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Integrated Assessment of the Impact of Trade Liberalization

A Country Study on the Viet Nam Rice Sector

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Foreword

Since 1989 Viet Nam has been undergoing a gradual transition from a centrally planned socialist to a market-oriented economy under the reform process known as *Doi Moi*, which literally means "change and newness", a term coined in 1986 for reform and renovation in the economy. This process of transition has been accompanied by high growth, macroeconomic stability and significant structural change. Further reforms have also been conducted by implementing policies of trade liberalization according to Viet Nam's commitments under the ASEAN Free Trade Area/Common Effective Preferential Tariff scheme (AFTA/CEPT) from July 1995, the Bilateral Trade Agreement between Viet Nam and the United States (USBTA) signed in July 2000, and as part of the negotiations to enter the World Trade Organisation (WTO).

The country has gone from being a rice importer to a net rice exporter, and is the second largest rice exporter in the world since 1995. In recent years, the annual volume of rice exports has grown considerably, reaching over 3.5 million tons, representing a share of about 16 per cent of the world rice market. The growth in rice production and rice exports has brought, among other effects, an increase in agricultural income and GDP, and has had a positive impact on poverty reduction. The policies promoting rice production and trade have also had a number of environmental and social impacts, such as adverse effects on human health from the misuse of fertilisers and pesticides, environmental degradation and loss of rice biodiversity from technology inputs.

The integrated assessment of the impact of trade liberalization on the rice sector of Viet Nam is very important since it provides the basis for formulating appropriate measures to mitigate the negative impacts and promote the positive ones. The assessment also supports further trade liberalization in the rice sector. In the Viet Namese context it has also been helpful in supporting national capacity to undertake impact assessment in agriculture and trade.

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United Nations Environment Programme

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Executive Summary

Rice plays a central role in Vietnamese agricultural production and food consumption. Agricultural land planted with rice is 53 per cent of the total area or 64 per cent of the area sown with crop plants. The annual area of rice cultivation was about 7.5 million hectares. Productivity is 4.2 tons/ha with a total output of 32.7 million tons in 2000, an annual growth rate of more than 5 per cent during the period 1989 to 2000. Rice production is the main source of income for rural households, representing 44–51 per cent of household revenue. In terms of export, rice brings the highest value in exported agricultural and forestry products. Over the past ten years, Viet Nam has become one of the largest rice exporters in the world with an average of 3.5 million tons of milled rice exported per year. This contributed 4.6 per cent to the total export turnover, or 21.6 per cent of agricultural exports.

This report presents an integrated assessment of the impacts of trade liberalization on the rice sector of Viet Nam. The assessment was supported by UNEP and carried out in 2002 and 2003 by an interdisciplinary team that involved members of various Vietnamese Agricultural Universities and Research Institutes. It examined the positive and negative impacts of the growth in rice production and rice trade.

Trade liberalization in Vietnamese agriculture has proceeded in a number of steps, starting in the 1980s and accelerating in 1989 with the transfer of decision-making to farming households, complemented by a range of land law reforms and the liberalization of other sectors in the early 1990s. The liberalization of trade included removal of domestic rice restrictions in 1997, relaxation in 1996, removal of rice export quotas in 2001, export and import promotion with tariff reductions during the period 1993-1998, and the abolishment of fertiliser import restrictions in 2001.

A stakeholder workshop was organised at the beginning of the assessment to undertake a strategic screening and build up awareness of the impact of trade liberalization in the rice sector. The workshop also specified and designed the assessment process: (i) description, strategic screening, and qualitative assessment; (ii) development of in-country methodologies and quantifying impacts; (iii) impact valuation; and (iv) policy recommendations and initial policy response.

A range of methodologies was adopted that included both quantitative and qualitative, and *ex-post* and *ex-ante* analyses. For qualitative analyses, a field survey was conducted in the Red River Delta and the Central Coast area. A Participatory Rural Appraisal exercise was conducted in the Mekong Delta to study rice farmers' knowledge, perceptions and actions with respect to the impacts of trade liberalization on rice production and the opportunities to produce rice using less pesticides and chemical fertilisers. For quantitative analyses, the assessment applied a modified PEM model to quantify the impact of further trade liberalization on the use of urea fertiliser in rice production. These quantitative models allowed incorporation of regression models for non-linear supply and demand functions, as well as the simulations for trade liberalization with different trade factors.

The findings of the assessment elaborated that the reform process, including trade liberalization, has resulted in significant changes in rice production and export, which has had important positive impacts on the economy, food security and poverty reduction, but negative environmental impacts. Many of the effects

of trade liberalization are interlinked. The increase of real income of the poor resulted from the increases in rice prices and the boom in rice production and exports, which in turn is partly due to the decrease of fertiliser prices or the rice/fertiliser price ratio. The poor benefited from the increase in the price of rice since they were the rice producers, and thus the poverty rate declined since the rice producers benefited most. These impacts and other opportunities act as an incentive to continue implementing policies that promote rice production and exports. However, rice expansion and intensification have negative environmental impacts, suggesting that the socio-economic improvements due to rice production are not sustainable. First, the increase in the price of rice and the decrease in the price of agrochemicals resulted in higher total levels of agrochemical use. This contributed to soil degradation, water pollution, loss of agrobiodiversity, and a decline in aquatic habitat and freshwater fishery harvests. Negative impacts on human physical health due to misuse of fertilisers and pesticides were also noted. Secondly, the expansion of rice cultivation posed a risk to remaining forests and wetlands that are particularly rich in biodiversity. Thirdly, rice intensification has lead to the replacement of traditional rice varieties with modern varieties. All of these environmental impacts will sooner or later incur economic costs for water purification, soil rehabilitation, health treatment, increasing natural calamities, etc.

Scenario analysis showed that further liberalization would result in a reduction of the domestic price of urea fertiliser, which supports rice production and export but also implies a higher level of environmental damage. Moreover, it was demonstrated that the current levels of fertiliser and pesticide use are not economically optimal, so that a reduction of their use would make both economic and environmental sense. Consequently, measures to moderate the consumption of agrochemicals should be developed. Suggestions coming forward from this study are (i) taxing or banning the most harmful agrochemicals, and (ii) providing technical support and research to promote organic rice farming for clean rice production. Initial studies indicate that clean rice production (i) would reduce production costs for agrochemicals, (ii) provides more scope for producing traditional rice varieties, (iii) has fewer negative health impacts, (iv) is more environmentally sustainable, and (v) can potentially command higher prices. This may require an increase in knowledge and extension programmes and labour, and slightly lower rice yields may be expected.

Abbreviations and Acronyms

AFTA /CEPT	ASEAN Free Trade Area/Common Effective Preferential Tariff Scheme
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of South-East Asian Nations
CIEM	Central Institute for Economic Management (Viet Nam)
EEPSEA	Economic and Environment Programme for Southeast Asia
FAO	Food and Agriculture Organization of the United Nations
GOV	Government of Viet Nam
GSO	General Statistic Office (Viet Nam)
HYR	High yielding rice
HYV	High yielding varieties
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IPM	Integrated pest management
IRRI	International Rice Research Institute
ISG	International Support Group
ISO	International Organization for Standardization
LCC	Leaf colour chart
MARD	Ministry of Agriculture and Rural Development
MOLISA	Ministry of Labour, Invalids and Social Affairs
MOT	Ministry of Trade
MPI	Ministry of Planning and Investment
MV	Modern variety (rice)
NBR	Net benefit ratio
NGO	Non-governmental organisation
NEA	National Environment Association
NIAPP	National Institute of Agricultural Projection and Planning (Hanoi)
NTB	Non-tariff barriers
PEM	Partial Equilibrium Model
PPD	Plant Protection Department
PRA	Participatory Rural Appraisal
QR	Quantitative Restriction
SOE	State owned enterprise
SWOT	Strength, weakness, opportunity and threat analysis
TBT	Technical Barriers to Trade
TV	Traditional variety (rice)
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USBTA	The Bilateral Trade Agreement between Viet Nam and the United States
USDA	United States Department of Agriculture
VASEM	Viet Nam Agriculture Spatial Equilibrium Model
VLSS	Viet Nam Living Standard Survey
VND	Vietnamese Dong
WTO	World Trade Organization

1. Introduction

Viet Nam is located in the centre of South-East Asia on the eastern side of the Indochina Peninsula. The population of Viet Nam reached 76.3 million in 1999 and ranks second in South-East Asia, seventh in the Asia-Pacific Region and twelfth in the world. Rice is the staple food crop of Viet Nam and is local in origin. The proportion of rice in cereal consumption is 94 per cent and in calorie intake 75 per cent. It is the most important crop in the agricultural sector and it is difficult to overstate the importance of rice to the Viet Namese economy. The area cultivated with rice accounts for 82 per cent of the total crop harvest area,[1] which represented about 7.7 million hectares in 2000. About 80 per cent of the population grows rice, almost half produce a surplus for sale.

This report presents the results of an integrated assessment of the impacts of trade liberalization in the rice sector of Viet Nam. The report examined the positive and negative impacts of the growth in rice production and rice trade. The assessment was carried out in 2002 and 2003 by an interdisciplinary team that involved members of various Vietnamese Agricultural Universities and Research Institutes.

Since 1989 Viet Nam has been undergoing a gradual transition from a centrally-planned socialist to a market-oriented economy under the reform process known as Doi Moi, meaning literally "change and newness", a term coined in 1986 for reform and renovation in the economy. This process of transition has been accompanied by high growth, macroeconomic stability and significant structural change.

Further reforms have also been conducted by implementing policies of trade liberalization according to Viet Nam's commitments under the ASEAN Free Trade Area/Common Effective Preferential Tariff scheme (AFTA/CEPT) from July 1995, the Bilateral Trade Agreement between Viet Nam and the United States (USBTA) that was signed in July 2000 and became effective in late 2001, and as part of the negotiations to enter the World Trade Organisation (WTO). Over the last two years, the Government has liberalized trading rights for all domestic firms. In addition, export quotas on rice were removed in early 2001. Most tariff rates have been lowered to 12 per cent and the maximum tariff rate was reduced to 50 per cent. Some non-tariff restrictions were replaced by long-term tariff-based measures.

The country has gone from being a rice importer to a net rice exporter, and is the second largest rice exporter in the world since 1995. In recent years, the annual volume of rice exports has grown considerably, reaching over 3.5 million tons. In 2000, Viet Nam's share in the world rice market was about 16 per cent. The growth in rice production and rice exports has brought, among other effects, an increase in agricultural income and GDP, and has had a positive impact on poverty reduction. The policies promoting rice production and trade have also had a number of negative environmental and social impacts, such as adverse effects on human health from the misuse of fertilizers and pesticides, environmental degradation and loss of rice biodiversity from technology inputs.

[1] Total crop harvest area in the year = land area planted to crop multiplied by the cropping rate.

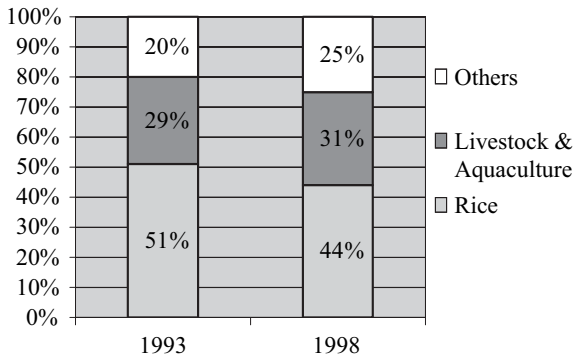
2. Background to the project

2.1 Relevance of the rice sector to the national economy

Rice continues to play a central role in Vietnamese agricultural production and food consumption. Agricultural land planted with rice is 53 per cent of the total area or 64 per cent of the land area for crop production. In 2000, the rice harvest area was nearly 7.7 million hectares, which is 1.3 times higher than 1989 and represents an average annual growth rate of 2.4 per cent. Rice productivity was 4.2 tons/hectare, over 1.3 times higher than in 1989. Rice output increased to 32.7 million tons in 2000, accounting for more than 91 per cent of total cereal food production in the country. The annual growth rate of rice production was over 5 per cent during the period 1989 to 2000 (GSO, 2001).

Rice in Viet Nam currently accounts for 96.2 per cent of total cereal food production, 61.7 per cent of total crop cultivation and 78.2 per cent of total agricultural revenue. The central role of rice is highlighted in the Vietnamese diet, since rice provides about 75 per cent of the caloric intake. According to the results of the 1992–93 Viet Nam Living Standards Survey (VLSS), 69.9 per cent of Vietnamese households grow rice and 99.9 per cent consume rice. About 95 per cent of rural households, which make up about 80 per cent of the population, grow rice and almost half produce a surplus for sale. Rice production is the main source of income for rural households, representing about 44-51 per cent of rural household revenue (Figure 1).

Figure 1: Sources of rural household revenue



Source: VLSS (1993 – 1998)

In terms of exports, rice brings the highest value compared to other agricultural and forestry export products. For example, the total turnover of agricultural and forestry export products in 2000 was US$ 2,894.4 million (GSO, 2002), of which rice accounted for the highest with 23 per cent, coffee the second highest with 17 per cent, and vegetables and fruit third with 7 per cent. Over the past ten years, Viet Nam has become one of the largest rice exporters in the world, with an average of 3.5 million tons of milled rice exported per year. In the period 1989 - 2000, Viet Nam exported nearly 30 million tons of rice, gaining a turnover of more than US$ 7 billion. This contributed 4.6 per cent of the total export turnover or 21.6 per cent of agricultural exports, which accounted for 30 per cent of total exports (MARD, 2002).

In the world rice market, Viet Nam is one of the largest consumers and exporters. During the last few years, Asian countries (including Indonesia, the Philippines, Singapore, Malaysia and Hong Kong) have been the main importers of Vietnamese rice, accounting for over 50 per cent of total rice exports. Middle East countries such as Iran and Iraq are also important markets for Vietnamese rice. In 2000, the volume of rice exported to the Middle East made up about 30 per cent of total exports (MARD, 2001).

2.2 Project objectives

The general objective of the present project is to conduct a national integrated assessment of the social, economic and environmental impacts of trade liberalization in the agriculture sector, with a specific focus on the rice sector. Specific objectives are to:

- enhance the country's understanding of the environmental, social and economic implications of trade liberalization in the rice sector;
- enhance and support national capacity in international trade policy and research;
- assess the positive and negative environmental impacts of trade liberalization policies and multilateral trade rules, especially the WTO accession requirements in the rice sector, taking into account social and economic impacts;
- elaborate country and sector-specific methodologies to assess these impacts;
- enhance coordination among national entities and increase national expertise; this is very important in order to identify and quantify both the negative and positive environmental, social and economic impacts of trade liberalization in the agriculture sector;
- formulate policy package proposals to mitigate the identified negative impacts of liberalized trade, and maximize positive impacts through economic and regulatory instruments as well as through community-based initiatives; and
- perform cost-benefit analyses of implementing policy packages comprising economic and regulatory instruments and community-based initiatives.

2.3 Project approach and process

2.3.1 Assessment team

The Hue University of Agriculture and Forestry (HUAF) led the integrated assessment team, members of which included economists, community development specialists, agronomists, ecological and environmental specialists from Hue University (in central Viet Nam); the Hanoi Agricultural University (in northern Viet Nam); the Mekong Delta Farming System Research and Development Institute (in southern Viet Nam); and experts from the Ministry of Agriculture and Rural Development (MARD).

2.3.2 Approach

A stakeholder workshop was organized at the beginning of the project to build awareness of the impact of trade liberalization in the rice sector. The stakeholder participants were from universities (Hue University, Hanoi Agricultural University); research institutes (Mekong Delta Farming System Research and Development Institute, National Institute for Plant Protection); government ministries (Ministry of Agriculture and Rural Development, Ministry of Trade, and Ministry of Natural Resources and Environment); local rice producers; traders; people organisations and NGOs (Oxfam). Workshop participants were also involved in participatory sessions for strategic screening and qualitative assessment of the environmental impacts of rice intensification and rice growth (including rice trade liberalization). This focused the assessments on environmental impacts, as these were identified as missing from policy analyses so far. The workshop also proposed and specified the methodology for the integrated assessments. Given that most of the team members were not familiar with the quantitative methods and there were limited opportunities for consultation, a combination of different methodologies was adopted. However, strengthening capacity on using quantitative methods needs to be prioritised.

2.3.3 Sources of data and consultation

Data from a range of statistical sources and literature were reviewed and used in the analysis. The main data sources were the Government Statistic Office (GSO), the Ministry of Agricultural and Rural Development (MARD), the Ministry of Trade, the Food and Agriculture Organization of the United Nations (FAO) and the International Rice Research Institute (IRRI). Where appropriate, data from other sources were also used.[2] Consultation took place with the ministry departments and

[2] Such as the Economic and Environment Programme for South-East Asia (EEPSEA) and the International Support Group (ISG) to MARD.

offices for data collection and technical support. Further consultation regarding trade liberalization in the rice sector was conducted with the university and agricultural research institutes but was very limited.

Primary data was also used to supplement the above data and provide further evidence on the issues being discussed. Primary data collection was carried out with field visits and interviews with individual farmer respondents using questionnaires. These surveys were applied in the Red River Delta and Central Coasts, where secondary data on rice production and trade were most available. A total of 194 farmer respondents were interviewed comprising 50 households from the irrigated rice area of the Red River Delta; 60 from the irrigated rice ecosystem of the Central Coast; and 84 from the rain-fed lowland rice ecosystem. The percentage of poor, medium, and better-off households was 30, 40, and 30 per cent respectively. Due to the small sample size, only limited conclusions can be made.

Participatory Rural Appraisal (PRA) exercises were conducted in the Mekong River Delta. This method was used depending on the availability of secondary data on rice production and practices from previous research in the region. The research team used a variety of PRA tools such as focus group discussions, SWOT (Strength, Weakness, Opportunity, and Threat) analysis, and stakeholder meetings. The PRA exercises involved different rice farmer groups and stakeholders at the local level (e.g. both small and large landholding groups, local officers, extension workers, rice traders, and rice millers). The local participants reviewed and updated the secondary data on the identified issues in the PRA exercises. The researchers facilitated discussions on rice production and trade and their integrated impacts.

2.3.4 Policy dialogue

Dialogue with policy makers was carried out through the International Support Group (ISG) to MARD. The assessment team collaborated with the ISG Secretariat and relevant ad-hoc theme groups, and communicated the assessment outcome via the ISG e-forum. Collaboration with the ISG Secretariat and policy makers at both ministerial level and local level was developed in order to integrate the integrated assessment outcomes into policy considerations. These policy makers were senior officials in the agriculture and rice sectors, trade, and scientific, technology and environmental management. The mechanism developed was as follows:

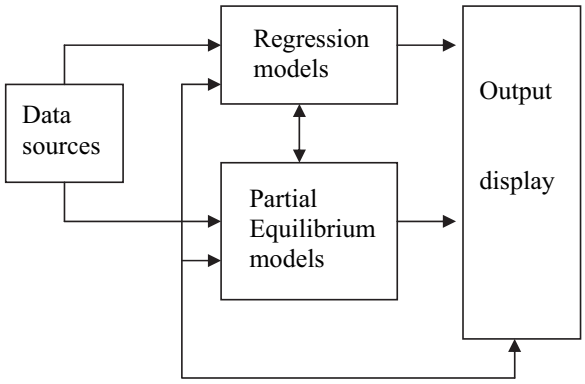
- the ISG Secretariat included the current project as a relevant activity to the ISG mission, particularly to the thematic ad-hoc group for global integration and policy analysis;
- representatives from the ISG Steering Board and Secretariat were invited to attend the workshop and meetings related to carrying out the integrated assessment activities;
- members of the integrated assessment team were invited to attend the policy dialogue activities of the ISG Plenary and the ISG Steering Board by arrangement with the ISG Secretariat;
- the ISG Secretariat posted the assessment results on their ISG e-forum;
- specific working sessions between the assessment team and the ISG Secretariat or ISG Steering Board were scheduled on an ad-hoc basis according to need.

2.3.5 Process for assessment implementation

Step 1	Step 2	Step 3	Step 4
Description, strategic screening, and qualitative assessment	Develop in-country methodology and quantify impacts	Impact valuation	Policy development and initial policy response
– Sensitise stakeholders – Rice growth policies – Trade liberalization – Categorize impacts – Preliminary assessment	– Literature review – Environmental indicators – Socio-economic indicators – Quantitative model	– Economic – Social – Environmental	– Recommendations – Policy dialogue – Policy response

2.4 Development of in-country methodology for trade liberalization analysis

In this study, the Partial Equilibrium Model (PEM) was adapted and used. The PEM allowed regression models for non-linear supply and demand functions as well as the simulations for trade liberalization with different trade restrictions to be incorporated. A quantitative framework was described as follows:



2.4.1 Base scenario (Po)

The base scenario served as a reference for comparison with the policy options. It was designed for the year 2005, with the following assumptions:

- Rice production including area cultivated with rice, agrochemical consumption, yield and output increased at the same rate in the year 2002;
- The domestic and international rice markets were similar to year 2002;
- The fertilizer market and domestic production were similar to year 2002.

2.4.2 Scenario options

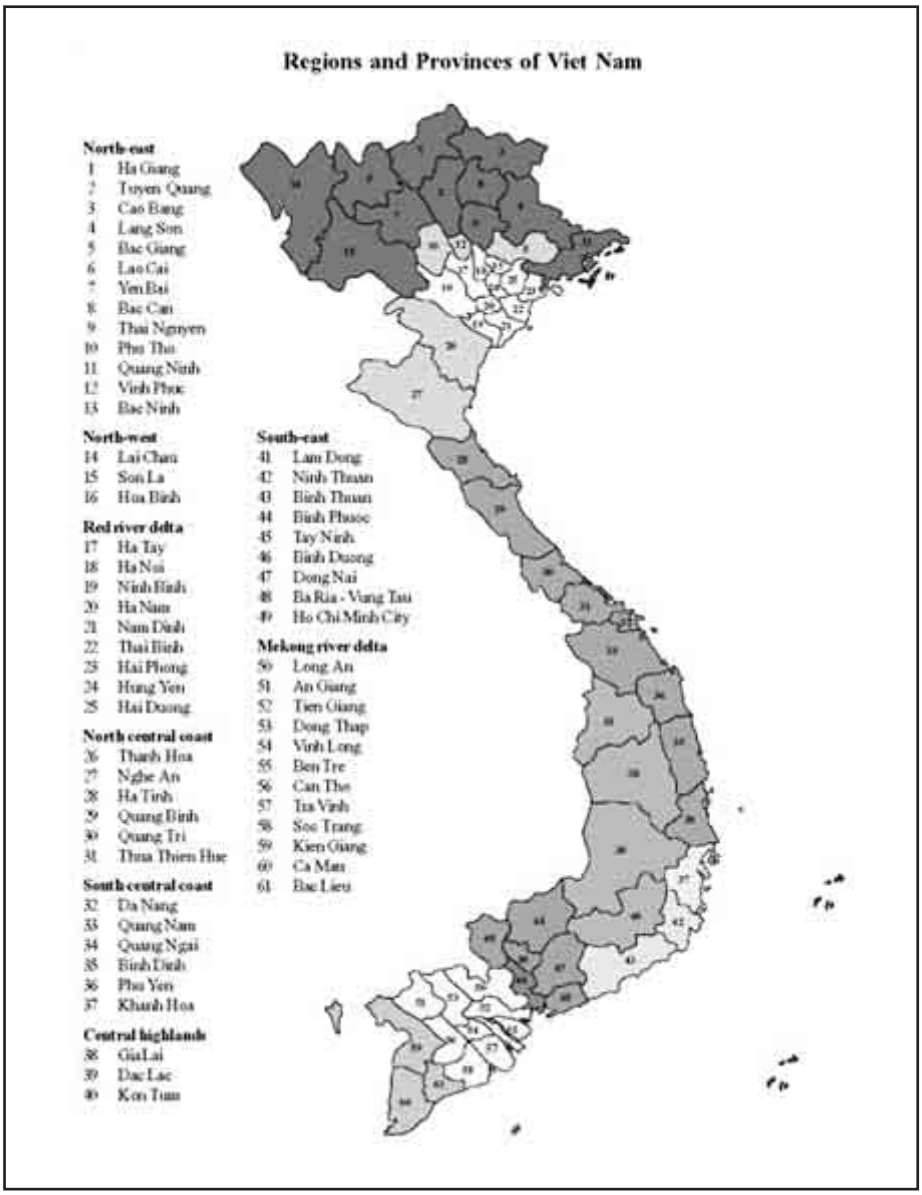
Further liberalization after removing the quotas would facilitate increased participation of the private sector and reduce the monopoly on fertilizer imports. This would promote competition and thereby reduce the implicit costs. As a result, the gap between world and domestic prices of urea fertilizer would decrease. The options on the different rates of the gap decrease between 2002 and 2005 are as follows:

- Scenario 1(OP1): 10 per cent
- Scenario 2 (OP2): 20 per cent
- Scenario 3 (OP3): 30 per cent
- Scenario 4 (OP4): OP3 combined with 10 per cent cut of rice area.

2.4.3 Options on trade liberalization under Viet Nam's trade agreements

To assess the impact of trade liberalization on the rice sector under Viet Nam's international and regional trade agreements, Option P1 assumed implementation of the ASEAN Free Trade Area/Common Effective Preferential Tariff scheme (AFTA/CEPT) with a reduction in tariff rates from 20 to 5 per cent. Option P2 analysed the effect of the Viet Nam-US Bilateral Trade Agreement (USBTA) on the rice sector with a reduction in US rice import tariffs from 35 to 8.3 per cent.

Figure 2: Map of Viet Nam showing national regions for rice production and surveyed areas



Note: Field surveys were conducted in Bac Ninh (13), Quang Binh (29), Quang Tri (30), and Thua Thien Hue Provinces (31)
The PRA application was conducted in Can Tho (56) and Tien Giang Provinces (52).

3. Policies affecting trade liberalization in the rice sector

There are three groups of policies identified that have major impacts on the rice sector in Viet Nam. These include:

– policies promoting rice production
– policies on trade liberalization in agriculture
– international commitments on trade deregulation.

3.1 Policies promoting rice production

3.1.1 Land laws (1988, 1993, and 1998)

– Resolution No. 10/NQ-TW (5/4/1988): Recognized the State, the collective and the private sectors as legally equal components in the economy. Under this policy line the agricultural ownership of lands was abolished. Lands were allocated to farm households for long-term (10 to 15 years) use. A tremendous growth in agriculture, especially in the rice sector began, and rice production increased quickly.
– Land Law (1993): Passed on land use rights, and allowed 20 year terms for allocating crop lands to farm households.
– Government Decree No. 10 CT-TTg (20/2/1998): Stipulated and further confirmed the full rights of land use to farmers. In 1999, 5.7 million hectares (78 per cent of the land area) were allocated to farmers, and 10.2 million households (87 per cent) received the official land tenure certificates. As a result, farmers were permitted to buy, own, and sell input factors such as machines, tools and animals. Furthermore, farmers were no longer required to sell a contracted amount of their rice to the State.

3.1.2 Improved infrastructure, agricultural technology and input services

– Increased investment of VND[3] 10.7 billion/year for irrigation makes up 13 per cent of the total national budget for agriculture.
– Investing in using and greening 'bare' land,[4] (started in 1994), and expansion of reclaiming wetlands for rice cultivation. Decree No. 99/TTg (1996) on agricultural development in the Mekong Delta put more stress on the expansion of rice lands.
– Decree No. 13-CP (2/3/1993): Supporting national extension work.
– Reorganizing the agricultural input (fertilizer and pesticide) service system (1998).

3.2 Policies on trade liberalization in the rice sector

3.2.1 Removal of internal rice restrictions

While the Mekong Delta region produces a rice surplus, in the northern provinces there is a rice deficit. Restrictions were put in place to ensure interregional equity in terms of security of rice supplies and to control illegal exports. The restrictions were mainly enforced in the form of fees, taxes, police checkpoints, permit requirements, and explicit bans. These measures all acted as a tax on internal trade in rice because they increased costs. Restrictions on domestic trade in rice were removed in 1997. Government Decision No. 140 (1997) abolished licensing and the control

[3] Vietnamese Dong.
[4] Lands which have no vegetation cover.

of domestic food transportation, and allowed farmers to buy, process, transport and conduct business activities for domestic consumption.

3.2.2 Rice export policy development

3.2.2.1 Export promotion

Trade policies such as export promotion, the replacement of quotas by tariffs, and the reduction of trade barriers were reformed. By 1998 the import management of consumer goods shifted to tariffs rather than quotas or licensing, although seven categories of goods remained under quantitative restrictions.[5] Customs tariffs were introduced in 1988, and the number of tariff lines and tariff rates increased (Tables 1 and 3). The effective rate of protection for some industries was quite high because tariffs on inputs and capital goods tended to be quite low while tariffs on consumer goods were high. Although the average tariff rates did not seem out of line compared to other developing countries, most of the imported items were in the high tariff bracket (between 30 and 60 per cent) and formed the bulk of State tariff revenues (CIEM, 2001). Similarly, the export tax structures were complex and suffered from frequent changes. In 1999, there were 12 rates of tax ranging from 0 to 45 per cent, with an average rate of 14 per cent.

Private companies were first allowed to engage directly in external trade in 1990/1991 and the trade licensing procedure for enterprises was progressively simplified throughout the decade. In 1998, the Ministry of Trade totally eliminated the licensing requirement. This allowed the foreign-invested enterprises to export goods not specified in their investment license, and domestic enterprises to export their production directly without an export/import license. However, the range of goods traded was limited by the scope of the activities that were recorded on companies' business registration certificates.

3.2.2.2 Relaxing and removal of rice export quotas

The Government has controlled the volume of rice exports since Viet Nam re-entered the international rice market as an exporter in 1989. The quota is based on estimates of domestic supply and demand and is set each year by MARD, the State Planning Committee, and the Ministry of Trade (MOT). The right to export rice under the national quota was allocated to two regional state-owned trading enterprises and a number of provincial state-owned trading enterprises. The provincial Government was authorized to allocate the quota after the reform of quota allocations in 1997.

Table 1: Indicators of nominal tariffs in Viet Nam, 1992-2000

Share of tariff lines	1992	1993	1994	1995	1996	1997	1998	1999	2000
0 – 10%	68	66	66	66	64	63	63	59	60
Above 10 – 20%	15	14	13	13	12	13	12	10	9
Above 20 – 40%	15	15	16	16	18	18	19	21	21
Above 40%	2	5	5	5	6	6	6	10	10
(No. of tariff lines)	(2813)	(2967)	(2934)	(3023)	(3180)	(3126)	(3163)	(6056)	(6341)
Average rate	10.7	11.8	12.3	12.3	12.9	13.4	13.6	16.3	16.2
Maximum rate	120	150	200	200	100	200	60	100	100
Standard deviation	14.8	16.7	17.5	17.3	16.1	17.0	15.9	18.7	19.1
Number of rates	26	31	35	34	30	35	28	12	19

Source: Extracted from CIEM (2001).

[5] Circular No.01/1998, Ministry of Trade: These are petroleum, fertiliser, cement, construction glass, paper, sugar, and steel of various kinds.

Table 2: A summary of the roadmap for rice-related trade reforms, 1988 - 2001

Year	Rice-related trade reforms	Export quota Million tons	Export tax (%)
1988	Contracts regime in agricultural production were introduced Dual price system terminated	..	10%
1989	Central Government monopoly on foreign trade was removed	..	10%
1990	Viet Nam Central Food Corporation (VINAFOOD) was established. Only SOEs were allowed to export rice, but provincial SOEs were also permitted to do so.	..	10%
1991	Export duty on rice was reduced from 10% to 1% Imported inputs were used to produce exports exempted from duties Viet Nam Agriculture Bank allowed to lend to households	..	1%
1992	The number of SOEs allowed to export rice reduced to 40, mostly concentrated in the south	..	1%
1993	Land use was reformed Resolution 5 gave further land use rights to individuals.	..	1%
1994	Rice export quotas imposed: 70% of quotas were allocated to selected SOE exporters and the rest to the SOEs recognized by the Rice Business Association and based on total rice output by province Restrictions imposed on the import of fertilizers by means of quotas and licenses to selected enterprises	2.0	1%
1995	High world prices and active rice trade. Controls on domestic trade to meet deficits in north resulted in illegal rice flows to China.	2.0	2%
1996	Export tax on rice was reduced from 2% to 1%.	2.0	1%
1997	Rice quotas were allocated by provincial Government Licensing for rice trade and transport in domestic market was cancelled Wholesale taxes on food was removed	3.5	1%
1998	Private sector rice exports allowed Foreign invested enterprises were allowed to export unlicensed goods Export tax on rice was exempted (reduced from 1% to 0%) Govt. curbed further imports in June after exceeding expected rate in May (at 2.5 million tons); domestic price was very high.	4	0%
1999	Right to export and import more liberalized: Conditions for rice export of private companies were relaxed, foreign invested enterprises could buy rice directly from the farmers for exports.	3.9	0%
2000	Rice restructuring policies were released (to stabilize annual paddy rice output at 33 million tons, focus on quality and varieties of rice) VAT on rice purchases for export was reduced from 5% to 3% Directions for restructuring and consuming agricultural products were introduced (Resolution 09/2000 of the Government).	4.0	0%
2001	Quotas on rice exports and fertilizer imports were cancelled. Rice export and fertilizer import were totally liberalized (regime of appointed rice exporters and fertilizer importers removed)[6] Temporary support measures for rice producers and exporters.	--	0%

Source: Adapted from Viet Nam's legal database & CIEM; Oxfam HK (2002); FAO (1994); IFPRI (1996); and Ryan (1999).

[6] Decision No.46/2001/QD-TTg dated 4 April 2001 on import-export management for the period 2001-2005.

Trade liberalization has allowed private domestic companies to participate in rice exports since 1997/1998. In addition, Viet Nam's revised Trade Law (1998) allowed foreign traders engaged in direct transactions to carry out trade deals and offer trade services. However, they were not allowed to export rice by themselves, but could only act as agents for the provincial food companies. However, the export quota was also eliminated in 2001. The Prime Minister signed Decree No. 46/2001/QD-TTg on Viet Nam's Export-Import Management Mechanism for 2001-2005, effective as of 1 May 2001. This Decree abolished both the rice export quota and the fertilizer import quota. In addition, the practice of directly nominating exporters and importers on these products was removed. Both the state owned and non-state owned enterprises holding a license to trade food or agricultural commodities could participate in rice exports.

3.2.2.3 Abolishment of fertilizer import restrictions

Compared to other Asian countries, Vietnamese rice production is an intense user of inorganic fertilizers. However, domestic inorganic fertilizer production supplies only 13 per cent of total demand, making the import of fertilizer critical (Goletti, 1998). MARD and the Ministry of Trade determined the type and quantity of fertilizer to be imported each year, thereby controlling fertilizer imports. Quotas were allocated to the provinces based on the expectation of provincial production. The provincial authorities would then allocate the quotas to the enterprises under their management. Non-state enterprises were also allocated quotas subject to fulfilling certain criteria such as clear affiliation as a branch of a state enterprise. The imported fertilizer quotas were adjusted following mid-year reviews of the local supply and demand conditions. The Government operated a Price Stabilization Fund to monitor fertilizer prices. Together with the liberalization of rice export quotas the fertilizer import restriction was abolished in 2001.

3.3 Viet Nam's international commitments to trade deregulation

Viet Nam is progressing towards further integration with the world economy, and is under some pressure to sign up to established agreements. For the coming years, the Government will commit to liberalizing its trade and investment rules, facilitate greater private participation in exports, abolish quantitative restrictions (QRs), lower tariffs and gradually develop the transparent, rules-based trading and investment system that will be required for entry into the WTO in the second half of the 2010 decade.

3.3.1 Viet Nam's commitments under AFTA

Viet Nam joined the Association of South-East Nations (ASEAN) on 28 July 1995, and subsequently committed to implementing the Common Effective Preferential Tariff scheme (CEPT) for the realization of the ASEAN Free Trade Area (AFTA) on 1 January 1996.

- *Tariff reduction:* Tariff lines on imports from ASEAN members (95 per cent, according to preliminary estimates) will be reduced to at most 20 per cent by the start of 2003, and to 0-5 per cent by the start of 2006, to complete the CEPT scheme.
- *Sectorial tariff-reductions*: By early 2004, the average tariffs for manufactured goods from ASEAN countries will be decreased by 50 per cent and the average import tariffs from ASEAN countries on textiles, leather, wood products, non-metallic mineral products (e.g., glass and ceramic products), and food products (including vegetable oil) will be decreased by more than 60 per cent.
- *Removal of non-tariff barriers (NTBs):* All goods in the Temporary Exclusion List (TEL) will be moved to the Inclusion List (IL) by 2003, and NTBs will be removed on goods in the TEL when the applicable tariff is reduced to 20 per cent or below. Currently, 4,230 tariff line items are in the IL and 1,800 items in the TEL.

3.3.2 Viet Nam's commitments under the USBTA

The Bilateral Trade Agreement between the United States and Viet Nam (USBTA) was signed on 13 July 2000, to become effective in late 2001. Viet Nam would reduce restrictions on foreign entry into numerous service sectors like banking, tourism, telecommunications and others according to the road map agreed under the USBTA. Also, the current process of licensing for foreign investments would be replaced gradually by a more automatic process of registration for foreign investments within seven years.

Viet Nam will gain better access to the US export markets upon ratification of the Agreement (subject to annual renewal). In exchange, Viet Nam will have to open its markets by adopting the following measures:

— In respect of goods

- *Trading rights*: Liberalized trading rights for the US will be made firm in three to six years.
- *Tariffs*: Reduce current tariff rates on a limited range of industrial and agricultural items (about 250) by 30 to 50 per cent over three years.
- *Quantitative restrictions (QRs)*: Remove QRs on most products in three to seven years, but for steel and cement after six years and petroleum products after seven years.

— In respect of services

- Overall: Open up the services sector considerably. Viet Nam will provide more market access than other low and middle-income countries under the Uruguay Round and only slightly less than the larger transition economies. The following are some examples of that opening:
  - *Banking services:* Allow US equity in joint ventures (up to a 49 per cent stake). After nine years, allow 100 per cent US-owned subsidiary banks. Also allow US equity in privatised Vietnamese banks at the same levels as Vietnamese investors. Phase-in the right of US banks to accept Vietnamese Dong deposits on the same basis as domestic banks, over eight years for business clients and ten years for the retail depositors.
  - *Non-bank financial services*: Allow 100 per cent US equity in financial leasing and in other leasing after three years.
  - *Insurance*: Allow joint ventures in three years and 100 per cent US equity in five to six years.
  - *Other services*: Allow immediately 100 per cent US equity in a range of technical services, including legal, accounting, engineering, computer-related and construction.

3.4 Viet Nam's accession to the WTO[7]

Viet Nam submitted an application to join the WTO as a developing country in January 1995. A detailed Memorandum on Vietnamese Foreign Trade and Economic Policy was introduced to the WTO Working Party for examination. The National Committee for International Economic Cooperation evaluated in October 2001 the preparations for an initial WTO offer regarding accession negotiations. This initial offer was approved by the Government of Viet Nam and sent to the WTO Secretariat in December 2001.

As a party to a number of bilateral trade agreements (BTAs), Viet Nam exemplifies many WTO standards relating to market access, non-discrimination and transparency. In implementing the BTAs, Viet Nam needs to liberalize almost every aspect of its trading system. The Vietnamese Government has accepted the importance of further liberalizing the economy and committing to global trade. Some of the crucial subjects to be discussed in the negotiation process are:

[7] Based on Baker & McKenzie, Burke, F., and Bui Thi Bich Lien (2001).

Policies affecting trade in goods

The import-export licensing requirement was abolished, and a working-capital requirement for trading enterprises was no longer effective. Wholly Vietnamese-owned enterprises, irrespective of ownership structure, nature (trading or manufacturing) and size of capital were allowed to import and export goods. In 2000, new regulations were issued to allow foreign merchants to establish branches and to trade a number of designated items.

Tariffs were cut several times and a number of quantitative restrictions were lifted. Recently, the Government issued a new import-export mechanism that offers greater market access for many key products by lifting restrictions over the next five years. This move to opening up markets illustrates Viet Nam's proactive approach to international integration, which, in some respects, is more liberal than is required by commitments to international agreements.

Concerning the use of tariff quotas: Currently, Viet Nam has no tariff quotas in place but reserves the right to impose tariff quotas when deemed necessary. Viet Nam is taking steps to implement the WTO Customs Valuation Agreement by drafting legislation based on the principles of the Agreement and introducing measures to combat commercial fraud and transfer pricing. In addition, Viet Nam is implementing the Agreement on a pilot basis for goods imported from ASEAN countries under the ASEAN-CEPT Programme.

Technical barriers to trade, standards and certification: The Directorate for Standards and Quality (STAMEQ) is responsible for advising the Vietnamese Government on issues related to standardization, metrology and quality management, and representing Viet Nam in international and regional forums. However, Viet Nam has not yet established an enquiry point to provide enterprises with information as required by the Technical Barriers to Trade (TBT) Agreement. Nearly 5,000 national standards exist in Viet Nam, of which approximately 1,000 are international standards adopted and translated for application in Viet Nam. Draft technical regulations or standards are not published prior to approval. Viet Nam has embarked on a programme to harmonize national standards with international standards. Viet Nam is developing the safety certificates, formerly known as mandatory product quality certification, on the basis of Systems 4 of the eight third-party certification systems introduced by the ISO. Safety certification includes sample testing and post-certification surveillance in the market or at the production site.

Trade-Related Investment Measures (TRIMs)

Viet Nam's legislation on foreign investment includes some measures inconsistent with the TRIMs Agreement. Viet Nam does not issue investment licences for projects to assemble motorcycles in simple CKD (complete knock down) form. Assembly projects in mechanical engineering and electric and electronic products are only approved in IKD (incomplete knock down) form. However, the Vietnamese Government has prepared a detailed Action Plan to bring these measures into line with the TRIMs Agreement, taking into account the flexibility of special and differential treatments accorded to developing countries.

Viet Nam is in the process of reforming its state trading enterprises. This creates a level playing field for all enterprises, and ensures that enterprise-trading activities are conducted in accordance with commercial considerations. The system of designating authorized enterprises to export rice has already been phased out. There is indication that Viet Nam will continue to update and supplement the information related to state trading enterprises.

Trade-Related Intellectual Property Rights (TRIPS)

As far as intellectual property rights are concerned, Viet Nam’s legal framework is reasonably sufficient and adopts many international standards. An Action Plan for implementation of the TRIPS Agreement has already been prepared for the review of WTO members. The crucial problem for Viet Nam in this area is that a huge gap remains between written law and practice. Although judicial, administrative procedures

and remedies have been designed to protect IP rights, enforcement of these rights remains ineffective. Rampant piracy and the lack of a workable mechanism to protect IP rights have become a growing concern for Viet Nam's trading partners.

Trade in services

Viet Nam takes a restrictive approach to trade in services, and the regulatory regime for this sector is in its infancy. Although a number of new laws have been introduced recently in a bid to create a more stable legal framework for full accession to the WTO, there are still considerable concessions to be made and much remains to be done. As a member of ASEAN and APEC (Asia-Pacific Economic Cooperation), Viet Nam is participating in negotiations to liberalize trade in services. It has offered certain commitments in services (telecommunications sub-sectors and tourism) under the ASEAN Framework Agreement on Services (AFAS). Local regulations on market access and non-discriminatory treatment were significantly improved after ratification of the BTA.

3.5 A review of Viet Nam's trade policies under the AoA framework[8]

3.5.1 Import tariff policy in agriculture

In the existing most favoured nation (MFN) import tariff schedule, there are 6,285 tariff lines with 19 levels ranging from 0 to 100 per cent. The average import tariff rate for the whole country is 16 per cent (including the 0 per cent rate) or 24 per cent (excluding the 0 per cent rate). As far as agricultural products are concerned, there are 836 tariff lines with 12 levels ranging from 0 to 100 per cent, accounting for 13.3 per cent of the total tariff lines. An average import tariff rate is 24 per cent (including the 0 per cent rate) or 28 per cent (excluding the 0 per cent rate).

Agricultural commodities are protected through higher tariff rates than for industrial commodities (an average tariff rate in agriculture is 24 per cent, while the overall average rate is 16 per cent), but compared with developed countries this is not significant. There are numerous tariff rates at many levels (12 levels ranging from 0 to 100 per cent). Processed products are protected through higher tariff rates than unprocessed or crude products, while the world trend is the opposite. This would indicate that Viet Nam's processing industry is not yet developed. The beverage industry is highly protected because it generates huge revenues for the State.

Both tariff and non-tariff measures are used to protect domestic industry. Viet Nam usually applies import prohibition or import licenses to limit imports whenever the economy needs to protect domestic production. This indicates that Viet Nam maintains a command and administration management style. While many countries interpret the regulations on quality (SPS measures) flexibly to

Table 3: Comparing import tariff rates in agriculture with the general import tariff structure

Import tariff rates (%)	Number of import tariff lines		Proportion (% of tariff levels)	
	Total	Agriculture	Total	Agriculture
0	2060	113	32.8	13.5
1- 10	1746	139	27.8	30.4
12 – 30	1153	112	18.3	26.1
35 – 50	1255	221	20	26.4
60	11	-	0.2	-
80 –100	60	30	0.9	3.6
Total	**6,285**	**836**	**100**	**100**

Source: MARD (2002).

[8] Based on ISG to MARD (2002).

support and protect their domestic products, Viet Nam does not pay much attention to this issue. Viet Nam has not issued any legal documents regulating other possible tariffs, such as *ad valorem* tariffs, in-quota tariffs, countervailing duty, anti-dumping duty, seasonal duty, etc.

3.5.2 Non-tariff measures

In recent years, Viet Nam has made progress towards creating more favourable trade and investment policies in accordance with international regulations. However, it still imposes various non-tariff barriers on some products.

3.5.2.1 Policies relating to controlling specific commodity groups

Until recently, the Prime Minister promulgated the annual Decisions on import-export controlling measures. As of 1 May 2001, import-export activities in Viet Nam are controlled for a five-year period (2001-2005) under Decision No. 46/2001/QD-Ttg. This was regarded as a step towards overcoming instability in policies: an import-export management regime over five years would help enterprises establish longer-term business plans. On the other hand, this Decision also created an opportunity to wipe out the complex administration regime, to abolish some non-tariff barriers, and to employ more economic tools consistent with Viet Nam's integration into the regional and global economy. Under Decision No. 46/2001/QD/TTg, there are some non-tariff measures as follows:

Quantitative restrictions

Under Article 6 in the Decision, the Government abolished quotas for rice export. In the past, quotas for rice exports were granted annually in January and September on the basis of balancing domestic demand and supply, seasonal conditions as well as considering the international demand and price. Abolishment of rice export quotas now allowed domestic producers to access the world market. Article 6.4 of the Decision, however, specifies, *"The Prime Minister will consider necessary measures to effectively intervene in the rice market"*. Taking control measures in emergency circumstances indicates that the Government pays close attention to one of the major export products of Viet Nam and to the importance of food security.

Decision No. 46 implies that some groups of import-export commodities are subject to the licensing list of sector Ministries. Relevant Ministries have guidelines for import and export on the principle that in the absence of licenses they should provide technical criteria and regulations on the use of products. Agricultural products in these groups come under the management of MARD, including seeds and all kinds of insects, which are subject to testing. Based on the test results, MARD will decide whether or not to allow import of the products into Vietnamese territory. If permitted, goods will be imported based on demand not quantitative restrictions or use of import licenses. For genetic sources such as plant varieties, seeds and breeds an import license from MARD is required. In addition, MARD is also responsible for issuing export licenses for some rare and precious animals and plants, seed and breeds.

Price control measures

The Ministry of Finance, in collaboration with the Ministry of Trade and the General Department of Customs, issues a state pricing management list and a minimum price list to calculate import tariffs every year. Use of a minimum buying price as a base for calculating import tax is considered a trade distortion. However, the number of products on these lists has fallen from 34 (in 1997) to 21 (in 1999) and 15 (in 2001).

As of 10 October 2000, under Decision 164/2000/QD-BTC, only seven commodity groups remain on this list, including only one agricultural product: beverages of all kinds (Chapter 22 of the current import-export schedule). As a result, in conformity with Decision No. 68/ 1999/ QD/ BTC dated 1 July 1999, sugarcane is taken off this list. The import of sugar is not likely to happen in the next five years, therefore there will be little impact on sugar production.

The use of a minimum pricing list for the taxation of imported goods has violated Article VII (regarding custom value of taxation in GATT, 1994). GATT (1994) specified that the customs value of imported goods would be according to

their transaction value or the transaction value of similar or identical goods. No customs value would be determined on the basis of the selling price in the country of importation or the administered price or a non-reasonable customs value. Moreover, the method or basis used to determine the customs value of goods would be stable and publicly accessible. In accordance with the Customs Law (approved on 12 July 2001), the Government has transformed, as of 1 January 2002, Viet Nam's existing pricing system and has entered into the pricing system based on the standards of GATT/WTO through legal tools. This action reflects progress in carrying out reform in the legal framework to comply with the integration process.

3.5.2.2 Policies relating to enterprises

From 31 July 1998 (under Decree No.57/1998/ND/CP), 100 per cent of Vietnamese-owned enterprises (except for foreign enterprises operating under the Foreign Investment Law in Viet Nam) were entitled to import and export goods in accordance with the provisions of their Business Registration Certificates. Nonetheless, the focal importers of certain commodities still exist as a non-tariff barrier to protect domestic production and prevent trade liberalization. The focal importers have some kind of monopoly to involve other exporters in the defined commodity.

For the period 2001-2005, the Government did not assign any focal importers and exporters of agricultural commodities. Article 6 of Decision No.46 stipulated that focal points in rice import-export be phased out. In addition, Decree No.44/2001/ND-CP, dated 2 August 2001, on the amendment and supplement of some Articles in Decree No.57/1998-ND/CP, indicated that Vietnamese businessmen had the right to export all kinds of goods except those that fall in the list of prohibited products, regardless of sector and type of commodity stated in their Business Registration Certificate. This means that from now on, enterprises from all economic sectors are permitted to export rice if they have an import-export registration code from the local Customs Departments.

However, for rice markets requiring governmental intervention and agreement, the Ministry of Trade will appoint implementing enterprises and control transaction conditions (including participation in bidding) with partners who are assigned by the importer's Government. The quantity of exported rice in G to G contracts will be distributed to provinces according to local rice-commodity volume. The Head of the People's Committee will directly appoint implementing local enterprises and representatives who will sign the contracts.

The phasing out of the focal exporters of agricultural products is liberalizing trade in a manner consistent with WTO rules on state trading enterprises. This in turn will have a positive impact for both farmers and exporters by strengthening competition among the enterprises exporting agricultural products.

3.5.2.3 Technical standards

Viet Nam has not specified (for the time being) any technical barriers to protect its domestic production except in Decree No. 92/CP dated 27 November 1993 on plant protection and quarantine, and Ordinance No. 93/CP dated 27 November 1993 on veterinary activities. These legal documents stipulate that all kinds of animals and animal products can only be moved from one locality to another, exported, imported or transited through Viet Nam after being inspected and their veterinary sanitation conditions certified by a Sanitary Inspection Certificate issued by Viet Nam.

Viet Nam is a full member of *L'Organisation internationale des Epizootics* (OIE) and the Asia-Pacific Plant Protection Council (APPPC). General opinion from the ISG to MARD 2001 is that the existing regulation system of Viet Nam on pest and disease control is quite adaptable to WTO regulation regarding content and transparency. In fact, this regulation has been ineffectively implemented both in terms of human health protection and protection barriers for domestic production. Measures on quality and standard management are also in conformity with WTO rules, but they are still not comprehensive and have some weaknesses.

3.5.3 Domestic support and export subsidy

Viet Nam is an agricultural economy with rural residents accounting for 70 per cent of the

population. The share of agriculture in GDP is about 24 per cent. As a key economic sector, agriculture plays an important role in the development and economic stability of the whole economy; it is also a sector that the Government has strongly supported for many years. In any country, support for agriculture tends to increase in accordance with the level of industrialization and modernization. Viet Nam is no exception.

3.5.3.1 Domestic support

Green Box

For many years, the Government has mainly invested in agriculture through these measures. From 1996 - 1998, VND 6,850 billion was invested annually in agriculture, focusing on:

– *Scientific research*: during the 1996 – 1998 period, the Government spent VND 200-260 billion per year on scientific research in the agricultural sector, of which VND 80-120 billion was spent in institutes belonging to MARD. The investment level has gradually increased, but is still low. According to reports from the institutes, half of the amount has been used to cover administration costs, which is why transfer of findings from the researchers to producers is limited.

– *Training*: the agricultural training system includes five universities, 30 tertiary, secondary and vocational training schools in the various fields including planting and farming, breeding, veterinary services, plant protection, agricultural mechanics, forestry, food processing, accountancy, etc. From 1996 - 1998, VND 120-140 billion has been spent annually on training agricultural technicians, economists, specialists and workers.

– *Extension*: in 1993 Decree No.13/CP dated 12 March 1993 regulating extension services was promulgated. Up to the present time, the national network of agricultural extension services has operated at governmental level (the Department of Agricultural and Forestry Extension belonged to MARD), both district and provincial, (including 61 provincial extension centres and extension divisions in 70 per cent of all districts). Expenditure on extension has been for paying the salaries of extension staff, running training courses and setting up performance points, and administration costs. Extension at the commune level, which receives partial financial assistance, operates on a voluntary basis, so advanced technology transfer to farmers is limited, especially in communes situated in highly mountainous and remote areas.

– *Agricultural infrastructure*: the Government has spent VND 3,000 billion annually on building and upgrading irrigation and drainage systems, dams, technical infrastructure of institutes, colleges, veterinary services and plant protection stations (excluding roads).

– *Public stockholding for food security purposes*: national stockholding activities for food security include: rice (about 500,000 tons per year), reservation of some varieties of maize, vegetables, veterinary drugs, pesticides, etc.

– *Environmental programmes*: the Prime Minister issued Decision No.327 dated 15 September 1992, on greening bare land and hills (Programme 327) and Decision No.773 on the utilization of unoccupied land and alluvial ground. Programme 327 has since changed to a five million hectare forestation programme (Program 661). Each year this programme receives VND 300 billion from the state budget.

– *Payments under regional assistance programmes*: including such activities as:

  - programmes on resettlement, migration, new economic zones;
  - funding transportation of food, salt, fertilizers and pesticides from the plains to the mountains and for transporting agricultural products from the mountains to the plains;
  - programmes on economic and social development of the Mekong River Delta, the Central Highlands and the North Mountain areas are in accordance with these criteria. Due to the fact that they are combined programmes, data has not been readily available.

– *Payment for relief from natural disasters:* to help farmers recover from natural disasters (for instance, support in paying for electricity for

irrigation or drainage, financial aid to buy crop seeds, veterinary drugs, plant protection etc.). Land use tax exemption was made for some kinds of crops in natural disaster hit areas. This may include the supply of food for the poor in critical circumstances or in difficult mountainous and remote areas or areas coping with natural disasters.

– *Plant protection and veterinary services*: preventing and fighting disease. In compliance with the WTO rules, and also due to a shortage of financial resources, Viet Nam has not applied many subsidies. For example, de-coupled income support, structural adjustment assistance provided through producer retirement programmes, structural adjustment assistance provided through resource retirement programmes (to remove land or other resources, including livestock, from marketable agricultural production), assistance provided through investment aids, income insurance and income safety net programmes.

– *Job creating programme*: Viet Nam's socio-economic programme in which eligible recipients are taught efficient production/ business methods and then granted preferential loans to develop their own production/business in order to generate more employment and income. This programme is described in the Blue Box.

Blue Box

Pursuant to the criteria of this Box, it is possible to classify into:

– *Investment support*: through the preferential credit programme of the Development Assistance Fund in accordance with the Law on the Promotion of Domestic Investment, the Government supports the interest rate differentials to enable banks to offer preferential interest rates. The Government may either freeze or write-off bad debts in the agricultural sector.

– *Input subsidies:* are generally available to low-income or resource-poor producers and those who live in difficult areas. The Government has established a Bank for the Poor. The Bank can lend at preferential interest rates (half the formal interest rate) to help expand production. Eligible recipients are those poor people living in mountainous, central coastline, or remote areas. The Government supports the interest rate differentials, and freezes or writes-off bad debts.

– *Support to encourage diversification from growing illicit narcotic crops*: the Government supports farmers' efforts to replace illicit narcotic crops with other crops by providing (free) appropriate plant seeds and seedlings, animal breeds and technical support, and monitors the farm diversification process. During the 1996 – 1998 period, the Government granted VND 532 billion annually through these support measures, divided into:

  • investment support: VND 183 billion
  • input support: VND 333 billion
  • support to encourage diversification from growing illicit narcotic crops: VND 15.6 billion.

AMS Box

The majority of government support under this Box comes from the Price Stabilization Fund and includes interest rate assistance to enterprises when market prices fall so low producers face heavy losses (mainly for rice; other commodities such as sugar, pork, cotton, etc., are produced in small quantities and are not often affected).

In 1999, the Price Stabilization Fund was moved to the Export Support Fund. It is worth considering whether this support measure still belongs to the AMS Box or should be under export subsidies, even though the contents remain unchanged.

In 1999, the Government promulgated some decisions related to finding solutions for the difficulties of the sugar industry in which outlays from the State Budget were spent to support enterprises in debt and to compensate for the different exchange rate levels.

Market price supports consisting of rice export quotas (phased out since 2001), import licensing for sugar, and paddy rice purchase at minimum price were all measures that distorted the domestic market price. The total value of support in the AMS Box was VND 86.7 billion (excluding calculation of non-tariff equivalent support of sugar, estimated

at VND 1,700 billion due to import licensing that makes the domestic price 30-40 per cent higher than the world price).

3.5.3.2 Export subsidies

Before 1998, the Government did not award any direct subsidies from the State Budget. Since the 1998 financial crisis, the currency of some Asian countries and Russia have been seriously devalued and the world prices for agricultural commodities have fallen sharply. This has affected production and farmers' livelihoods. In response the Government has increased subsidies.

Year 1998

Export subsidies were given to canned pineapple exported to the United States (assistance for importing the pineapple bud was put under domestic support measures). Under Prime Minister Decision No.178, the Government provided interest rate support to enterprises that export some farm products (e.g. meat, vegetables) in the form of granting loans at the preferential lending rate of 0.2 per cent per month. This rate was lower than the normal interest rate applicable for export credit loans that commercial banks are generally charging.

Since 1999

Export subsidies have been applied through another fund established under the Export Support Fund. Some subsidies from this fund are as follows:

- Rice:
  - Interest rate support for purchasing rice for temporary reserves
  - Compensation for lost rice exports
- Vegetables and fruit:
  - Support to import the pineapple bud
  - Support to export canned cucumber, pineapple and plum
- Coffee:
  - Compensation for lost coffee exports during 1999 and 2000
  - Interest rate support for purchasing coffee for temporary reserves
- Pork:
  - Support to export pork meat
- Sugarcane:
  - Support to import sugarcane varieties
- Tea:
  - Support to import tea varieties.

4. Rice production in Viet Nam

This section describes the characteristics of rice production in Viet Nam, beginning with land use and agricultural land allocation for rice and other activities at the macro level. It then analyses the characteristics of rice farming households by using national regional statistics and field surveys from 2003. The growth in rice production is then discussed and compared with information on other crop production. Finally, information on rice production inputs, costs and returns, and "clean rice" issues is presented.

4.1 Land allocation patterns for agricultural land

Information on agricultural land and rice land allocation is presented in Table 4. The total land allocated to paddy rice accounts for almost half of agricultural land use. More than half of paddy rice land is planted twice per year. More than 94 per cent of the rice-growing land area is allocated to individual households. The allocation of land to individuals has been taking place since 1989 and was recognized by the Land Law in 1993. It is one of the most effective promoters of rice production. According to the 1993 and 1998 Land Laws, farmers are allowed to sell, lease, mortgage and inherit land. This leads some households to sell or lose their land when unable to repay loans.

The average size of landholdings per household is quite small, about 0.9 hectares (Table 5). The average size of landholdings in the plains, where the rice growing area is dominant, is even smaller. Only about 12 per cent of rural households hold

Table 4: Proportion of rice land compared to agricultural land and patterns of land allocation, 31 December 2000

Type of land use	Land area (in '000 ha)	Ratio of agricultural land area (%)	Area allocated to individual households (%)	Communal land area (%)	Allocated to organisations/ enterprises (%)
Total agricultural land	9,345.3	100.0	85.7	3.9	10.4
Total paddy rice land	4,267.8	45.7	94.4	3.4	2.2
3-crop paddy rice land	465.9	5.0	98.3	1.5	0.3
2-crop paddy rice land	2,681.3	28.7	94.9	3.1	2.0
1-crop paddy rice land	1,069.2	11.4	91.6	4.6	3.8
Rice nursery land	51.4	0.6	93.2	6.0	0.8
Burnt-over paddy upland	199.9	2.1	93.9	4.1	2.1
Other annual crop lands	1,661.7	17.8	85.9	6.2	7.9
Garden land	628.5	6.7	98.1	0.7	1.3
Perennial crop land	2,181.9	23.3	68.7	1.4	30.0
Pasture land	37.6	0.4	1.3	76.1	22.6
Water surface land	367.8	3.9	69.0	12.6	18.4

Source: Department of Planning and Projection, MARD (2002).

more than 1 hectare of land (VLSS 1993-1998). The number of rural households not owning agricultural land makes up a small ratio as a result of the relatively equitable process of decollectivization. According to the results of the 1994 Agricultural Census, less than 2 per cent of agricultural households are landless. The problem of landless farmers is growing, however, particularly in the Mekong Delta. Statistical data has indicated that the landless farmers in the Mekong Delta increased from less than 0.7 per cent in 1994 to 5.7 per cent in 1998 (Nguyen, 1999). Farm sizes tend to be smaller in the north, particularly in the densely populated Red River Delta. Rice is the predominant crop in every region except the Central Highlands. More than 90 per cent of agricultural land is allocated to rice production in the two major deltas (Red River and Mekong River). As a result, farmers practice rice intensification and increased rice cropping. Two rice crops per year are common for irrigated rice. In some places, farmers even cultivate three rice crops per year, although the agricultural department no longer recommends this cropping practice because the risks from natural disasters or pest infestation seem to be increasing.

Most farmers plant rice to meet their food demands. They only sell their rice when there is a surplus or for other demands such as health services and education. As a general rule, there are many different varieties of rice planted in a certain region. Thus, the rice type and quality varies greatly among households and villages. There are very few areas specializing in growing rice for export. In 2002, MARD set up a rice-for-export zone in the Mekong Delta.

The figures on rice production and consumption per capita, and rice traded at the household level is different between the regions. In the North Uplands and Central Highlands where rice production per capita is low, the amount of rice traded is also low (11.8 and 14.7 per cent in the North Uplands and Central Highlands respectively). In 1998, rice traded at household level was on average 44.8 per cent (Table 5).

4.2 Rice growing seasons, cropping intensity, harvest area and yield

In Viet Nam, the average rice cropping intensity is 1.6 harvests per year. About 55 per cent of paddy rice is double cropped (Table 6). Double cropping is widespread in the Red River Delta, the river basins along the central coast, and the Mekong River Delta, and involves two rice crops per year;

Table 5: Landholding, rice production and consumption in agricultural households by region

Region	Landholding size (ha /hh)	Annual crop land (% of landholding)	Rice prod. per capita in agric. sector (Kg)	Family consumption (% rice pro.)	Rice traded or bartered (% rice pro.)	Value of rice sold per capita (000'VND)
Whole country	**0.90**	**52.0**	**577**	**55.2**	**44.8**	**444**
North Uplands	0.96	44.1	300	88.2	11.8	70
Red River Delta	0.85	29.5	435	75.9	24.1	233
North Central Coast	0.60	51.8	330	79.8	20.2	126
South Central Coast	0.44	80.4	453	64.9	35.1	333
Central Highland	1.51	33.6	223	85.3	14.7	82
South-East	1.37	45.9	661	43.2	56.8	712
Mekong River Delta	1.03	80.4	1,338	31.9	68.1	1,575

Source: VLSS (1998).[9]

[9] Official exchange rate in 1998: 1US$ = VND 13,297.

one is harvested in the rainy season and the other is harvested in the winter-spring season. In the Red River Delta, the winter-spring crop is planted in February and harvested in May-June, while in the Mekong Delta the process takes place three months earlier. The highest yield and production is attained in the winter season. In the Mekong Delta and other irrigated regions in the south, a double crop rotation may involve a rainy season crop and a summer-autumn crop (planted in April-May and harvested in August-September). Upland rice and lowland rain-fed rice is single cropped. Upland rice is un-irrigated and is planted on slopes where it is impossible to flood the fields. It is mainly grown in the Central Highlands and the Northern Uplands. Upland rice fields are burned, planted with rice for 2 to 3 years, and then left fallow for 8 to 20 years. Lowland rain-fed rice is also un-irrigated, but it is planted where rainfall and topography allow the rice fields to be submerged during at least part of the growing season. A significant portion of the Mekong River Delta (600,000 hectares) is rain-fed, particularly along the eastern coast and southern Ca Mau peninsula. Rice yields are 2 to 3 tons per hectare. The lowland rain-fed rice area is declining as the irrigation and drainage networks are expanded (Xuan et al., 1995).

The potential for rice expansion is very limited. Not only is agricultural land absorbed for urban and industrial development, but also an increasing share of the land is being allocated to aquaculture, vegetables and other crops as farmers diversify production to meet the demands of urban consumers (MARD, 2002). In addition, cropping intensity on existing rice land could be increased through investment in flood control and drainage, especially on the southern coast where dry season salinity is a problem.

4.3 Classification of rice farming households

The 2003 field survey conducted by the assessment team in Bac Ninh Province (Red River Delta) and in Quang Binh, Quang Tri, and Thua Thien Hue Provinces (Central Coast) provides data on rice farming households in the irrigated area and the rain-fed lowland rice ecosystem. The average size of farms in the irrigated area is smaller than in rain-fed lowlands (0.37 and 0.68 hectares respectively). The percentage of landholdings planted with rice in irrigated areas is higher than in rain-fed lowlands (99 and 75 per cent, respectively). Similarly, findings for the two ecosystems show that the average size of lands of the poor households is smaller, 0.29 hectares for the poor households and 0.46 hectares for the better-off in the irrigated area, and 0.53 and 0.82 hectares respectively in the rain-fed lowlands (Table 7). Government classifications of types of farming practices are described hereafter.

Rice cropping intensity in the irrigated area is higher than in the rain-fed lowlands. Farmers in the irrigated area harvest two rice crops per year. Some areas in the rain-fed lowland (often called one-rice land) only plant one crop per year because the

Table 6: Viet Nam's rice cropping system, cultivated area, yield and production in 2001

Type of rice crop	Cultivated area ('000 ha)	Irrigated rice Area (%)	Upland and rain-fed (%)	Yield (quintal/ha)[10]	Production ('000 metric tons)
Winter-spring rice	3,057	94	6	50.6	15,475
Summer-autumn rice	2,180	100	0	37.6	8,190
Long winter rice	2,248	73	17	36.9	8,305
Total	**7,485**	**89**	**11**	**42.7**	**31,970**

Source: Department of Planning and Projection, MARD (2002); and GSO Year Book (2001).

[10] A unit of weight equal to a hundredweight.

Table 7: Characteristics of rice farmers and rice culture by type of households

Indicator	Irrigated rice ecosystem				Rain-fed lowland rice ecosystem			
	Total	Poor	Medium household	Better-off household	Total household	Poor household	Medium household	Better-off household
No. households interviewed	110	32	45	33	84	27	27	30
No. persons/hh*	5.1	5.1	5.0	5.4	5.9	6.0	6.2	5.5
No. Male labour/hh	1.5	1.3	1.3	1.8	1.1	1.1	1.1	1.0
No. Female labour/hh	1.3	1.3	1.2	1.4	1.1	1.0	1.1	1.3
Age of household head	47	46	48	46	51	51	48	54
Primary school att. (%)	6.4	12.5	6.7	0.0	52.4	55.6	48.1	53.3
Element school att. (%)	67.3	68.8	68.9	63.6	36.9	37.0	40.7	33.3
High school att. (%)	26.4	18.8	24.4	36.4	10.7	7.4	11.1	13.3
Land size (ha/hh)	0.371	0.289	0.364	0.462	0.684	0.534	0.688	0.816
Rice land (% area)	99.3	99.8	99.0	99.4	75.1	73.2	76.8	75.1
Rice harvest (ha/hh)	0.710	0.549	0.696	0.885	0.803	0.641	0.779	0.971
Rice cropping rate: crop/yr.	2.0	2.0	2.0	2.0	1.89	1.85	1.89	1.93
Gross return 000'VND/ha	8,827	8,403	8,953	9,068	5,849	5,821	5,853	5,869
Variable cost ratio (%)	58.9	60.9	58.6	57.4	74.2	72.5	74.4	75.5
Net return rate (%)	41.1	39.1	41.4	42.6	25.8	27.5	25.6	24.5
No. rice cultivars /hh	2.3	2.0	2.6	2.4	1.8	1.8	1.7	2.0
HHs planting TV (%)	14.5	15.6	13.3	15.2	58.3	59.3	55.6	60.0

**household.*
Source: Field survey data (2003).

water supply is not adequate. However, rice-cropping intensity can also reach 1.9 crops per year. The average number of rice varieties used by households is 2.3 in the irrigated area and 1.8 in the rain-fed lowlands. In irrigated areas, 14.5 per cent of households still use some traditional varieties. The total share of traditional rice varieties grown in the irrigated area is very low (less than 5 per cent) while the percentage of households using traditional rice varieties in the rain-fed lowlands is still high (58.3 per cent). The share of traditional rice in the total growing area varies from 30 – 50 per cent.

Gross returns from rice production in the irrigated area are much higher than in the rain-fed lowlands (VND 8,827 and 5,849 thousand respectively). The percentage of net returns to farmers follows a similar pattern (41 and 26 per cent of gross returns respectively). Net returns include the profit and the family labour cost for paddy rice production. The cost composition is described in detail in section 3.5.

A study carried out by Oxfam (2001) on the poor communities shows that 8 million Vietnamese live in the poorest and remotest communes and about 6 million live in households that aspire to growing and eating more rice than produced on their own land. An overview of 95 households in the poor communes interviewed in depth is presented in Table 8.

4.4 Rice growing and food production

In recent years, rice production has rapidly developed in terms of area, productivity and output. In 2000, the area of land cultivated with rice was nearly 7.7 million hectares, 1.3 times

Table 8: Overview of rice farmer households from the poor communes (Tra Vinh and Nghe An Provinces)

Archetype	Characteristics
Net sellers, with **diversified** livelihood strategies	Produce enough to eat all year round, and sell some rice; have (irrigated) land; tend to be the better off in the remote rural communities. Some are (retired) officials or teachers. In the coastal south these households may diversify into (risky) shrimp farming.
Net buyers, with **diversified** livelihood strategies	Produce an insufficient quantity of rice for the households to eat all year round, but do also sell rice after harvesting to repay loans for inputs, school and health related expenditures; they have some irrigated land and may also grow dry-land rice (in mountainous areas); they may grow alternative staple crops (especially those living in mountainous areas) and they engage in wage labour, livestock keeping, gardening, fishing, petty trade, and so on.
Net buyers, non-diversified livelihood strategies	Produce an insufficient quantity of rice for the households to eat all year round, but do also sell rice after harvest to repay loans for inputs, school and health related expenditure; they have some irrigated land and may grow dry-land rice (in mountainous areas); they may also grow some other crops and keep some small livestock or do wage labour (especially in the lowlands in the South), but their diversification options are fewer. They may be caught in a debt-spiral.
Pure buyers, non-diversified livelihood strategies	The adult members of these households tend to sell their labour, on which they depend heavily; they may keep some small livestock and do some gardening. They lack resources for diversification, and tend to be the poorest, in both the lowlands and the mountainous areas. They may be too poor to be given formal or informal loans.

Source: Based on Oxfam (2001).

higher than the 1989 level, an average annual growth rate of 2.4 per cent. Rice productivity is 4.2 tons/ha, over 1.3 times higher than in 1989 (Table 9). Due to growth in productivity and cultivated area, rice output has increased by 1.7 since 1989, up to 32.7 million tons in 2000, equivalent to an annual average growth rate of over 5 per cent. However, the loss ratio during the harvest season in Viet Nam is high at more than 10 per cent, causing big losses for the sector. According to the GSO (2001), paddy rice production increased more than 60 per cent during the 1990s (4.6 per cent annually). The increase in national rice production is due to higher yields and greater cropping intensity. Yields have grown by almost 33 per cent (2.9 per cent annually), while cropping intensity has risen by 22 per cent (2.0 per cent annually). This indicates that higher yield is responsible for 57 per cent of the production growth, while increased crop intensity accounts for 38 per cent, contributing approximately 1.6 million hectares. This suggests that increased rice harvesting during the 1990s is mainly due to the cropping rate e.g. in some locations in the Mekong Delta farmers harvest three crops per year. The area devoted to rice cultivation actually declined in 2000 and 2001 (MARD, 2002). The small decline in cultivated area can be explained by production growth and the interaction effects (IFPRI, 2000).

The potential for yield increase is more difficult to estimate. The average annual yield has grown 2.8 per cent since 1985, at over 4.2 tons per hectare in 2001. These yield growth rates, however, may not be sustainable, and may depend on the use of chemical fertilizers. Pingali *et al*. (1998) argue that further increase in Vietnamese yields may be difficult to achieve. For example, fertilizer use expanded rapidly in the 1980s in response to

Table 9: Trends of rice and other food crop production in Viet Nam (1990-2001)

Year	Rice harvest (000' ha)	Paddy rice yield (Ton/ha)	Paddy production (000'Mt.)	Other food crop (a) area (000'ha)	Other food crop production (000'Mt.)	Vegetable & bean area (000'ha)	Annual industrial crop (b) (000'ha)	Perennial crop area (000'ha)
1985	5,704	2.78	15,875	1,103	2,523	369	558	451
1990	6,028	3.18	19,225	1,080	2,263	426	512	780
1991	6,303	3.11	19,622	1,145	2,368	426	543	782
1992	6,475	3.33	21,590	1,232	2,624	445	495	756
1993	6,559	3.48	22,837	1,237	2,665	475	567	807
1994	6,599	3.57	23,528	1,210	2,670	315	629	835
1995	6,766	3.69	24,964	1,206	2,607	519	717	1268
1996	7,004	3.77	26,397	1,214	2,821	565	694	1390
1997	7,100	3.88	27,524	1,231	3,094	596	728	1565
1998	7,362	3.96	29,142	1,178	2,714	623	808	1638
1999	7,648	4.10	31,393	1,220	2,860	660	892	1818
2000	7,666	4.26	32,530	1,222	1,868	660	729	1865
2001	7,485	4.27	31,970	1,264	2,429	699	741	1913
2002	7,486	4.55	34,063	1,380	2,639	712	805	1955

Notes: a/ Maize, sweet potato, potato, cassava
b/ Cotton, jute, rush, sugarcane, tobacco, soybean, groundnut

Source: GSO Statistical Data of Viet Nam Agriculture, Forestry and Fisheries 1975-2000, GSO Yearbook (2002).

market liberalization, but application rates in the two main deltas are now similar to those in other irrigated regions of Asia (Table 10). Furthermore, the high yields depend on labour-intensive cultivation methods that farmers may not be willing to continue as wage rates rise. In summary, chemical fertilizers contribute greatly to the growth in yield and potential growth in the future. This suggests that the environmental impact of an increase in rice cultivation is mainly through the use of chemicals.

Table 10: The growth of rice yield and rice production in other Asian countries

Country	1990		2000		Annual growth rate	
	Yield (ton/ha)	Production (mn* tons)	Yield (ton/ha)	Production (mn tons)	Yield (%)	Production (%)
China	5.7	192	6.3	190	0.9	0.0
Bangladesh	2.6	27	2.9	30	1.1	1.2
India	2.6	112	3.0	135	1.5	2.0
Pakistan	2.3	5	2.9	6	2.5	3.6
Philippines	3.0	10	3.2	13	0.9	3.4
Thailand	2.0	17	2.3	23	2.0	3.4
Viet Nam	3.2	19.2	4.2	32.6	2.9	5.4

**million*

Source: FAOSTAT (2001) and IRRI (2001).

Table 11: Average production cost, price, and profit of Vietnamese rice

	Red River Delta		Mekong Delta	
	VND/kg Paddy	USD/kg Paddy	VND/kg Paddy	USD/kg Paddy
Production cost	1,197.0	0.105	1,006.0	0.089
Material/machinery	778.5	0.069	754.4	0.066
Labour cost	418.4	0.037	251.5	0.022
Price sold	1,914.8	0.169	1,362.5	0.120
Profit	717.8	0.063	356.6	0.031

Source: Institute of Agricultural Economics (1997).

4.5 Rice production inputs, costs and returns

The production costs for Vietnamese rice are relatively low compared to other countries, especially in the two main rice bowls of the country, the Red River Delta and the Mekong Delta. In 1997, the average rice production cost was 1,197 VND/kg (US$ 0.105) for paddy rice in the Red River Delta and 1,006 VND/kg (US$ 0.089) in the Mekong Delta (Table 11).

Statistical data (ISG to MARD, 2001) show that the cost of production represents 34 to 42 per cent of gross revenue depending on the season and region. The remainder (58 to 66 per cent) is in the form of family labour and family owned land. Among the purchased inputs, fertilizer is the most important, accounting for 29 to 33 per cent of costs, followed by seeds, machinery, and agricultural land taxes. The share of expenses allocated to labour and machinery is almost twice as high in the Mekong Delta as in the Red River Delta, reflecting the differences in cultivation methods indicated above. However, rice farmers in the Red River Delta allocate a larger share of expenses to animal traction, cooperative fees, and irrigation.

Survey results (Table 12) show that the total costs and profits from rice production are consistent with the average statistics. In general, the gross returns or productivity and profit from rice production are low. The gross returns for irrigated rice are equivalent to US$ 600 - US$ 750 per hectare, and US$ 400 for rain-fed rice (2002). The profit is

Table 12: Average rice production costs and returns by region, agro-systems and rice variety, 2002-2003

Unit = 000'VND/hectare/crop

Indicator	Irrigated Red River Delta		Irrigated Central		Coast	Rain-fed lowlands, Central Coast		
	000' VND	Ratio (%)	000' VND	Ratio (%)	MV 000'VND	TV 000'VND	Total 000'VND	Ratio (%)
Gross returns	11,048	100.0	9,169	100.0	6,281	4,902	5,997	100.0
Fertilizer cost	1,461	13.2	1,346	14.7	1,255	718	1,112	18.5
Pesticide cost	295	2.7	383	4.2	468	8	346	5.8
Seeds cost	321	2.9	392	4.3	346	215	310	5.2
Irrigation cost	294	2.7	440	4.8	408	216	354	5.9
Agric. tax cost	425	3.8	279	3.0	200	200	200	3.3
Machine cost	686	6.2	789	8.6	726	648	698	11.6
Hired lab. cost	130	1.2	116	1.3	599	618	601	10.0
Family lab. cost	4,724	42.8	2,953	32.2	1,295	892	1,186	19.8
Profit	2,714	24.6	2,472	27.0	987	1,388	1,192	19.9
Net income		67.4		59.2	2,282	2,280		39.7

Note: MV = Modern Variety ; TV = Traditional Variety
Exchange rate (2002) US$ = 15.330VND
Source: Field survey data (2003).

therefore low in absolute value. The gross return structure indicates that the family labour costs account for the highest ratio in the gross returns, at 20 per cent for the rain-fed lowlands and 32 to 43 per cent for irrigated rice. The profit ratio from the gross returns is 20 per cent in rain-fed lowlands and 26 to 27 per cent for irrigated rice. In this study, the net income was composed of profit and the family labour costs. The survey results suggested that the total net returns from rice production share quite a high percentage of the gross returns. This is about 40 per cent for the rain-fed lowland rice and more than 60 per cent for the irrigated rice. A comparison between the modern and traditional varieties shows that these varieties produce the same net returns per hectare (2,280 VND). The traditional varieties produce a higher profit than the modern ones (1,388 and 987 VND respectively).

Fertilizer costs and irrigation fees seem to be the main factors that reduce profit in the rain-fed lowland. This explains why the traditional rice varieties are still maintained in the rain-fed lowlands. Among the cash costs (including seeds, fertilizers, pesticides, irrigation, taxes, hired labour, and machinery services) for rice production, fertilizer is the highest at 18.5 per cent for rain-fed lowland rice and 13 to 15 per cent for irrigated rice. Fertilizer costs for modern rice varieties in the rain-fed lowlands account for the highest percentage, and for traditional varieties the lowest, and the pesticide costs for traditional varieties is almost zero. This suggests that misuse of chemicals for rice relates mainly to the modern varieties.

Table 13: Inputs, yields and returns per hectare of triple rice farming in Dong Thap and Vinh Long Provinces, Mekong Delta, 1999

Items	Winter-Spring			Spring-Summer			Summer-Autumn			Total per year		
	Qty (kg)	Costs (000' VND)	% total costs	Qty (kg)	Costs (000' VND)	% total costs	Qty (kg)	Costs (000' VND)	% total costs	Qty (kg)	Costs (000' VND)	% total costs
A. Materials												
Seed	190	366	8.5	193	361	9.4	209	404	9.8	592	1,131	9.2
Chemical fertilizers		840	19.6		969	25.3		927	22.5		2,736	22.3
N	98			100			97			295		
P	48			57			53			158		
K	30			27			26			83		
Manure	0	0	0.0	0	0	0.0	0			0	0	0
Pesticides (ai.)	3.41	368	8.6	3.25	286	7.5	3.65	407	9.9	10.31	1,061	8.7
Fuel and others		129	3.1		169	4.4		151	3.7		449	3.7
B. Labour												
Family (m-d)	32	802	18.7	39	978	25.5	42	1,028	25.0	113	2,808	22.9
Hire (m-d)	13	983	22.9	14	1,071	27.9	12	1,203	29.2	39	3,257	26.6
C. Fixed costs												
Land tax		629	14.7		0	0.0		0	0.0	0	629	5.1
Water magt		171	4.0		0	0.0		0	0.0	0	171	1.4
Total costs		4,288	100.0		3,834	100.0		4,120	100.0	0	12,242	100.0
Rice yield (tons)	6.3			4.4			4.1			14.8		
Rice price (VND/kg)	1,701			1,680			1,640			1,674		
Gross return		**10,716**			**7,392**			**6,724**			**24,832**	
Net return		**6,428**			**3,558**			**2,604**			**12,590**	
BCR		1.5			0.9			0.6			1.0	

Source: Nhan et al. (2002).

Other findings in the Mekong Delta illustrate the different practices and rice cropping systems for inputs, yield and returns.[11] In direct-seeded practice, farmers usually apply high seeding rates of 200 kg/ha or higher (Table 13). Farmers apply high seeding rates to suppress weeds as the field levels are uneven, and to grow more panicles (branching cluster of flowers) and hence rice grains per unit area. Farmers used a lot of nitrogen (N) and phosphorus (P) but not potassium (K) for the rice crops. Doses in the Mekong Delta for nitrogen and phosphorus are much higher than recommended (i.e. 90-40-30). Farmers tend to apply more phosphorus in the wet season (WS) than in the dry season (DS) crop. A previous study showed that 70 per cent of farmers in different agro-ecological areas in the Mekong Delta apply nitrogen at higher rates than recommended, from 23 to 58 kgN/ha/crop.[12]

More recently, farmers are using more potassium, probably to combat disease resulting from unbalanced nutrient application in intensive rice culture, and improved technical knowledge. Farmers tend to use more potassium fertilizer (92 per cent higher) in triple rice than in double rice cropping. This finding can confirm that intensive rice farming requires a balanced nutrient supply and sufficient potassium. Secondary data show that farmers do not use organic fertilizers or manure for rice growing in the Mekong Delta.[13] Results from the same study (i.e. Cai Be District, Tien Giang Province and Thot Not District, Can Tho Province) indicate that pesticide use in 1994-95 was lower than in 1990-91 in both Tien Giang and Can Tho Provinces. More rice crops per year can result in heavier pesticide use. Nhan *et al.* (2002) reported that farmers applied more herbicides, insecticides (two times higher) and especially fungicides (three times higher) in triple rice cropping than in double rice cropping.

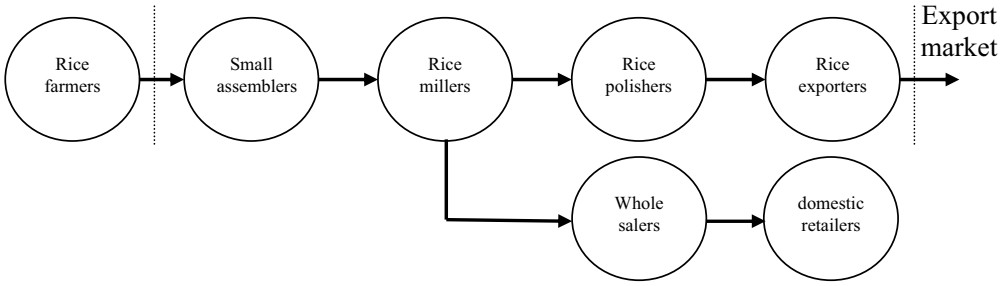
Of total production costs, fertilizer and labour costs are the most important. Labour input in the wet season crop is higher compared with the dry season because more labour is required for harvesting and the post harvest rainy season and annual monsoon floods. Financial analysis shows that there is an increase in gross return (GR), total cost (TC), net return (NR) and benefit-cost ratio (BCR), overall. This is because of the higher market prices of rice. Production costs, gross and net returns, and BCR are higher for DS than WS rice. Consequently, double rice growing produces a higher BCR compared to triple rice. Comparative analysis shows that the efficiency of fertilizer and pesticide investments is lower in triple rice than in double rice. These findings imply that rice intensification with more crops per year and higher agro-chemical investments are not the best economic option. Average rice yield in the dry season (or Winter-Spring crop) is 2-3 tons/ha higher than in the wet season (or Summer-Autumn crop) in most of the study sites. The wet season crop yield is low due to unfavourable natural factors (cloudiness, raining, high temperatures, drought and flooding), soil conditions (acidity and toxic substances emerging from the oxidation in deep soil from a low water-table, and poor nutrient status after the harvest), and the residue of rice pests from the previous crop. These are probably the main reasons why farmers use more phosphorus in the wet season than in the dry season. Moreover, the quality of rice produced in the wet season is usually lower than in the dry season, especially the second wet season crop, due to heavy rain, flooding and poor drying conditions.

4.6 The rice and input market system[14]

At the local level, rice and farm inputs are being sold and bought in larger quantities compared with the years prior to *Doi Moi*. Many traders of all sizes have entered the market, both state-owned and private. There are numerous marketing channels, but rice is typically channelled from the farmers to the export market through four levels: (i) retail dealers (assemblers); (ii) rice millers; (iii)

[11] Dang Kieu Nhan (2002).
[12] Vo Tong Xuan (1996).
[13] Dang Kieu Nhan (2002).
[14] Based on Oxfam (2001).

Figure 3: Typical marketing chain for rice in Tra Vinh Province



rice polishers; and (iv) rice exporters. These traders create a certain division of labour and finance in the rice market. The marketing levels that collaborate with each other and somehow share profit margins and losses are presented schematically hereafter.

4.6.1 Retail dealers (assemblers)

Some surveys indicate that private dealers *(hang xao)* account for more than 95 per cent of paddy purchases from farmers in every region of the country. This is consistent with current findings. In Tra Vinh, dealers use carts and boats to collect paddy directly from farmers, then they sell it to medium and large-scale rice millers. Many dealers with some financial means and transport are also farmers. The dealers often receive pre-payment at current market prices from the millers, after which they go to villages to buy paddy for a small profit.

4.6.2 Medium and large-scale millers

Medium and large-scale millers are concentrated in the "rice-bowl" area of the country – the deltas – and most millers are private enterprises. In Cang Long District (Tra Vinh Province), there are around ten millers with a processing capacity of about 5-10 tons per hour. These millers are located on the banks of canals or rivers and often own large boats for transporting the rice to and from other provinces.

The millers provide milled rice as a finished commodity for the domestic market and as a base material for polishers who process the rice for export. With the current low price of rice, the millers' main profits come from by-products like rice husk *(trau)*, broken rice *(tam)* and starch *(cam),* which is used as animal feed. Though a difficult business, the millers can continue their operations because they keep a limited stock and the price of rice increases or decreases gradually so they can adjust their buying and selling prices accordingly; and whatever the domestic or world market price, their services are needed.

4.6.3 Polishers

Rice polishers process the milled rice into export quality. One polisher often buys milled rice from several millers, depending on the prices in different locations. When rice exporters acquire contracts to export, they advance money (usually 70-90 per cent of the contract value) to the polishers, who then buy and process the milled rice for export quality (i.e. 5, 10 or 25 per cent 'broken' rice). In fact, to be safe, polishers usually act as 'processing agents' for rice exporters (though they may be independent private businesses or sometimes affiliates of the rice exporters). In the past 2-3 years, export prices were low, therefore profits from preparing rice for export were also low, and the level of export in 2000 and 2001 was lower than in 1999. Surviving polishers are now finding other ways to stay in the fiercely competitive market.

4.6.4 Exporters

Before 1999, all rice exporters were state owned enterprises (SOEs), including the regional food companies (VINAFOOD I & VINAFOOD II) and the provincial food companies. Most of these designated SOEs try to sign foreign contracts, after which they can allot money to the polishers for buying and processing rice for exports. The SOEs have the advantage over aspiring private enterprises in that they can borrow money from the bank without collateral. The deputy-director of the Tra

Vinh food and import-export company said: *'My company has no problem borrowing money for exporting rice. The bank is ready to lend us hundreds of billions of dong with an interest rate of 0.7 per cent per month.'* A number of SOEs also have milling and polishing facilities but just act as 'transaction offices', and their facilities operate at a minimum level. For example, some SOEs that are designated as rice exporters in the north just sign foreign contracts, buy polished rice in the south and export it with a high margin.

Traditional export markets are becoming increasingly restricted and it is more difficult to stay profitable in the rice exporting business. Weak export prices cannot cover the costs of SOEs for buying rice at the Government's 'floor price' of VND 1,300 per kg. Due to unstable export opportunities, SOEs are unable to guarantee contracts with farmers (i.e. buying commodities from the farmers at guaranteed prices and thus forming a designated base for exports), which is promoted and expected by local authorities. Under current liberalization of the rice sector, the SOEs that used to specialize in rice exports are now trying to diversify their operations in order to stay in business. Since 1999, several private companies started to engage in rice exports, but they were only operating on a small scale. Although restrictions have been lifted (no export quotas, no designated exporters), very few private exporters can currently operate on a larger scale, mainly because of the need for credit. Some private companies are specializing in organizing the complete production cycle for 'branded' high quality rice (e.g. the *Nang Huong – Cho Dao* brand).

4.6.5 Domestic marketing of rice

In all research sites, the main impression is that the domestic rice market is now well integrated. Even in Ky Son – the most remote district in Nghe An – price fluctuations and levels of milled rice are increasingly linked to that in the lowland. Better transportation and communication, and the role of private traders are the main drivers of this situation. Although the price is over 50 per cent higher in the remote hamlets compared with in the rice bowl of the Mekong Delta, considering the distances travelled and transport costs, this is seen as a small price difference.

Domestic rice marketing has been totally free since 1997. Generally, private traders dominate the local rice market, especially in the south. Rice retailers usually buy rice from farmers after harvesting or from wholesalers, and then transport it to their establishment to serve their local client base. Stabilization of the domestic rice market continues to be one of the most important objectives of central and local Governments, particularly in rice-deficit areas. For example, SOEs still play an important role in supplying and stabilizing the rice market in Nghe An by responding to local conditions and increasing the supply when needed (e.g. before *Tet*, New Year). The Nghe An Food Company and the provincial Company on Trade and Development Investment in Mountainous Areas ship milled rice from the south to Cua Lo, and then transport it to mountainous districts during rice shortages (e.g. before *Tet*). The Nghe An Food Company also keeps 5,000-7,000 tons of rice in stock for emergencies (i.e. natural calamities such as floods or severe drought). Therefore, in recent years, the rice market in Nghe An has been relatively stable.

4.6.6 Rice seeds

Most households studied use rice seeds from the previous crop for the next crop. It is estimated by Tra Vinh's officials that after one year or three crops, about 95 per cent of households in the province will exchange seeds with other farmers in the locality, i.e. 1.2 – 1.3 kg of normal paddy rice for 1 kg of a good locally produced variety. However, a seed market is not developed in all areas. Each household in each village/hamlet in rural Viet Nam uses a (slightly) different rice variety, or often a mixture of local varieties. Thus, as one official from Tra Vinh's DOT said, *'in every rice sack for export there are tens of varieties. That's why most of Viet Nam's rice for export is 'no name' rice. Logically 'no name' rice can only get a low price.'*

Authorities at all levels now consider the quality of the seed to be one of the most important ways they can help farmers improve the quality and value of agricultural products, and to decrease production costs. High yielding varieties (HYVs) are included

in the subsidized budget under Decree 20 and various national and provincial seed programmes in both Nghe An and Tra Vinh. Promoting the use of HYVs is one of the main tasks of agricultural extension services. Though HYVs are widely promoted, net rice sellers are often more aware of using HYVs than the others; and the use of HYVs by the poor farmers is still rather limited in the poor and remote areas (see section 2.5 on domestic support and subsidies).

4.6.7 Rice processing in the Mekong Delta

It is estimated that post-harvest rice loss is about 15 per cent annually in the Mekong Delta.[15] The figures for Tien Giang and Can Tho are more or less the same, i.e. between 13 and 17 per cent. This loss of rice is especially important in the WS crops due to heavy rain during the harvest, high water levels in the rice fields from rain and monsoon flooding. Also, rice-drying facilities (i.e. drying yard and drying machine) do not meet requirements. For instance, the total capacity of the drying machine in Can Tho only covered about 25 per cent of the total rice produced in the wet season.

Local capacity for milling and polishing rice is more than the total rice produced locally in both Tien Giang and Can Tho. Rice milling in these provinces is at about 40 per cent of capacity. The private sector has played a very important role in rice processing, contributing 61.9 per cent capacity in Tien Giang and 88.7 per cent capacity in Can Tho. However, most private sector rice mills are small-scale and out of date.

Low quality rice is still a marketing problem. A large number of farmers are still using extreme short duration rice varieties with poor grain quality, poor raw processing properties (i.e. drying and storage) and poor milling (small-scale and out of date rice mills). In the past, the Government has invested a lot of money in the Mekong Delta provinces for irrigation, but did not invest in applied research (i.e. seed production, pest management and fertilizer application) or extension activities. For instance, investment in irrigation comprised 94.7 per cent of total investment in the Tien Giang Province from 1996-2001. Growing high-quality and aromatic rice for export in the Mekong Delta in general, and in the provinces in particular, is now a high governmental priority.

4.7 Studies on promoting clean rice farming

Application of organic or bio fertilizers on rice was tested by Can Tho University and Dong Thap Muoi Research Center for Agriculture. These organic or bio fertilizers are *K-humate, CropMaster and Agrostim*. Findings from these studies have shown that use of organic fertilizers resulted in a 50 per cent reduction in the total amount of chemical fertilizers needed, and thus costs, and reduced incidence of the *Pyricularia oryzae* infection without significantly reducing rice yields compared to when chemical fertilizers are used. However, the effect of these organic fertilizers on rice yields was lower on acid sulphate soil than on alluvial soil (Tran et al., 2002).

Since 1996 Can Tho University has been implementing the use of a leaf colour chart (LCC) for the application of fertilizer in rice production. Results from multiple on-farm trials confirmed the yield advantage of using the LCC-based nitrogen management technique compared with normal farmers' practices (De, 1999). LCC-based fertilization for rice can save between 36 and 50 kgN/ha/crop while rice yields remain the same or higher. By applying this technique, the rice crop is less infected with pests and produces higher quality grains. This technique is now well incorporated with IPM.

The effects on rice yield of using composted rice straw incubated with *Aspergillus awamori* or *Trichoderma sp* were multi-location tested by Can Tho University. Experimental findings have shown that the rice yields where this rice straw fertilizer was applied were not significantly lower compared to rice produced using the recommended chemical fertilization formula (Phan, 2001). The study concluded that rice straw incubated with *Aspergillus awamori* or *Trichoderma sp* should be used alone or in combination with half the recommended fertilization formula to reduce chemical fertilizer use and sustain soil fertility.

[15] Oxfam (2001).

5. Integrated assessment results

5.1 Economic impacts

The impact of the reforms, including trade liberalization, on the Vietnamese economy has been tremendous, even though the reforms are still not completed. The Vietnamese economy grew rapidly at approximately 7-8 per cent per year between 1990 and 2000, despite a slowdown following the Asian crisis in 1997 (CIEM, 2001). Firm domestic credit policies, tight monetary policies and interest rate reforms stabilised the hyperinflation of the 1980s. The exchange rate remained relatively stable after the rationalisation of the multiple exchange rate system and successive devaluations. By 1992, the margin between the official and free market rates was virtually eliminated, although anecdotal evidence suggested the re-emergence of a 'grey' market in foreign exchange after the 1997 crisis (CIEM, 1998). The reform process began to slow down in the late 1990s. The largely demand-led growth in the early 1990s, in which the dominant force was the expansion of state-owned import substituting and non-tradable industries, proved unsustainable. The weaknesses in the Vietnamese economy, mainly in the large and inefficient state owned enterprises (SOEs) and the financial sectors, were starting to become evident in the mid 1990s, and were compounded by the Asian crisis in 1997 (CIEM, 2001).

In the rice sector, the impacts of the policy reforms are significant in terms of rice exports. The stable and high growth of rice production helps Viet Nam meet domestic demand and have a surplus for export. In the period of 1989-2000, Viet Nam exported nearly 30 million tons of rice, a turnover of more than US$ 7 million, equivalent to an average growth rate of about 13 per cent/year in terms of export volume and over 12 per cent/year in terms of export values. During recent years, Asian countries (including Indonesia, the Philip-

Table 14: Selected indicators of the Vietnamese economy

Indicator	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
GDP at constant 1994 prices (trillion.VND)	125.6	132.0	139.6	151.8	164.0	178.5	195.6	213.8	231.3	244.6	256.3	273.6
GDP growth (%)	4.7	5.1	5.8	8.7	8.1	8.8	9.5	9.3	8.2	5.8	4.8	6.8
Exchange rate (period average) (VND/US$)	..	..	10,037	11,202	10,641	10,966	11,038	11,033	11,683	13,268	13,943	14,167
Exports (mill.US$)	1946	2404	2087	2581	2985	4054	5449	7256	9185	9360	11540	14308
Imports (mill.US$)	2566	2752	2338	2541	3924	5826	8155	11144	11592	11499	11622	15200
Trade balance	-620	-348	-251	40	-939	-1772	-2706	-3888	-2407	-2139	-82	892
Trade as % of GDP	..	63.1	50.9	51.9	52.4	60.6	65.4	74.7	73.9	70.5	79.9	..
CPI Inflation	..	67.1	67.6	17.5	5.2	14.5	12.7	4.6	3.6	9.2	0.1	-0.6
GDP Deflator annual%	82.57	42.10	72.55	32.63	14.33	14.54	19.48	6.14	12.13	8.94	..	..

Source: Winters (2002) calculated from GSO statistics; CIEM (2001); IMF IFS (2001) for exchange rates.

pines, Singapore, Malaysia and Hong Kong) have remained the main importers of Vietnamese rice, accounting for over 50 per cent of total rice exports. Middle East countries (such as Iran and Iraq) are also big export markets for Vietnamese rice. In 2000, the volume of rice exported to Middle East markets accounted for about 30 per cent of total exports. At present, rice import demands from African countries remains low, indicating a potential to develop the market in this area.

5.1.1 Estimate of the impacts of trade liberalization[16]

The economic integration and trade liberalization policies have had enormous impacts on the national economy in general and the agricultural sector in particular. However, trade liberalization also created competition pressure on domestic production, strongly affecting traders, exporters and producers. In order to take advantage of the opportunities and limit the negative impacts of liberalization, it is necessary to evaluate the advantages and forecast the effects of further liberalization. In the ISG study (2002) a partial equilibrium model (PEM) was used to assess the impact of open trade on selected crops. The main purpose of the analysis was to prepare additional information and justification for the promotion of agricultural export commodities under the context of international integration.

5.1.2 Option P0 (base scenario for 2005)

Base scenario 2005 (Option P0) was designed to simulate production, distribution and marketing of Vietnamese rice for the year 2005 without further trade liberalization. Option P0 served as a reference to compare the different policy options.

Table 15: Viet Nam's rice export policy reforms and outcomes, 1989 – 2001

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Export quota (million tons)	-	-	-	-	-	2.0	2.0	2.0	3.5	4.0	3.9	4.0	-
Quantity export (million tons)	1.420	1.624	1.033	1.946	1.722	1.983	2.058	3.047	3.682	3.793	4.508	3.476	3.729
Export price (US$/ton)	204	187	228	214.3	210	214	257.6	285	242.1	265.2	222.0	187	179
Value of rice export (mill. US$)	290.0	303.7	235.5	417.0	361.6	424.4	530.2	868.4	891.3	1006.0	1023.3	654.4	667.3
Share of total export value (%)	-	17.54	11.53	16.85	12.11	10.47	10.2	11.85	9.75	10.75	5.68	-	-
High quality: Less 10% broken (%)	-	14.2	34.5	37.8	51.2	74.5	54.2	45.5	41	53	-	-	-
Share in world export (% volume)	-	13	7.9	12.1	23	24.6	26.8	18.8	21.1	21.1	16.4	18.1	-
Share in world export (% value)	-	3.7	3.4	3.6	3	5.4	3.8	5.8	5.2	7	-	-	-
World rice price index (1990=100)	112	100	109	99	88	100	119	125	112	113	-	-	-
Export tax (%)	10	10	1	1	1	1	3	2	2	0	0	0	0
Farmgate prices: (paddy, VND per kg)	-	-	-	994	1,215	1,137	1,704	1,441	1,468	2,029	1,739	1,481	1,316
Retail prices*: (milled rice, VND per kg)	-	-	-	2,092	2,100	2,325	2,418	2,790	2,707	3,411	3,162	2,718	2,534

* 1992-1995 Medium quality rice purchase prices of Vinh Long province; 1996-2000 prices in Mekong River Delta.
Sources: FAOSTAT (2001); IFPRI (1996); Ryan (1999); GSO Year Book (2001); GTAP version 5 (2001).

[16] Based on ISG to MARD (2002).

5.1.3 Option P1 and P2 (trade liberalization under Viet Nam's trade agreements)

To assess the impact of trade liberalization on the rice sector under Viet Nam's international and regional trade agreements, two trade liberalization options (P1, P2) were tested. Option P1 tested the implementation of the AFTA/CEPT, with a reduction in tariff rates from 20 to 5 per cent. The second option P2 was formulated to analyse the effect of the Viet Nam-US bilateral trade agreement where US rice import tariffs are reduced from 35 to 8.3 per cent.

5.1.4 Options P3 and P4 (rice supply restriction)

Options P3 and P4 tested the government policy of increasing and sustaining export prices with the effect of reducing the area of land planted with rice. P3 and P4 assumed a 10 and 20 per cent reduction in the harvesting area respectively. A PEM-simulated impact is summarized in Table 16 below.

The data in Table 16 suggest that trade liberalization has had a positive impact on the rice sector. However, the extent of the impact depends largely on the scale and dimension of the liberalization policy. Option P1 showed that AFTA trade liberalization brings significant benefits to the rice sub-sector. The fulfilment of AFTA commitments in terms of tariff reductions from 20 to 5 per cent brings about an increase in the export price of rice by 4 per cent. Export volumes also increase by 10 per cent. This could be explained by the fact that there is a relatively high demand for rice in ASEAN countries. The simulation result in Option P2 indicated that the effect of the USBTA seems to be negligible with respect to the rice sector because the effect of the supply restriction increases the price of Vietnamese rice. The reduction in the harvesting area increases the total added value accrued to the rice sector. Thus, the added value of 1.6 per cent is likely the highest level.

According to an evaluation by IFPRI and MARD (2000), Viet Nam has one of the lowest rice production costs in the world, indicating a competitive advantage in international markets. This can also be clearly shown in the competitive Domestic Resource Cost (DRC) of Vietnamese rice, especially in the Mekong River Delta. In the period 1995-2000, the average DRC of rice in the Delta is only 0.42 against 0.7 in the Red River Delta. Despite recent fluctuations in the world rice markets, Viet Nam maintains a strong advantage in rice export. Thus, when Viet Nam further engages in economic integration and trade liberalization, there are still many opportunities for it to increase its exports to other markets. Viet Nam’s rice exports showed signs of increasing in 2002 and 2003 (MARD).

Table 16: Estimated impacts of further trade liberalization in the rice sector of Viet Nam

Indicator	Base scenario (P0)	Tariff cut (P1, P2)		Supply restriction (P3,P4)	
		Difference: P1/P0 (%)	Difference: P2/P0 (%)	Difference: P3/P0 (%)	Difference: P4/P0 (%)
Rice supply price (VND/kg)	1,443	4.4	0.9	7.6	15.7
Rice supply quantity (000' ton)	35,169	1.1	0.2	-8.3	-17.0
Rice demand price (VND/kg)	2,643	3.7	0.7	6.4	13.2
Rice demand quantity (000' ton)	15,117	-1.7	-0.3	-2.8	-5.6
Rice export price (US$/ton)	166	4.2	0.6	6.6	13.9
Rice export quantity (000 ton)	4,543	10.4	2.1	-26.5	-54.7
VAD (Billion VND)	34,220	8.0	1.6	1.6	1.6
DRC	0.756	-6.9	-1.5	-11.2	-20.9
Exchange Rate (VND/US$)	11,358	-6.9	-1.4	-11.3	-20.8

Note: Base scenario for 2005 (P0):
P1: AFTA trade liberalization with tariff reduction from 20 to 5 per cent
P2: Viet Nam-USBTA: US tariffs against rice import reduced from 35 to 8.3 per cent
P3: 10 per cent reduction of rice growing area;
P4: 20 per cent reduction of rice growing area;
VAD: Value Added; DRC: Domestic Resource Cost.*

$$* DRC = \Sigma^{n}_{j=k+1} aij\ p^{*}_{j} / (pbi - \Sigma^{k}_{j=1} aij\ pb_{j})$$

Where:
- *j = 1,2..., k Trade input*
- *j = k+1, ..., n Domestic non-trade input.*
- p^{*}_{j} *Shadow price of the input*
- ^{pb}i *Boder economic price.*
- a_i *Technical coefficient*
- pj^{b} *Boder price*

Source: Thematic Group on Integration, ISG to MARD (2002).

5.2 Social impacts

5.2.1 Farmers' perceptions of the social impacts of rice intensification

Changes in rice farming in terms of production, inputs and outputs as a result of policy reforms create important social impacts. Rice farmers perceived changes in production and social issues in terms of intensive rice farming. In the PRA exercises in the Mekong Delta, farmers indicated that the rice yield tended to increase steadily through different farming periods: 20-25 years ago (farmers grew TV rice and began to cultivate MV rice), 10 years ago (double cropping in Can Tho and triple cropping in Tien Giang Provinces), and 5 years ago to the present.

The increase in rice yield resulted from improved technical knowledge and experience of rice farmers through the IPM programme and extension activities, well-levelled rice fields and less soil acidity. This impacted greatly on food supply, rice sales, rice inputs, family income, and employment of the poor. One of the most positive social impacts of rice intensification was more rice for family food and sales (Table 17).

However, a few farmers also complained that the amount of rice sold now was less than 5 years ago due to lower productivity, and that they had to sell more rice to cover production inputs. Furthermore, the remaining rice was not enough for their family supply. Rice intensification produces more rice but less income and fewer

Table 17: Different farmer groups' perceptions on production and the socio-economic impacts of HYR cultivation

Items	Sites	Small-scale groups			Large-scale groups		
		5 years ago	10 years ago	20-25 years ago	5 years ago	10 years ago	20 -25 years ago
Rice yield	1	-	- -	- - -	+	- -	- - -
	2	-	- - -	- - -	-	- - -	- - -
	3	++/-	- -	- - -	+/-	- -	- - -
	4	-	- -	- -	- -	- -	- - -
	5	0	- -	- - -	0	- - -	- - -
Food supply	1	-	- -	- -	++	- -	- -
	2	-	- -	- - -	-	- -	- - -
	3	++	- -	- - -	+	-	- - -
	4	-	- -	- -	0	- -	- - -
	5	-	- -	- - -	-	-	0
Rice sale	1	-	-	- -	+	- -	- -
	2	- -	-	- - -	- -	+/-	- - -
	3	- -	- - -	- - -	+	-	-
	4	- -	- -	- -	- -	- - -	- - -
	5	-	- -	- - -	-	-	-
Inputs	1	-	- -	- - -	-	- -	- - -
	2	++	+	- - -	+++	+	- -
	3	- - -	- -	- - -	- -	- -	- -
	4	++/-	+/- -	- -	- -	- -	- - -
	5	- -	- -	- - -	+	++	-
Income	1	++	++	-	++	- - -	- -
	2	- -	- - -	- - -	- -	- -	- - -
	3	++/-	- - -	- - -	+	- -	-
	4	+/-	- -	- - -	- -	- -	- - -
	5	+	- -	- - -	+++	+	-
Employment opportunities for the poor	1	+	++	-	++	++	+
	2	++	+++	-	++	+/- -	- - -
	3	-	+	- -	++	++	+
	4	++	++	- - -	+	++	- - -
	5	+	++	- - -	+	++	- -

Note: 0 = no change, +/- = higher (more)/lower (less), ++/- - = fairly higher (more)/lower (less), +++/- - - = much higher (more)/lower (less).
Source: Field survey data (2003).

employment opportunities for the poor. Six out of ten farmer groups indicate that current inputs for rice farming were higher than in the past. Moreover, seven out of ten groups perceived current rice farming as less profitable than 5 years ago due to higher agrochemical inputs and higher prices for materials and labour. However, some farmers were able to reduce input costs and increase their income after applying IPM or ICM (integrated crop management) techniques efficiently. Most farmers agreed that shifting to double or triple rice harvesting provided more opportunities for employing the poor. On the other hand, mechanisation for land preparation, seeding and harvesting and applying improved technologies (direct-seeding, levelling and less supplementary transplanting, using effective herbicides) have negative effects on the livelihoods of the landless poor who rely on hired labour.

Table 18: Changes in rice trade participation, income level, and income sources of rice farming households in the irrigated rice areas during the last five years, by region

Indicator	5 years ago			Current time (2002-3)		
	Average	Irrigated Red River Delta	Irrigated Central Coast	Average	Irrigated Red River Delta	Irrigated Central Coast
Households selling rice (%)	91.8	82.0	100.0	86.4	70.0	100.0
Households buying rice (%)	15.5	14.0	16.7	18.2	20.0	16.7
Net rice buyer households (%)	5.5	8.0	3.3	7.3	10.0	5.0
Net rice seller households (%)	89.1	80.0	96.7	83.6	70.0	95.0
Monthly income per capita (000' VND)	-	-	-	203.7	176.7	226.3
Rice production income (%)	54.3	46.9	60.6	47.4	40.4	53.2
Other crop production (%)	6.2	8.1	6.1	5.9	7.0	5.3
Livestock husbandry (%)	22.9	23.4	21.6	24.9	21.9	27.5
Non-farm income (%)	16.6	21.6	10.8	21.8	30.7	13.9

Note: Number of interviewed households in Irrigated Red River Delta, 50; Irrigated Central Coast, 60.
Source: Field survey data (2003).

The supplementary field survey in the irrigated rice ecosystems in the Central Coast and Red River Delta provided results consistent with data from the Viet Nam Living Standard Survey (VLSS) 1993-1998 and the qualitative studies in the Mekong Delta on farmers' participation in the rice trade and their income sources. Most rice-farming households participate in the rice trade (92 to 100 per cent). While the percentage of net rice seller households was high, it seems to have decreased during the last 3 years, from 89.1 to 83.6 per cent. The share of income from rice production also decreased from 54.3 to 47.4 per cent (Table 18). This indicates that farmers diversified production due to the low price of rice in 2000-2001. The data at national level also indicated a reduction of the total rice harvesting area (Table 9) in 2000, corresponding to the low price of rice during 1999-2000.

5.2.2 Assessment of the poverty rate in Viet Nam

There are two official sources of poverty data: the General Statistical Office (GSO) and the Ministry of Labour, Invalids and Social Affairs (MOLISA). GSO defines two kinds of poverty lines: the food poverty line and the total poverty line. These two

Table 19: Criteria applied to identify the poverty line in Viet Nam

Institution	Type of poverty	Poverty line	Criteria, time
GSO poverty line	Food poverty	107,000 VND/ Month (VLSS 1997-8)	To purchase food equivalent to 2,100 Kcal/man/day
	Total poverty	149,000 VND/ Month (VLSS 1997-8)	The food poverty accounts for 70% of total minimal expenditure
MOLISA poverty line	Rural uplands & Islands	80,000 VND/Month	Revised in 2001
	Rural Plains	100,000 VND/Month	Revised in 2001
	Urban Areas	150,000 VND/Month	Revised in 2001

Source: GSO and MOLISA (2002).

lines are defined in such a way that in real terms over time they are the same. Therefore, it is possible to compare poverty figures over the years. The database is the Viet Nam Living Standard Survey (VLSS). Since the first VLSS was a living-standard measurement survey carried out by the World Bank, the poverty lines of GSO are sometimes called World Bank Poverty Lines or International Poverty Lines.

On the other hand, MOLISA identifies the poor at commune level for the purpose of selecting target communes for poverty reduction programmes. The poverty line is defined by the amount of cash income that meets the minimum requirements. The poverty line is modified from time to time, making comparison over the years difficult. The latest figures as shown in Table 19 are applicable for the period from 2001 to 2005.

5.2.3 Changes in household income and poverty rates in Viet Nam over the period 1993-1999

Statistics from GSO and MOLISA indicated that in the 1990s, along with an annual economic growth rate of 7-8 per cent, incomes increased. This increase in income was combined with improvements in living standards and achieved a remarkable performance with respect to poverty reduction. The real total income of households increased by over 27.6 per cent between 1993 and 1998. Meanwhile, the income from agriculture increased 60.6 per cent (Table 20).

The level of poverty according to MOLISA poverty lines decreased from 30 per cent in 1993 to 15.7 per cent in 1998. According to the GSO food poverty line, poverty decreased from 20 per cent in 1993 to 13.3 per cent in 1999, along with a total reduction from 41.6 to 28.2 per cent (GSO total poverty line) over the same period. The decrease in poverty in rural areas was greater than in urban areas in absolute terms, although the percentage of reduction in rural areas was similar to that of urban areas. Over the period 1993 to 1999, total poverty decreased from 32 to 16.8 per cent in urban areas, and from 44.3 to 29.6 per cent in rural areas (total poverty line). This is because about 90 per cent of Viet Nam's poor live in rural areas (Table 21). The change in the gap between the rich and the poor may relate to wage rates and employment. Rice producers in better-off groups may benefit more from the higher price of rice because more of their rice is marketed. Unfortunately, data limitation constrained further analysis.

The regions that have a large number of poor are the Northern Uplands, the Mekong River Delta and North Central Coast. These three regions account for 70 per cent of the entire poor in the country. On the other hand, the regions that have the highest percentage of poverty are the Northern Uplands, the Central Highlands and the North Central Coast. In these regions, agriculture is the dominant economic activity. The level of poverty in the rural areas of all regions continues to be greater than in the urban areas. Poverty tends to be most concen-

Table 20: Sources of household income in rural Viet Nam, 1993-1998

Source of Income	Average household income (constant 1998 '000 VND)		Growth for 5 year (%)	Share in household income (%)	
	1993	1998	1993-98	1993	1998
Agriculture	2,867	4,606	60.6	37.2	46.8
Non-farm enterprises	1,443	1,884	30.5	18.7	19.2
Wage income	1,687	1,685	-0.1	21.9	17.7
Other income	1,710	1,663	-2.8	22.2	16.9
Total	7,707	9,838	27.6	100	100

Note: Official exchange rate in 1998: 1US$ = 13,297VND.
Source: World Bank estimates based on VLSS93 and VLSS98 (1999).

Table 21: Changes in poverty rates in urban and rural areas, 1993 - 1996 and 1999

Indicator	Area	1993	1994	1995	1996	1999
Food poverty rate (% total hhs)	**Viet Nam**	**19.99**	**18.06**	**16.50**	**15.70**	**13.33**
	Urban area	10.10	8.57	7.40	6.85	4.61
	Rural area	22.14	20.19	18.62	17.73	15.96
Total poverty rate (% total hhs)	**Viet Nam**	**41.64**	**38.43**	**34.44**	**31.31**	**28.21**
	Urban area	32.05	29.02	25.53	22.27	16.83
	Rural area	44.35	41.10	36.96	33.86	29.60
Gini Coefficient of the income quintiles[17]	**Viet Nam**	**0.350**	**0.359**	**0.367**	**0.354**	**0.390**
	Urban area	0.358	0.365	0.381	0.348	0.406
	Rural area	0.316	0.325	0.330	0.275	0.335

Source: Figures on social development in the Doi Moi Period in Viet Nam, GSO (2000), Multi-purpose household surveys of 1994, 1995, 1996, and 1999; and VLSS, 1998.

trated in mountain areas, remote areas, and areas with a high level of minorities and appears to be a localised problem. Due to family consumption needs, rice farmers in regions that are not favourable for rice production benefit little from increased rice trade since the amount of rice traded in these regions is low and therefore any benefits from increased prices are also low. Other issues may relate to extension programmes and/or investments for promoting rice production and/or exports in the rice development zones, currently the Mekong Delta, the Red River Delta, and the Coastal Lowlands.

5.2.4 The impact of trade reforms on poor households

Winters (2000) develops a framework for exploring the links between trade liberalization and poverty by considering the effect of trade liberalization on the prices of tradable goods and then of its impacts on household and individual welfare. In this framework, impacts of trade reforms trickle down to poor households via direct effects on product and factor markets, and indirectly through changes in government revenue and social spending. Trade-induced price changes in product markets affect both the nominal and households' real income in their capacity as producers as well as consumers. The lowering of tariff barriers is likely to reduce the price of imported goods, and at the same time export liberalization may lead to obtaining higher prices for exported goods. The direction and strength of these effects on real income depends on whether households are net buyers or net sellers of the products concerned.

Viet Nam's economy remains primarily agrarian, providing 70 per cent of employment. Thus, this is a key sector for poverty analysis. Price liberalization, de-collectivisation in agriculture and currency devaluations have had a huge impact on agricultural households as well as on consumers. In order to assess the impact of price changes on poverty, price movements in post-reform Viet Nam were studied. Then the effect of these price changes on households, first as net producers and then as net consumers, is analysed. The extent to which price changes affect welfare depends on the net supply

[17] The Gini coefficient of Ghana in 1988: 0.347; Thailand 1988: 0.479; Indonesia 1996: 0.356; and Malaysia 1995: 0.462.

position of each household expressed at current prices as a proportion of total expenditure: price changes in any commodity that has a large share in household expenditure or income (production) will generate relatively large welfare effects on households. Rice is the most important single source of income for the majority of Vietnamese households and accounted for about 30 per cent of household income in 1998 (VLSS).

Calculations from GSO statistics show the proportionate changes in the real retail prices of selected consumer goods and services (Table 22). It is clear that Viet Nam's leading export products such as rice and marine products saw relatively higher price increases during this period than other products. While it cannot be claimed that these price increases are due solely to trade liberalization, a strong trade component is probable.

In contrast to benefits to producers, price increases in consumer goods, especially rice, are bound to generate adverse effects on net consumers. According to VLSS 1992-1993, rice alone accounted for a 42 per cent share in total food expenditure. The figure is even higher for poor households who appear to spend 51 per cent of their food expenditure on rice. In addition, rice comprises about 75 per cent of the total caloric intake of a typical Vietnamese household (Minot and Goletti, 1998). Clearly the price of rice is a major determinant of poverty and deserves close attention.

5.2.5 Estimate of the impact of trade liberalization on poverty rates[18]

Various institutions have carried out a number of studies focusing on the social and economic impacts of trade liberalization in the rice sector of Viet Nam. The environmental impact is not generally incorporated. Among the most comprehensive studies are those conducted by the International Food Policy Research Institute (IFPRI). Nicholas Minot and Francesco Goletti constructed a quantitative model called the Viet Nam Agricultural Spatial Equilibrium Model (VASEM) to examine the impact of eliminating the internal rice trade restrictions and rice export quotas on household income and poverty by combining the results of the simulations with household data on rice marketing patterns.

Table 22: Price movements 1993 - 1998 (real prices in VND)

Consumer goods/services	Change	*Consumer goods/services*	Change
Mackerel	76.87	Fresh carp	0.90
Vitamin C	40.40	Shelled nuts	0.37
Sea shrimps	33.31	Black beans	-0.69
Fish sauce	32.53	Green beans	-1.95
Paddy rice	**26.15**	Soya curd	-1.99
Spring rice	**26.05**	Glutamate	-3.24
Salt	21.55	Soya beans	-3.66
Beef topside	21.30	Pork	-4.03
Glutinous rice	20.68	Kerosene	-4.44
Haircut	16.50	White sugar	-6.29
Cotton fabrics	13.75	Electricity	-17.78
Supply water	13.65	Vitamin B1	-18.17
Chicken carcass	11.80	Beer	-22.45
Duck's eggs	10.76	Photography	-25.23
Petrol	10.39	Woollens	-37.97
Papers	3.46	**CPI (% Change)**	**48.5**

Source: Yoko Niimi calculated from GSO (2002).

[18] Based on IFPRI (2000).

Table 23: Estimated effects of removal of internal rice trade restrictions and rice export quotas on household income and the poverty rate in Viet Nam

	Change in household income (%)		Change in poverty rate (%)	
Effects of removing internal rice trade restriction	*Poor households*	*Non-poor households*	*Maintained restriction*	*Removed restriction*
Whole country	-0.2	0.2	25	25
Urban areas	0.8	0.4	7.6	7.5
Rural areas	-0.3	0.1	29.4	29.4
Effects of removal of the rice export quota	*Poor households*	*Non-poor households*	*Maintained quota*	*Removed quota*
Whole country	1.7	1.4	25.0	24.7
Urban areas	-5.4	-2.6	7.6	9.1
Rural areas	2.1	2.7	29.4	28.6

Source: IFPRI (2000).

The elimination of internal rice-trade restrictions does not have a clear effect on poverty. However, it does increase the income of urban and non-poor households. The removal of rice export quotas shows a higher effect on household income and poverty. The real income of poor households (defined as the poorest 25 per cent) rose by 1.7 per cent. The real income of urban households, primarily net buyers, fell 2.6 and 5.4 per cent (poor and non-poor respectively) as a result of the higher prices associated with eliminating the export quota. The poverty rate rose in urban areas (from 7.6 to 9.1 per cent), while falling in rural areas (from 29.4 to 28.6 per cent). The overall poverty rate fell slightly from 25.0 to 24.7 per cent. The slight increase in urban poverty is possibly due to the increase of the price of rice as a result of the removal of trade restrictions. It may also relate to increased urbanization and rural-urban migration. Data on permanent migration is not available.

5.3 Environmental impacts

5.3.1 Strategic screening of environmental impacts of rice production and trade

A two-day stakeholder workshop on the integrated assessment of trade liberalization in the rice sector was held to introduce participants to relevant issues. The workshop included participants from research institutes, universities, local officers, extension workers, food and rice processing companies, rice traders, and representatives from rice farmers' unions. Presentations at the workshop reviewed the following topics:

- policy reform related to the rice sector and policy development for environmental protection since 1981;
- milestones and measures for rice trade liberalization and for global integration, including accession to the WTO;
- rice industry growth, exports, supply, demands and issues of environmental impact assessment;
- reviews of environmental impacts of rice cultivation practices, particularly from using inorganic fertilizers, pesticides, modern varieties, and irrigation;
- review of the social and economic impacts of rice trade liberalization;
- review of application of quantitative assessment in rice trade liberalization;
- options for integrating environmental concerns into rice cultivation practices.

It is clear that the reviewed research has mainly dealt with the technological and socio-economic impacts of intensification of rice production and trade but neglected (relatively) the environmental impacts. Related environmental data and references

come mainly from agricultural universities, agricultural research institutes and statistic offices. Addressing the environmental impacts is thus a new issue to the participants. The next step therefore was to focus on screening and quantifying the environmental impacts and integrate them with the socio-economic impacts.

Six thematic areas on the environmental impacts of rice production and rice trade were discussed:

– environmental impact of soil management and fertilization in rice cultivation;
– environmental impact of pesticide use in crop production;
– environmental impact of plant breeding and change in cropping system;
– environmental impact of traded goods in the rice sector;
– environmental impact of rice technology transfer;
– environmental impact of economic structure and environmental laws.

Participants worked in small groups to reach a common understanding and perform a group screening of the environmental impacts, followed by a plenary session. The overall impression was that the impact of rice trade liberalization was generally positive in terms of socio-economic impacts but negative in terms of environmental impacts. The outputs of the screening exercises are presented in Tables 24 and 25.

Rice intensification involves technological inputs and practice to increase rice productivity. The major strategies are to improve irrigation, increase cropping intensity, grow high yielding varieties (HYVs), apply higher levels of fertilization, and a greater use of pesticides. These are perceived generally as environmentally negative impacts, although some positive impacts were also indicated, such as improved agricultural land productivity and reduced pressure on forests. Rice intensification increases cropping, and farmers in most rice growing areas harvest two or three crops per year. Increased cropping provides more jobs and meets the food supply demand of the local population, thereby, reducing pressure on natural forest exploitation for food. Rice is a traditional crop that has been grown for centuries in Viet Nam, and intensification does not necessarily compete with forestlands.

Table 24: Strategic assessment of the environmental impacts of rice intensification in Viet Nam

Type of environmental impact	Specific impact	Change in rice varieties and cropping system	Change in pesticide use	Change in fertilizer use
Soil	Soil degradation	---	---	---
	Productivity (Integrated farm)	+++	++	++
Water	Water contamination	--	--	--
	Eutrophication	--	--	--
	Water resources	--	-	-
Air	Methane emission	-	--	-
	Dusts from processing	--	---	--
Forest	Clear forest for rice lands	--	0	-
	Pressure on forest exploitation	++	+++	+++
Biodiversity	Expanding rice lands	--	-	-
	Aquatic biodiversity	--	--	--
	Fishery resources	---	--	--
	Natural enemies	---	--	--
	Rice genetic resource	---	--	-
Human	Physical health	---	-	--

Note: (---/+++) negative/positive very important, (--/++) important, (-/+) not significant, (0) not clear
Source: Study data (2002)

Table 25: Strategic assessment of the environmental impacts of the growth of rice production and trade in Viet Nam

Impact determinant	Factors	Environmental impact	Function/ process/ explanation
Nature of goods	Increased rice production Increased rice export Increased chemical fertilizer use Increased pesticide use	-- -- -- --	Increased tradable goods involve processing, transport, and delivery of the harmful inputs e.g. pesticides and agro-chemicals
Technology transfer	Increased rice cropping Replaced rice varieties Changed fertilization New plant protection measures Increased machine operations Fields converted to aquaculture Fields converted to urban areas	- - ++ + - -- --	This was the nature of the new technologies adopted, among which only the improved fertilization and plant protection (e.g. IPM) was perceived as having mitigation effects
Economic scale	Competed water sources	-	Large economic scale
Large	Decreased efficiency of resources Invested to environment projects	-- ++	consumes resources and impacts negatively on environment except environmentally friendly projects
Economic structure	Increased rice share in agriculture Decreased share of agriculture	++ --	Urbanization and industry produced negative environmental impacts
Environment standards	Changed environmental laws Env. standards of technology Env. standard of agri. goods	+++ + +	Liberalization embedded international standards with national laws

Note: (---/+++)negative/positive very important, (--/++) important, (-/+) not significant, (0) not clear
Source: Study data (2002).

Screening of the environmental impacts of growth in rice production and trade indicates a generally negative impact on the environment. Trading activities involve processing, transportation and inputs, thereby producing a negative impact on the environment. However, the technologies transferred and adopted in rice farming can also help to mitigate the environmental impacts. For example, fertilization techniques and crop protection practices such as Integrated Pest Management (IPM) helps improve productivity and reduces the use of pesticides.

Growth in rice production and export creates a large scale of economic activity. This generally produces a negative environmental impact. However, trade liberalization and economic integration also requires the improvement of environmental standards and laws, and new systems of environmental management have been functioning since the 1990s. Such changes in organisational structure, regulations and environmental standards have a positive effect on the environment.

5.3.2 Farmers' perceptions of environmental impacts

The PRA applied in the Mekong Delta indicated that farmers perceived environmental impacts mainly through the increased use of agrochemicals. According to participatory scoring results, the effects of the use of agrochemicals were contradictory. Most farmers, both small and large scale, agreed that the increased use of chemical fertilizers was a consequence of intensification in rice production and lower soil fertility. However, some farmers thought the current use of chemical fertilizers (2002) was higher than ten or 20-25 years ago, but lower than five years ago. This was due to the application of IPM techniques and extension activities promoted by local Government. Participants agreed that there was greater use of

fungicide and herbicide because of the abundance of these products on the market.

Most farmers agreed there has been a negative impact on soil fertility, water quality of rivers and canals, and wild fish resources due to the intensification of rice cultivation. Intensive rice growing, with the continuous flooding of fields and not using organic fertilizers, is probably the main reason for soil degradation. Some farmers think soil fertility is improved from better levelling and less acidity. Even though insecticide use is generally low, river water is seriously polluted from the extremely toxic chemicals used to kill the "golden snail". Golden snail is a serious pest in freshwater rice areas in the Mekong Delta. The decline of natural fish resources is, according to farmers, partly due to over-fishing as a result of population growth, partly due to the use of toxic chemicals and partly due to field-water management for HYR. Farmers indicated that the occurrence of pests is currently less serious than plant diseases.

Table 26: Farmers' perceptions of the environmental impacts of HYR production and use of agrochemicals

Items	Sites	Small-scale groups			Large-scale groups		
		5 years ago	10 years ago	20 -25 years ago*	5 years ago	10 years ago	20 -25 years ago*
Chemical fertilizer use	1	-	- -	- - -	++	- -	- - -
	2	++	++	- -	- -	- - -	- - -
	3	- -	- -	- - -	- -	- -	- - -
	4	+/-	- -	- -	-	- -	- - -
	5	- -	- - -	- - -	-	- -	- - -
Insecticide use	1	-	- -	- - -	+	+	- - -
	2	++	++	- - -	+++	++	+
	3	++	+++	- - -	++	++	- - -
	4	+/-	++	- -	+++	+++	- - -
	5	+++	++	0	+	++	- - -
Fungicide use	1	-	- -	- - -	- -	- - -	- - -
	2	++	- - -	- -	-	- -	- -
	3	+/- -	- -	- -	- -	- -	- -
	4	-	- -	- -	+	- - -	- - -
	5	- -	- - -	- - -	-	- -	- - -
Herbicide use	1	- -	-	-	-	- -	- - -
	2	++/-	- - -	- - -	- -	- -	- - -
	3	- -	- - -	- - -	++	+	- - -
	4	+/-	- -	- -	- -	- - -	- - -
	5	-	- - -	- - -	0	-	-
Soil productivity	1	+	++	+++	++	++	+++
	2	++/- -	++/- - -	+++	++	++/- -	++/- -
	3	++	++	+++	++/-	++/-	++/-
	4	+/-	+	++	+	++/-	+++/-
	5	+	++	+++	++	++	+++
River/canal water quality	1	+	++	+++	+	++	+++
	2	++/- -	++/- -	+++	+	+++	+++
	3	++	++	+++	++	++	+++
	4	++	++	++	++	+++	+++
	5	+	++	+++	+	++	+++
Natural fish	1	+	++	+++	+	++	+++
	2	+++	++	+++	++	+++	+++
	3	++	++	+++	+	++	+++
	4	++	++	++	++	+++	+++
	5	+	++	+++	+	++	+++
Rice pest occurrence	1	++	++	++	+++	+	-
	2	++	++/--	- -	- -	- -	- - -
	3	++/- -	++/- -	++/- -	++	++	++
	4	++/- -	++/- -	- -	+++/--	++/- - -	+++/- - -
	5	++	+	+	+/-	++/- -	- -

Note: 0 = not change, +/- = more(better)/less(worse), ++/- - = fairly more(better)/less (worse), +++/- - - = much more(better)/less(worse)
*20-25 years ago = traditional rice farming and starting to grow HYR

Source: Field survey data (2002)

Table 27: Farmer perceptions of the environmental impacts of rice intensification

Type of impact	Irrigated rice, Red River Delta				Irrigated rice, Central Coast			
	Pos.	Neg.	Not sig.	Unknown	Pos.	Neg.	Not sig.	Unknown
On rice productivity (implied soil fertility)	86.0	8.0	6.0	0.0	68.3	20.0	11.7	0.0
On human living water sources	52.0	12.0	26.0	10.0	30.0	0.0	53.3	16.7
On human living environment (from improved irrigation)	56.0	12.0	2.0	30.0	90.0	0.0	10.0	0.0
On harvest of aquatic resources in the rice fields	0.0	**100.0**	0.0	0.0	0.0	51.7	48.3	0.0
On human physical health (due to increased use of pesticide)	0.0	96	4	0	0.0	**100.0**	0.0	0.0
On human physical health (due to increased use of fertilizers)	0.0	44.0	48.0	8.0	0.0	0.0	71.7	28.3

N.B: Figures are expressed in percentage of total respondents
Source: Field survey data (2002).

Results of the field survey in the Red River Delta and Central Coast show that farmers agreed there were some positive impacts on soil fertility, human water resources and the living environment from rice intensification within their settlement areas. These perceptions were based on the fact that rice yields increased continuously. Improvement in water management or irrigation and increased cropping intensity created favourable working conditions. However, it is necessary to note that the farmers may not have perceived that increased rice productivity may be due to continuously increasing

Table 28: Fertilizer consumption for all crops including rice, 1985 - 2001 (pure volume*)

Year	Total fertilizer (tons)	Total N fertilizer (tons)	N in urea fertilizer (tons)	Real domestic price (VND/kg N)	Urea fertilizer for rice		
					Quantity (tons)	Share in N fer. (%)	Share in total fer. (%)
1985	469,200	342,300	276,500	--	221,800	64.8	47.3
1990	560,279	425,379	352,379	11,326.72	322,746	75.9	57.6
1991	781,900	619,000	546,900	6,148.26	454,929	73.5	58.2
1992	766,400	541,300	448,800	5,232.77	381,207	70.4	49.7
1993	754,100	565,000	508,800	5,066.78	461,782	81.7	61.2
1994	1,184,900	874,900	754,200	4,043.00	545,770	62.4	46.1
1995	1,223,700	813,700	674,800	5,115.35	583,330	71.7	47.7
1996	1,484,500	995,300	818,300	4,778.74	628,451	63.1	42.3
1997	1,471,700	922,900	725,800	3,494.76	661,976	71.7	45.0
1998	1,856,900	1,186,100	925,800	2,879.09	712,341	60.1	38.4
1999	1,950,000	1,068,000	898,000	2,688.77	792,148	74.2	40.6
2000	2,097,000	1,158,000	973,000	--	758,963	65.5	36.2
2001	--	--	--	--	727,503	--	--

* The pure weight of nutrient element in the manufactured products, e.g. approximately 40 per cent nitrogen in urea fertilizer; 18 per cent P2O5 weight in the manufactured phosphorous fertilizer

Source: Calculated based on FAOSTAT, IRRI, 2001; and GSO Statistics, multiple years.

rates of fertilizer application. The impact on soil quality requires further study.

While improvements in human water resources and living conditions benefited from improved irrigation, the environmental impacts due to the use of chemical pesticides was negative on aquatic harvest and on physical human health. Negative impacts due to fertilizer use did not seem to be significant.

5.3.3 Impact of the use of chemical fertilizers

5.3.3.1 Fertilizer consumption for all crops including rice

There have been a number of studies to determine the threshold standards beyond which crop nutrient management may be considered uneconomic or inefficient.[19] These studies mainly dealt with irrigated rice and were supported by the Economic and Environment Programme for South-East Asia (on economically optimal rates) and the International Rice Research Institute (on rice nutrient management). The applications of these developments are presented in the following sections.

National data shows that the use of chemical fertilizers has increased dramatically since the 1980s. With the adoption of the "contract system", fertilizer use climbed to 376,000 tons (57 kg/hectare) in 1983 and to 544,000 tons (85 kg/hectare) by 1990. Since 1990, fertilizer use has increased three-fold, reaching 1.5 million tons (200 kg/hectare) in 1996 (FAOSTAT and GSO, 1996). This increase is attributed to the liberalization of fertilizer imports, falling urea/paddy price ratios, and increased rice cropping intensity (IFPRI, 2000). It was estimated that 75-80 per cent of total fertilizer consumption is for rice.[20]

Application of plant nutrients is around 170 to 182 kg/hectare. According to the VLSS, 92 per cent of farmers use chemical fertilizers. However, an IFPRI survey in 1996 showed that organic fertilizers were used by more than two-thirds of Vietnamese farmers, with wide regional differences. While more than 80 per cent of farmers apply organic fertilizers in the North and the South Central Coast, less than 30 per cent of farmers in the Central Highlands, the South-East, and the Mekong River Delta apply organic fertilizers.

Most farmers use insecticides. More than 80 per cent of farmers spray their own pesticides in the two deltas (Dung, 1994; Dac, 1996). Weeds are controlled more often manually than with herbicides, but more herbicides have been applied recently. Integrated pest management (IPM) was an important topic in research and extension activities during the 1990s. More information on IPM programmes is provided in the following section.

In recent years, Vietnamese farmers used about 2 million tons of fertilizer annually (pure volume), of which more than half was nitrogen (Table 28). The volume of imported fertilizers in manufactured products is around 3.5 million tons annually, of which the largest volume is for urea fertilizer (about 1.8 million tons). Domestic production (capacity) now satisfies just 4 per cent of urea and 50 per cent of phosphate fertilizer demands, but can satisfy (much more than) 100 per cent of demand of mixed nitrogen-phosphorous-potassium (NPK) fertilizers.

Data on fertilizer consumption specifically for rice is not available. However, fertilizer consumption has increased annually together with the expansion of rice production and the increase of fertilization rates. Urea appears to be the most common nitrogenous fertilizer for rice. In 2000, the total amount of urea used in rice cultivation was about 750 thousand tons, accounting for 65 per cent of nitrogenous fertilizer used for all crops in Viet Nam. The data in Table 28 indicates that urea fertilizer consumption for rice cultivation increased while the real domestic price decreased substantially. This can be seen as a partial effect from trade liberalization.

[19] Dung and Dung, EEPSEA (1996); Dung et al., EEPSEA (1997); Khiem, IRRI (1995); Hussain, IRRI (1995); and Dawe, IRRI (2000).
[20] MARD (2001).

5.3.3.2 Changes in fertilization rates

Information from previous studies (Dang Kieu Nhan *et al.,* 2002) on rice inputs, production costs, and returns was validated by PRA in the Mekong Delta. Among the key inputs, farmers are mostly concerned about the price of fertilizers, which can account for more than 20 per cent of total production costs. In recent years, the price of domestic fertilizers has stabilized, but the price of imported urea is volatile (this depends on world oil prices, which peaked in mid 2001 and are still high). Farmers thus face a double problem: the low price of farm outputs (rice) and the high price of (some) farm inputs. For example, farm-gate prices of imported urea fertilizers increased in 2000 by 10-30 per cent (i.e. from VND 2,000 to VND 2,200-2,600 per kg), while farm-gate paddy prices decreased by 20-30 per cent (i.e. from VND 1,500 down to VND 1,000-1,200 per kg). The main concern of farmers is how to raise enough money from selling their surplus paddy rice to pay for fertilizers. It can be seen from Table 29 that an increase of annual cropping rates (from two crops to three) substantially increases the use of chemical fertilizers and pesticides. While this practice contributes to increasing productivity, it reduces economic efficiency and increases the environmental impacts.

Due to weak prices for agricultural products, and huge overdue loans from sales agents (farmers cannot repay their credit), farmers reduced the use of fertilizers, creating serious problems for both importers and local manufacturers. To reduce production costs for farmers, in April 2000 the Government decided to lift import taxes and additional levies for urea, SA (super phosphate), kali and DAP fertilizers. In early 2001, the Government reduced the import tax for NPK from 5 per cent to 3 per cent and for phosphate from 10 per cent to 5 per cent. In April 2001, the Government lifted all restrictions on fertilizer imports (no import quotas and licences, no designated importers). As a result, most fertilizer prices on the market decreased by VND 200-400 per kg. The tariff reductions and liberalization of trade made the fertilizer market more competitive.

Besides the total exemption of taxes and levies on imported fertilizers, there are also proposals that the Government increase import taxes for NPK and phosphate fertilizers up to the level of the year 2000 to 'reduce difficulties' for domestic producers. This is a test for the Government in balancing the reasonable policy of protecting domestic production with the reduction of production costs for farmers in difficult times.

Table 29: Rice yields and use of agrochemicals for HYR production in the Mekong Delta in 1999

Items	2 rice crops	3 rice crops	3 crops / 2 crops difference (%)
Rice yields (tons/ha/crop)			
Dry season	6.3	6.0	-4.7
1st wet season	4.7	4.3	-8.5
2nd wet season	0.0	3.9	-
Total /year	11.0	14.2	29
Fertilizers (kg/ha/year)			
N	190	283	49
P	111	156	41
K	40	78	95
Pesticides (kg/ha/year)			
Insecticides	1.5	2.9	93
Fungicides	1.6	4.9	206
Herbicides	0.8	1.4	75
Fertilizer investment efficiency (kg paddy rice/kg N, P, K)			
N	62	56	-10
P	113	104	-8
K	472	268	-43
Pesticide investment efficiency (kg paddy/kg ai.)			
Insecticides	9.9	8.5	-14
Fungicides	12.6	5.0	-60
Herbicides	25.5	14.2	-44

Source: Nhan et al. (2002).

A review of previous studies showed that most research has dealt with technical recommendations.[21] Quantitative models applied for studying agrochemical inputs in rice were not available. Some case studies looked at the economics of the use of fertilizers and pesticides.[22] These provide basic information and methodology. Son and Hien (1995) estimated the N, P, and K rates for yield maximization and for profit maximization by using the regression model. They found that the economically optimum rates of fertilizer use were lower than the maximum yield rates.

5.3.3.3 Misuse of chemical fertilizers

The field survey in the Red River Delta and the Central Coast (2003) indicated that during the last five years, famers have increased the application rate of chemical fertilizers. Therefore, the increase in rice yield has depended very much on fertilization. Farmers in the Red River Delta used a higher rate of manure compared to farmers in the Central Coast (Table 30). This finding is consistant with the previous studies on fertilization. Farmers seem to be aware of the effectiveness of organic fertilizer. However, insufficient local supply and difficulty in transportation constrained farmers in increasing the use of organic fertilizer. In the rain-fed lowland area, organic fertilizer was hardly used. This was partly because the low yield could not cover the input costs. In traditional practices, farmers did not apply organic fertilizer because traditional rice was single cropped and fertilization effiency was generally low. Comparison with actual fertilization rates and the optimal production rate applied for irrigated rice (details presented in Annex 2) indicate that the surveyed farmers in the Red River Delta and in the Central Coast applied a lower fertilizer rate than the optimal production rate, especially for potassium and phosphorous, explaining why farmers and other stakeholders were not concerned with the environmental impacts of fertilizer use.[23]

Table 30: Optimum rate of fertilization, current rate and past 5-year rate for different rice seasons in the Lowland Central Coast and the Red River Delta

Rice ecosystem	Fertilization rate	N (kg/ha)	P2O5 (kg/ha)	K2O (kg/ha)	Manure (kg/ha)	Paddy yield (kg/ha)
		Winter-Spring crop				
Irrigated rice in Central Coast	Optimum prod. rate	93.0	58.0	69.0	3,000	5,480
	Current actual rate	83.8	42.4	42.2	3,147	5,480
	Past-5-year actual rate	75.1	35.2	31.0	2,823	4,982
Irrigated rice in Red River Delta	Optimum prod. rate	95.0	61.0	56.0	8,300	5,669
	Current actual rate	86.0	57.5	64.1	8,344	5,669
	Past-5-year actual rate	79.0	51.5	51.9	7,167	4,900
Rain-fed rice in Central Coast	Current actual rate	86.3	44.4	53.4	119	3,471
	Actual rate for MV	97.4	51.9	62.4	178	3,422
	Actual rate for TV	64.5	29.5	35.9	2	3,568
		Summer-Autumn crop				
Irrigated rice in Central Coast	Optimum prod. rate	88.0	42.0	45.0	2,900	5,057
	Current actual rate	90.2	40.6	38.7	2,946	5,057
	Past-5-year actual rate	73.6	34.2	33.3	2,607	4,602
Irrigated rice in Red River Delta	Optimum prod. rate	95.0	50.0	45.0	8,100	5,403
	Current actual rate	80.6	49.0	61.4	8,094	5,403
	Past-5-year actual rate	73.0	47.4	47.4	6,850	4,658
Rain-fed rice in Central	Current actual rate	94.4	49.2	74.7	0	3,691
	Actual rate for MV	104.8	52.6	85.8	0	4,072
	Actual rate for TV	56.3	36.5	33.7	0	2,295

Source: Field survey data (2003).

[21] Dung and Dung, EEPSEA (1996).
[22] Dung et al., EEPSEA (1997).
[23] Optimal fertilizer rate (for a rice yield identified) = Crop nutrient requirement - indigenous nutrient supply /first crop recovery of fertilizer.

Table 31: Economically optimal and actual rates of chemical fertilization for rice in Viet Nam

Agrochemical input	Spring rice, Red River Delta			Summer rice, Red River Delta		
	Optimal	Actual	misused	Optimal	Actual	misused
Nitrogen (kg N/ha)	100.8	121.9	12.13	91	95.99	4.99
Phosphorus (kg P_2O_5/ha)	66.2	61.68	-4.48	54.4	44.57	-9.83
Potassium (kg K_2O/ha)	20.2	29.11	8.86	15.6	24.66	9.06
Fungicides (g.a.i/ha)[24]	378	510	132	148	235	87
Insecticides (g.a.i/ha)	1376	1463	87	1286	622	-664

	Spring rice, Mekong Delta		
Nitrogen (kg N/ha)	86	113	27
Phosphorus (kg P_2O_5/ha)	113	57	-56
Potassium (kg K_2O/ha)	18	13	-5
Pesticides (g.a.i/ha)	743	1017	274

Source: Dung and EEPSEA group, IDRC (1997).

Another study carried out by researchers from the EEPSEA (Dung and Dung, 1996) dealt with the economically rational level of fertilizer used for rice in Viet Nam. It employed a regression model to relate farmers' economic profiles and pesticide exposure to identify health impairments that may be attributed to prolonged pesticide use. The negative effects on farmers' health were estimated by means of a dose-response function. Another EEPSEA research group (Dung *et al.,* 1997) applied production (regression) models to estimate the economically optimal level of inorganic fertilizer and pesticide use in the two Deltas (Red River in the North, and Mekong in the South). The misused amount against the economically optimal level was computed and valuated as an environmental cost. The findings indicated that the actual rates of nitrogenous and potassium fertilizers used in the Red River and Mekong Deltas were higher than economically optimal. The actual rate of pesticide use was also higher than the economically optimal rate (Table 31). The impact of pesticide use on human health is further discussed in the following section.

5.3.3.4 Estimation of the impact of trade liberalization on fertilizer use

An analysis of urea fertilizer use was conducted to determine the impact of trade liberalization on the level of imports and prices. The level of urea fertilizer consumption can be used as an indicator of the environmental impacts of rice production. The assumption was that domestic demand for urea was affected by market prices. Most urea used in Viet Nam is imported, so the world market price of urea has a strong impact on the domestic price. However, the extent of the gap between the imported and domestic price varies according to other factors such as transaction costs or those referred to as the "implicit" costs from the trade policy. A Partial Equilibrium Model was constructed for this analysis with the following functions and scenarios:

The demand function is defined as:

$$Ln(Q_t^D) = a_i^D + E_i^D \, Ln(P_{it}^D) \quad (1)$$

Where: Q_t^D is the domestic demand quantity of urea in year t
P_{it}^D is the urea price in year t
a_i^D is the intercept of demand function
E_i^D is the demand price elasticity

[24] Treatment Dose: gram of active ingredient per hectare

The relationship between the world and domestic prices was represented with:

$$P_t^W \, RER_t(1 + TAX_t^M) + MARGM_t + IMT_t = P_t^D \quad (2)$$

Where: P_t^W is the world market price of urea in year t
RER_t is a real exchange rate between VND and USD in year t
TAX_{it}^M; IMT_{it} are the import tax and implicit import tax on urea in year t.
$MARGM_t$ is the importer-trader price margin.

The base scenario (Po)

A base scenario served as a reference for comparison with the policy options. It was designed for year 2005, with the following assumptions:

– rice production, including cultivated rice area, agrochemical consumption for rice, rice yield and rice output increases at the same rate as for year 2002
– domestic and international rice markets are similar to year 2002
– fertilizer market and domestic production are the same for year 2002.

Scenario options

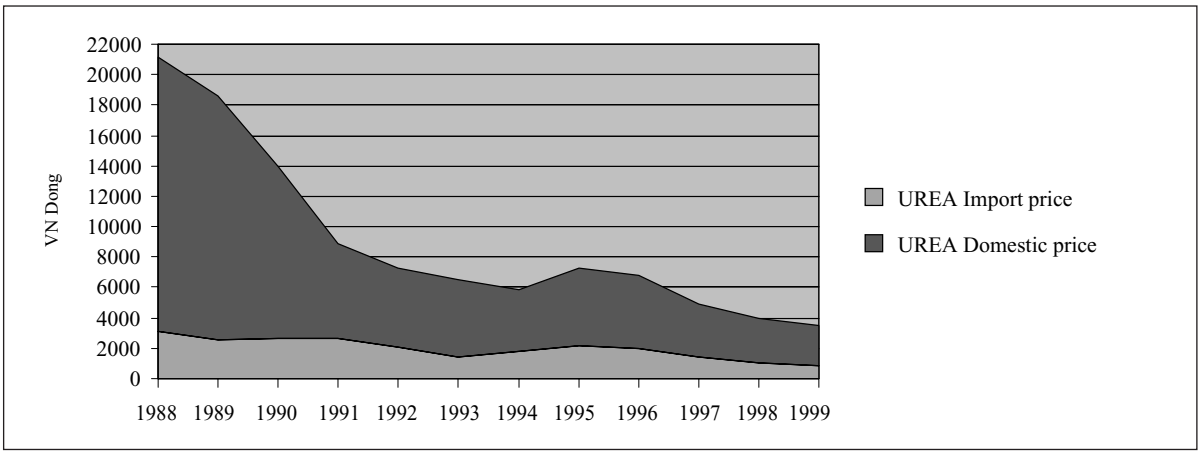
Further liberalization after removing the quotas would facilitate increased participation of the private sector and reduce the monopoly on fertilizer imports, promoting competition and thereby reducing implicit costs. As a result, the gap between the world and domestic prices of urea fertilizers would decrease by:

– scenario 1(OP1): 10 per cent
– scenario 2 (OP2): 20 per cent
– scenario 3 (OP3): 30 per cent
– scenario 4 (OP4): OP3 combined with 10 per cent cut of area cultivated with rice.

As shown in Table 28, the trend in urea consumption for rice production in Viet Nam increased from about 293 thousand tons/year in 1988-1989 to 546 thousand tons/year in 1994-1995, and to about 759 thousand tons in 1999-2000. As a result, the average consumption of urea per hectare increased almost three-fold in the last decade. The price elasticity of urea was relatively high (-0.76814), indicating that if the price of urea increased by 1 per cent, demand would decrease by 0.768 per cent. This was consistent with the domestic price trend of urea fertilizer. In contrast with the rice price increase, the urea fertilizer price decreased significantly in the same period from VND 7000 per kg in 1988-1989 to around VND 2000 per kg in 2001-2002.

Analysis of the relationship between domestic and international prices indicated that world prices were much lower than domestic prices and the

Figure 4: World-domestic gap in the price of fertilizer



Source: Author's elaboration (2003)

Table 32: Impact of further liberalization on urea fertilizer price and consumption

Indicator	Base scenario (Po)	OP1/Po (%)	OP2/Po (%)	OP3/Po (%)	OP4/Po (%)
UREA domestic price (VND/kg)	2538.8	-11.2	-14.3	-17.4	-17.4
Domestic production (tons)	35,000	0	0	0	0
Domestic demand (tons)	767,525	2.3	11.0	13.4	2.0
UREA import (tons)	732,525	2.4	11.5	14.0	2.1

Source: Author's elaboration (2003)

transmission of international prices to domestic prices was weak. The main factor explaining this finding was the non-tariff barrier, i.e. the monopoly of state-owned fertilizer import companies. For a long time, companies were appointed by the Government to import fertilizers. For example, before 1994 about 90 per cent of fertilizers were imported by the Agricultural Material Corporation (Vigegam). In 1994 and 1996 this figure was 70 per cent and 40 per cent, respectively. However, the monopoly and company inefficiency made for high transaction costs, resulting in increased domestic prices. For example, during the period 1988 – 2002, the average domestic price of urea in Viet Nam was 55.23 per cent higher than the world price. As a result of trade liberalization, particularly after non-tariff barriers were removed and private sector companies could participate in fertilizer imports, the domestic price of urea converged towards world prices, and the transmission of world prices to the domestic price has continued in recent years.

According to Table 32, it is clear that trade liberalization has had a positive impact on the fertilizer market in Viet Nam with the reduction of the domestic price of urea fertilizer, and a narrowing gap between world and domestic prices.

Simulation results indicate differences according to the scale and dimension of trade liberalization. For Option 1, if the gap between the world and domestic price is reduced by 10 per cent (equivalent to a decrease of 11.2 per cent in the price of urea), the demand for urea in Viet Nam will increase by 17,761 tons or 2.3 per cent. Similarly, if the price gap is reduced by 20 and 30 per cent (Options 2 and 3), these figures will be 84,351 tons or 11 per cent and 102,695 tons or 13.4 per cent respectively. When a 10 per cent reduction in rice area is combined with liberalization (Option 3), the demand for urea is higher than the base scenario of 15,673 tons or 2 per cent (Table 32). Scenario analyses using the PEM model indicated that further trade liberalization would cause the gap between the world (import) price and domestic price of urea to narrow faster, and demand would increase.

5.3.3.5 Impact of pesticide use

Rate of pesticide use for crop production including rice

Review of national data statistics from the National Plant Protection Department (PPD) showed that pesticide use has increased from 20,300 tons in 1991 to 36,589 tons in 2001 (Table 33). The dose increased from 0.67 kg per/ha to 1.13 kg per/ha, respectively. It was estimated that about 50 per cent of this amount was used for rice (Hoang Anh Cung, 1995). The level of pesticide use soared dramatically between 1991 and 1994, and recently the level of fungicide and herbicide use has been increasing at an even higher rate. The ratio of fungicide and herbicide use was approximately the same as insecticide. Pesticide use has not increased much in recent years, perhaps as a result of the expanding IPM programme and the campaign to encourage farmers not to spray at the early stage of planting rice. This is positive in terms of environmental impacts. According to the PPD, the 1995 level of pesticide use changed from 0.23-2.74kg/ha (Table 34). Pesticide use for rice production was less than for vegetables. When compared to developed countries such as Japan (14.30 kg/ha) and the Republic of Korea (10.70

kg/ha), pesticide use in Viet Nam is still low, similar to other countries in the area (e.g. Philippines: 1.56kg/ha) but higher than other developing countries such as Pakistan and Bangladesh.

Most pesticides used in Viet Nam in the past belonged to WTO Categories I and II, such as Methyl Parathion, Methamindophos, Fujione, Bassa, Padan and are banned under WHO regulations. However, these pesticides are cheaper. In addition, other pesticides not used in Viet Nam, or that are banned, are still sold broadly on the market. According to an inspection by the Sub-Plant Protection Department of Hai Phong Port (2000) 13.8 per cent of stores sell pesticides not on the list of pesticides allowed in Viet Nam, 18 per cent of stores sell banned pesticides, and pesticide smuggling still occurs. According to PPD (2000), pesticide imports before 1994 were restricted to between 7,500-8,000 tons of active ingredient (AI) and accounted for 30-62 per cent of total pesticides used per year. However 2,500 tons of AI pesticides were imported in 1997 and only 1,000 tons in 1999.

The EEPSEA study (Dung *et al.,* 1997) also identified the human health impact of pesticide use. The 1996-97 winter-spring crop survey revealed that 69.7 per cent of farmers were quite sure of the acute poisoning symptoms from pesticide exposure, while only 1.4 per cent of the respondents had no opinion on the effects of pesticide exposure. Interviews with the pesticide sprayers showed evidence of eye, skin, cardio-vascular and neurological effects, indicating a number of acute poisoning symptoms. Among the symptoms, the eyes, the neurological system (headache, dizziness) and skin effects were the most discernible. Farmers experiencing pesticide exposure over time may be confronted with several health impairments at the same time. The incidence of multiple health problems was significantly related to alcohol drinking habits, dosage and the number of contacts with insecticides, herbicides, and fungicides. Estimation of health impacts are summarized as follows:

– insecticides have significant negative effects on farmers' health according to the number of contacts rather than dosage;
– herbicides and fungicides impact substantially on farmers' health according to quantities used;
– the effect of smoking is not significant in all models, while drinking significantly influences health, especially headaches;
– age has a positive effect on headache symptoms; the general state of health is significantly related

Table 33: Total amount of pesticides used and average doses for all crops in Viet Nam

Year	Total ton of products*	Pesticide %	Fungicide %	Herbicide %	Dose Kg ai/ha/crop
1991	20,300	83.3	9.5	4.1	0.67
1992	23,100	75.4	7.0	15.6	0.77
1993	24,800	72.7	9.1	15.6	0.82
1994	20,380	68.3	15.4	12.5	0.68
1995	25,666	64.1	13.5	19.4	0.85
1996	32,751	53.0	23.0	22.0	1.08
1997	30,406	50.5	23.9	25.0	1.01
1998	42,738	47.9	24.3	26.7	1.35
1999	33,715	48.3	23.1	26.9	1.05
2000	33,637	50.1	27.4	19.7	1.02
2001	36,589	47.3	29.5	21.7	1.13

* Manufactured products (used in the field) contain approximately 20-60 per cent of active ingredient (AI)
Source: PPD (2002)

Table 34: Average dose of pesticides used for rice in national regions of Viet Nam

	Dosage (kg/ha)			
Region	Insecticide	Fungicide	Herbicide	Total
Mountain Region	0.20	0.03	-	0.23
Midland Region	0.54	0.11	-	0.65
Red River Delta	0.32	0.67	0.11	1.15
Central North Region	0.41	0.44	0.12	0.97
Central Coastal Region	1.14	0.65	0.95	2.74
Mekong River Delta	1.42	0.49	0.35	2.66

Source: PPD (1995).

to health impacts, except for the combined ailment effects.

Integrated Pest Management (IPM) in Viet Nam

In the early 1980s, the FAO (Food and Agriculture Organization of the United Nations) developed an Integrated Pest Management (IPM) Programme for rice in South and South-East Asia. Viet Nam's National IPM Programme (IPM-FFS) began in 1992 and is connected with projects supported by the FAO, IRRI, the BUCAP Programme, PPD, DANIDA and other institutes and organisations. The general objective of the programme is to enhance farmers' knowledge, and improve cultivation and pest control techniques that help farmers make field-based decisions. The National IPM programme has been carried out in 61 Provinces and cities throughout the country. A follow-up study of the IPM-FFS programme and a practical survey found that the amount of pesticides used (especially insecticides) decreased by an average of 50 per cent. IPM-FFS participants' profits rose from 15 to 20 per cent because their insecticide, fertilizer and seed costs decrease while yields remained as high or higher due to better crop management.

After IPM training, farmers are ready to apply other models such as rice/duck, rice/fish cultivation as well as IPM techniques for other crops such as peanuts and fruit. The activities of the IPM programme strengthen farming communities and unions at the village level. Hundreds of IPM clubs have been established and illustrate the socialization of IPM and other agricultural production activities. The IPM programme not only helped participants to understand the environmental preservation and conservation issues better, but also to build visions for a beautiful country and a clean agricultural environment for the future.

Pesticide use as a result of IPM implementation

The Integrated Pest Management programme is based on the principle of protecting the ecosystem by taking advantage of natural enemies to control pests, reduce the use of pesticides, grow a healthy crop resistant to disease and compensate for damage caused by disease and pests. As of 2001, 19,224 farmers have graduated from IPM-FFS training (Programme Advisory Committee, 2001). After training, farmers significantly decreased insecticide use. The Vinh Phu Sub-Plant Protection Department (1999) reported that IPM implementation on rice has brought about remarkable effects (Table 35).

Pest and fertilizer management was carried out by the PPD in the 2000-2001 Winter-Spring season in the Phu Loc Commune, the Tam Binh District, and the Vinh Long Province. Other measures also attained good results, including a sparse sowing model (120kg/ha), fertilizer applied by calorimetric measure and no insecticide spraying during the rice season. These models of production reduced costs

by about VND 412,000/ha, and gained full support from all participating farmers.

5.3.3.6 Degradation of genetic diversity of rice

Degradation of rice genetic resources was a concern indicated in the stakeholder workshop. While replacement of traditional rice varieties (TV) with modern varieties (MV) has been the major contributor to increased rice yield and production, this creates pressure on rice diversity and causes the loss of traditional rice cultivars. A survey carried out in 2001 by MARD showed that the number of TVs, though still high, was now much lower than modern varieties (Table 36). The area planted with TV rice is decreasing, accounting for 3.6 to 21.4 per cent of the rice growing area depending on the region. The survey also indicated that most irrigated rice lands were planted with MV rice, which requires application of high rates of chemical fertilizers and pesticides. TV rice is maintained in parts of the marginal rain-fed environments such as uplands, coastal sandy and flood-prone areas. Here farmers apply very low rates of fertilizer and almost no pesticides for TV rice cultivation. The declining cultivation of TV rice indicates negative environmental impacts in terms of reduced genetic resources for rice and the increased use of chemical fertilizers and pesticides.

Statistical data for the Mekong Delta shows that high yielding rice (HYR) occupies 75 per cent of the well-irrigated land area (MARD, 2002). Double rice cropping is still dominant (accounting for about 59 per cent of the total area) while single cropping (including HYR with medium growth duration) and triple cropping are minor, covering 31 and 10 per cent respectively. Due to the Government's "rice fist" policy (rice production promoted for food security and export as discussed in preceding section), between 1985 and 1999 HYR has replaced TV rice in most areas. Study findings indicate that the area planted to TV rice decreased by 91 per cent while the area for HYR increased by 263 per cent from 1975 to 1985 (MARD 2002).

Table 35: Results of IPM application and pesticide use

Area	IPM field	Non- IPM (farmer) field	Difference (%) IPM/Farmer field
Pesticide cost (VND/ha)	218,500	388,410	-43.7
Yield (kg/ha)	6,264	5,980	4.7
Gross return (VND/ha)	9,033,525	8,601,075	5.0
Total cost (VND/ha)	4,025,100	4,306,860	-6.5
Income (VND/ha)	4,978,425	4,294,215	15.9

Source: PPD of Phu Yen District (2000).

Table 36: Number of TV rice cultivars and growing area of TV rice in the cropping year 2000-2001

National region	Winter-spring crop			Summer-autumn crop		
	Number of MV	Number of TV	TV growing area in '000ha	Number of MV	Number of TV	TV growing area in '000ha
Northern	160	38	41.9 (3.6)*	145	73	161.2 (11.5)
Central	116	13	8.8 (4.2)	126	41	59.1 (21.4)
Southern	167	21	136.8 (8.4)	147	27	73.3 (4.7)
Total			187.5 (6.2)			293.6 (8.9)

**Note:* The numbers in parenthesis show the percentage of area planted to TV rice.
Source: MARD (2002).

5.3.3.7 Natural resources and the environment

Changes in forest cover

An environmental study by the ISG to MARD (2003) indicates that from 1943 to 1993, forest cover in Viet Nam decreased from 14.3 million to 9.3 million hectares - an average loss of 100,000 ha/year. The main causes of this are deforestation due to slash and burn agricultural practices for expansion of food production, degradation due to "agent orange" used during the war, and forestry development in timber production. The Government then implemented Programme 327 on forest conservation and management, a five million hectare reforestation programme, and promoted plantation activity. The total forested area (including plantations) increased to 11.3 million hectares. Plantation land has almost doubled - from 0.7 million hectares in 1990 to 1.6 million hectares in 2000. The Government has set a target for forest coverage to be expanded by at least 43 per cent by 2010, and natural forest extraction has been restricted.

Between 1995 and 2000, changes in the use of natural resources in Viet Nam indicate a general improvement in environmental conditions, especially the expansion of forest cover by 3.1 and 37.5 per cent for natural forest and plantation forest respectively (see Table 37). The area planted with rice increased by 3.7 per cent, while total forestry lands increased by 7.3 per cent. This implies that the increase in rice production and export was not necessarily associated with natural resource degradation in terms of forest cover. However, there has been a 15.5 per cent loss of mountain and wetland ecosystems rich in biodiversity. Other data on land use changes further indicate an overall environmental improvement (Table 37). This data supports the strategic screening process presented in the preceding section that rice cultivation reduces pressure on forest exploitation to support livelihoods.

National statistics on total land composition do not seem to be consistent, and field observation has indicated that there are complexities and confusion in distinguishing between the forested land (with hills) and mountainous-forested land. An increase of forestlands, including natural forest cover, may account for the decrease in land defined as mountainous. The decrease of wetlands was

Table 37: Changes in land use and different types of forest cover in Viet Nam, 1995-2000

Indicator	1995		2000		Difference
	Size in (000' ha)	Ratio in (%)	Size in (000' ha)	Ratio in (%)	2000/1995 (%)
Agricultural lands	7,994	24.3	9,345	28.4	16.9
Paddy rice lands	4,114	12.5	4,268	13.0	3.7
Other annual crop lands	1,510	4.6	1,862	5.7	23.3
Perennial crop lands	1,418	4.3	1,974	6.0	39.2
Aquaculture lands	453	1.4	557	1.7	23.0
Forestry lands	10,795	32.8	11,581	35.2	7.3
Natural forest cover	9,479	28.8	9,771	29.7	3.1
Planted forest cover	1,316	4.0	1,810	5.5	37.5
Specialized lands	1,271	3.9	1,533	4.7	20.6
Settlement lands	440	1.3	443	1.3	0.7
Urban residential lands	57	0.2	72	0.2	26.3
Rural residential lands	383	1.2	371	1.1	-3.1
Other mountain and water lands	9,980	30.3	8,432	25.6	-15.5

Source: General Administration of Land (2001).

probably due to the conversion of wetlands for aquaculture or integrated farming. Data on aquaculture and wetlands need to be updated, but the expansion of aquaculture has been a critical issue in recent years.

Loss of biodiversity

Viet Nam is one of the world's 10 most biologically diverse countries, and contains about 10 per cent of the world's species of fauna and flora, even though the country covers less than 1 per cent of the earth's surface. In terms of fauna diversity, 275 mammal species and sub-species, 828 bird species, 82 amphibians, 258 reptilian species and over 5000 insect species have been recorded. Flora diversity is evident in the 13,766 reported species of plants, of which 2,393 are lower plant species and 11,373 are flowering plant species. The freshwaters of Viet Nam are also rich in flora and fauna biodiversity, including species of fish, shrimp, crab, snail, mussels, amphibians, insects and plants. There are about 544 species of fish in Viet Nam, of which an estimated 35 are endemic. In addition, there are 52 species of crab and shrimp, of which 27 are considered endemic. Mounting pressures from population growth, dam and road construction, and expansion of agricultural lands are resulting in serious habitat losses. Mature natural forests have been damaged or destroyed, logged, cleared and replaced by plantation forests. This habitat loss is threatening the country's biological diversity. Not surprisingly, according to government statistics, of all Viet Nam's endemic species, 28 per cent of mammals, 10 per cent of birds, and 21 per cent of reptile and amphibian species are endangered due to habitat loss and hunting. Wetlands are among the most threatened habitats in Viet Nam, with half of globally threatened birds in Viet Nam dependent on this ecosystem for their survival. However, wetlands have not yet gained official recognition as a distinct land-use or conservation management category. In 2000, the National Environment Agency (NEA) identified 79 wetlands of national importance of which only 16 are included within decreed special use forests.

Water pollution

Trends indicate that biochemical oxygen demand (BOD) and ammonium nitrate (NH_4-NO_3), both indicators for measuring organic pollution, vary widely and exceed national water quality standards several-fold (NEA, 2000). Problems are worse during the four-month dry season when river flows are reduced. Results of the current study suggest that pollution is most obvious in locations where rivers flow through urban and industrial centres. Groundwater is emerging as an important source of water for domestic, industrial, and agricultural uses. It is estimated that 20 per cent of the ground water reserves (50-60 billion m^3) are currently being exploited. While the quality of ground water remains good, there are some pockets of contamination. There is evidence of pollution from poorly maintained septic tanks, garbage dumping, and industrial effluents and overexploitation in parts of Hanoi, Ho Chi Minh City and the Mekong Delta. Saltwater intrusion into ground water aquifers is observed in about 15 coastal provinces. In some neighbourhoods of Hanoi, overexploitation of ground water is causing land subsidence. NEA's National Marine Stations, which monitor coastal water quality, report an increase in some pollutants while others remain steady. The three critical pollutants are oil, pesticides, and faecal matter, and contamination fluctuates widely. Pesticide concentration measured between Cua Luc and Quy Nhon appears to be within the permissible range. Total coliform ranges between 0 and 201,500 (MPN[25])/ 100 ml, indicating that coastal waters vary from very clean to very dirty.

Soil degradation

Land degradation in Viet Nam can be attributed to a variety of causes including urbanization, insecure land tenure, poor logging practices, drought, expansion of aquaculture and agriculture. About 50 per cent of Viet Nam's lands have been identified as having poor quality soil as a result of human activity. Viet Nam's many steep slopes and burnt areas are susceptible to soil erosion during heavy

[25] Most probable number.

rains. The eroded topsoil is carried away and deposited as silt in rivers, lakes and estuaries, and the rich diversity of organisms is lost. Potential soil erosion ranges from 50-3,200 tons/ha/year and affects about 23 million hectares, 70 per cent of the country's land area. Salinization and acidification are observed in the plains and coastal areas, but are most common in the Mekong Delta region. Recently, a number of irrigation works and hydroelectric dams have diverted the flow of rivers. One consequence of this is saline intrusion into groundwater in estuary areas such as Thai Binh, Hai Phong, Quang Ninh Provinces in the North, and the Mekong Delta region in the south. This salinization not only affects drinking and industrial water, but also threatens ecosystems and agricultural systems. The severity of the salinization depends on the topography and flow, with areas such as the Mekong Delta affected more than the Red River Delta. The exposure of coastal acid-sulphate soils in estuarine areas through the development of coastal aquaculture for example, causes acidification of land and water. The area of such soils has reduced from 2.1 million hectares in 1980 to about 1.5 million hectares to date.

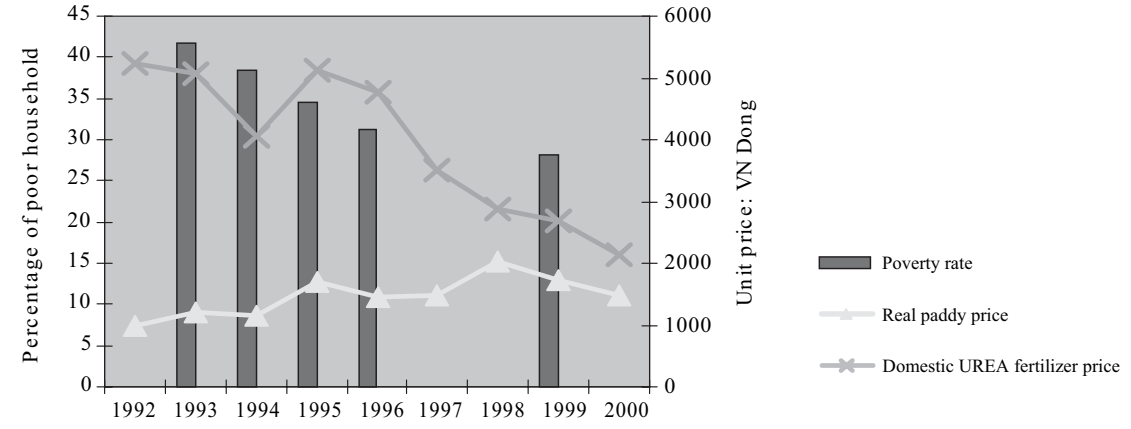
In summary the negative impacts of expanding rice production, processing and export, and the excessive use of agrochemicals include:

– loss of rice genetic resources
– soil degradation and water pollution
– loss of natural resources, habitat and biodiversity.

5.4 Integrated impacts

The reform process during the 1990s, including trade liberalization, has resulted in significant changes in rice production and export. These changes have had important positive impacts on the economy, food security, and poverty reduction, but mainly negative environmental impacts. However, many of the effects of trade liberalization are interlinked. For example, an increase of the real income of the poor (by 27.7 per cent from 1993-1998) resulted from the increase in the price of rice and the boom in rice production and export, which in turn is partly due to the decrease in fertilizer prices or the rice/fertilizer price ratio. The poor benefited both as producers and employees. The food poverty rate declined from 20 to 13 per cent from 1993-1999, and the total poverty rate from 42 to 28 per cent, while equity between rural and urban areas also improved as rice producers benefited from growth in the rice sector. These impacts provide the incentive to continue policies that promote rice production and export. However, the negative environmental impacts of rice expansion and intensification suggest that the socio-economic improvements due to rice production are not sustainable.

Figure 5: Trends of rice price, fertilizer price and poverty



Source: Author's elaboration (2003)

First of all, the increase in the price of rice and the decrease in the price of agrochemical inputs resulted in higher levels of agrochemical use. This contributed to soil degradation, water pollution, loss of agrobiodiversity, loss of aquatic habitat and freshwater fishery harvests, and negative impacts on human physical health, particularly on the poor and less-educated farmers. Secondly, expansion of the area planted with rice will create pressure on the remaining forests and wetlands, which are particularly rich in biodiversity. Many local communities depend upon this biodiversity for their food and living environment. Thirdly, rice intensification has led to the replacement of traditional rice varieties by modern varieties. All of these environmental impacts will sooner or later incur economic costs, for example for water purification, soil rehabilitation, health treatments, response to increasing natural disasters, etc.

In addition, scenario analysis showed that further liberalization would result in further reduction of the domestic price of urea fertilizer, which is good for rice production and export but implies a higher level of environmental damage. Moreover, the study has demonstrated that the current levels of fertilizer and pesticide use are not economically optimal (i.e. a lot of agrochemicals are wasted), so that a reduction of their use would make both economic and environmental sense. Therefore, measures to moderate the level of agrochemical consumption should be developed.

Suggestions emerging from this study include: (i) taxing or banning of the most harmful agrochemicals (pesticides); and (ii) the provision of technical support and research (within the green box category) to promote organic farming for clean rice production. Initial findings indicate that clean rice production costs less (no agrochemical inputs), offers more scope for using traditional rice varieties, has less negative health impacts, is more environmentally sustainable, and possibly achieves higher prices. However, more knowledge, increased extension activities and more labour may be required. In addition, slightly lower rice yields may be expected.

5.5 Valuation of impacts

5.5.1 Economic valuation of policy change

Ryan (1999) developed a framework for the evaluation of policy research and to assess the impact of IFPRI's research on assessing the impact of alternative internal and external trade policies for rice production in Viet Nam. The policy assessment framework measures the economic impacts of policy changes, and the contribution of IFPRI's policy research work from 1995 to 1997.

The relaxation of rice export quotas and internal restrictions on the rice trade by the Government in 1995-1997 were estimated to have had a value (in 1995) of US$ 61 million using a 5 per cent discount rate. If continued to 2000, this will rise to US$ 222 million and to US$ 966 million by 2020. For an incremental investment of less than US$ 1 million, a conservative estimate of the benefit to Viet Nam of the IFPRI research contribution to policy change (including reduction in policy implementation lag) indicates a value (1995) of US$ 45 million. This represents a benefit-cost ratio of 56. An optimistic assessment is that the present value is US$ 91 million with a benefit-cost ratio of 114.

The value added estimate from the scenario analysis shows that by 2005 the impact of trade liberalization in the rice sector under implementation of AFTA/CEPT with a reduction in tariff rates from 20 to 5 per cent will produce a value added of VND 2,727 billion (US$ 58 million). The impact of trade liberalization under the USBTA where US tariffs on rice imports from Viet Nam are reduced from 35 to 8.3 per cent, produces a value added of VND 532 billion (US$ 48 million).

The option for structural adjustment is considered in response to the low price of rice. A 10 or 20 per cent reduction of the area cultivated with rice in an agricultural diversification programme will produce a value added of VND 563 billion (US$ 55 million) or VND 541 billion (US$ 60 million) respectively.

5.5.2 Environmental impact valuation

By assessing the economically optimal level of pesticide and fertilizer use, Dung and the EEPSEA

Table 38: Estimated economic benefits of rice policy changes and cost of IFPRI policy research in Viet Nam

Year	Benefit of policy change (US$ million)	Cost of IFPRI research (US$ million)
1995	0	0.183
1996	16	0.552
1997	54	0.138
1998	60	0
1999	66	0
2000	80	0
2001	80	0

Source: Ryan (1999).

group (1997) estimated the cost of overusing pesticides and fertilizers in irrigated rice production. This was computed by comparing the cost of farmer practices with the cost at economically optimal levels.

To value the damage to farmers' health, a health cost function and a linear-log regression model was defined. The valuation method was a market-based approach, using available information on market prices (Table 39). Quantitative data on the environmental impact of the misuse of pesticides and chemical fertilizers were not fully available. Therefore, some environmental impacts such as water pollution or effects on aquatic/fishery resources are not included in the applied valuation models. It should be noted that the development of an in-country valuation methodology is underway.

As indicated, negative environmental impacts result primarily from the misuse of agrochemicals. The environmental cost based on the economically optimal rate shows that the total costs in 2001 were VND 374.8 billion in the Red River Delta and VND 833.7 billion in the Mekong Delta.

Table 39: The cost of overusing agrochemicals for irrigated rice production, 2001

Impact cost	Red River Delta			Mekong Delta		
	Unit cost VND/ha	Irrigated rice (000'ha)	Value bill.VND	Unit cost VND/ha	Irrigated rice (000'ha)	Value bill.VND
Overuse of fertilizer	211,324	1,140	240.9	44,930	3,350	150.5
Overdose of pesticide	117,464	1,140	133.9	105,644	3,350	353.9
Human health cost	--	--	--	98,310	3,350	329.3
Total			374.8			833.7

Source: Authors' calculations based on economically optimal rates developed by EEPSEA, 2001.

6. Proposed policy package for mitigating the negative impacts and enhancing the positive

6.1 Overview of the impact of trade liberalization and policy considerations

In terms of social and economic impacts, the reform process, including trade liberalization, has resulted in significant changes in rice production and export, with positive impacts on the economy and on poverty reduction. Findings on the effects of trade liberalization indicate the real income of the poor increased as a result of the increase in the price of rice, the boom in rice exports, and the decrease in the price of fertilizers. The continuous decrease in the poverty rate corresponds significantly with the positive changes in the rice sector, since the majority of poor households in rural areas are rice farmers. The positive impacts provide the incentive for continuing policies to promote rice production and exports.

Negative environmental impacts were seen in the increased use of pesticides and non-organic fertilizers. The main concerns include the overuse/misuse of agrochemicals for rice intensification and resulting environmental pollution, a need to sustain soil fertility, rice yields and farmers' income, and producing high-quality rice for "rich" markets. This led research institutes and the PPDs to pay attention to promoting "organic" or clean rice farming. According to a report by the PPD (2002) of Viet Nam, the total amount of pesticides used in the country went up from 9,000 tons in 1985 to 20,000 - 30,000 tons in 2002 (2.2 - 3.3 fold). The Mekong Delta is a good place for agrochemical companies to do business due to a high demand for these products. In an unpublished study (Dang Kieu Nhan, 2002) it was found that an average of 150 tons of pesticide is consumed annually in each province in the Mekong Delta. Recently, in a collaboration programme, the IRRI, the PPD of Viet Nam and the Me Kong Rice Research Institute initiated a pilot programme using the "3 low-3 high" technique in Can Tho and Tien Giang Provinces with a view to encouraging clean rice production in the whole of the Mekong Delta. The 3 low-3 high technique means "**low** seeding rate, insecticide and N fertilizer use, and **high** yield, rice quality and income", and is a form of IPM.

The outcome from this integrated assessment has been to encourage and increase interest in organic rice farming, although food security requirements (especially in the case of rice) prevents Viet Nam from focusing entirely on policies to promote organic agriculture. While some farmers have diversified rice production, it is difficult for the Government to convert large tracts of land to organic agriculture. However, field survey data has indicated that high-grade rice can be grown with less input of fertilizers and pesticides.

The issue then is how to devise proactive policies that promote both clean production and rice exports. In this context, the MARD has suggested diversification, which may reduce the rice growing area and at the same time increase intensive use of inputs due to a lack of farming options. Future projects should include assessing the policy options for mitigating the environmental impacts of chemical inputs, and:

– dissemination of information on organic agriculture to farmers;
– concrete studies on the relationship between the environment, product quality, and input use;
– national environmental standards should be aligned with international standards as far as possible, however, it may not be necessary to invest in expensive certification infrastructures unless specific markets require this;
– accurate information on market premiums and certification requirements for organic products should be obtained and disseminated;
– WTO provisions on trade and environment should be clarified through structured training; and
– EIA assessments should be included in technology transfer to ensure environmentally sound technology and avoid the import of environmentally harmful products.

More generally, it is felt that there is a need to increase awareness of environmental issues, and especially the interface with trade. Further learning and sharing of experiences with other developing countries about how these two interests can be effectively coordinated, would be helpful. Building task forces of trade and environment experts as well as improving documentation on trade and environment issues are priority matters. The development of national information dissemination networks on trade and environment would also be useful.

6.2 Farmers' suggestions for clean rice farming

6.2.1 Farmers' suggestions for future rice farming in the Mekong Delta

Through the PRA, farmers proposed economic and environmental solutions for rice farming (see Figure 6). Key strategies for sustaining rice yields, encouraging lower inputs, achieving higher rice prices and higher levels of income, and enhancing the eco-environment include greater use of organic or bio-fertilizers, adopting suitable rice-based farming systems or double cropping, implementing IPM and other techniques (i.e. row-seeding and LCC-based fertilization), and growing high quality rice varieties. However, technological solutions alone are not enough, and appropriate policy development, planning and organisation of both State and local Governments are essential.

6.2.1.1 Farmers' definitions of high quality and clean rice

Large-scale farmers generally have a better knowledge and perception of organic or clean rice farming than small-farmers. Table 40 summarises the characteristics of high quality and clean rice.

6.2.1.2 How to produce high quality and clean rice

– *Rice varieties*: use only pure rice varieties with high grain quality such as IR 64, Jasmine, Khao Daw Mali, VD20, ST3, etc. However, these varieties are only slightly resistant to major pests and diseases, so to produce clean rice, only the pest resistant rice varieties should be selected.
– *IPM and other techniques*: IPM, low-seeding rates or row-seeding, safe pesticide use (i.e. bio-pesticides or stopping pesticide use after crop flowering).
– *Fertilization*: minimize use of chemical fertilizers by adopting appropriate or LCC-based fertilization, and increase use of organic or bio-fertilizers.
– *Farming systems*: only double rice cropping or

Table 40: Farmers' definition of high-quality and clean rice

High-quality rice	clean rice
– Long grains without chalkiness, no pesticide and nitrate residue – Aromatic and fewer broken milled grains – Pure rice variety, without weed seed	– Grains without pesticide and nitrate residue

Source: Field survey data (2003).

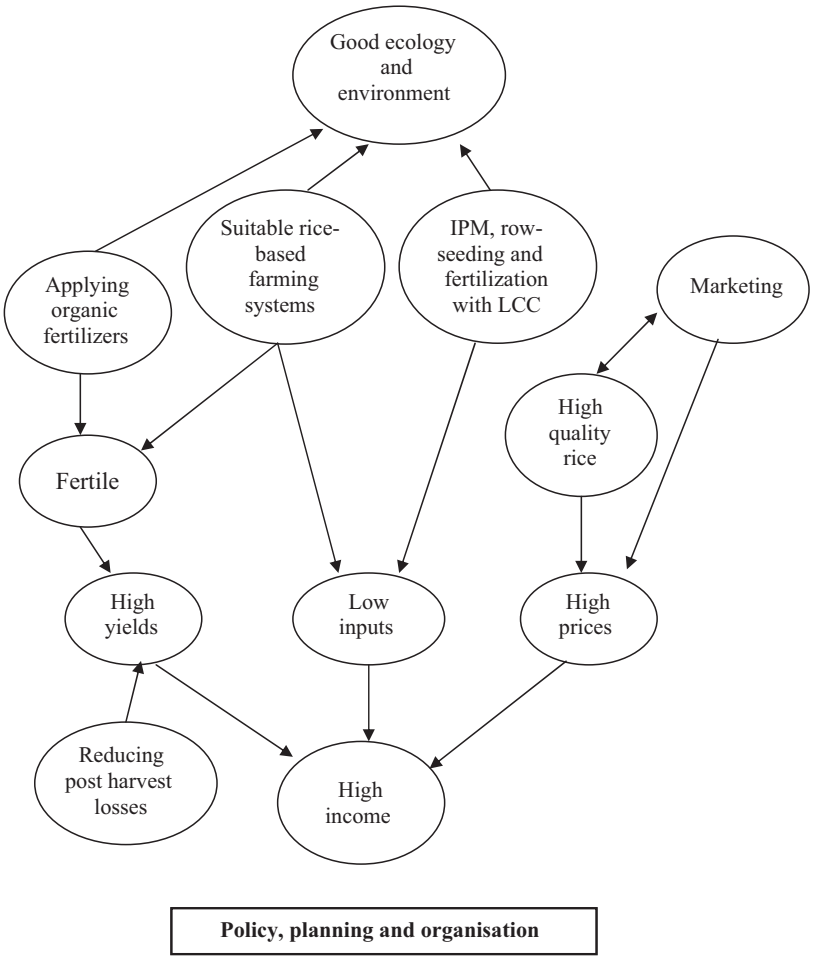
double cropping integrated with upland crops or fish/prawn farming should be practiced.

6.2.2 SWOT analysis for high quality and clean rice production

In general, although farmers, especially large-scale farmers, know about high-quality or clean rice production, for various reasons they have not modified their farming methods accordingly. Farmers who do cultivate high quality and clean rice highlight the many advantages of this production such as achieving higher prices, reducing agrochemical use and improving environmental conditions and human health. Identified strengths, weaknesses, opportunities and threats are presented in Table 41. However, failures in government policy, planning, organisation and marketing for clean rice are seen as the main cause of problems and constraints. Most farmers participating in the study sites agreed that producing clean rice in local conditions is quite feasible if the problems and constraints are resolved.

Producing high-quality or clean rice is for "rich markets" and for export. This type of rice production could contribute to promoting cooperative rice farming, developing post-harvest industries and services, strengthening and widening rice-export markets, efficiently re-use organic wastes and enhancing the environment. Commodity rice farming is now not restricted to large-scale farmers alone, but also includes small-scale farmers who also have to sell their rice after harvest to cover expenditures. Therefore cooperative farming may be essential to expanding the production of clean rice. Medium-quality rice can be bought in local markets for family consumption if necessary. According to interviewed farmers, the advantages of high-quality or clean rice production are significant.

Figure 6: Suggested solutions by farmers for rice farming in the future (PRA exercise)



6.2.3 Farmers' suggestions for clean rice production in the Red River Delta and Central Coast

The concept of clean rice production had not been introduced to the farmers in these research sites before this survey was conducted. However, the farmers quickly understood the concept when it was explained because they were already familiar with the concept of clean or safe vegetables. Most farmers (86 per cent) realize that clean rice production will play an important, even very important role in the future.

Perceived benefits of clean rice production were that it could limit negative impacts on the environment (64 per cent) and safeguard human health (48 per cent). It also could help reduce production costs (20 per cent) and improve competitiveness (14 per cent). Most farmers apply fertilizers according to agricultural extension guidelines but also according to the actual requirements in the field. In addition, experience and weather also plays a role in deciding on fertilizer use.

According to 64 per cent of respondents, the use of manure contributes to increasing rice yields, better rice quality (54 per cent of respondents), and improvement in land quality (40 per cent of respondents). It also helps to improve economic efficiency (16 per cent) and reduce incidence of

Table 41: Farmers' practices for clean rice production in the irrigated rice systems of the Red River Delta and Central Coast

Farmers' practice of fertilization	% Res.
1. Base for fertilization decision	
– Status of rice field growth	54
– Fertilizer efficiency observed	6
– Agricultural extension recommendations	66
– Soil fertility	0
– Own experience	12
– Weather	14
– Neighbours' application	2
– Family financial situation	2
2. Measure to reduce production costs	
– No specified measures applied	62
– Increased manure application	28
– Used less pesticides, fungicides	8
– Balanced fertilization	14
3. Evaluation of manure use for rice	
– Higher yield	64
– Improved soil fertility	40
– Higher economic efficiency	16
– Higher rice quality	54
– Pest and disease reduction	8
– Chemical use decline	2
4. Difficulties in use of manure	
– No difficulty	26
– Insufficiently manure sources	48
– High manure price	6
– Difficulty in transportation	22
– Not familiar with use of manure	2
– High time consumed	4

Farmers' perception of clean rice	% Res.
1. Importance of clean rice production	
– Not important	8
– Important	80
– Very important	6
– No idea/don't know	6
2. Benefit from clean rice production	
– No idea/don't know	2
– Reduce cost	20
– Reduce negative environment impacts	64
– Increase competitiveness of rice	14
– Safe the physical human health	48
3. Problems on clean rice production	
– No idea/don't know	26
– Low yield if use less chemicals	40
– More pest/disease if use less pesticide	16
– Not locally technical supports	16
– Not available suitable rice variety	4
– Low price/ market problem	4
– Poor irrigation	2
– Insufficiently manure sources	10
– Poor knowledge on clean rice	4
4. Measure for clean rice development	
– No idea/don't know	16
– Control use of pesticides	4
– Introduce disease resistance varieties	66
– Provide technical/financial supports	62
– Zoning for clean rice area	10
– Introduce bio-fertilizers	2
– Develop clean rice support policies	10

*The total number of respondents was 110
Source: Field survey data (2003).

pest and disease (8 per cent). Twenty six per cent of farmers said that they did not encounter any difficulty in applying manure, however 48 per cent of the farmers did not have enough manure, and 22 per cent said that transportation of manure to the rice field was really hard work. Sixty eight per cent of farmers stated that they had not applied any measures specific to reducing production costs, although 28 per cent tried to reduce costs through increasing manure applications, and 14 per cent by balancing fertilizer use and using less pesticides and fungicides.

Sixteen per cent of farmers thought that the problems of producing clean rice mostly concern increased incidence of pest and disease when pesticide and fungicide use is decreased, and 40 per cent thought rice yield would decline as less chemicals are used. Several reported that lack of technical support was a problem (16 per cent). In addition, insufficient supply of manure was also considered a restriction to clean rice production (10 per cent). Many farmers (66 per cent) thought that the introduction of rice varieties that can resist pest and disease would be a good solution for clean rice production. Technical and financial support was also considered necessary by 62 per cent of farmers. Plans to set up a zone for clean rice production was supported by 10 per cent, and issuing the right policies for clean rice production was proposed by 10 per cent of farmers.

6.3 Proposed policy package

The proposed policy package for mitigating the negative impacts and promoting the positive impacts of liberalization in the rice sector is based not only on the types of impacts that have been identified in the integrated assessment, but also takes account of the context of transition towards a market-oriented economy. In addition, the policy-making processes involve multiple levels that are not always entirely transparent. Therefore, together with further understanding of the processes, the policy responses should take into account the perceptions of farmers and local communities and consider the generally low awareness among all stakeholders of the range of impacts, especially the environmental impacts. Major strategies for the proposed policy package include:

1. Build awareness of environmental and other impacts of rice intensification and trade by disseminating environmental education via media networks and extension systems. This should include the provision of equitable and appropriate access to extension and technical training for all stakeholders.

This will involve conducting further studies on identifying the linkages between rice farming and trading and assessing the social, economic and environmental impacts. The information and knowledge gained from the impact assessments can be made available through the extension systems. Identification and development of extension programmes can also be supported with environmental education activities. In current efforts, MARD is already expanding the national extension system network to include all communes in rural provinces. The improvement of extension programmes is already receiving technical and financial support. By offering opportunities and options to different stakeholders, environmental education will support informed decision-making on farming practices and trading farm products.

2. Sensitise policy makers to the environmental impacts by initiating appropriate policy dialogue to facilitate consideration of environmental costs and banning or taxing pesticide and chemical fertilizer use in rice cultivation.

Given that, currently, information on environmental impacts is not generally available or included in public statistics, it is difficult to influence policy makers on procedures of policy development. Information on the environmental impacts of trade liberalization should therefore be made available and widely distributed. Integrated assessments and impact studies should be followed up with active dissemination of information at all policy-making levels. Identification and targeting of policy makers throughout the policy development process is important for disseminating information. Multiple information channels can be utilized such as convening workshops, publishing reports and using the Internet.

3. Encourage further policy dialogue through ISG to MARD to reduce and stabilize plans for rice production and export, and improve the quality and price of Viet Nam's rice exports

The state should focus more efforts on improving product quality and reducing costs through the active application of improved technologies and scientific advancements. The production costs of rice are generally low, depending on the technologies employed. Inputs and investments in rice cultivation are very different among households, ecosystems and regions. Farmers also need to be better informed about what consumers in world markets want. Traders need to increase communication with farmers and their representatives in order to explain the advantages of single variety shipments, branding and labelling of rice. The question of improved quality (humidity, cleanliness, percentage of broken grains) of any variety of rice is mainly a matter of investing in modern processing and storage facilities, i.e. primarily the responsibility of intermediaries. The Government, through State-owned banks, could support targeted small and medium enterprises by providing credit facilities to make these investments.

4. Promote integrated and/or organic rice farming (green box) by providing research and technical support to diversify farm production and develop non-farm rural small business

This includes redeveloping farm businesses and developing entrepreneurial skills in farmers by providing technical support, information and training. Market participation is now a reality for all producers, workers and consumers. Ability to take advantage of the opportunities will depend upon financial and physical assets, but also on basic knowledge and skills such as accounting, investment and minimizing financial risks. It is important to improve micro-finance services for the most vulnerable. This involves improving government credit programmes, banking system operations, and more effort to set up local savings groups or credit activities such as provision of revolving loans.

5. Continue further trade liberalization in agricultural sectors with specific policies on purchase, stocking, and exporting

Measures should include:

– further reduction/removal of all non-tariff barriers, particularly in administrative procedures so that marketing and trading costs can be reduced and price competitiveness enhanced;
– end protection of state owned enterprises; and
– replace the system of subsidising interest on credit with new forms of credit guarantee facilities for all Vietnamese exporters. The Government needs to set levels of control but also facilitate exports in a transparent way, and offer equal opportunities for accessing credit or new forms of insurance to all Vietnamese companies.

7. Lessons Learned and follow-up proposal

Trade liberalization in Viet Nam's rice sector as part of the reform process towards integration into the world economy has produced substantial social, economic, and environmental impacts. Study findings indicate that the real income of the poor has increased as a result of the boom in Viet Nam's rice exports, and the price of fertilizer has decreased as result of tariff reductions and other trade measures. Though the increase in the price of rice produced a generally negative impact on consumers, the continuous reduction of the poverty rate was a significantly positive impact since the share of income in poor households in rural areas increased.

Negative environmental impacts resulted mainly from the increased use of agrochemicals, and the overuse or misuse of non-organic fertilizers and pesticides. Trade liberalization contributed to the reduction of the cost of imported fertilizers thereby increasing consumption levels. Due to the relatively minimal environmental impacts in combination with poor availability of information, stakeholder awareness and concern for the environmental impacts of increased rice cultivation and trade is much lower than for the socio-economic impacts. However, lack of awareness of the environmental impacts of rice policies is probably due to the priority given to issues of food security and poverty reduction. Trade liberalization in the rice sector has thus far been assessed mostly in terms of positive socio-economic effects without sufficient environmental impact evaluation.

Current negative environmental impacts resulting from expansion of the land area cultivated with rice, processing techniques for export quality rice and excessive use of agrochemicals are three-fold and lead to: (i) soil degradation and water pollution; (ii) loss of rice genetic resources and agrobiodiversity; and (iii) loss of natural resources, habitat and biodiversity.

7.1 Main lessons learned

The assessment has drawn the attention of stakeholders to the environmental impacts of rice production and rice trade liberalization and has facilitated awareness building. Assessment involved the combination of a variety of methods and study tools such as quantitative models and qualitative PRA and interview techniques. Methodology is important; each group or stakeholder may only be convinced to participate in the learning activities with appropriate facilitating tools or processes.

General observation has indicated that in-country capacity for undertaking integrated impact assessment is low. Data availability *ex-post* is limited, making responsive policy analysis difficult. Many agricultural researchers were not familiar with the use of quantitative assessment methods, particularly the assessment team who are knowledgeable on the qualitative relationships among rice cultivation, trade and environment. Environmental impact valuation is relatively new in Viet Nam, where centralized planning for commodity pricing and exchange valuation has only recently been reformed.

The assessment team are, however, familiar and experienced with participatory methods. Consequently, participatory tools and methods have been used for involving rice farmers and local stakeholders in the assessment. Nevertheless, the application of these tools and methods (e.g. PRA) requires trained researchers. This implies that wider awareness building needs to start with capacity building for the researchers and extension agents.

7.2 Follow-up proposal

7.2.1 Build awareness of the integrated assessment results

Build awareness of the environmental impacts of policy reforms for researchers and stakeholders, especially the impact of trade liberalization, through various forms of communication and training workshops. The initial sensitisation of policy makers to the integrated impacts of rice intensification and rice trade liberalization is made through stakeholder workshops. The dialogue should include environmental education in the current programmes for rice export by MARD.

7.2.2 Proposed study on the promotion of organic rice farming

Promotion of integrated/organic rice farming is recommended based on the results of the quantitative models used for the integrated assessment and also on farmers' responses. Producing clean rice will benefit the poor as rice producers and at the same time will mitigate the negative environmental impacts by reducing the levels of agrochemical consumption. A key hypothesised outcome is an expansion of organic rice farming, which builds on the initial IPM techniques adopted and rice diversification by adopting "integrated rice crop management". This study would involve farm-based activities, stakeholder participation and educational and capacity building on integrated impact assessment of rice-related policies. A follow-up study on the promotion of organic rice farming is proposed as follows:

1. Examine current practices in organic rice production and assess requirements for producing organic rice in the major rice production regions (i.e. the Mekong River Delta, Central Coast and Red River Delta). This study would be conducted in collaboration with the MARD programme for zoning in view of producing high quality rice for export, especially in-site identification for zoning and initiating research.
2. Participatory identification of rice growing techniques and of suitable rice-based farming systems for applying organic farming practices. This would be farm-based and community-based research on farmer-managed trials. Biological, economic and environmental data would be collected and evaluated. The aim is to strike the optimal balance between respect for environmental standards, reducing the costs of agrochemical inputs particularly for poor households, and the optimal rate of return to investments made.
3. Establishment and agreement on environmental standards with respect to water and soil quality among stakeholders, to provide a legal basis to reduce the use of agrochemicals. It is very important to provide a basis for the assessment of the economic value of the negative environmental impacts.
4. Expansion of the use of PRA tools and process, such as the SWOT analysis that was carried out, in order to identify the major constraints and institutional problems in clean rice production, i.e. to reduce the excessive use of agrochemicals in agricultural extension.
5. Develop farmer-to-farmer demonstration pilots for organic rice production and trade in target areas with a community-based organisation. This would involve training for extension staff, local stakeholders and farmers, as well as capacity building on community organisation for organic rice production and trade.
6. Disseminate and/or make use of information and knowledge that is generated during the above activities to support environmental education, build awareness of the impacts of rice farming and trade, and build capacity of the extension systems.
7. Evaluate the integrated impacts of expanding organic rice production and trade.

References

Baker & McKenzie, Burke and Bui Thi Bich Lien (2001) "Viet Nam's WTO Accession Negotiations", The International Support Group to MARD.

Beard, James (2001) *Unofficial CEPT schedule for Viet Nam* received in February, with newer information on rice received in October, from James Beard, Centre for International Economics, Sydney.

Centre for International Economics (1999) *Non-tariff barriers in Viet Nam. A framework for developing a phase out strategy*, report prepared for the World Bank, Centre for International Economics, Canberra and Sydney.

CIEM (1998) *Viet Nam's Trade Policies 1998*, Centre for International Economics, Canberra and Sydney.

CIEM (2000) *Economic integration and Viet Nam's development strategy*, Ha Noi.

CIEM (2001) "An overview of Viet Nam's trade policy in the 1990s", research paper, University of Sussex (UK)/Central Institute of Economic Management project, Ha Noi.

CIEM (2002) *Viet Nam's economy in 2001*, The National Political Publisher, Ha Noi.

Dang Kieu Nhan, Nguyen Duy Can & Nguyen Van Sanh (1992) "Rice-fish/prawn integrated farming systems in Thot Not, Can Tho province and Cai Be, Tien Giang province: A case study", presented to the annual meeting of Viet Nam Farming System Network, 22-25 November 1992 in Thai Nguyen city, Bac Thai, Viet Nam (in Vietnamese with English abstract).

Dang Kieu Nhan, Nguyen Viet Hoa & Nguyen Van Danh (1995) "Evaluation of changes in rice-fish/prawn integrated farming systems in Thot Not, Can Tho province and Cai Be, Tien Giang province", report submitted to IDRC, Can Tho University internal report.

Dang Kieu Nhan, Le Thanh Duong and N. Vromant (2002a) *Rice intensification and natural resource management in freshwater integrated rice-fish farming systems in the Mekong Delta*, Viet Nam. Conf. Proc. Can Tho University, pp 792-801 (in Vietnamese).

Dang Kieu Nhan, Nguyen Ngoc De & Duong Ngoc Thanh (2002b) "Socio-economic and environmental impacts of intensive rice culture and opportunities for sustainable rice production in the Mekong Delta, Viet Nam", presented in a workshop on trade liberation and socio-economic and environmental impacts of rice production, HUA and UNDP, 8-9 November 2002, Hue city, Viet Nam.

Dang Kieu Nhan, Vo Van Ha, Nguyen Thanh Binh and Le Xuan Thai (2003) *Socio-economic and environmental impacts of intensive rice cropping and opportunities for « clean » rice production in the Mekong Delta, Viet Nam: A participatory study*, Mekong Delta Farming Systems Research and Development Institute Can Tho University, Can Tho city, Viet Nam.

Dawe, D. *et al.* (2000) "How widespread are yield declines in long-term rice experiments in Asia?", Field Crop Research.

Do Kim Chung and Kim Thi Dung (2002) *Pest Management in Rice Production in Viet Nam: A Socio-economic Assessment*, The Agricultural Publisher, Ha Noi.

Dollar, D., Glewwe, P. and J. Litvack (eds) (1998) *Household welfare and Viet Nam's transition*,

World Bank (Regional and Sectoral Studies), Washington DC.

Dung, *et al.* (1996) *Economic and Health Consequences of Pesticide Use in Paddy Production in the Mekong Delta, Viet Nam*, The Environmental Economic Programme for Southeast Asia (EEPSEA), International Development Research Centre, Ottawa, Canada.

Dung, *et al.* (1997) *Impact of Agro-Chemical Use on Productivity and Health in Viet Nam*, The Environmental Economic Programme for Southeast Asia (EEPSEA), International Development Research Centre, Ottawa, Canada.

Duong Ngoc Thanh (2002) "Comparative socio-economic analysis of selected farming systems in the coastal areas of the Mekong Delta" (PhD thesis), University of the Philippines.

European Commission (1998) *Commission Regulation (EC) No. 327/98* of 10 February.

FAO (2001) *Review of Basic Food Policies*, Rome.

FAO (2001) *Rice Market Monitor,* various volumes. Commodities and Trade Division, Rome.

FAOSTAT (2001) *FAOSTAT Agriculture Data*, www.fao.org, accessed November 2002.

Gauchan, Devendra (2001) *Economic valuation of rice landrace diversity: A case study of Bara Ecosite*, Nepal-Tarai Nepal Agricultural Research Council (NARC).

General Statistics Office (2002) *Statistical Yearbook,* various years. General Statistics Office, Ha Noi.

Goletti, Francesco (1998) *Trade Distortions and Incentives in Agricultural Trade: The Case of Rice, Sugar, Fertilizer, and Livestock-Meat-Feed Sub-Sectors in Viet Nam*, Background paper for the World Bank Viet Nam Rural Development Strategy, FAO Loan Agreement No. TCI 44/98, IFPRI, Washington DC.

Goletti, Francesco and Karl Rich (1998) *Policy Simulation for Agricultural Diversification*, Final report, Strengthening Capacity for the Renewal of Rural Development in Viet Nam, UNDP VIE/96/008/A/01/99, IFPRI, Washington DC.

Goletti, Francesco and Nicholas Minot (1997) From famine to surplus: Past trends and future challenges of the rice economy of Viet Nam. Paper prepared for a book manuscript for the International Food Policy Research Institute, IFPRI Washington DC.

Goletti, Francesco and Nicholas Minot (1997) *Rice Markets, Agricultural Growth, and policy Options in Viet Nam*, MSSD Discussion Paper No. 14, International Food Policy Research Institute, Washington DC.

GSO (2000) Figures on social development in the "Doi Moi" period in Viet Nam, The Statistical Publisher, Ha Noi.

GSO (2000) *Viet Nam Living Standards Survey 1997-1998*, VIE/95/0423, The Statistical Publisher, Ha Noi.

GSO (2001) Socio-economic conditions of Viet Nam for 10 years, 1991-2000.

GSO (2002) Statistical data of Viet Nam agriculture, forestry and fishery 1975-2000.

GSO, Statistical Yearbook, various years.

Hang, Nguyen Tho Thu (1999) *The International Market for Viet Nam's Rice Exports: Opportunities and Challenges*. Class no. 4, Thesis no. 9. Viet Nam-Netherlands MA programme in Development Economics, http://mdehn.virtualave.net/class4/hang/summary.htm

Hossain, M., Duong Ngoc Thanh and F.B. Gascon (1995) "Change from deepwater to irrigated rice ecosystem in the Mekong River Delta: Impact on productivity and on farmers' income" in Denning, G.L. & V.-T. Xuan (eds), *Viet Nam and IRRI: A partnership in rice research*, International Rice Research Institute, the Philippines, and Ministry of Agriculture and Food Industry, Viet Nam.

IFPRI (1996) "Rice market monitoring and policy options study", paper prepared as end-of-assignment report to the Asian Development Bank for TA No. 2224–VIE, December.

JBIC (2002) *Sector Study for Agriculture and Rural Development Sector in the Socialist*

Republic of Viet Nam, Sanyu Consultants Inc. for the Japan Bank for International Cooperation.

JBIC (2003) *Environmental Sector Study for Japanese ODA in the Socialist Republic of Viet Nam*, Nippon Koei Co. Ltd.

Khiem, N. T. and P.L. Pingali (1995) "Supply response of rice and three food crops in Viet Nam" in Denning, G.L. and Xuan Vo-Tong (eds) *Viet Nam and IRRI: A partnership in rice research*, International Rice Research Institute, the Philippines, and Ministry of Agriculture and Food Industry, Viet Nam.

MARD (2000) *The Competitiveness of the Agricultural Sector of Viet Nam: A Preliminary Analysis in the Context of ASEAN and AFTA*, prepared under Technical Cooperation Project TCP/VIE/8821(a) by The Ministry of Agricultural and Rural Development of Viet Nam, and the Food and Agriculture Organization of the United Nations.

MARD (2001*) General report on analysis of Viet Nam's agricultural policy under the context of WTO,* Ha Noi.

MARD (2002) *Evaluation of potential impacts on Viet Nam's agriculture during implementing Common Effective Preferential Tariff programme (CEPT) under the Agreement on ASEAN Free Trade Area (AFTA)*, Ha Noi.

MARD (2002) *Impact of trade liberalization on some agricultural sub-sectors of Viet Nam: Rice, coffee, tea and sugar*, Ha Noi.

Minot, N. and F. Goletti, (1997) "Impact of rice export policy on domestic prices and food security: Further analysis using VASEM", paper prepared for the World Bank.

Minot, N. (1998) *Competitiveness of Food Processing in Viet Nam: A Study of the Rice, Coffee, Seafood, and Fruit and Vegetables Sub-sectors*, prepared for Developing Strategies Institute, Ministry of Planning and Investment, Ha Noi, and Medium-Term Industrial Strategy Project TF/VIE/95/A58, UNDP, Ha Noi; International Food Policy Research Institute, Washington DC.

Minot, N. and F. Goletti (2000) *Rice Market Liberalization and Poverty in Viet Nam*, Research Report, International Food Policy Research Institute, Washington DC.

Neefjes, Koos (2000) *Environments and Livelihoods - Strategies for Sustainability*, Oxfam, Oxford.

Nguyen Ngoc De (1999) "Leaf colour chart-base fertilization for rice in the Mekong Delta", Conf. Proc., Farming Systems, R & D Institute, Can Tho University, pp 153-176 (in Vietnamese).

Nguyen The Dung (1999) *Capacity Assessment for Viet Nam's National Target Program for Hunger Eradication and Poverty Reduction – Part 1. Program Assessment*, UNDP, Ha Noi.

Nguyen Van Chinh, Vu Quan Viet, Tran Van and Le Hoang (2002) *Viet Nam's economy in the years of reforms*, The Statistical Publisher, Ha Noi.

NIAPP (1995) *Processing, marketing and consuming rice in the Mekong River Delta,* Sub-National Institute for Agricultural Planning and Projection, Ho Chi Minh City.

NIAPP (1995) *Rice Post-Harvest Technology in the Red River Delta*, National Institute for Agricultural Planning and Projection, Ha Noi.

Oryza (2000 and 2001) *Country Market Reports,* on-line at http://oryza.com/.

Oxfam (UK) & Oxfam (HK) (2001) *Rice for the Poor and Trade Liberalization in Viet Nam*, Final Report for discussion and feedback, Ha Noi.

Oxfam (UK) and Oxfam (HK) (2001) *Research on international trade, local markets, and rice dependent livelihoods in Viet Nam*, Ha Noi.

People's Committee of Can Tho province (1999) Agricultural planning to 2010 in Can Tho province.

People's Committee of Tien Giang province (2001), Rice economy planning period 2001-2005.

Pham Lan Huong (2001) *Impacts of trade and investment policy on income distribution in Viet Nam*, Central Institute for Economic Management, Ha Noi.

Pohl Nielsen, Chantal (2002) *Viet Nam in the International Rice Market: A Review and Evaluation of Domestic and Foreign Rice Policies*, Report No. 132, Danish Research Institute of Food Economics, Copenhagen.

Poverty Working Group (1999) *Viet Nam Development Report 2000: Attacking Poverty*, Joint report of the Government-Donor-NGO Working Group, Ha Noi.

Que, Nguyen Trung (1998) *Effects of Liberalization on Agriculture in Viet Nam: Institutional and Structural Aspects*, Working Paper no. 40, The CGPRT Centre, Bogor, Indonesia.

Que, Nguyen Trung and Nguyen Ngoc Que (2000) *Effects of Trade Liberalization on Agriculture in Viet Nam: Commodity Aspects*. Working Paper no. 52, The CGPRT Centre, Bogor, Indonesia.

Ryan, James G. (1999) *Assessing the Impact of Rice Policy Changes in Viet Nam and the Contribution of Policy Research*, IFPRI

Socialist Republic of Viet Nam (2001) *Poverty Alleviation Strategy 2001-2010*, Ministry of Labour, Invalids and Social Affairs.

Socialist Republic of Viet Nam (2001) *Strategy for Socio-economic Development 2001-2010*, endorsed by the 9th Congress of the Communist Party of Viet Nam.

Tran Ba Linh, Vo Thi Guong, and Nguyen Van Truong (2002a) "Effects of organic fertilizer CropMaster on rice yields on alluvial and acid sulfate soils of Can Tho and Vinh Long province", Conf. Proc. Can Tho University, pp 660-668 (in Vietnamese).

Tran Ba Linh, Vo Thi Guong and Ho van Hoang (2002b) "Effects of organic fertilizer Agrostimon rice yields on alluvial and acid sulfate soils", Conf. Proc., Can Tho University, pp 669-676 (in Vietnamese).

Tran Thi Ut (1998) "Impacts of modern rice technology on rice production and its role in income distribution and poverty alleviation in Viet Nam", PhD thesis, University of the Philippines.

United States Department of Agriculture (2001) *Rice Outlook,* Economic Research Service, Washington DC.

Viet Nam Economic Times (2001*) Economy 2000-2001 - Viet Nam & the World.*

Vo-Tong Xuan, Le Quang Minh, and To Phuc Tuong (1996) "Leaching of acid sulphate soils and its environmental hazard in the Mekong River Delta" in Denning, G.L. & Xuan V-T (eds), *Viet Nam and IRRI: A partnership in rice research*, International Rice Research Institute, the Philippines, and Ministry of Agriculture and Food Industry, Viet Nam.

Vu Tuan Anh (1994) Development in Viet Nam: Policy reforms and economic growth, *The Gioi* publisher, Hanoi.

Winters, L.A. (2000) "Trade, Trade Policy and Poverty: What Are the Links", CEPR Discussion Paper No. 2382, London, UK.

Winters, L.A. (2002) "Trade Liberalization and Economic Performance: An Overview", mimeo, University of Sussex, UK.

World Bank, Asian Development Bank, UNDP (2000) *Viet Nam Development Report 2001; Viet Nam 2010: Entering the 21st century; Overview & Part 1 – Pillars of Development*, Ha Noi.

Yoko Niimi (1997) Reports on the competitiveness of the rice production and trade systems in the Mekong Delta of Viet Nam. VASI, HCM College of Economics, University of Can Tho.

Yoko Niimi, Puja Vasudeva-Dutta and L.A. Winters (2002) "Trade Liberalization and Poverty Dynamics in Viet Nam", Discussion paper provided by CIEM.

Annex 1: data tables and figures

Annex 1/Table 1: Selected indicators of agriculture, forestry and fisheries sectors

	1985	1990	1995	1998	1999	2000
Gross Domestic Product						
(billion, constant 1994 price) a/	106,176	131,968	195,567	244,596	256,272	273,666
Agricultural	54,175	61,817	82,307	96,102	104786	112112
Forestry	4,216	4,969	5,033	5,257	5624	6068
Fishery	6,682	8,135	13,523	16,920	18253	21775
Ratio in total GDP (%)						
Agricultural	51.0	46.8	42.1	39.3	40.9	41.0
Forestry	4.0	3.8	2.6	2.1	2.2	2.2
Fishery	6.3	6.2	6.9	6.9	7.1	8.0
Gross output						
(billion VND, constant 1994 prices)	109,189	131,968	195,567	244,595	256,269	273,666
Agricultural	33,536	35,717	43,658	49,639	52,370	54,493
Forestry	1,710	2,205	2,399	2,459	2,536	2,544
Fishery	2,686	4,081	5,262	5,768	5,987	6,680
Agricultural land (000 ha)	6,942	6,993	7,358	7,843	n.a	9,345
Ratio in total land (%)	(21.0)	(21.1)	(22.2)	(23.7)	n.a	(28.4)
Total population (000)	59,872	66,107	71,966	75,456	76,597	77,635
Rural population (000)	-	53,136	57,057	57,922	58,515	58,830
Agricultural population (000 ha)	41,244	45,413	50,335	52,051	52,160	52,638
Ratio of rural population (%)	-	(80.5)	(79.2)	(76.8)	(76.4)	(76.1)
Ratio in total population (%)	(68.9)	(68.7)	(68.1)	67.5)	(68.1)	(66.9)
Forestry population (000)	-	131	155	185	227	207
Ratio in total population (%)	-	(0.3)	(0.3)	(0.2)	(0.3)	(0.3)
Fishery population (000)	-	1,171	1,390	1,557	1,706	n.a
Ratio in total population (%)	-	(2.6)	(2.8)	(2.0)	(2.2)	n.a
Agricultural labour force (000)	15,665	17,678	24,041	24,985	25,257	25,399
Ratio in total labour force (%)	-	(68.6)	(69.5)	(68.3)	(66.8)	(66.3)
Forestry labour force (000)	-	60	71	90	98	103
Ratio in total labour force (%)	-	(0.23)	(0.2)	(0.2)	(0.2)	(0.2)
Fishery labour force (000)	-	554	658	765	818	-
Ratio in total labour force (%)	-	(2.1)	(1.9)	(2.0)	(2.2)	(-)
Total Households	-	-	12,250	12,588	13,301	13,909d/
No. of agricultural households (000)	8,315	9,357	10,468	10,981	11,199	11,377
No. of forestry households (000)	-	26	31	38	42	n.a
No. of fishery households (000)	-	229	268	302	340	-
Size of agricultural land (ha)						
Per agricultural household b/	0.83	0.75	0.70	0.71	-	0.74
Per agricultural labour force c/	0.59	0.40	0.35	0.31	-	0.37

Sources: (1) General Statistical Office (GSO), Statistical Data of Agriculture, Forestry and Fishery, 1985-1995
(2) General Statistical Office (GSO), Statistical Data of Agriculture, Forestry and Fishery, 1990-1998
(3) GSO, Agriculture of Viet Nam, 1945-1995
(4) GSO, Statistical Yearbook 1995

Notes: a/ VND: Vietnamese dong, in 1994 prices, ratios in GDP represents the figures in 1986 prices
b/ Calculated agricultural land divided by no. of agricultural households
c/ Calculated agricultural land divided by no. of agricultural labour force
d/ As of October 2001

Annex 1/Table 2: Movement of rural labour force

	1990	1995	1996	1997	1998	1999	2000	2001
Labour Force at the beginning of year								
Whole country	28939.7	33600	34589.6	35187.3	35588.5	36579.6	37783.8	38643.1
Rural	23150.5	26880	27671.7	27727.1	27735.3	28367.9	29363.4	29917.1
New entries								
Whole country	1346.3	989.6	597.7	401.2	991.1	1204.2	859.3	846.7
Rural	1077.8	791.7	55.5	8.2	632.6	995.5	553.7	384.9
Newly created employment in rural area	1062.8	780.6	54.8	8.0	625.5	984.5	550.0	380.6
Labour Force end of year Whole country Rural	30286.0	34589.6	35187.3	35588.5	36579.6	37783.8	38643.1	39489.8
	24228.3	27671.7	27727.1	27735.3	28367.9	29363.4	29917.1	30302.0
Un-employment rate (%)								
Whole country	2.6	2.4	2.32	2.27	2.21	2.34	2.4	2.2
Rural	1.4	1.4	1.3	1.2	1.11	1.15	1.2	1.1

Source: Statistical data on labour force and employment in Viet Nam, 1996-2000 and 2001.

Annex 1/Table 3: Changes of exports of agricultural, forestry and fishery products

	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total export (million US$)	699	2,404	2,087	2,581	2,985	3,600	5,499	7,256	8,900	9,360	11,540	14,483	15,027
Total export of agric., forestry and fishery products (million US$)	397	1,106	1,089	1,276	1,444	1,728	2,521	3,069	3,400	3,323	3,774	2,894	2,628
Ratio of total export (%)	(56.8)	(46.0)	(52.2)	(49.4)	(48.4)	(48.0)	(46.3)	(42.3)	(38.2)	(35.5)	(32.7)	(20.0)	(17.5)
In which agric. Products (million US$)	274	783	628	828	920	1,081	1,746	2,160	2,231	2,274	2,546	2,563	3,249b/
Main agric. products (000 ton)													
Rice	59	1,624	1,033	1,947	1,722	1,950	1,988	3,003	3,575	3,730	4,508	3,477	3,729
Tea	10	16	8	13	21	17	19	21	32	33	36	56	68
Coffee	9	90	94	116	123	156	248	284	392	382	482	734	931
Rubber	35	76	63	82	97	105	138	195	195	191	265	273	308
Processed meat a/	- .	16.2	25.0	12.1	19.7	12.6	12.1	10.2	28.8	12.0	11.8	11	26
Frozen shrimp	9	38	42	40	42	54	45	51	68	432 a/	402 a/	-	-
Frozen cuttle fish	1	4	7	6	11	15	14	20	40	61 a/	103 a/	-	-

Notes: a/ Million US$
b/ Including agriculture and forestry products

Sources: GSO, Statistical Data of Viet Nam Agriculture, Forestry and Fishery 1975-2000,
GSO,Statistical Data of Agriculture, Forestry and Fishery 1990-1998 and in the year 2000,
Statistical yearbook 2001

Annex 1/Table 4: World supply/demand for rice (million tons on milled basis)

Major producers	1997/98		1998/99		1999/2000		Est. 2000/01	
	Production	Consumption	Production	Consumption	Production	Consumption	Production	Consumption
China	133.8	135.9	132.4	137	138.9	136.5	136.4	136.7
India	81.6	79.3	85.2	80.7	87.8	86.5	88.5	87.0
Indonesia	32.6	35.4	32.4	35.2	33.5	36.5	33.7	36.6
Viet Nam	18.9	15.1	20.4	14.5	20.6	16.9	20.8	16.9
Thailand	14.9	8.7	15	9	16.5	10.1	16.7	10.0
Japan	8.3	9.2	7.4	9.1	8.6	9.2	8.6	9.2
US	5.5	3.3	5.6	3.5	6.2	3.9	6.1	3.9
World Total	380.9	382.9	385	385	404.5	398.6	400.3	402.7

Source: Eagleton, Dominic (2001), and FAO cited by Viet Nam Economic Times (2/2001).

Annex 1/Table 5:The production costs and returns of winter-spring rice by region and variety

Unit = VND/hectare/crop

	Irrigated Central Coast in 000'VND	Irrigated Central Coast in ratio (%)	Irrigated Red River Delta in 000'VND	Irrigated Red River Delta in ratio (%)	Rainfed Central in 000'VND	Rainfed Central in ratio (%)	MV in Rainfed Central 000'VND	TV Rainfed Central 000'VND
Gross returns	9,535	100.0	11,370	100.0	5,861	100.0	5,799	5,979
Fertilizer cost	1,396	14.6	1,529	13.4	1,023	17.5	1,177	721
Pesticide cost	395	4.1	300	2.6	273	4.7	403	16
Seeds cost	398	4.2	344	3.0	309	5.3	354	220
Irrigation cost	437	4.6	311	2.7	273	4.7	342	138
Agri. tax cost	279	2.9	425	3.7	200	3.4	200	200
Machine cost	792	8.3	661	5.8	678	11.6	737	561
Hired lab. cost	98	1.0	156	1.4	588	10.0	598	569
Family lab. cost	2,970	31.1	4,752	41.8	1,170	20.0	1,290	935
Profit	2,770	29.1	2,892	25.4	1,347	23.0	698	2,619

Source: Field survey data (2003).

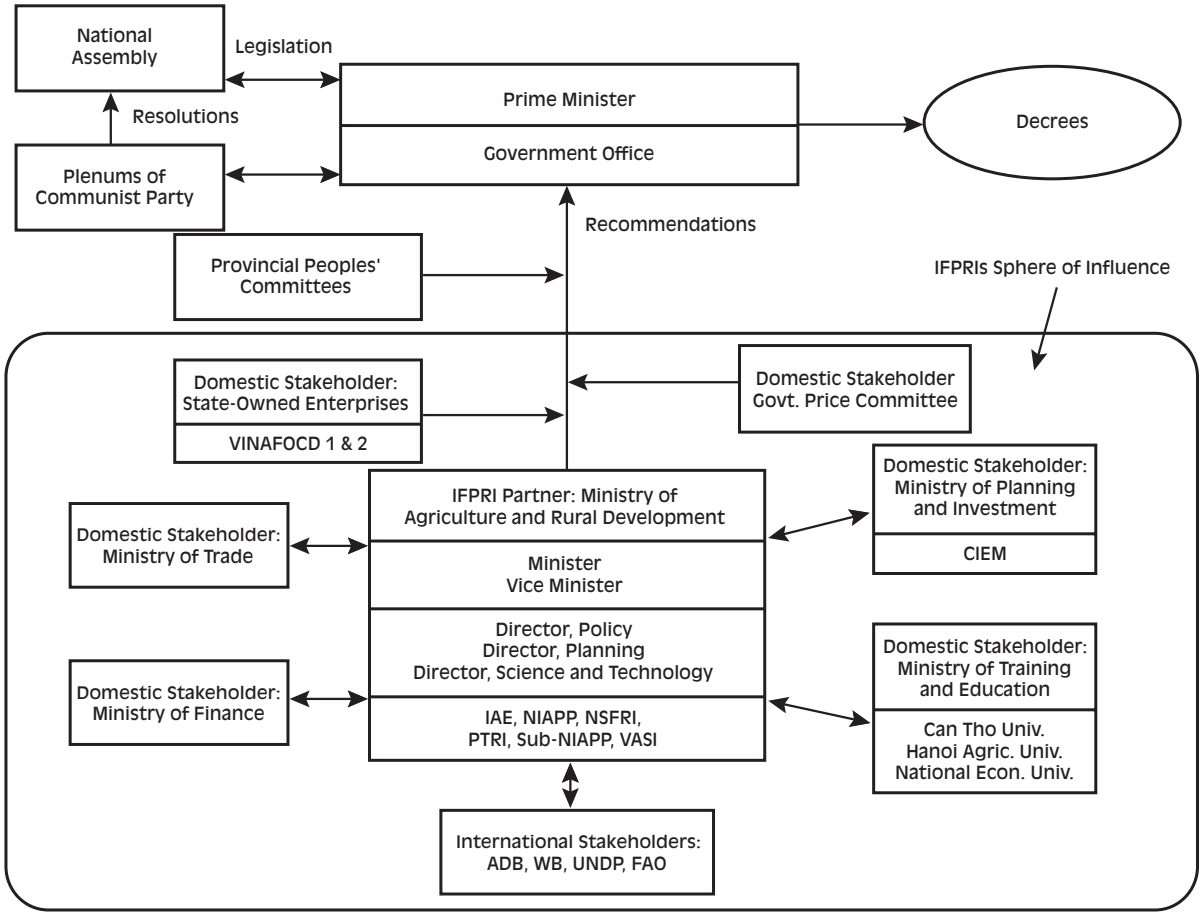
Annex 1/Table 6:The production costs and returns of summer-autumn rice by region and variety

Unit = VND/hectare/crop

	Irrigated Central Coast in 000'VND	Irrigated Central Coast in ratio (%)	Irrigated Red River Delta in 000'VND	Irrigated Red River Delta in ratio (%)	Rainfed Central in 000'VND	Rainfed Central in ratio (%)	MV in Rainfed Central 000'VND	TV Rainfed Central 000'VND
Gross returns	8,802	100.0	10,726	100.0	6,133	100.0	6,763	3,824
Fertilizer cost	1,296	14.7	1,393	13.0	1,200	19.6	1,332	714
Pesticide cost	370	4.2	289	2.7	418	6.8	532	0
Seeds cost	386	4.4	297	2.8	310	5.1	337	210
Irrigation cost	442	5.0	277	2.6	435	7.1	473	294
Agric. tax cost	279	3.2	425	4.0	200	3.3	200	200
Machine cost	786	8.9	711	6.6	718	11.7	714	734
Hired lab. cost	134	1.5	103	1.0	614	10.0	600	667
Family lab. cost	2,935	33.3	4,696	43.8	1,202	19.6	1,299	848
Profit	2,174	24.7	2,535	23.6	1,036	16.9	1,276	157

Source: Field survey data (2003).

Annex 1/Figure 1: Decision making process for rice policies in Viet Nam



Annex 2: Calculating the optimal rate of fertilization for rice

1. Method

General procedure

– Identify all nutritional constraints other than N, P and K

– Estimate the farm or field specific potential indigenous supply of N (INS), P (IPS) and K (IKS).

– Develop a farm or field specific recommendation for NPK use to achieve a defined target yield.

– Optimal Production Fertilizer rate = (Crop nutrient requirement - indigenous nutrient supply) /first crop recovery of fertilizer.

Specific calculation

Calculating N fertilizer recommendation

– Estimate crop N demand for a target grain yield (UN): Based on the figure of relationship between maximum yield, target yield and total N uptake.

– Estimate potential indigenous N supply (INS):

+ If grain yield (t/ha) in an N omission plot was measured, estimate INS

If GY (NPK) <=GY(0N) then INS (kg N/ha) = GY(0N) x 15

If GY (NPK) >= GY(0N) then INS (kg N/ha) = GY(0N) x 13

+ If grain yield was measured in an NPK plot only and a good estimate of RE_N is available, use equation:

INS (kg N/ha) = (GY x 17) - (RE_N x FN)

GY: Grain yield (t/ha)

RE_N: The apparent recovery efficiency of applied N (0.3 - 0.5 kg N/kgN applied)

FN: the amount of fertilizer N added.

– Estimate recovery efficiency of applied N fertilizer (RE_N)

– Calculate N fertilizer rate as a function

FN (kg N/ha) = (UN -INS)/RE_N

UN: the total N uptake with grain and straw (kg/ha)

INS: the potential indigenous N supply (kgN/ha)

RE_N: the recovery efficiency of N taken up (kg/kg N applied)

Calculating P fertilizer recommendation

– Estimate crop P demand for a target grain yield (UP): Based on the figure of relationship between maximum yield, target yield and total P uptake.

– Estimate potential indigenous P supply (IPS):

+ If grain yield (t/ha) in an P omission plot was measured, estimate IPS

If GY (NPK) <=GY(0P) then IPS (kg N/ha) = GY(0P) x 2,6

If GY (NPK) >= GY(0P) then IPS (kg N/ha) = GY(0P) x 2,3

+ If grain yield was measured in an NPK plot only and a good estimate of RE_P is available, use equation:

IPS (kg P/ha) = (GY x 3) - (RE_N x FN)

GY: Grain yield (t/ha)

RE_P: The apparent recovery efficiency of applied P (0.2 - 0.3 kgP/kgP applied)

FP: the amount of fertilizer P added.

– Estimate recovery efficiency of applied P fertilizer (RE_P)

– Calculate P fertilizer rate as a function

FP (kg P/ha) = (UP -IPS)/RE_P

UP: the total P uptake with grain and straw (kg/ha)

IPS: the potential indigenous P supply (kgP/ha)

RE_P: the recovery efficiency of P taken up (kg/kg P applied)

Calculating K fertilizer recommendation

– Estimate crop K demand for a target grain yield (UK): Based on the figure of relationship between maximum yield, target yield and total K uptake.

– Estimate potential indigenious K supply (IKS):

+ If grain yield (t/ha) in an N omission plot was measured, estimate IKS

If GY (NPK) <=GY(0K) then IKS (kg K/ha) = GY(0K) x 15

If GY (NPK) >= GY(0K) then IKS (kg K/ha) = GY(0K) x 13

+ If grain yield was measured in an NPK plot only and a good estimate of RE_K is available, use equation:

IKS (kg K/ha) = (GY x 17) - (RE_K x FK)

GY: Grain yield (t/ha)

RE_K: The apparent recovery efficiency of applied K (0.4 - 0.6 kg/kgK applied)

FK: the amount of fertilizer K added.

– Estimate recovery efficiency of applied K fertilizer (RE_K)

Calculate K fertilizer rate as a function

FK (kg K/ha) = (UK -IKS)/RE_K

UK: the total K uptake with grain and straw (kg/ha)

IKS: the potential indigenous K supply (kgK/ha)

RE_K: the recovery efficiency of K taken up (kg/kg K applied)

2. Application

– Implement at the farm level without available facilities for chemical soil or plant analysis.

– Calculate the site specific N, P, K in irrigated rice. In principle, the same approach can be used for rain-fed lowland or upland rice. However, crop and cropping systems specific data for modelling the relationship between grain yield and nutrient uptake and estimating INS, IPS and IKS are required. Unpredictable changes in soil moisture availability in upland and rain-fed systems may make this difficult because one of the major assumptions for the model is that water availability does not limit growth.

– Assuming balanced fertilizer use, proper crop management, no other agronomic constraints to grain yield.

Annex 3: Update on rice production in Viet Nam (2002) and MARD policy on rice production

1. General evaluation of transition of economic structure in 2001 - 2002

– In the early years of the 21st century, the reform of Viet Nam's economic structure took place against a difficult background due to the decreasing price of agricultural products, frequent disasters accompanied by negative impacts from world economics. However, the Government has made an effort to achieve expected objectives and plans in all sectors, including increased agricultural production.

– Local Governments are considering implementing new cropping patterns, increasing cultivated areas, improving policy impact awareness, developing projects for using high quality rice varieties, and increasing the number of crops per year by using short duration, high yield and high quality hybrid varieties.

– The results of economic transition have included an increasing percentage of agricultural goods exported, improved quality of rice for export and achieving higher prices, up from US$ 20 to US$ 30/ton. Finally, the reformed agricultural sector integrates better with the global market.

2. Rice production in 2002

According to primary evaluation in 2002, the area cultivated with rice was 7.47 million hectares, a decrease of 17,000 hectares compared with 2001, whereas rice yields increased by 0.15 tons/ha, up to 4.4 tons/ha. Gross national output reached 33 million tons, an increase of 1 million tons compared to 2001.

– *Winter-spring season:* Area, average yield and gross output were 3 million hectares, 5,5 tons/ha and 16 million tons respectively.

– *Summer season:* Area, average yield and gross output were 2,2 million hectares, 3.85 tons/ha and 8.47 million tons respectively.

– *Wet season:* Area, average yield and gross output were 2.2 million hectares, 3.75 tons/ha and 8.25 million tons respectively.

The area cultivated with rice increased mainly in the winter-spring season and summer season in the Mekong River Delta and the wet season in the Red River Delta. The Mekong River Delta region produced approximately 17 million tons of rice, of which 11 million tons were for selling, at a price of VND 1,600 - 1,700/kg. Average yields in the wet season in the Red River Delta achieved 5.95 tons/ha.

3. MARD strategies for high quality rice production, 2002 - 2003

a. Expand cultivation of high yield and high quality rice using three groups of rice varieties and maintaining maximum growing area of winter spring crop:

  – Line breed rice group with high yield

  – Hybrid rice group with high yield

  – High quality rice group

– Using these rice varieties, national regions will improve farming efficiency.

b. Develop zoning for high quality rice production, using 1.3 million hectares to harvest 1 million tons of high quality rice per year:

– 1 million hectares per season designated in the Mekong Delta region

– 300,000 hectares designated in the Red River Delta in 2003

– Establish contract system to buy rice from these zones.

c. Adopt cost reduction strategies to produce rice by using high intensification technologies and low inputs for high yield and high quality rice, decrease damage after harvesting and decrease production costs.

d. Strengthen institutions

– Develop collaborative activities among international and national organisations, government ministries, businesses and other relevant organisations, especially in the promotion of trade activities

– Build training programmes on international integration with exporting strategies for agricultural products

– Expand extension networks to the village level, providing each commune with at least one or two extension workers to help farmers develop high quality rice production, especially in important rice production provinces.