor people (landless laborers, small farmers, urban poor) in different ways. It is likely that, with cheaper foods, higher farm incomes and spillover effects on nonfarm activities will be poverty reducing for large segments of the poor. However, the negative externalities on health and environment may be very damaging locally.

Implications for cost recovery. Although there are no studies in Vietnam that identify the beneficiaries of irrigation investments, it is obvious that a large, if not the major, share of benefits has not gone to the farmer-users but to the nonfarm sector. These include, in particular, low-income consumers who benefited from the decline in rice prices and those who had benefited from expanded employment opportunities in the nonfarm sector. But for those who advocate cost recovery (or frequently *full cost recovery*) this point is ignored. Furthermore, although the World Bank has been by far the most constant and insistent advocate of cost recovery for decades, there is no evidence of better cost recovery or of covenant compliance either (World Bank 2003). How much should farmer-users pay? Most would agree users should pay for O&M. O&M cost recovery is not only appropriate, but critical for the supply of goods and services. But to achieve this would require a realignment of institutional arrangements so that suppliers are accountable to users (World Bank 2003). One option is the difficult task of IMT, which, as noted earlier, has had mixed success. Another option is to facilitate private-sector provision of goods and services, not only for irrigation O&M, but for other agricultural services as well.

Investment Priorities and Policies

This report focuses on the agriculture sector. However, we have emphasized throughout the close linkage between the agriculture sector, the rural nonfarm sector and the economy as a whole. Investment priorities and policies should not be set in any one sector in isolation. Fortunately, the current emphasis by MARD on rural development recognizes the critical role of investments and policies in the nonfarm sector in sustaining agricultural growth and realizing the multiplier effects of that growth on economic development and poverty reduction. Furthermore, it must be acknowledged that in Vietnam, more than in most other countries, the national government (GOV) and multilateral lending institutions (MLI) are working closely together to develop and implement a strategy for agriculture and rural development.

This section contains the summary and conclusions of our report. First we discuss considerations in establishing the appropriate investment and policy priorities for agriculture. Then we turn briefly to the priorities for the nonagriculture sector.

Agriculture

Taxation and subsidies. Over the past decade the GOV has removed quotas and tariffs on agricultural products in large part in response to falling commodity prices. Efforts to protect farmers by purchasing rice and coffee at floor prices were unsuccessful and resulted in considerable loss to the government. Of greater concern in the long run is the heavy subsidization of the sugar sector and the almost certain need in the future to protect the domestic fertilizer industry. Here again the lessons of failure elsewhere should give pause to the GOV (Tomich et al. 1995).

Research and extension. Underinvestment in research and extension is a well-recognized and documented problem. Plans are underway to reorganize the research-extension service and a comprehensive strategy document has been prepared (GOV-UNDP-FAO 2001). However, the document tends to cover all areas without setting clear priorities and there is thus the danger that the reorganization will not lead to greater research productivity even with more funds available.

The research-extension system must be able to address the needs that will differ by commodity and by region of the country. The task is to: a) decide the priorities for public research investment, b) to establish the appropriate linkages with international research centers or advanced research institutions for both research support and training, and c) to facilitate the role of the private sector in providing research support, particularly for export crops through joint-ventures and similar activities.

The highest priority in the past has been for rice. Obvious areas that deserve priority in public-funded research in the future are the crop-livestock sector and natural-resources management, including water resources. (In the third section on this page we identify some of the issues, which require research to assist in setting investment priorities in irrigation). No matter how well funded, the Vietnamese research sector will have limited capacity and must be prepared to "beg, borrow or steal" new and improved technologies and adapt these to local Vietnamese conditions.

Rural credit. Despite the expansion of the agricultural finance sector farm households and farm enterprises engaged in processing and marketing lack access to medium- and long-term credit. The GOV may wish to examine the experience of Indonesia and others in establishing rural financial institutions that serve poorer households.

The lack of credit is a major obstacle to private farm-market traders. Thus, private traders, with potential for greater efficiency and labor absorption, have difficulty competing with SOEs in agricultural trade and marketing. The GOV needs to relax restrictions on access to foreign sources of credit and remove the bias, which favors SOEs in lending.

Irrigation and flood control—unanswered questions. Over the past two decades MLI and national governments have been attempting to improve the performance efficiency of the irrigation sector in Asia (Siddiq et al. 2002; Pitman 2002). The main strategy pursued had been IMT or the devolution of responsibility for O&M of public irrigation systems to local user groups. These efforts are frequently accompanied by systems rehabilitation including canal lining. The results have been mixed. Even the World Bank acknowledges that this strategy has been only partially successful (Pitman 2002). As noted in the last section on p. 27 there is clear evidence in several instances in Vietnam that local self-financing of maintenance has been improved and government budgets have been reduced. However, the impact of this on efficiency—that is to say water savings and increased water productivity—and on future capital expenditure for rehabilitation is unclear. In setting irrigation investment priorities and policies, there are a number of questions that need to be addressed

some of which can only be answered through research and some of which may be very site-specific. These include:

- How has private investment in pumps and of tube wells improved water productivity in public irrigation systems?
- What are the benefits of canal lining in terms of improved water productivity and the costs in terms of reduced groundwater recharge?
- What impact does the adoption of pumps and tube wells have on the willingness of farmers to participate in an IMT or take responsibility for management for all or part of surface-irrigation systems?
- What impact does low and declining agricultural-commodity prices have on the benefits from irrigation, on plans to expand irrigation and on the desired level of cost recovery?
- Given that a major share of benefits from irrigation is captured by the nonfarm sector and farmers typically have little say in decisions on construction, what portion of costs are farmers expected to pay?
- How can the policies of the multilateral lending agencies be changed to discourage governments from following the practice of "deferred maintenance" to secure loans for rehabilitation?

Given the large expenditure for irrigation, research or dialogue to find answers to some of these questions, in order to guide investment priorities and create the incentives for improved performance of irrigation systems, is clearly justified. It is our judgment that the most important single factor affecting water resources productivity in Vietnam and elsewhere in Asia in the past decade has been the rapid expansion of private-sector investment in pumps and tube wells. This revolution in the use of water resources has enormous implications for improving the performance of public irrigation systems, a fact largely ignored by the national water-resources agencies and multilateral lending institutions.

Moreover, to achieve improved efficiency in public irrigation systems, IMCs would need to be given real autonomy over their income situation and control over the enforcement of ISF. As irrigating farmers—in particularly rice farmers—often operate at the margin of profitability and face paying a host of other local fees, ISF increases cannot be likely achieved without accompanying increases in crop productivity from increased service provision. Moreover, IMCs could be cross-subsidized through payments for current service provision to nonagricultural uses.

The growing competition for water and the seasonal scarcity or surplus of water places pressure to manage and allocate water and control flooding more effectively at the basin level. While efforts are being made to reduce government management of water resources at the local level, greater government involvement in management and regulation will be required at the basin level. For example, some provinces are currently developing their own water-resources plans without regard to basin-level implications. The GOV created the basin authorities to tackle these problems, but movement on establishment of authority for these entities is very slow.

Nonfarm Sector

Rural development. In the discussion of indirect benefits of irrigation in the section under Irrigation Sector (p. 24), we emphasized the preconditions for realizing the benefits of investment in irrigation and the agriculture sector as a whole, the indirect benefits and the so-called multiplier effects. These include the price effects and the employment effects. Investments in rural infrastructure (roads, electricity, communications) and in human

capital (education and health) will foster employment and income gains in the rural nonagriculture sector and will, in turn, generate the demand for agricultural products.

Industrial sector. In Vietnam, macroeconomic policies such as overvalued foreign exchange rates and protection offered to SOEs have had more impact on the agriculture sector than direct taxes on agriculture. Today, one of the most serious threats to continued agricultural development is the continued protection of SOEs. Although less that 25 percent of GDP is from agriculture, 60 percent of the rural labor force remains in this sector. SOEs tend to be capital-intensive and private enterprises are not growing fast enough to absorb surplus labor from agriculture.

Targeting Investment Priorities and Policies

In targeting the investment priorities and policies we should take into account the major challenges in the strategy of MARD (figure 1, p. 2), "attacking poverty" and "driving economic growth and national policy." While most of the poor are found in the major deltaic areas of Vietnam, the severest poverty is found in the remote hill areas where minorities make up a significant portion of the population. The lowland areas are likely to yield the highest returns where the more remote uplands face some of the severest social and economic problems.

Setting investment priorities for the Ministry of Agriculture and Development is a difficult task. Ideally, we would like to have ongoing research focused on determining the benefits and costs of current investments. We need answers to the questions raised in the third section on p. 42. These data would be of value to MARD as it moves all too slowly to reform the national agricultural research system. In the absence of such data we can only make some general conclusions regarding directions for future investments.

One thing is clear. There is a general underinvestment in research and extension with the exception of rice and perhaps an overinvestment in low-return irrigation projects. The continuing strong link with international agricultural research centers helps offset the lack of investment in agricultural research and extension.

In the lowland areas, assistance needs to be given to crop diversification at both the farm and regional level. Emphasis should be on improved management of water resources and rehabilitation of existing systems as opposed to investment in new systems. There appears to be little justification for the current emphasis on canal lining. Most of the funds would be better spent on other forms of rural infrastructure—transportation, communication, electricity.

The major emphasis in the upland areas should be on research and development of forage-livestock systems to meet the growing demand for livestock products. Initially, it might pay to target certain areas for dairy, beef and other livestock enterprises.

For export crops, the emphasis should be on improving the quality at both producer and processing level and on information technology to provide real time data on prices and market demands. There is also an urgent need for a program of market development that gives domestic producers and exporters of crops, such as rice and coffee, the financial capacity to hold stocks without undertaking undue price risks.

Much of the above can be achieved effectively only with the development of human capital and technologies in the agricultural production, processing and service sectors.

APPENDIX TABLE.
Data used in the regression analysis.

Variable	Variable label	Source
O	Gross output of agriculture (1994 constant VND billion)	GSO – Statistical yearbooks
A	Agricultural land (in '000 hectares)	GSO – Statistical yearbooks
L	Agricultural labor (in '000 persons)	GSO – Statistical yearbooks
RS	Research stock (1994 constant VND million)	Based on data from MARD (2001).
RDS	Transportation stock (1994 constant VND million)	Based on data from MARD (2001).
IRS	Irrigation stock (1994 constant VND million)	Based on data from MARD (2001).
ES	Education stock (1994 constant VND million)	Based on data from MARD (2001).
T	Number of tractors	Statistical Data of Vietnam Agriculture, Forestry and Fishery 1975–2000. Statistical Publishing House.
P	Number of pumps (in '000)	Statistical Data of Agriculture, Forestry, and Fishery 1990–1998 and Forecast in The year 2000. Hanoi 1999. Statistical Publishing House; Statistical Data of Agriculture and Forestry 1985–1995, Hanoi, 1996: years 1985–1995, but not 1990.

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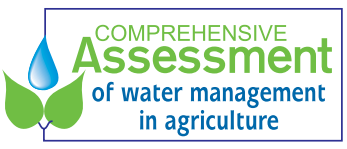

Postal Address: IWMI, P O Box 2075, Colombo, Sri Lanka **Location:** 127 Sunil Mawatha, Pelawatte, Battaramulla, Sri Lanka
Telephone: +94-11 2787404, 2784080 **Fax:** +94-11 2786854
Email: comp.assessment@cgiar.org **Website:** www.iwmi.org/assessment

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