



Integrated Assessment of the Impact of Trade Liberalization on the Rice Sector

UNEP Country Projects Round III

A Synthesis Report





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Foreword

Integrated assessment is the evaluation of the environmental, social and economic effects of past and future policies, and their linkages in the context of sustainable development. It provides policy makers with the information necessary to make informed decisions about the design and implementation of policies that promote sustainable development. In the context of trade-related policies, integrated assessments can help policy makers better analyse and understand the key relationships between trade, the environment, economic development, poverty and social equity.

International trade can have both positive and negative environmental, social and economic effects. These effects may vary across regions, ecosystems and industrial sectors. Integrated assessment provides tools for considering the full range of these effects, both short and long-term, both direct and indirect. The information gained through integrated assessments can be used to ensure that sustainable development gains from trade liberalization are maximized while negative impacts are minimized. UNEP has by now facilitated a series of three rounds of country projects focused on integrated assessment of trade and trade-related policies, starting in 1997 with the first round. The eighteen countries taking part in the studies have been selected to represent different regions and continents, and to ensure a diversity of natural resource sectors, ecosystems, economic development and market conditions. The success of the first two rounds of country projects has led to increased interest by both developed and developing countries in the use of integrated assessment methodologies.

This document provides a synthesis of the integrated assessment studies conducted in the third, most recent, round of country projects commissioned by UNEP, which focused on the rice sector. Over the past two years, UNEP has worked closely with national institutions in China, Colombia, Indonesia, Ivory Coast, Nigeria, Senegal and Viet Nam to identify the environmental, social and economic implications of trade liberalization in the rice sector.

This publication and the national country reports are designed to be of particular use to environment and trade analysts, as well as to policy makers and trade negotiators. This synthesis report commences with an introduction describing the value of integrated assessment to national policy makers, and the history of the UNEP-supported process of national country studies that has led to this third round focusing on the rice sector. This introduction is followed by a discussion of the rationale for integrated assessment that describes the purposes integrated assessments can serve in clarifying trade linkages, informing policy makers, supporting negotiators, and promoting inter-ministerial, regional, and international cooperation. The synthesis report then provides an overview of the specific objectives of the rice projects followed by a description of the background country conditions and context of each study, noting varying factors such as functions of the rice sector and the characteristics of rice production.

After setting out these contextual issues, the synthesis report continues with a detailed analysis of the processes and methodologies involved, including the issue of local capacity building. In the next section the report summarizes the broad, overarching results of the country studies, noting the differing environmental, economic and social implications of trade liberalization and trade rules in the different settings of each country. These outputs are then examined in terms of sectoral findings and integrated

impact analysis, followed by the policy recommendations formulated by each country team and what is needed to deliver the policy message. The synthesis report ends with a list of lessons learned, conclusions and recommendations for next steps which will be of practical value to government officials, negotiators and other stakeholders interested in using integrated assessments as a tool to ensure that trade liberalization maximizes its contribution to national well-being and development. The Executive Summaries prepared by each country team complete the publication.

This report is a synthesis of the main findings and conclusions from seven country studies and attempts to draw general conclusions and lessons learned. However, the findings should be read in light of the fact that the countries varied significantly with respect to environmental conditions, economic development, the stage of application of trade liberalization rules and their status as a net rice importer or exporter. The value of integrated assessment is that these important contextual factors *are* taken into account when developing an understanding of key linkages and formulating policy responses.

Acknowledgements

The preparation of this publication has been made possible by the cooperation and commitment of many individuals and organizations.

At the country level, each of the seven national teams and their leaders worked intensively to organize national workshops, gather field data, analyse economic, social and environmental trends and develop policy recommendations. The work of the multidisciplinary national teams, supplemented by inputs from a wide group of national as well as local stakeholders that participated in workshops and consultations, was essential in ensuring that diverse cultural, environmental, economic and social perspectives and felt priorities were integrated into the country analyses and conclusions. National Steering Committees were established to ensure projects remained relevant and on-track. They helped to identify emerging environmental, social and economic problems, to identify causes and interrelations, and to elaborate policy responses. In some cases, national governments, particularly environment, agriculture and trade ministries were important and active participants.

At UNEP, the project was initiated and led by Hussein Abaza. Sophie Forster Carbonnier and Mariko Hara coordinated and provided technical and logistical support to the project. The country teams prepared the full studies as well as the summaries included in this synthesis report. Thanks are due to Jan Joost Kessler, Konrad von Moltke and Fulai Sheng for having provided critical reviews of draft reports. This appreciation is also extended to the members of the international working group on rice set up by UNEP to guide and implement the projects and provide comments. The members of this group, who attended the two international expert meetings on 19-20 February and 17-18 November 2003 in Geneva, and provided useful contributions and comments on these occasions, are: Tunji Akande, Nigerian Institute of Social and Economic Research; Claude Auroi, IUED; Luisa Bernal, South Centre; Concepción Calpe, FAO; Céline Charveriat, Oxfam International; Martha Chouchena-Rojas, IUCN; Aliou Diagne, West Africa Rice Development Association; Salah El Serafy, Consultant, USA; Aimée Gonzales, WWF International; Dongmei Guo, State Environmental Protection Administration, China; Nestór Gutiérrez, Federación Nacional de Arroceros, Colombia; Mark Halle, IISD; Dimitris Diakosavvas, OECD; Panos Konandreas, FAO; Doug Koplow, Earth Track, Inc.; Hans-Jörg Lehmann, Federal Office for Agriculture, Bern; Eric Peters, European Commission; Majda Petschen, WTO; Shishir Priyadarshi, South Centre; Sarah Richardson, Maeander Enterprises Ltd., Canada; Abdoulaye Sene, Institut des Sciences de l'Environnement, Dakar; Shefali Sharma, IATP; Miho Shirotori, UNCTAD; Matius Suparmoko, Jenderal Soedirman University, Indonesia; Robert Teh, WTO; Gerard van Dijk, UNEP Regional Office for Europe; Truong van Tuyen, Hue University of Agriculture and Forestry, Viet Nam; Scott Vaughan, (ex-Carnegie Endowment) OAS; Rene Vossenaar, UNCTAD; Alex Werth, ICTSD.

Sophie Forster, Susan Broomfield and Benjamin Simmons prepared the introduction to this Synthesis Report. Kevin Lyonn of Sustainable Development Services provided the sections dealing with country contexts, process, outcomes and conclusions. Susan Broomfield edited the final report and Executive Summaries; however full responsibility for the content of the latter remains with the authors. Logistical support was provided by Desiree Leon and Rahila Mughal from UNEP.

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United Nations Environment Programme

The United Nations Environment Programme (UNEP) is the overall coordinating environmental organization of the United Nations system. Its mission is to provide leadership and encourage partnerships in caring for the environment by inspiring, informing and enabling nations and people to improve their quality of life without compromising that of future generations. In accordance with its mandate, UNEP works to observe, monitor and assess the state of the global environment, improve the scientific understanding of how environmental change occurs, and in turn, how such change can be managed by action-oriented national policies and international agreements. UNEP's capacity building work thus centres on helping countries strengthen environmental management in diverse areas that include freshwater and land resource management, the conservation and sustainable use of biodiversity, marine and coastal ecosystem management, and cleaner industrial production and eco-efficiency, among many others.

UNEP, which is headquartered in Nairobi, Kenya, marked its first 30 years of service in 2002. During this time, in partnership with a global array of collaborating organizations, UNEP has achieved major advances in the development of international environmental policy and law, environmental monitoring and assessment, and the understanding of the science of global change. This work also supports the successful development and implementation of the world's major environmental conventions. In parallel, UNEP administers several multilateral environmental agreements (MEAs) including the Vienna Convention's Montreal Protocol on Substances that Deplete the Ozone Layer, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (SBC), the Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam Convention, PIC) and the Cartagena Protocol on Biosafety to the Convention on Biological Diversity as well as the Stockholm Convention on Persistent Organic Pollutants (POPs).

Division of Technology, Industry and Economics

The mission of the Division of Technology, Industry and Economics (DTIE) is to encourage decision makers in government, local authorities and industry to develop and adopt policies, strategies and practices that are cleaner and safer, make efficient use of natural resources, ensure environmentally sound management of chemicals, and reduce pollution and risks for humans and the environment. In addition, it seeks to enable implementation of conventions and international agreements and encourage the internalisation of environmental costs. UNEP DTIE's strategy in carrying out these objectives is to influence decision-making through partnerships with other international organizations, governmental authorities, business and industry, and non-governmental organizations; facilitate knowledge management through networks; support implementation of conventions; and work closely with UNEP regional offices. The Division, with its Director and Division Office in Paris, consists of one centre and five branches located in Paris, Geneva and Osaka.

Economics and Trade Branch

The Economics and Trade Branch (ETB) is one of the five branches of DTIE. Its mission is to enhance the capacities of countries, especially of developing countries and countries with economies in transition, to integrate environmental considerations into development planning and macroeconomic policies, including trade policies. ETB helps countries to develop and use integrated assessment and incentive tools for sustainable development and poverty reduction. The Branch further works to improve the understanding of environmental, social and economic impacts of trade liberalization and the trade impacts of environmental policies, and to strengthen coherence between MEAs and the World Trade Organization. Through its finance initiative, ETB helps enhance the role of the financial sector in moving towards sustainability.

In the field of environmental economics, ETB aims to promote the internalisation of environmental costs and enhance the use of economic instruments to contribute to sustainable development and poverty reduction, including in the specific context of MEAs. The UNEP Working Group on Economic Instruments serves as an advisory body to UNEP-ETB's work programme on economics and has been instrumental in the preparation of UNEP publications on economic instruments.

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Abbreviations and Acronyms

ADRAO	Association for the Development of Rice Production in West Africa
AFTA	ASEAN Free Trade Area
ANADER	Agence Nationale d'Appui au Développement Rural (Côte d'Ivoire)
AoA	Agreement on Agriculture
ASEAN	Association South East Asia Nations
BULOG	State Trading Enterprise (Indonesia)
CAPSiM	CCAP's Agricultural Policy Simulation and Projection Model (China)
CARE	Crédit de Relance Agricole (Côte d'Ivoire)
CAS	Chinese Academy of Science
CASA	Crédit d'Ajustement du Secteur Agricole (Côte d'Ivoire)
CBA	Cost-benefit analysis
CCAP	Centre for Chinese Agricultural Policy
CEPT	Common Effective Preferential Tariff (Viet Nam)
CGE	Computable general equilibrium model
CGPP	Caisse Générale de Péréquation des Prix (Côte d'Ivoire)
CIR	Cost of Internal Resources (Senegal)
CIRES	Centre Ivoirien de Recherches Economiques et Sociales
CIRIZ	Inter-professional Committee on Rice (Senegal)
COFCO	China National Cereals, Oils and Foodstuffs Import & Export Corporation
CORPOICA	Agricultural Research Corporation (Colombia)
DANE	National Statistics Agency of Colombia
DTIE	UNEP Division of Technology, Industry and Economics
EIA	Environmental Impact Assessment
ETB	UNEP Economics and Trade Branch
FAO	Food and Agriculture Organization of the United Nations
FCFA	West-African franc zone currency
FEDEARROZ	Federación Nacional de Arroceros/National Rice Growers Association (Colombia)
FMARD	Federal Ministry of Agriculture and Rural Development (Nigeria)
FME	Federal Ministry of Environment (Nigeria)
FOB	Free On Board
GDP	Gross domestic product
GIE	Groupements d'Intérêt Economique (common economic interest groups)
GM	Genetically Modified
GMOs	Genetically Modified Organisms
ha	Hectare(s)
IATP	Institute for Agriculture and Trade Policy
ICM	Integrated crop management
ICTSD	International Centre for Trade and Sustainable Development

IDR	Import dependency ratio
IISD	International Institute for Sustainable Development
IITA	International Institute of Tropical Agriculture (Nigeria)
IMF	International Monetary Fund
IPM	Integrated Pest Management
ISG	International Support Group (Viet Nam)
ISRA	Institut Sénégalais de Recherche Agricole
IUED	Institut Universitaire d'Etudes du Développement/Graduate Institute of Development Studies
MAP	Policy Analysis Matrix (Senegal)
MARD	Ministry of Agriculture and Rural Development (Viet Nam)
MEA	Multilateral Environmental Agreements
MERCOSUR	Mercado Común del Sur (common market including Argentina, Brazil, Paraguay and Uruguay)
MOT	Ministry of Trade (Viet Nam)
NERICA	New Rice for Africa
NGO	Non-governmental organization
NISER	Nigerian Institute of Social and Economic Research
OAS	Organisation of American States
OECD	Organization for Economic Co-operation and Development
PEM	Partial equilibrium model
PNR	Projet National Riz (Côte d'Ivoire)
PRA	Participatory Rural Appraisal
PRCEE	SEPA Policy Research Centre for Environment and Economy (China)
REI	Réseau d'Etudes d'Impact (Côte d'Ivoire)
RRA	Rapid rural appraisal
SAC	Sociedad de Agricultores de Colombia
SAED	Society for land use in the River Senegal delta and the valleys of the Rivers Senegal and Faleme
SEPA	State Environmental Protection Administration (China)
SODERIZ	Société de Développement de la Riziculture (Côte d'Ivoire)
TEC	Tarif Extérieur Commun (WAEMU / Senegal)
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	U.S. Agency for International Development
VAT	Value added tax
Viet Nam-USBTA	Bilateral Trade Agreement between Viet Nam and the United States
WAEMU	West African Economic and Monetary Union
WARDA	West African Rice Development Association
WTO	World Trade Organization
WWF	World Wide Fund International

Introduction

There has been increasing recognition of the importance of integrated assessments over the last few years with the goal of informing decision-making and planning processes at the strategic level of policy-making. Different approaches coexist and vary in name and terminology (e.g. strategic environmental assessment, strategic impact analysis, sustainability impact assessment), but they all share the same objective of ensuring that sustainability considerations are fully addressed in policies, plans and integrated programmes. It is still unfortunately the case that many important decisions on trade, development and public expenditure do not take into account environmental, social and other factors and costs involved in the proposed policy or action.

Since 1997, UNEP has supported work on integrated assessments of trade and trade-related policies and has developed tools to help practitioners conduct integrated assessments. By identifying key relationships between trade, the economy, the environment and society, integrated assessments provide policy makers with the information they need to develop policies that support sustainable development. The initiative to strengthen institutional and human capacities to integrate a range of considerations in development planning and decision-making in developing countries and countries in transition was undertaken by UNEP in response to a request by its Governing Council in its resolutions GC21/14 and GC22/10. In the first round of capacity building activities for integrated assessment and planning, UNEP-ETB worked closely with six countries – Bangladesh, Chile, India, the Philippines, Romania and Uganda – on specific projects to identify the impacts of trade liberalization on national environmental resources and the use of

economic instruments to manage these impacts in a sustainable manner.

Following this successful first round, which was completed in 1999, a second round of country projects was launched in 2000. Projects in this round focused on applying integrated assessment and planning methodologies to the agricultural sector in China, Ecuador and Nigeria; the fisheries sector in Argentina and Senegal; and the forestry sector in Tanzania. In response to country requests, a third round of national capacity building for integrated assessment and planning was undertaken. At the beginning of the third phase, UNEP convened a preparatory meeting, with the participation of experts from IGOs, NGOs and relevant UN agencies, to come up with concrete plans for the new set of UNEP country projects. The meeting advised UNEP to focus on the rice sector due to its importance in the national economies of many countries and as a major source of food for large segments of the population worldwide. This new round of studies also focused more explicitly on the aspect of rural and urban poverty.

Based on the criteria specified by experts, seven countries – China, Colombia, Côte d'Ivoire, Indonesia, Nigeria, Senegal and Viet Nam - were selected for this third round. Earlier rounds of country projects were undertaken simultaneously with the drafting of the UNEP *Handbook on Integrated Assessment of Trade-related Measures The Agriculture Sector*. This practical guidebook provides useful information for designing and implementing integrated assessments of agriculture policies, and serves as a useful supplement and complement to the UNEP *Reference Manual for the Integrated Assessment of Trade-Related Policies*, published in 2001.

At the request of governments, UNEP/ETB has, in 2004, initiated a new round of country-level studies, which has expanded the approach to what has been called ‘integrated assessment and planning for sustainable development’. The aim of these UNEP projects is to strengthen and improve

existing plans and planning processes in support of sustainable development, such as Poverty Reduction Strategy Papers (PRSPs) and regional development plans. It will do so by undertaking an integrated assessment of critical issues and linkages in relevant areas of poverty, trade and the environment.

1. The rationale for integrated assessment

In many developing countries, trade, economic, environment and other sectoral policies are developed through separate and distinct policy processes. Isolated policy-making, however, is commonly a cause of policy failures that often become evident only after substantial damage to natural and environmental resources, negative impacts on vulnerable social groups, and/or economic losses have already occurred.

Integrated assessment provides a way to consider the full range of costs and effects, short and long-term, direct and indirect, that policies may have on the economy, environment and society. In that perspective, integrated assessment involves not only technical and scientific research but also a process of stakeholder dialogue that serves the fundamentally important purposes of qualifying or validating in real life terms the scientific conclusions reached, and of acquiring stakeholder perceptions on critical issues as well as insights on complex qualitative relations and interactions. Integrated assessment must be demand driven to bring about feasible and desirable policy change.

A further logical element of integrated assessment is capacity building at national as well as decentralized levels. Integrated assessment is not a “one-off” exercise. It can and should be used to analyse options before a policy is decided upon (*ex ante*), to monitor and evaluate the impacts of ongoing policy application and, in pursuit of lessons to be learned, in the evaluation of policies already applied (*ex post*). A very important element of the UNEP programme is to install and support capacity at the national level to carry out integrated assessment in the scope and with the iterative frequency that is required.

Generally speaking, integrated assessment of policies, and trade-related policies in particular, can serve at least six main purposes:

- 1. Exploring and clarifying the linkages between trade, the economy, society and the environment.** Over time, a better understanding of these relationships can encourage policy makers to develop “best cost” sustainable development strategies and policies and build understanding and support among stakeholders for those measures.
- 2. Informing policy makers across government and contributing to inter-ministerial coordination.** Providing information to policy makers across government departments on the implications of proposed trade policies helps to enhance coordination between trade, environment, planning and relevant sectoral ministries, facilitate communication and integrated policy-making, and build consensus and administrative capacity.
- 3. Informing negotiators.** Providing information to negotiators to pursue trade-related policies in ways that promote sustainable development by identifying the environmental and development effects of trade policies or agreements early in the process, thus enabling the modification of the trade-related policy or agreement if appropriate.
- 4. Developing policy packages.** Results from the assessment can help countries design integrated environmental, social and economic policies at the national level to accompany the trade-related policy/agreement. These policies should be designed to promote the beneficial impacts of trade liberalization while concurrently mitigating any negative impacts.

- 5. Increasing participation and transparency in decision-making.** The involvement of NGOs, private sector, local communities, industry and other domestic interest groups can help to build consensus, provide new insights and strengthen national capacities, as well as ensuring that a broad range of views are considered in the assessment.
- 6. Developing regional and international understanding and cooperation.** The assessment process can assist in creating new regional and

subregional partnerships, which have the potential to support the planning and creation of sustainable development policies at national, regional and international levels.

Integrated assessment is best seen as the beginning not the end of a process designed to enhance the contribution of trade to sustainable development. The logical next step is to respond to the information and analysis provided by an integrated assessment through developing and implementing a range of integrated policy measures.

2. The specific objectives of the rice studies

In addition to the general aims of integrated assessments described above, the specific objectives of the rice studies were also to:

- assess the positive and negative impacts of trade liberalization;
- perform cost-benefit analyses of policy packages;
- develop country and sector specific methodologies to carry out these assessments;
- enhance countries' understanding of the implications of multilateral trade rules (World Trade Organization Agreement on Agriculture (WTO AoA) and regional trade agreements) in the agriculture sector on their environment, society, national economy and development, with special focus on the rice sector;
- enhance and support national capacity in international trade policy and research and in national negotiating capacity in bilateral, regional and multilateral agreements;
- enhance coordination between national entities and increase their expertise in identifying and quantifying economic, environmental and social impacts of trade liberalization on the agricultural sector;
- formulate policy proposals to mitigate negative impacts and enhance positive impacts of trade liberalization through economic and regulatory instruments and community-based initiatives.

3. The country contexts

The seven studies were conducted in countries that have differing economic, environmental and social conditions. This section describes the country contexts in terms of the importance of rice, the characteristics of rice production, the international rice market and the state of application of trade liberalization measures and multilateral agreements.

3.1 Why and how is rice important?

In all seven countries, rice has a high importance for food security and for the economy in general. In **China**, rice is the most important food crop and accounts for up to 45 per cent of total grain production nationally. However, China's share of world rice production dropped to less than 30 per cent after 2000. Given the enormous importance of rice in terms of domestic food security and the fact that China's rice exports, which account for up to 20 per cent of world rice exports, amount to no more than 5 per cent of domestic output, the major influences on China's rice sector are very much internal rather than external. A major influence has been a change in demand structure. The rice growing area is widespread and very varied in ecological terms. Eighty-five per cent of the area is in the mid and downstream plain of the Yangtze River and the basin plain and delta of the Pearl River. The change in demand structure brought about by adjustment policies has already produced a reduction of area in the south (where rice is of lesser quality) and increased the higher quality area in the north (so-called 'mountain rice').

In **Colombia**, rice occupies a major volume of the area under cultivation, accounts for about 4 per cent of the agricultural gross domestic product (GDP) and is a staple food in low-income households.

In **Côte d'Ivoire**, rice production accounts for 5 per cent of the GDP. Domestic demand is far beyond domestic production although 20 per cent of agricultural households are involved in rice production.

A similar situation occurs in **Indonesia** where the country has the fourth largest rice-growing area in Asia with 50 per cent of households involved in rice production but failing to meet domestic demand. Rice is the greatest source of calories for the rural population and about 20 per cent of household income is spent on rice purchases. Rice is crucially important in Indonesia for food security and rural development.

In **Nigeria**, rice production has increased by 10 per cent per year since the mid 1970s and rice is now a major national staple crop and food. Since the 1960s, national rice consumption has increased markedly and now occupies a critically important place in relation to food security and in generating employment and income. The Government aims to expand this development so as to become a net exporter of rice by 2007.

In **Senegal**, the demand for rice continues to increase and rice imports necessitate the use of scarce foreign exchange. The Government, therefore, aims to increase national production. Rice accounts for 34 per cent of national average cereal consumption and 25 per cent of rural household spending. It is noteworthy that locally produced rice covers only 20 per cent of domestic demand and is largely consumed in and around the production areas. In fact, around 30 per cent of domestic production is consumed by the producing households themselves. At present, it appears that the major benefit derived from the sector has been in terms of food security and rural livelihoods.

In **Viet Nam**, the importance of rice is even more marked since rice production covers 82 per cent of the total crop area and accounts for 75 per cent of caloric intake and 94 per cent of cereal consumption. Fully 80 per cent of the population is involved in rice production and is dependent on it for income. Around 45-50 per cent of rural household revenue comes from rice. Viet Nam is now a major rice exporter. The value of total rice production accounts for 78 per cent of total national agricultural revenue.

This brief summary demonstrates clearly that rice plays a major, if not critical, role in the economies (production and consumption), the societies (food security, employment, income-generation, even culture in certain cases) and, given the large overall areas under production (either irrigated or rain fed), in the environmental conditions of all the countries where the studies were undertaken (by occupying land, using water, influencing biodiversity and making use of agro-chemicals). For these countries, policies and practices concerning rice, whether external or internal, are clearly vital to their sustainable development.

3.2 Rice production

In terms of the characteristics of rice production in the countries concerned, the first point of note is that, even within countries, there are a series of variables including the size of farms, the type of water supply used, the type of rice grown, the farming systems, the crop cycles possible and practiced, and the subsequent stages of processing involved.

In **China**, different from other rice producing countries, the majority of rice production is irrigated. The cultivation area is huge and very differentiated ecologically and the rice varieties produced and their varying qualities make it difficult to generalize about the sector. So-called 'mountain-rice' is much more efficient in terms of water use than most irrigated rice.

In **Colombia**, there are two main production systems, irrigated (mechanized or not) and rain fed

upland traditional (manual). Irrigated production produces higher yields per hectare but the traditional upland system is important for the food security of the isolated populations that cultivate it. Moreover, the traditional system is environmentally friendly since it does not use agro-chemicals and preserves native rice varieties from extinction. Upland production accounts for only 6 per cent of the area under cultivation and 1.5 per cent of total national production but it employs over 50 per cent of the rice producers in the country, usually on an area of less than three hectares, which is considered locally to be subsistence level.

In **Côte d'Ivoire**, rain fed production constitutes 93 per cent of the total rice growing area but also produces lower yields than irrigated areas. In the rain fed areas, farms are small, based on family labour, unprotected from climatic risks and the produce is largely for consumption by the producers themselves as a basic element of food security. Rain fed production has increased, albeit slowly, through extensification of existing practices and existing low yields. Irrigated rice production is more commercially oriented and has used investment to produce higher yields. Until trade liberalization took place, Government support went, by and large, to encourage irrigated production. Growth in overall production has been slow due to the rather low yields of rain fed production that accounts for 85 per cent of total production.

Rice farming in **Indonesia** is also based on small farms. Half of the farmers cultivate less than one quarter of a hectare and their main objective is family food security. Only about 60 per cent of farms are irrigated and can practice double cropping. There is virtually no more potential to expand rice production, an increase of production should result from intensification.

In **Nigeria**, in view of the rapid increase in demand for rice in recent years, production takes place in all climatic and ecological zones of the country. However, production increase has taken place through extensification rather than intensification. Rain fed lowland production accounts for 50 per cent of the total cultivated area, rain fed uplands

account for 30 per cent and the high-yield irrigated sector accounts for only 16 per cent. The high demand therefore makes large-scale rice imports necessary. The local processing of paddy is not efficient being based on small mills where up to 49 per cent of the rice processed is broken.

In **Senegal**, the most important production area is that along the River Senegal where intensive irrigated production is practiced giving yields of 5.5 tons/ha. However, the best use is not yet made of this area since double cropping, although possible, is not practiced and new investment is needed in technology to achieve potential yield levels. The rain fed areas in the south (Casamance) are extensive, covering 61 per cent of the total area under rice cultivation but they account for only 29 per cent of domestic production. The processing of paddy is reported to be of poor quality, which is one reason imported rice is preferred.

In **Viet Nam**, rice production is characterized by small, irrigated farms (often less than one hectare), labour-intensive practices, and growing use of inorganic fertilizer. Multiple cropping is widespread in irrigated areas, reaching up to three crops per year in the Mekong Delta but in rain fed lowlands many farmers only grow one rice crop per year due to inadequate water supply. There is little opportunity for extensification but intensification is feasible in existing areas through investment in flood control and drainage. Traditional rice varieties are widely grown. Net profits for the farmers vary from around 20 per cent in rain fed lowlands to about 24 to 27 per cent in irrigated areas, and traditional varieties produce higher profits than modern ones, mainly because the costs of pesticides and fertilizers are lower for the traditional varieties. Viet Nam is said to have the lowest rice production costs in the world, which gives it a competitive advantage in international markets.

Integrated Pest Management (IPM) has become common in a number of the countries in which the studies were undertaken, such as Colombia, Indonesia and Viet Nam. IPM has environmental benefits while it also reduces farmers' costs since they need to buy less agro-chemical inputs. The

major disadvantages are the need for IPM training, the sometimes slightly lower yields and the pressure from extension agents to use agro-chemicals. The use of organic fertilizers, with similar benefits for both farmers and the environment, is still uncommon in all of these countries.

3.3 The international rice market

Of the seven countries concerned, only China and Viet Nam are net rice exporters and rice exports create considerable assets for the economy. For China, the domestic market is much more important than the export market, despite the fact that China's rice exports amount to 20 per cent of the world rice market. The remaining five countries are net importers although Nigeria and Indonesia are aiming to become exporters in the near future. Trade liberalization measures and consequent international price reductions have resulted in both Colombia and Indonesia becoming net importers while China and Viet Nam have increased exports considerably. Production costs of rice are particularly low in both China and Viet Nam. The internal demand for rice remains high in all countries and is unlikely to change. Finally, rice imports often place a heavy burden on scarce foreign exchange, and may cause rice prices to decline thus making rice production by local farmers an unprofitable enterprise. The result may well be strong pressure to increase local production in a way that will encourage growth but not respect the environment.

3.4 Trade liberalization measures

One of the principal goals of the rice projects was to develop a better understanding of the potential effects in the rice sector of trade liberalization pursuant to multilateral agreements. In different countries, liberalization in the rice sector has occurred variously through participation in bilateral, regional or multilateral trading arrangements, structural adjustment programmes, or through national initiatives. Isolating the effects of a particular agreement or arrangement is therefore often very difficult. Nevertheless, knowledge of the differing economic contexts of each country, and

the associated legal and institutional environments, will help when understanding the findings of the various country reports.

China has been implementing liberalization measures since 1978 and the foreign trade market has opened up particularly in the 1990s with foreign trade in agricultural products having multiplied by 14 in 20 years. The introduced internal liberalization measures already produced a change in demand structure for rice that will affect production, income and the nature of the rice trade. Following accession to the WTO at the end of 2001, China will also have to comply with the WTO AoA and with basic accession undertakings concerning market access, domestic support and export subsidies. Action on these issues is still limited in scope but will logically continue the move towards the opening of markets.

In **Colombia**, implementing the WTO AoA resulted in a 388 per cent increase in food imports. Residual protection measures for domestic food production are still to be dismantled.

Côte d'Ivoire liberalized the rice sector under structural adjustment in 1995 and the study indicates that domestic liberalization measures have been much more influential on recent trends in the sector than international measures.

In **Nigeria**, trade liberalization took place under economic adjustment measures between 1986 and 1993. Implementation was very variable and inconsistent. Today, Nigeria (different from the other countries except Indonesia) is implementing a new policy to become a net exporter of rice within the WTO Agreements.

In **Senegal**, the rice sector was liberalized in 1995. The devaluation of the FCFA created a sharp rise in production costs that have, by and large, stabilized. The change was much more attributable to regional agreements such as the West African Economic and Monetary Union (WAEMU) than to the WTO AoA.

In **Indonesia**, trade liberalization has been encouraged by structural adjustment, the Association of South East Asia Nations (ASEAN) Free Trade Area (AFTA) and the WTO. The AoA requirement that

all subsidies be abolished has implied a drop in the price, profitability and production of local rice, thus increasing dependence on rice imports.

Market liberalization in **Viet Nam**, including the rice market, was instigated both by the *Doi Moi* development policy and by Viet Nam's bilateral arrangements, particularly with the USA. Viet Nam is now negotiating membership in the WTO and belongs to various regional arrangements. It remains to be seen what impact the conditions of WTO membership will have on the enormous rice sector in Viet Nam.

In sum, it can be said that rice is of great importance in each of the countries studied. In most cases, its importance stems from food security needs, rural development and employment, poverty reduction and domestic consumption. In many cases, its importance goes further and deeper into the cultural field where rice cultivation is the basis of a traditional culture as such. As many reports commented, it was difficult to isolate with specificity the impacts on the rice sector of particular policy measures. Apart from the classic analytical problem of attributing specific causes, the problem may have been made more difficult since, except for China and Viet Nam, rice was not a major export from the country studied. Its great value is, at the time of the study, concerned more with the intricate and often changing conditions of food security needs, income generation and the domestic market where the tracking of policy impacts is complicated.

Systems of production were broadly similar in each country – rain fed (whether lowland or upland) and irrigated (mechanized and non-mechanized). The rain fed areas tend to provide support to local culture, food security and rural income, to preserve traditional biodiversity and to conserve natural resources by limited use of water and of polluting agro-chemicals. They are, on the other hand, extensive areas usually with relatively low crop yields, but high grain-water use ratios. Irrigated rice production is uniformly higher in yield, more attuned to commercialisation and less extensive in area under cultivation, but relatively

inefficient in its use of water (which is particularly important in semi-arid countries like Senegal and parts of China and Nigeria with widespread water scarcity). On the other hand, the benefits of income generation/employment and environmental conservation are less apparent, particularly since such production depends largely on human-made water systems such as dams and canals. Moreover, commercially oriented irrigated production uses both modern varieties of rice and large amounts of agro-chemical treatments, thus causing loss of biodiversity and environmental degradation.

The timing, origin and nature of trade liberalization differ considerably between countries, as is further discussed below. Nigeria appears to see the WTO Agreements as a platform on which to build a policy of becoming a net exporter of rice. Other countries attribute trade liberalization measures more to structural adjustment or regional agreements than to the WTO AoA. Viet Nam and China initiated their own liberalization measures.

4. Process and methodologies

This section reviews the various component elements of the process involved in the case studies. The country projects were each undertaken using a process, timing and methodology based on those set out in UNEP's *Reference Manual for the Integrated Assessment of Trade-Related Policies*, tailored to local conditions. Issues for review are the multidisciplinary character of the technical team leading the study, the range of stakeholders involved in different ways and points in time, the issue of data availability and collation, the methodologies employed in each study, the timing of the assessment in regard to the trade liberalization process and the issue of local capacity building.

The process began in April 2001 when UNEP invited participants from several rice producing countries to a meeting in Geneva to discuss potential studies to assess the economic, social and environmental impacts of the AoA. The different country teams submitted proposals and, for the seven proposals accepted by UNEP, a Memorandum of Understanding was signed between UNEP and the respective national institutions.

4.1 Country teams

Integrated assessment needs high quality sectoral inputs – from experts in economics, sociology, environment and development at least – in order to provide the basis for a high quality integrated final assessment. The implementing partners put together teams that were impressive in both their skill and experience and in the range of expertise.

China: The State Environmental Protection Administration (SEPA) managed the project and the SEPA Policy Research Centre for Environment and Economy (PRCEE) coordinated it. Team members

included experts from the following institutions: Centre for Chinese Agricultural Policy (CCAP) of the Chinese Academy of Sciences; Institute of Agricultural Economics at the Chinese Academy of Agricultural Sciences; the School of Environment at Beijing Normal University; Dept. of Environmental Protection Enforcement and Inspection at SEPA; the Beijing Station of Agricultural Environmental Monitoring; and the Beijing Institute of Petrochemical Technology. Between them, team members provided expertise in agricultural policy, economy, environmental economics and science, Geographical Information Services (GIS), agricultural environment protection, agricultural economics and environmental management.

Colombia: The national rice-growers association (FEDEARROZ) played the lead role and the team was composed of experts from FEDEARROZ the Directorate of International Trade, Ministry of Agriculture Ministry of Environment, the Inter-American Institute for Cooperation in Agriculture (IICA) and the University of Rosario.

Côte d'Ivoire: The West African Rice Development Association (WARDA) and the Réseau d'Etudes d'Impacts provided the technical quality and multidisciplinary of the team.

Indonesia: The Steering Committee for the project brought together the Rector of Jenderal Soerdiman University, the Deputy Minister of Environment and of Planning, the Director of the Rice Security of the Ministry of Agriculture, the Director-General of the Ministry of Foreign Affairs and a group of experts from the Ministry of Trade and Industry.

Nigeria: The project was housed in the Institute for Social and Economic Research. The core team

provided expertise in agricultural economics, environment and natural resource management, rural sociology and gender analysis, economics and modelling and soil sciences.

Senegal: The study was carried out by a team from the Institute of Environmental Sciences, Faculty of Science and Technology, Cheikh Anta Diop University of Dakar (UCAD) plus resource persons from the Department of Analysis, Prevision and Statistics of the Ministry of Agriculture, the Inter-Professional Committee on Rice (CIRIZ) and other institutions.

Viet Nam: The multidisciplinary team brought together expertise in community development, economics, agricultural systems and farming systems.

It is clear that the need for expert input and a multidisciplinary approach was amply fulfilled by each country team.

4.2 Stakeholder dialogue and participation

It is a basic principle of integrated assessment that there should be a wide, relevant and active involvement of those affected by the issue under analysis. Such a process serves to validate and “ground-truth” the scientific analyses of the project teams and, in many cases, such consultation reveals both new and relevant data and “real life” interpretations and approaches.

China: A number of institutions participated in the study. They included the Development Research Centre of State Council, the Division of Negotiation on Agriculture Sector, Ministry of Agriculture, the Agricultural Policy Research Centre, Ministry of Agriculture, China Agriculture University and Nanjing Agriculture University. The field survey was helped by the following stakeholder institutions: Heilongjiang Station of Agricultural Environment Monitoring, Spread Station of Agricultural Technology in Qing’an County, Heilongjiang Province, Shayang County Government, Hubei Province, Tongcheng County Government, Anhui Province and Tongcheng County Agricultural Bureau, Anhui

Province. An initial stakeholder meeting was held to review the basic issues of the project and the different institutions participated as the research developed.

Colombia: The groups represented by the stakeholders were FEDEARROZ, the producer association, INDUARROZ and MOLLIARROZ, the industrial associations, USOCOELLO, the association for the irrigation district of the Coello river, Sociedad de Agricultores de Colombia (SAC), the national producer society, the national Ministries of Agriculture, Environment and External Trade, the National Department of Planning, the National Statistics Agency of Colombia (DANE), the Agricultural Research Corporation (CORPOICA), the National Agricultural Exchange, the Latin American Reserve Fund and experts from the Universities of Los Llanos and Rosario and from local NGOs. Two stakeholder meetings were held, the first to gather opinion about the impacts of trade liberalization on every link in the rice production and marketing chain and the second to qualify the preliminary results of the assessment. The Minister of Agriculture actively participated in the second stakeholder meeting.

Côte d’Ivoire: The stakeholder group included members of WARDA, the Réseau d’Etudes d’Impact de la Côte d’Ivoire (REI), the Ministries of Agriculture, Interior Trade, External Trade and Environment, the Bureau National d’Etudes Techniques de Développement (BNETD), the Programme National de Gestion des Terroirs (PNGTER), the Agence Nationale d’Appui au Développement Rural (ANADER), the Centre Ivoirien de Recherches Economiques et Sociales (CIRES), the Association des Riziculteurs de Côte d’Ivoire (ANARIZ-CI), the Association Nationale des Organisations Professionnelles Agricoles (ANOPACI), the Projet National Riz (PNR) and the Organisation des Volontaires pour le Développement Local (OVDL, an NGO working in rice-producing communities). At a national stakeholder meeting in January 2003, the Minister of Agriculture launched the project. The internal political situation precluded holding further meetings.

Indonesia: An initial stakeholder meeting was held with representatives from the Ministries of Agriculture, Industry and Trade and Environment, the State Food Logistic Agency, the Jenderal Soedirman University, the farmers' organization, the Indonesian Pesticides Analytical Network, the Land Research Institute and the WACANA MULIA Research and Training Institute. The results of the study were discussed at a national seminar on Natural Resource Accounting.

Senegal: The stakeholder process was carried out by organizing six meetings or workshops: to launch the project; with importers, local traders, technical services and management groups (individual interviews were held with major importers); with decision makers and strategic actors; with producers and service providers; with consumers and communication professionals and a workshop on methodology. In these processes, the following groups were consulted: the society for land use in the River Senegal delta and the valleys of the Senegal and Faleme rivers (SAED), the society for agricultural and industrial development (SODAGRI), the inter-professional centre for the agricultural trades (CIFA), the National Rice Observatory (ONRS), the Market Regulation Agency (ARM), the Ministries of Agriculture, Commerce, Environment, Economy and Finance and the regional development Directorates for Fatick, Kaolack, Kolda and Saint-Louis, peasant organizations, traders, importers, NGOs, the Association for the development of rice production in West Africa (ADRAO), the Universities of Dakar and Saint-Louis and the Centre for Ecological Monitoring (CSE).

Viet Nam: Much of the implementation process involved stakeholder participation. An initial workshop aimed at building awareness of the impacts of trade liberalization in the rice sector and at formulating the methodology to be used in the study. In addition to the project team, the following groups participated: Mekong Delta Farming System Research and Development Institute, National Institute for Plant Protection, Hue University of Agriculture and Forestry, Hanoi University of Agriculture, Hue University of Economics, the Ministries of Agriculture and Rural Development, Trade and Natural Resources and Environment, local rice producers, traders, farmers' unions and NGOs (Oxfam).

In overall terms, the stakeholder participation element of the assessment process was carried out in a highly representative and productive manner, but with some variations between countries (see overview below). The range of groups consulted and involved included decision makers and in most cases NGOs, local farmers and private sector representatives. The high level of governmental and political involvement has been important in terms of the potential to bring about policy change and generate commitment for follow-up.

4.3 Availability and collation of data

For the majority of countries, availability of and access to relevant data did not appear to pose a problem. Only Viet Nam commented on the limitation of available data. However, in most other countries one can observe a relative scarcity of information and data when it comes to concrete

Stakeholder participation

	China	Colombia	Côte d'Ivoire	Indonesia	Senegal	Viet Nam
NGO participation	-	+	+	-	+	+
Farmers participation	-	+	+	+	+	+
Private sector participation	-	+	-	-	+	+
Number of multi-stakeholder meetings	1	2	1*	2	6	4

* The internal situation in the country precluded any further meetings

social and environmental impacts of trade policies. Primary data was collected through field surveys, interviews, focus group meetings, Participatory Rural Appraisal (PRA) and focused questionnaires. Secondary data was accessed from official sources (Ministries of Agriculture, Environment, Finance, Economics, the National Statistics Office, Central Bank, Customs Bureau, State Trading Enterprise) and from previous studies and the databases of international organizations such as the UN Food and Agriculture Organization (FAO), the U.S. Agency for International Development (USAID), the World Bank and the United Nations Development Programme (UNDP).

4.4 Methodologies

All country teams stressed the need to use both quantitative and qualitative methods particularly in the attempt to isolate and specify the impacts of trade liberalization. They adapted their choice of methodology to the capacity available and to the characteristics of the given country and its rice sector. In most cases, both *ex ante* and *ex post* approaches were used. For environmental assessment, Environmental Impact Assessment (EIA) techniques, PRA, structured field surveys, Partial Equilibrium Models (PEM), Cost-benefit analysis (CBA), Contingency Valuation, economic valuation were generally used and in one case were complemented by Logarithmic Cost Function and Tornquist indexes. In terms of social and economic impacts, PEMs (with secondary time-series data), Input-Output analyses, substitution cost projection, CBAs, PRAs, and regression and gross margin analysis were used. In one case a Policy Analysis Matrix (MAP) supplemented CBA and PEM. China utilized the specific PEM Agricultural Policy Simulation and Projection Model (CAPSiM) of the CCAP as the basis for multisectoral analysis and simulation.

Qualitative analysis focused mainly on the perceptions of and reactions to trade liberalization of producers, processors, traders and consumers including the aspect of rice as an element of food security and rural income. Quantitative measures

were used to identify the impacts of trade liberalization on production, exports and prices. In terms of the integration of the different sectoral assessments, apart from qualitative cause-effect relations and logical reasoning, CBA and economic valuation appear to have been the preferred tools.

4.5 Timing

As noted earlier, integrated assessment can be used at various stages in the “life” of a given policy. In its most effective mode, it can be used to identify, from the beginning, what would be the best policy to pursue. Such occasions are, however, still relatively rare in real life and integrated assessment can be used to monitor and, where necessary, adjust a policy already in implementation and to analyse *ex post* what effects were caused by a given policy that has been implemented. In the seven studies, the assessment took place after the countries concerned had begun to implement either WTO or regional trade liberalization agreements. However, in three countries the studies had noticeable *ex ante* characteristics. Viet Nam is not yet a member of WTO. To some extent, therefore, the Viet Nam study can be termed *ex ante*. However, Viet Nam has already begun to implement trade liberalization through its own *Doi Moi* policy and in the context of regional and bilateral agreements, especially with the USA. In that perspective, the Viet Nam study has *ex post* characteristics. For China, the timing in relation to accession to WTO is to a real degree *ex ante* given that China joined WTO only at the end of 2001. The analysis is to a large extent predictive. The situation faced by Nigeria is also quite particular. Given the rise in domestic demand for rice and the “staggering levels of rice imports” that the study highlighted, this radical change in the rice sector in Nigeria virtually constitutes an *ex ante* context since the situation demands very substantial change in policy or, indeed, a new policy as such.

4.6 Capacity building

As noted in the Introduction, integrated assessment should not be a “one-off” exercise. To maximize its

usefulness, capacity to reiterate such assessments needs to be firmly installed at the local level within regular systems and procedures. Each of the study teams acknowledged this need and made various proposals for capacity building. The Colombia team proposed the formulation of an Environmental Action Plan for Agriculture within which integrated assessment would be a normal tool. In Côte d'Ivoire, the team recommended the establishment of an observatory for the rice sector to monitor and evaluate progress through integrated assessment. The Indonesia team proposed that a new agricultural policy be formulated which would, at least by implication, involve capacity building for integrated assessment. In Indonesia, a group of economists will meet regularly to monitor developments and encourage policy change. The Nigeria team quite specifically proposed the mainstreaming of integrated assessment within the activities of the body that should be established to

formulate policy and monitor its application. In Senegal, the team emphasized the need to regularize and consolidate the gains made by the project. The Ministries of Trade, Environment and Agriculture have already decided to establish regular lines of communication and exchange. The team proposes that this advance be improved by the inclusion of other stakeholders under the aegis of the inter-professional associations and that assessment become a totally regular activity. The Viet Nam team stated clearly that assessment, sectoral or integrated, was a new phenomenon in the country. Previous central pricing systems had made assessment irrelevant. The team proposed that the gains of the project be consolidated in two ways: public programmes of environmental education and the organization, by the International Support Group (ISG) of the Ministry of Agriculture and Rural Development (MARD), of a policy dialogue which would include the regular use of integrated assessment.

5. Outcomes

In this section, the outcomes of the seven country studies are summarized. First, general observations made by the teams are listed, followed by detailed findings concerning environmental, economic and social impacts identified as effects of trade liberalization and an integrated analysis of these impacts, and finally policy recommendations and messages generated on the basis of the outcomes for the national political and decision-making process. Where possible, outcomes have been quantified, but in many cases qualitative insights are provided.

5.1 General observations

China: The team emphasized that the sheer size and scale of China's rice sector made it non-comparable with other countries; the size of the domestic market is such that exports and the international rice market have little if any influence on the sector. Rice production is and will therefore be determined mainly by domestic policies. The important aspects of the WTO for rice in China will be those of reduction of tax and subsidies internally. Therefore, it is difficult to trace and pinpoint the effects on the rice sector of the WTO AoA and of any external trade liberalization measures as such. The issue is complicated further by the number of rice varieties grown, the widespread and ecologically differentiated cultivated areas and cropping systems. The Executive Summary gives full details of a disaggregated kind analysing the situations of key rice growing areas and typical provinces. Under a WTO scenario, the simulation predicted that by 2010 average per capita rice consumption will decline but total rice demand will increase to 128 million tons because of population growth. By 2010, rice will account for less than 30 per cent of

grain consumption. In the north-east, high quality japonica rice on will benefit from expansion, while in Central China low quality indica rice areas will continue to shrink and face competition.

Colombia: The study highlighted the fragility of the agricultural sector, including rice, especially in light of its importance for poverty reduction, employment and income generation. The decline of the rice price has affected the diversity of cropping systems and caused reduced wealth and welfare in Colombian tropical areas. Further emphasis was put upon the serious impact that protectionism and subsidies in agriculture as practiced by developed countries have on the Colombian economy and society.

Côte d'Ivoire: The study indicated that the trends and changes in the rice sector were not the result of domestic or external policy change, although domestic policy had a greater impact than external policy changes. In essence, the prospects for sustainable rice production depend on whether farmers can increase production and, consequently, their income within environmental standards. The emphasis will be on income generation. The risk is that environmental standards will not be respected.

Indonesia: The study team found it difficult to isolate the impacts of the WTO AoA especially since structural adjustment changes were being implemented in the country at the same time. In overall terms, it is stated that trade liberalization has increased Indonesia's dependency on rice imports, decreased its self-sufficiency ratio and generally affected rice production in Java. The assumption that trade liberalization impacts could be tracked through analysis of price changes for rice proved not to be feasible. The main importance of rice production is poverty reduction and rural development.

Nigeria: The study revealed a huge increase in national consumption of rice, necessitating “staggering volumes of imports”. The reasons underlying the phenomenon were rural food security and the convenience of urban consumers. There is a great need for the country and all stakeholders to identify, understand and deal with the “trade-offs” between production increases in pursuit of self-sufficiency, food security especially in rural areas, the enormous national demand, employment and environmental consequences. In planning the expansion of rice production, there should be an integrated analysis of the implications of any chosen policy.

Senegal: The study demonstrated clearly to all participants and stakeholders that integrated assessment was both valid and timely. An unexpected finding was that consumers did not benefit from trade liberalization since traders did not pass on to consumers the price reductions available. This was seen as a distortion of the principles underlying trade regime changes and a problem that should be addressed by increased transparency. Following trade liberalization, the “winners” were the Government, the importers (whose number had, however, been severely reduced due to competition), the middlemen and to a lesser extent certain categories of producers.

Viet Nam: Rice is the mainstay of a complete culture in Viet Nam. Moreover, Viet Nam is currently the second largest exporter of rice in the world. In general, the impacts of trade liberalization in the rice sector in Viet Nam are positive in terms of the economy, food security and poverty reduction. However, the environmental impacts of rice production are a cause for serious concern. For example, the low price of agro-chemicals encourages excessive use creating soil degradation and water pollution, while expansion of the area under cultivation will pose risks to forest and wetlands biodiversity and habitat. Such environmental damage, if it occurs, will involve considerable economic and financial costs in the future to repair the damage caused. Integrated assessments as carried out are absolutely essential if the best possible policy course is to be chosen.

In conclusion: three strong commonalities emerge from these observations:

- it is difficult to track and trace the specific effects that can be attributed to the application of trade liberalization;
- in almost all cases, domestic reform measures – specific to trade and those associated with macroeconomic adjustment – had more influence than changes emanating from external agreements;
- in all cases, the primary national importance attributed to rice production was that of providing food security and contributing to poverty reduction.

5.2 Environmental impacts identified

To facilitate a comparison of findings across countries, the environmental impacts of trade liberalization are grouped under five headings: agro-chemicals, water, land, biodiversity and human health. The Viet Nam study comments that, by and large, increased production brings economic and social benefits but is negative for the environment. To varying degrees, the other studies are in agreement.

5.2.1 Agro-chemical use

Agro-chemicals, particularly a range of pesticides and fertilizers, are used in the production of rice. The studies found that the use of agro-chemicals in rice production varies between countries, depending upon accessibility, costs and whether cropping is irrigated or rain fed. Agro-chemical use tends to be highest in irrigated cropping, where prices for agro-chemicals are low and production increase is achieved through intensification. In most countries the prices of agro-chemicals have increased due to trade liberalization, except Viet Nam where prices were already high due to import tariffs. The incentive to increase the use of agro-chemicals to achieve short-term production increases is clear. However, while up to a certain level the use of agro-chemicals provides significant increases in

production at least in the short-term, all studies identified serious environmental impacts such as soil degradation, water pollution and loss of biodiversity, particularly in cases of very high use.

There are four countries where the use of agro-chemicals has been low, mainly due to prohibitive prices. In Côte d'Ivoire, the cost of agro-chemicals is largely prohibitive for its use in rain-fed cropping systems that represent 93 per cent of the rice growing area. However, with the confirmed trend towards irrigated production agro-chemical use could well cause future problems. In Senegal, agro-chemical use is not a major problem since their use in the predominant rain-fed production systems is rare. Instead, organic fertilizers such as manure, or rice straw mixed with manure, household wastes and ash are used in rain-fed rice-growing areas. Similarly in Colombia, indigenous communities that grow traditional varieties along the banks of rivers do not use agro-chemicals. However, increased use of agro-chemicals went hand in hand with the reduction in farm size, the tendency towards monoculture in pursuit of increased production and profit and the short-term approaches of tenant farmers with no land security. In Nigeria, overall agro-chemical use is low. However, in most rice-growing areas pressure for intensification (including agro-chemical use) has caused decline in soil quality, loss of soil fertility and salinization, but in some rice-growing areas agro-chemical use will remain low due to inaccessibility and cost.

There are three countries where agro-chemical use is high and the reduced price of agro-chemicals has caused further increased use and environmental pollution. The China study indicated that fertilizer use overall in agriculture may increase by 3.7 per cent by 2010 and the rice sector would account for 50 per cent of that increase. This would have a significantly negative environmental impact in all major rice producing areas. The increase in pesticide use overall would be greater but its projected impact in the rice sector would be only a 2.5 per cent increase. However, another effect of trade liberalization is that of increased rice growing

in the north, where less agro-chemicals are being used, and reduced rice production in the south, where agro-chemical use is high. The overall national balance may turn out to be positive. In Indonesia, the pressure to increase production through intensification on small farms has caused high use of agro-chemicals for many years, but has not changed in any sense due to trade liberalization. In Viet Nam a huge increase in agro-chemical use until 2001 followed the drop in price and was reported as causing major environmental problems, including contamination of river and canal waters, fish and aquatic plants. The high agro-chemical use and awareness on its environmental and health impacts has caused the increased application of IPM techniques that are more environmentally sound. IPM techniques are also introduced in China and Indonesia. In Viet Nam, traditional rice varieties typically grown in rain fed lowlands require less agro-chemicals than modern varieties.

5.2.2 Water

Irrigated rice production uses much more water than rain-fed rice production as well as other crops that are less water demanding, and may thus compete with alternative uses of scarce water. The China study foresees a strong increase in demand for water for rice production in the north-east where water is scarce but where the higher quality types of rice are grown in increasing volume. Pressure for increased production will cause important water supply problems. The central area will not be greatly affected at all and in the south – where the less marketable types of rice are grown – there is abundant water. Of the other countries studied, Senegal and Viet Nam identified water supply as being an environmental problem caused to some degree by trade liberalization. In Senegal, a system of dams has been built to manage water supply along riverbanks, with a consequent loss of habitat for biodiversity and fisheries as well as soil quality. If pressure to increase rice production continues, serious water supply problems can be expected, while water may be used more efficiently for other crops. In all countries where agro-chemicals are intensively used, water quality is a major problem due to

pollution. Both high water use and decline of water quality may affect human health.

5.2.3 Land use

Virtually all country teams cited changes in land use provoked by trade liberalization, causing environmental damage. The possible changes are of three kinds: intensification of rice production systems, extensification/expansion of rice producing areas and converting rice producing areas to non-agricultural use. In principle, intensification of rice production in pursuit of increased production is an alternative to expanding rice-producing areas, but from most studies it appears that both intensification and expansion strategies are adopted to increase production.

Intensification may cause soil degradation, loss of soil fertility, water pollution and loss of biodiversity due to excessive use of agro-chemicals (see above) and unsustainable land-use practices. Both Colombia and Indonesia cited the reduced size of rice farms, intensive monoculture and the lack of long-term land security of tenant farmers as posing environmental risks when farmers were under pressure to increase production.

Expansion may involve forest and wetland clearance for rice production and may lead to loss of biodiversity habitat, soil degradation and salinization, particularly if cleared soils are marginal or fragile. Colombia, Côte d'Ivoire, Nigeria, Senegal and Viet Nam all pointed to clearing of forests and wetlands for rice fields as causing significant environmental damage. In Côte d'Ivoire, insufficient investment in irrigated rice production had caused pressure to expand rain fed areas of production at the expense of forests. On the other hand, Côte d'Ivoire cited the possibility of irrigated production replacing rain fed production as stimulated by higher prices of rice post-liberalization, resulting in the (opposite) trend that is beneficial for forests, wetlands and biodiversity.

Lastly, several studies cited the clearance of land that had been rice-growing area for purposes of other land-use, because the land is no longer

sufficiently productive in terms of yield, profit or income. Alternative uses include industrial or manufacturing development, and clearance then often entailed soil erosion, loss of biodiversity, water pollution and exposure to natural hazards.

5.2.4 Biodiversity loss

A distinction can be made between loss of wild biodiversity and loss of agrobiodiversity. Many of the impacts cited above involve the loss of wild biodiversity, particularly where forests and/or wetlands are being cleared. Colombia cited a loss of biodiversity because of the trend towards monoculture provoked by the effects of trade liberalization and the lack of market opportunities for alternative crops. Côte d'Ivoire concluded that the expansion of rain fed rice growing would certainly involve land clearance, which will be exacerbated by the use of "slash and burn" cultivation techniques. Indonesia identified the same risks and probabilities.

In terms of agrobiodiversity, Colombia, Nigeria and Viet Nam pointed specifically to the loss of traditional rice types and genetic biodiversity caused by a demand for increased production based on new high yielding varieties especially using irrigated and/or mechanized production techniques and high levels of agro-chemicals.

5.2.5 Human health

Several studies pointed to the risks to human health stemming mainly from the use of agro-chemicals affecting human health, directly or through water pollution. This may eventually stimulate farmers to reduce agro-chemical use. In addition, air pollution and human health problems that are caused by the burning of rice husks can and should be avoided by using the husks, which contain useful nutrients, as organic fertilizer. These are indirect problems and can be attributed to trade liberalization only through its impact on production techniques as discussed above. The China team factored in greenhouse gases into their simulation and found that, in a WTO scenario, the net effect would probably be some reduction.

5.2.6 Conclusion

In most countries the negative environmental impacts of increased rice production are predominant. Increasing prices of agro-chemicals potentially lead to reduced use and less pollution, but this effect has not been observed, because of low price elasticity of farmers and poor domestic policies to develop and promote alternatives such as IPM. One important question is to what degree these impacts are serious by causing unacceptable risks for human health, irreversible loss of biodiversity or irreversible loss of productive soils. This highlights the need to establish country-specific environmental objectives or standards for acceptable environmental change, which unfortunately do not yet exist in most countries.

5.3 Social impacts identified

The aim was to examine the effects (direct and indirect) induced by trade liberalization on the quality of life of the rice producers, exporters, importers, traders and consumers. The principal measurements are changes in income and employment, with possible distinctions between ‘winners’ and ‘losers’.

China: The simulation showed that by 2005 the value of agricultural output will increase by 2.8 per cent more than the increase in food prices. Thus, producers will be winners. However, as other studies also indicate, the large scale and rich farmers will benefit more than the poor or subsistence level farmer. On a regional level, the greatest benefit will be in the south (a major exporting area) where agricultural output value will increase by 1 to 8 per cent. In contrast, in the west and north, there will be a decrease by 1 to 4.5 per cent in agricultural output value. However, given the measures concerning taxes and subsidies required by trade liberalization, rural areas and administrations in a post-WTO scenario will get less revenue and will, therefore be less able to undertake the necessary measures to mitigate the environmental and social impacts of increased production volumes.

Colombia: The effects identified were negative.

Trade liberalization in rice led to pressure to increase rice production and, therefore, to a decrease in rice rotation crops such as sorghum, maize, soy and cotton. The cultivation of these rotation crops had been a major source of local employment. The increase in poverty obliged many families to become involved in the cultivation of illegal crops and move into a society of crime and violence. Former seasonal workers moved from the countryside to the urban areas in search of work. Their presence can be noted from the 10.9 per cent level of urban unemployment in 1999.

Côte d’Ivoire: The major influences seem to have been domestic liberalization measures and the FCFA devaluation, with trade liberalization playing a minor role. The analysis showed the consumer to have suffered from the increase in the price of local rice. There was a significant decrease in consumer surplus. On the other hand, the paddy rice producer benefited from the WTO measures, at a maximum average of FCFA 4 billion per year.

Indonesia predicted that, on the basis of a computable general equilibrium model (CGE) model, WTO measures would reduce poverty although the benefits would be greater for the rich than for the poor. However, the empirical evidence seems to contradict these expectations: rural poverty increased during the period of trade liberalization but this is probably due to the simultaneous occurrence of a recession and a drought period the effects of which are difficult to separate from those of trade liberalization. Yet, today rural poverty is still increasing due to the low international price of rice discouraging farmers, especially small farmers. As a result, there is a tendency among farmers to diversify production or, alternatively, sell their land and migrate to the cities.

Nigeria: The team carried out a quality of life comparative survey, comparing farmers whose income was based on the increased price of rice with the national average. The findings were that those involved in the rice sector experienced a significant improvement in employment, food security, income to finance children’s education and active community cohesion. In addition to the

farmers, the rice importers are clear winners since the consumer preference is now firmly for imported rice due to defective processing of domestic produce.

Senegal: The findings were that many local producers, especially small-scale farmers, suffered negatively from the drop in the price of rice. The financial burden was aggravated by the fact that although rice was zero-rated for value added tax (VAT), the producers had to pay VAT on their inputs with no possibility of recovery. Large-scale producers, however, have benefited. In reaction to this situation there have been attempts to establish associations that can help the small farmer. Other winners are the importers, of which now only seven remain forming a cartel that controls prices, and the middlemen (wholesalers) who profited by keeping the price of imported rice artificially high, retaining the margins of a drop in the international price. These changes are due to the fact that the market is not sufficiently transparent to deal with the importer cartel and the distortions introduced by the middlemen. Hence, consumers are the main losers.

Viet Nam: The PRA conducted showed that farmers believed the rice sector had done well in the period before trade liberalization. Yields increased because of better technical knowledge, use of agro-chemicals at a rate higher than economically optimal, and accumulated experience. There was considerable benefit to food security, sales, income and employment. In the period 1993-98, household income increased by 27.6 per cent and poverty declined, especially in rural areas. However, trade liberalization and the pressure to increase production has caused other social effects as well. Firstly, in spite of higher production levels, modernization of rice production has reduced employment openings. Partly as a result, in the irrigated system areas, farmers have started diversifying out of rice production since income from rice has recently dropped from 54.3 per cent of household income to 47.4 per cent. Secondly, the opening of the internal market benefited both the incomes of the urban and non-poor households, but the rise in the price of rice was negative for the consumer and particu-

larly negative for the poor consumers. However, overall the elimination of the export quota created a certain degree of equality since it decreased urban income by 2.6 per cent while increasing the income of the poor by 1.7 per cent.

In sum, the different conditions and characteristics of each country were vividly illustrated in the range of social impacts identified. There was much variation between the analyses made but on three points almost all studies agreed. Firstly, WTO measures may in many cases tend to increase income and reduce poverty, at least initially. Secondly, however, trade liberalization measures definitely tended to benefit the rich and large-scale producer more than the poor and small-scale producer. As other study teams have commented, the Viet Nam team concludes that intensification of rice production is probably not cost-efficient for the poor, and at times did not sufficiently motivate them to remain rice farmers. Lastly, the poor were always the hardest hit by the negative effects of trade liberalization in terms of food security, income and employment.

5.4 Economic impacts identified

Trade liberalization is often cited as offering a range of economic benefits. The picture from the studies is, however, mixed, indicating that in some cases the economic benefits can be significant, in others there may be minimal impact and in others distinctly negative impacts. In all cases, the effects of trade liberalization are difficult to unpack from those of a range of other variables, including changes in the domestic economic and institutional environment such as internal adjustment measures, economic recession and currency devaluation.

In **China**, the CAPSiM simulation showed several expected outcomes of trade liberalization under WTO rules. By 2010, the domestic price of rice would increase by 2.3 per cent as a result of which domestic per capita consumption would decline slightly. Total domestic production would, however, increase slightly to meet population growth needs while overall net rice exports would increase by 4

per cent. While the domestic consumer will face higher prices, the application of WTO rules will improve China's food security and self-sufficiency. It will also create economic incentives for higher quality domestic production of rice, especially the indica variety grown in the centre and south-east. When the overall results were projected to provincial level, they showed that production and export of the high quality japonica rice grown in the north-east will benefit significantly from WTO rules as will a few provinces in central and southern China. However, rice production (of the indica variety) in the centre and the south-east coastal areas will decline. This will make available land currently used for rice growing for other uses.

The **Colombia** study cites two main economic effects of trade liberalization and advances in productivity and technology: a 38 per cent decrease in the rice price and a 28 per cent decrease in production costs. These decreases should have made Colombian rice more competitive internationally. The study then argues that the decrease in international prices has been even greater, mainly as a result of subsidies in exporting countries, giving Colombian rice a comparative disadvantage. To protect domestic production, the Government has therefore maintained a number of protection mechanisms. To find an explanation of the continuing decrease in real rice prices, the study analyses substitutability between rice and wheat and how it affects product prices. The conclusion is that the steady decline of the international wheat price dragged the price of rice down with it.

In **Côte d'Ivoire**, the effect of the devaluation of the FCFA appears to have had the greatest effect on the development of the rice sector, followed by domestic liberalization measures. In sum, the impact of domestic policy reforms and domestic trade liberalization has been greater on the rice sector than that of world trade liberalization. The rice sector has been characterized by continuing inconsistency of Government policy, frequent change of policy and frequent institutional change. The Government put strong emphasis on investment in irrigated rice, which produces only 15 per cent of total domestic production. Today, the lack

of investment in those areas is leading to production decreases and even abandonment of the irrigated areas. However, liberalization of the rice sector resulted in the dismantling of parastatal marketing structures, which led to a rapid growth of small processing units in substitution of the industrial units but has made it more difficult to find marketing outlets for local rice production. This apparent paradox of low marketability of locally produced rice in the face of rising rice imports is due to the lack of competitiveness of locally produced rice in terms of quality and price.

In **Indonesia** it seems particularly difficult to isolate the impact of trade liberalization, since the International Monetary Fund's (IMF) structural adjustment programme guided trade liberalization in response to the economic crisis. However, taking both in conjunction, the abolition of input subsidies as a result of structural adjustment has driven up the prices of agro-chemicals and thus of production costs. At the same time increased imports resulting from trade liberalization and the need to meet domestic food security and market demand have driven down rice prices. The major conclusion is that on the whole the net income of rice producers has decreased even after the imposition in 1998 and 2003 of tariffs on rice imports. This is exacerbated by the increase in land rent costs as a result of increased demand for land for non-agricultural uses and population growth. Incentives to continue rice production continue to decrease which, over time, will induce many farmers to sell up and migrate or to diversify.

In **Nigeria** it would seem that trade liberalization has engendered positive economic impacts in rice production with a 475 per cent increase in gross margins after trade liberalization, in spite of a substantial (626 per cent) increase of production costs mainly due to the increased price of agro-chemical inputs. However, in order to protect domestic production, Nigeria has employed various trade policy instruments such as tariffs, import restrictions and outright import bans at various times. Rice processing and rice marketing have also generated higher income since trade libera-

lization, which suggests greater commercialisation of the product. Even rice imports have generated employment and increased income in a number of areas, including trading, wholesaling, transport, and other services. Despite these positive effects, the study reveals that the returns could be higher with improved yields and a better quality of domestically processed rice, especially as Nigerian consumers are showing a marked preference for better quality imported rice.

In **Senegal** reforms have mainly affected the most important rice production area, namely the River Senegal Valley where modern rice varieties have been introduced. But the increase in the prices of inputs and equipment, together with the difficulties of operating the credit system, have had a tremendous effect on the cost effectiveness of local rice production through a reduced use of inputs and an increase in productive costs. Rice growers are penalized by the 18 per cent VAT on inputs – a cost which they cannot recover since the VAT is not applied to rice. This makes locally produced rice significantly less competitive with imported rice. Furthermore, almost a third of domestically produced rice is for own consumption and not sold on the market. On the other hand, the effect of the liberalization of the rice market has been successful in the private sector: the transfer of functions and input supply from the Government to the private sector has helped to improve access to land, capital and inputs, while it has also made it easier to distribute resources between rice growing and other non-agricultural activities. Furthermore, in an effort to increase productivity of the sector as a whole through liberalization, better use is made of by-products, and there has been rapid increase in the trade of straw, bran, flour, and rice husk. Nevertheless, due to continuing high rice production costs, diversification with other crops is under increasing discussion.

The **Viet Nam** study describes the effects of trade liberalization as ‘tremendous’. In the 1990s, the GDP grew at an annual rate of 7 per cent. In the rice sector, production increases met both domestic food security needs and export requirements. In the

same period, the average annual growth in volume of rice exports was 13 per cent and at least 12 per cent in growth of export values. Trade liberalization had a particularly positive economic impact on agriculture and created healthy domestic competition throughout the rice sector. Firm domestic credit policies, tight monetary policies and interest rate reforms stabilized the hyperinflation of the 1980s, and the exchange rate remained relatively stable after the rationalization of the multiple exchange rate system and successive devaluations. However, trade liberalization also created competition pressure on domestic production, hurting traders, exporters and producers. As a result of its low production costs it is expected that the country will maintain a competitive advantage in international markets despite price fluctuations and further economic integration.

In conclusion, in the face of the considerable differences in the economic situation of the seven countries studied, it is difficult to identify commonalities. However, most teams concluded that trade liberalization was due rather to domestic adjustments than to WTO AoA. Almost all countries experienced a rise in the price of domestic rice and a decrease in the price of imported rice creating potentially positive benefits, at least initially, for the domestic producer and the overall consumer. However, these benefits did not always materialize due to trade cartels. Most countries also saw an increase in production costs particularly given the cost of agro-chemical inputs (except for Viet Nam), which, in conjunction with the low price of imported rice, affected many local producers in rice importing countries (e.g. Indonesia). Trade liberalization measures also provoked an increase in production (which might or might not be sustained), stimulated institutional reform and privatization, and created a strong incentive to improve the quality and competitiveness of domestic rice production and processing.

5.5 Integration of impacts

All of the studies highlight the importance of the rice economy in terms of providing food security

and improved livelihoods particularly in rural areas. UNEP's approach in supporting the country projects to conduct integrated assessment is to provide the country teams with a menu of options and tools that can be used to achieve this end. It is up to the country teams to select the most appropriate tool(s) to undertake an assessment. This is based on data availability, accumulated in-country experience and knowledge in using the selected tool(s), relative emphasis given by government to environmental, social and economic considerations, and the political acceptance of the selected tool(s). Accordingly, UNEP did not advocate or prescribe one uniform tool for assessments. The extent to which the studies have been able to assess the three components has therefore depended on the type of tools selected in the assessment, the emphasis laid by the country teams on environmental, economic and social considerations, and their preparedness to undertake further in-depth and rigorous analysis to be able to compare impacts and assess trade-offs. All teams acknowledged the need for weighing the pros and cons for prioritising one consideration over the other and the implications of doing so. The ultimate outcome was that there is a need for policy development and implementation, including that of trade liberalization policies, that results in maximizing the quality of human life through sustainable economic activity that respects the limits of the environment. The main points presented by the country teams are as follows:

China: It was concluded that WTO measures were on balance positive for the economy and social welfare. However, the beneficial impacts are mainly found in high quality japonica rice production areas, while the impacts in indica rice production areas would be less positive or even negative as a result of severe competition, low quality and negative environmental and health impacts. In irrigated rice producing areas in the south, there are major environmental and social risks associated with increased rice production. By contrast, in the north the major problem will be that of scarce water supplies.

Colombia: The agricultural sector in Colombia saw a 25 per cent decrease in its cultivated area between 1990 and 2002, which had a negative effect on employment and the purchasing power of non-qualified labour. Rice activities have increased since 1996 and rice has become the most profitable short-cycle crop. This caused an increase in monoculture with additional negative environmental impacts because of increased mechanized farming, pest-related problems due to the lack of crop rotation, and reduced effectiveness of agrochemicals as a result of their continuous use. Many poor farmers have not been able to specialize and intensify and therefore shifted to illegal crops. Consumers may appear to have benefited from the reduced price of rice and imported foods, but in real terms consumers have suffered as a result of high unemployment and their consequent inability to buy the cheap food. In addition, these developments have caused environmental damage and have increased the incidence of crime as associated with illegal crops. In sum, trade liberalization and domestic economic policy have produced certain economic benefits but their effect has been largely negative in social and environmental terms.

Côte d'Ivoire: The changes that took place between 1994 and 2000 were essentially due to internal measures rather than external agreements. Winners from the liberalization measures were traders, processors and importers of rice. Paddy producers have benefited to a small extent. The urban consumer has been the main loser. More productive irrigated rice production systems have avoided the negative environmental impacts which extensification of rain fed production would have caused. However, the key element of increasing farmer capacity to consolidate production gains into steady additional income is not yet proven.

Indonesia: Rural poverty increased during the domestic adjustment and trade liberalization period. The income of rice producers, especially of small-scale farmers, declined while the cost of inputs increased. A major effect has been the trend towards conversion of agricultural land to non-agricultural uses, involving very considerable envi-

ronmental and social losses. The possibility of farmers converting to other crops is problematic in view of the relatively long “lead-time” required for market chains to be developed, the financial investments involved, and the need for supportive policies to be set in place. The problem is exacerbated for small-scale farmers in the light of their poverty and dependence on rice as a staple security food.

Nigeria: In Nigeria one of the social and economic impacts of deforestation and biodiversity loss is the damage to the livelihoods of a significant proportion of the population that depends on free and open access to a great variety of biological resources for food, fuel, housing materials and economic security. On the other hand, rice farmers may have little option but to impact on the environment because of their need to produce rice to generate income. Whilst environmentally friendly practices such as organic farming and IPM/integrated crop management (ICM) may limit the negative impact, these require investment and training, and thus support from the state, NGO’s and other institutions.

Senegal: Domestic rice production, particularly irrigated rice, is important in terms of food security and generation of employment and revenue in rural and poor areas. Policy must incorporate and counter the potential for environmental damage. Rice production should be integrated with other crops that might be more efficient in terms of water use, and developmental activities such as fishing, forestry, stockbreeding and the production of energy. Crops should be diversified in order to minimize economic and social dependence on rice. However integration and diversification requires the training and capacity building of farmers, and new strategies need to be developed to deal with socio-economic problems related to production, distribution and marketing.

Viet Nam: Reform processes, including trade liberalization, have had positive impacts on the economy, food security, and poverty reduction, but mainly negative impacts on the environment. The effects of trade liberalization are interlinked in that the real income of the poor increased as a result of a boost in production and imports and an increase

in rice prices, plus a decrease in the price and increase in the use of fertilizer imports. But the increased use of agro-chemicals has had negative impacts on the environment and human health. Furthermore it is estimated that further extensification of rice production would cause clearing of forests and wetlands which would result in the loss of biodiversity as well as social impacts such as the loss of livelihoods for some local communities. These negative impacts would, over time, demand large scale financing for environmental rehabilitation and to limit the societal effects from environmental damage. It is preferable, therefore, to moderate the use of agro-chemicals now and to encourage organic rice farming even though that would imply slightly lower yields, more labour and investment in training and capacity building.

In conclusion: Most countries experienced economic benefits from adjustment and trade liberalization. However, most studies also concluded that trade liberalization caused either actual damage or serious risks to the environment. In social welfare terms, the conclusions were mixed as, in the short-term, both winners and losers were involved, thus in many cases increasing social inequality. In the majority of countries, trade liberalization tended over time to have a negative effect on or create risks for food security, rural development and poverty reduction.

5.6 Policy recommendations

Each team formulated a set of policy recommendations aimed at mitigating or removing the negative effects of trade liberalization and at maximizing its positive effects. The recommendations are summarized below:

China

- Enhance the competitiveness of production in indica rice areas through green food production, more competitive crops and improvement of indica rice quality.
- Encourage rational agro-chemical input application rates and wider use of alternatives such as IPM, by raising the price of chemical inputs and

converting financial support for chemical inputs to other production factors.

- Government could ensure an increase in farmers' incomes in rice trade liberalization by helping farmers to improve their product quality through more investments on scientific research to accelerate green and super quality rice development.
- Take advantage of the finding that the change of rice paddy areas caused by free trade will tend to decrease overall national greenhouse gas emissions.
- Increase the price of irrigation water and introduce technologies to encourage efficient use and saving of water resources in the north.

Colombia

- A rice sector environmental evaluation should be carried out to measure and understand the current situation.
- In terms of the rice production system, crop rotation should be encouraged to reduce monoculture, IPM should be encouraged and supported, rice sub-products should be recycled and laser levelling should be promoted.
- Integrated rural development plans should be formulated to improve rural living standards.
- A committee composed of institutions from rice production should manage the implementation of the recommended policies.
- Protection measures by developed countries should be decreased.

Côte d'Ivoire

- Review the rice import system to ensure that consumers benefit from domestic liberalization and the removal of import taxes.
- Organize the producers' associations so that they can improve the quality and price of paddy.
- Ensure better price transmission through all levels of the rice production and marketing chain.
- Promote more productive irrigated and lowland rice production.

- Study the potential impact of intensification of irrigated and lowland rice on surface and ground water pollution and on the mining of soil nutrients.
- Set up an observatory for the rice sector to monitor developments and recommend appropriate action.

Indonesia

- For reasons of food security and poverty reduction, domestic rice production should be promoted and subsidies to production costs should be permitted.
- The poor consumer should be subsidized and an import tariff should be applied to protect domestic producers.
- The population should be encouraged to diversify consumption to foods other than rice.
- The Government should develop rice-marketing infrastructures to reduce marketing costs and promote small-scale post harvest technology and management.
- The Government should support IPM and conservation technologies.
- The Government should develop an environmentally friendly agricultural sector, focus on production in islands other than Java and ensure that the price of land-conversion includes the price of the environmental functions of the land.
- Liberalization measures should be pursued but in a way that incorporates environmental costs.

Nigeria

- Land use planning: marginal land should be protected by land-use taxes and soil conservation levies; extensification should be controlled by land zoning and mandatory forest and soil conservation programmes.
- Production: IPM and integrated soil-fertility techniques should be encouraged along with crop residue recycling and crop rotation.
- Processing: better quality milling should be standardized, including waste and effluent management.

- Consumption: a substantial import tariff on rice should be used within WTO rules to enhance the competitiveness of domestic producers.

Senegal

- Increase rice production to meet food security needs.
- Develop marketing structures to reduce marketing costs.
- Invest in social and environmentally sustainable production systems including irrigated and rain fed systems incorporating organic farming in a move away from extensive systems.
- Protect local production from “unfair competition” by reserving a portion of the market for domestic rice production, using WTO AoA tariff mechanisms and the VAT on imports.

Viet Nam

- Improve awareness of environmental and social impacts by public education, extension services and training.
- Establish a dialogue with policy makers that will encourage the internalisation of environmental costs and reassess existing policies and practices.
- Promote IPM and integrated, organic rice farming.
- Refine the application of trade liberalization measures by removing all non-tariff barriers (thus reducing marketing and trading costs), stop the protection of state-owned enterprises and establish access to credit facilities for all Vietnamese exporters.

5.6.1 Synthesis of policy recommendations

Despite the differences between the countries concerned, a strong consensus merged from the studies on the following policy proposals.

- The multifunctionality of the rice sector must be preserved, especially in terms of food security, poverty reduction and rural livelihoods.
- Integrated assessment using simple tools should be a normal element of mainstream decision-making in agriculture so as to identify and deal

appropriately with the important environmental and social factors involved such as agro-chemical use, water efficiency, consequences for wild and agrobiodiversity, rural poverty, food security and social equality (winners and losers).

- The possibilities of applying tariffs to imports under WTO AoA or regional agreements should be used so as to assist domestic production, especially in importing countries, as justified by the objectives of food security and poverty reduction.
- Professional associations and collectives should be promoted to monitor the sector and provide the services and assistance (particularly to the small-scale farmer) in quality improvement, marketing, processing, extension and training which the central government provided before trade liberalization took place.
- More environmentally friendly intensified production systems should be supported, including IPM, organic and low external input sustainable farming systems.
- Public education should be provided on the environmental and social costs involved in trade liberalization of the rice sector.
- There is a need to develop national and possibly sub-national environmental and social sustainability standards or objectives that can be used to determine in an objective way whether observed or expected environmental or social impacts and risks are acceptable or not.

5.7 Delivery of conclusions and recommendations to national decision makers

Given the high level of partners identified and engaged by UNEP, it was possible to deliver the country teams’ conclusions and recommendations directly into the national political process – even into the groups responsible for negotiations with the WTO – in China, Colombia, Côte d’Ivoire, Senegal and Viet Nam.

6. Lessons learned and next steps

The studies produced consensus on the basic lessons learned.

- There is a real need to develop guidelines and procedures to systematically apply integrated assessment to development issues, since at present decision makers by and large ignore environmental and social consequences and costs. Integrated assessment should be used as a participatory approach and tool to identify best policy options and best practices on issues such as food security, poverty, economic growth and environmental management, i.e. sustainable development. Several teams proposed that an inter-professional association be set up to continue the exchange of data and experience and thus improve learning. Capacity for integrated assessment is low – many teams commented that experience in using both quantitative and qualitative methodologies is limited but that the programme has helped in improving that capacity.
- The tools and procedures for integrated assessment need to be refined, improved and simplified so as to make them more specific and user-friendly. The emphasis in the current analyses differs significantly between studies, ranging from sophisticated models to simple PRAs and assessment matrices and check-lists. This can be explained by the different local experiences, preferences and conditions, but also by the availability of data. It highlights the need for developing a catalogue of tools and methods that can be used for different situations and with variable data requirements.
- The participatory multi-stakeholder process and policy dialogue is an essential component of integrated assessment and must receive attention

that is at least equal to that of the analytical studies being undertaken. Key stakeholders should be identified and involved in the integrated assessment process at critical moments, not only for consultation but also for active involvement and contribution to knowledge. In addition, dialogue with policy makers must receive attention from the outset to generate the commitment and sense of ownership necessary to arrive at validated and usable policy recommendations. The process of integrated assessment, therefore, needs to be carefully designed and implemented. This may require expertise in terms of process facilitation, communication, policy analysis and negotiation.

- In terms of the integration and comparison of important economic, social and environmental impacts, appropriate tools and greater experience in their use are needed. The key output of an integrated assessment is the identification and application of the inter-sectoral relationships, the thresholds of acceptable change or risks and the trade-offs, so as to identify a clear formulation of best policy options. Further work is needed to define and structure the process and technique of integration of impacts with greater precision and ease of application and to develop national standards that can be used to define acceptable thresholds of change or risks.

6.1 Next steps

Most teams recommended programmes to implement the findings of the studies with three areas of action being highlighted – raising public awareness, promotion of more environmentally friendly integrated production techniques, and maintenance of a dialogue with policy makers.

7. Executive summaries of the country studies

7.1 China

7.1.1 Background of the project

Market-oriented reforms have been implemented in China since 1978, which resulted in substantial growth in China's economy. The annual growth rate of the gross domestic product (GDP) was nearly 9 per cent in 1979-2002. Under the background of domestic market reform, the development of China's agriculture has gradually stepped into a new phase. Agricultural production, the rural economy and the rural environment have undergone great changes in the past 25 years. The average annual growth rate of the agricultural GDP reached nearly 5 per cent in 1979-2000, which is much higher than the population growth over the same period. Economic growth has led to a significant decline in poverty in the country. At the same time, rural environmental quality has been declining as a result of overuse of chemical inputs and water in agricultural production. China's accession to the WTO will bring further trade liberalization that will alter the domestic market and policies.

Given the above, the overall goal of this project is to enhance understanding of the implications of multilateral trade rules and trade liberalization on national sustainable development and the environment and enhance negotiating capacity. The ultimate goal is to formulate policies and policy packages to correct the identified negative impacts of liberalized trade, and to maximize the positive ones, through economic and regulatory instruments.

7.1.2 Organization of the project

Given the complexity of the project, different stakeholders are involved. The State Environmental Protection Administration (SEPA) organized this project at the country level. Experts from the Policy Research Center for Environment and Economy (PRCEE) of SEPA, the Center for Chinese Agricultural Policy (CCAP) of the Chinese Academy of Science, and the Environment School of Beijing Normal University (BNU) composed the research team. The stakeholder workshop was organized at the beginning of the assessment to review the related studies and collect the relative data for the assessment. All the stakeholders cooperated in the research process to analyse the background of trade liberalization, identify the trade liberalization paths impacting on the rice sector, select methods and define the research approach. Experts from the CCAP projected the impacts of trade liberalization on the rice sector in 2005 and 2010 at the national level using China's Agricultural Policy Simulation Model (CAPSiM). Based on the results of the model, they then assessed the impacts on poverty and the use of chemical inputs. Experts from the BNU assessed the environmental impacts of rice trade liberalization in different regions and conducted field surveys in two provinces, Heilongjiang and Hubei, which are two typical provinces in the north and south rice-growing areas of China. Experts from the PRCEE of SEPA integrated all the results and concluded the final report.

There were many difficulties in this study. Firstly, rice is especially important to the country's food safety, and its foreign trade accounts for no more than 5 per cent of domestic production, so rice production is mostly determined by the domestic environment directly and international trade circumstances indirectly, making it more complicated to identify the impacts of trade liberalization on the rice sector. Secondly, China has a vast territory with considerable variations in natural conditions and in the level of social and economic development in the different rice growing areas, which also added significant difficulties to the research.

7.1.3 Trade liberalization in China

In conformity with the market reform since 1978, China's foreign trade market has, generally speaking, opened up, especially during the 1990s. China's foreign trade of agricultural products has increased 14-fold in two decades. The Chinese Government reduced the average tariff rate for agricultural products from 46.6 per cent in 1992 to 21.2 per cent in 1997.

China joined the WTO at the end of 2001. This required China to not only comply with the WTO rules including the WTO Agreement on Agriculture (AoA), but also to fulfil its commitments related to WTO accession. China's WTO access commitments in the agricultural sector mainly include three aspects: market access, domestic support and export subsidies. The commitments on market access will involve lowering tariffs of all agricultural products to 17 per cent in 2004, and increasing access to China's markets by foreign producers of some commodities through tariff rate quotas (TRQ) and removing quantitative restrictions on others. In return, China is supposed to gain better access to foreign markets for its agricultural products, as well as a number of other indirect benefits. Domestic support and export subsidies are the other two critical issues that arose during the course of negotiations. Current agricultural support policies in China mainly include Green Box and Amber Box policies. Following accession to WTO, China must enhance the Green Box

policies and adjust the Amber Box policies according to WTO rules.

China National Cereals, Oils and Foodstuffs Import & Export Corporation (COFCO) had been the nation's single-desk state trading company for grain. It also managed the imports of edible oils. However, COFCO has undergone a series of reforms since the late 1990s. Specifically, since the late 1990s officials have tried to streamline importing procedures by commercialising COFCO and demonopolizing the trade of a number of commodities. For example, soybeans have been completely liberalized with a single tariff management scheme. The effective tariff rate on soybean imports has been only 3 per cent since 1999. For rice and maize, the Jilin Grain Group Import and Export Company (JGIEC), a provincial level of the State Trading Enterprise (STE) established in April 2001, has taken over the import and export responsibilities of COFCO for most maize and rice exports from north-east China. The establishment of the JGIEC marked the end of COFCO's complete monopolization of China's grain trade. Moreover, within the COFCO network (COFCO has always had branches in each province and key municipality), competition has also been introduced. Better incentives were given to managers and branch officials to increase the attention they gave to activities that affect profitability. China's accession to the WTO is the continuation of the market-opening trend in China.

7.1.4 The rice economy in China

Rice is the most important food crop in China's agricultural economy. Over the last three decades, the rice growing area has represented about 27–29 per cent of the total grain growing area in the country and rice accounts for 42–45 per cent of total grain production. Chinese rice is also the largest component of the world rice economy. China's rice growing area accounted for nearly one quarter of the world's growing area and more than one third of the world's rice production before the late 1990s. However, China's share in the world's rice growing area and production has declined

significantly since the late 1990s. The area share declined from 23 per cent in 1990 to 19 per cent in 2000 and 17 per cent in 2003. Its share in world rice production also declined from 38 per cent in 1990 to less than 30 per cent after 2000. China's rice economy is also facing a number of challenges and opportunities in production, consumption and trade. A careful examination of China's rice economy suggests that the sector remains difficult to predict since it defies categorization (i.e. conventional and hybrid rice, indica and japonica rice). The potential for future productivity increases is difficult to gauge by studying other developing countries since in China a larger proportion of the rice growing area is irrigated compared to any other main rice-producing nation. Furthermore, the demand structure has been changing. All of this will have a significant effect on rice production, farmers' incomes and rice trade.

China's rice growing area is widely spread. It reaches Hainan Island in the south (18°9'N), Heihe River in Heilongjiang (52°29'N) in the north, Taiwan in the east, and Xinjiang Uygur Autonomous Regions in the west; it is also found in the low coastal tide fields in the south-east, and in the high Yunnan-Guizhou plateau 2600m above sea level. China's rice growing area is divided into two major areas: north and south. It is further divided into six rice-growing zones, according to natural conditions, variety types, farming systems and administrative divisions. More than 85 per cent of the rice growing area lies south of the Qinling Mountain Range and Huaihe River, mainly in the midstream and downstream plain of the Yangtze River, the basin plain and the delta area of the Pearl River. Rice grown in the south is mostly of the medium and low quality indica variety. The rice growing area of the north lies mainly in the north-east, where the fertile soils and appropriate climate provide good conditions for developing high quality japonica rice. With the structural adjustment in production and changes in demand, the rice growing area shrank rapidly in the south and increased steadily in the north.

From 1980 to 2002, China's rice exports reached record levels for 20 years. Asia and Africa are the

major export markets for Chinese rice. Asia accounts for 57 per cent of China's rice export market, Africa 30 per cent, North America 7 per cent and Europe the remaining 6 per cent. The most important importers of Chinese rice are Indonesia, the Philippines, Japan and Korea in Asia, Côte d'Ivoire and Libya in Africa, Russia and Romania in Europe, Cuba, USA and Canada in North America. China's importing market is much simpler. Most of China's rice imports originate from Thailand. In 1999, 99 per cent of China's imported rice came from Thailand. China's southern cities are the major market for high quality Thai indica rice.

7.1.5 Path analysis of the impacts on the rice sector of China's accession to the WTO

In the first 11 months of 2002, the first year of WTO accession, China only imported 180,000 tons of rice, a 9 per cent decrease compared to the previous year, while rice exports amounted to 1,638,500 tons, a 3.2 per cent increase compared to the previous year. The net export increase is 5 per cent. But the advantageous effect of trade liberalization on rice exports is not obvious for the following main reasons. Firstly, rice is an important agricultural product for food security in a country with such a large population. This means that foreign trade of rice could not undergo complete liberalization immediately after China's accession to the WTO. On the basis of grain shortages in recent years, especially in 2003, foreign trade of rice is determined more by domestic policies than by the international market in order to guarantee food safety. Secondly, although China's foreign trade in rice is very important to the world rice market and its share of total world rice exports ranges from 10 to 20 per cent, the country's total rice exports represent less than 3 per cent of domestic output. Therefore, even if trade liberalization can have obvious impacts on rice imports and exports, it is difficult to reflect the influences in the domestic rice market.

Rice production and the rice economy are mainly determined by domestic support policies. China's

agricultural support policies will be adjusted according to the WTO rules. The adjustment trends mainly include the enhancement of Green Box policies and structural adjustment of Amber Box policies. Currently implemented measures in accordance with WTO rules mainly include reducing agricultural taxes, reducing distribution subsidies, implementing direct subsidies for grain production, and so forth, most of which are aimed at encouraging domestic rice production.

7.1.6 Methodologies and projection results

In order to evaluate the impact of China's WTO accession in 2001-2005 and further trade liberalization until 2010 on China's rice economy, poverty, and the rural environment a quantitative method has been developed based on the CAPSiM. The CAPSiM was developed to provide a framework for analysing policies affecting agricultural production, consumption, price and trade at the national level, and is a partial equilibrium model. Most of the elasticities used in the CAPSiM were estimated using state-of-the-art econometrics and with assumptions that make the estimated parameters consistent with theory. Both demand and supply elasticities change over time as income elasticities depend on the income level, and cross-price elasticities of demand (or supply) depend on the food budget shares (or crop area shares).

The results of the model show that under the WTO scenario the average national per capita rice consumption in China will decline gradually during the projection period from 2001 to 2010. But although per capita rice demand falls in the projection period, total rice demand continues to increase mainly because of population growth. By the end of the forecast period, aggregate rice demand will reach 128 million tons. Total grain demand is projected to increase by about 18 per cent in 2001-2010. Rice will fall from a share of about 34 per cent of total grain consumption in 2001 to less than 30 per cent in 2010. The WTO scenario projections in terms of rice supply show that China produces slightly more rice than the

increased demand. Rice output is expected to reach 129 million tons in 2005, and 138 million tons in 2010. The rice growing area is expected to reach 28.6 million ha in 2005, which is 1 per cent higher than in the baseline scenario without WTO membership, and 28.3 million tons in 2010, which is 1.4 per cent higher than the baseline.

The impacts of trade liberalization are not the same in the different rice growing areas of China in 2005 and 2010. China's japonica rice production will benefit from trade liberalization in general. The expansion area mainly lies in Heilongjiang, Jilin and Liaoning provinces in north-east China, and a few provinces in central and south-west China such as Anhui, Jiangsu and Yunnan. In comparison, the positive impact on the indica rice growing area is slight. Central China is the major indica rice growing area in China but it has been shrinking in the past few years because of the low quality of the rice produced there. After China's accession to WTO, rice production in these areas will face more intensive competition.

7.1.7 Case studies

Two typical provinces were selected as case study sites, Heilongjiang province and Hubei province, from the north and south rice growing areas respectively. Both these provinces are important rice producing regions in China. Heilongjiang province is the largest rice-producing province in the north, and the main polished japonica rice export province in China. Hubei province is traditionally an indica rice-growing region and lies in the middle reaches of the Yangtze River Valley.

The investigation revealed that fluctuations in rice production in the two case study provinces mainly depends on grain support policies and the state of domestic grain storage. In other words, changes in the price of rice and in production depend more on adjustments in domestic support policies according to WTO regulations than on trade liberalization directly.

The impacts of trade liberalization on farmer's incomes in the two provinces mainly come from

changes in the price of rice and adjustments in support policies after China joined the WTO. In Heilongjiang province, farmer's incomes mainly depend on the revenue of dry land crops rather than rice, so they are less influenced by rice price changes than farmers in Hubei province whose incomes are mainly determined by the revenue from rice.

The ecological impacts of trade liberalization on the rice sector in the two provinces are concluded as follows. Firstly, the use of chemical inputs per unit area is relatively stable according to the household survey. In other words, the impacts of input and output price fluctuations on the use of chemical inputs per unit area are trivial, so the total change in the use of chemical inputs is mostly caused by changes in the crop area. Secondly, the acceleration in the optimisation of rice production and in the development of green production under trade liberalization is helpful in improving the quality of the environment. Thirdly, after China's accession to the WTO, the adjustments of agricultural policies such as rural taxation reform will result in more serious financial problems for the township governments making the implementation of rural ecological and environment protection projects more difficult.

7.1.8 Economic impacts

Based on the results from the CAPSiM model of the impact of China's accession to the WTO on the rice area at the national level the impacts on the rice area were then allocated to the provincial level, taking the comparative advantages in each province into account. The results show that China's japonica rice production will benefit from trade liberalization in general. Most of the area expansion lies in Heilongjiang, Jilin and Liaoning provinces in north-east China, and a few provinces in central and south China, such as Anhui and Jiangsu. Conversely, indica rice production will shrink under international market competition. These production areas mainly lie in central China and along the south-eastern coastland. Central China is the major rice growing area but it has been

shrinking in the past few years due to the low quality of the rice produced there. Following China's accession to the WTO, rice production in these areas will face more intensive competition. The development of the economy in the south-east is fast, so the costs of land and labour are relatively high. If other industries benefit from greater opportunities than agriculture under trade liberalization, rice production in these areas will be gradually reduced.

Trade liberalization is likely to facilitate China's export of japonica rice to East Asian countries such as Japan and Korea. Although super quality indica rice imports will also rise, the domestic market for super quality indica rice will still be limited over the next 10 years and the increased imports will largely be offset by a moderate export of medium quality indica rice from China. Overall, the share of net rice exports in China's domestic production will rise by about 4 per cent in 2010 due to trade liberalization. Increased rice exports will raise the average domestic rice price by 1.5 per cent in 2005 and 2.3 per cent in 2010. Indeed, the average price of rice will increase to a certain extent if the price of indica rice does not fall slightly. A price increase due to WTO accession provides a better incentive for domestic rice production. However, per capita rice consumption will decline slightly as a result of such a price change. An increase in rice production and a decline in per capita rice consumption due to China's WTO accession and further trade liberalization under the new round of Doha negotiations will improve China's rice self-sufficiency level. The rice self-sufficiency level is expected to reach 107 per cent under the WTO scenario, which is higher than the 103 per cent in the baseline scenario.

7.1.9 Social impacts

The impacts of trade liberalization on rural households were predicted based on income group and region. If China fulfils its promises under the WTO agreement, the changes in domestic prices will affect both production and consumption in all rural households. The simulation analysis predicts

that, after 5 years, the agricultural output value of the average farm will rise by 2.8 per cent. During the same period, food expenditures will rise by 1.1 per cent, i.e. at a rate lower than the increase in production output value. Aggregate food expenditures also rise as a result of the overall food price increase and reduction of total food consumption. For importable commodities, a drop in prices results in increased consumption of these commodities. A reduction in expenditure on importable foods means that consumers gain from both the increase in consumption and the decline in price. For exportable commodities, the consumers lose from the rising prices and decline in consumption.

Not all farm households, however, benefit equally from China's accession to the WTO. Our results show that in 2005 and 2010, the poor gain much less than the average and richer farmers. Agricultural output values for the poor will increase by 77 *yuan* per household in 2005, 191 *yuan* for the average farmer and 583 *yuan* for the top 10 per cent richest farmers. Even in percentage terms, the increase in agricultural output values for the poor is lower than for the rich. On the other hand, food expenditure increases for all farmers, but in percentage terms the rates of increase are nearly identical in 2005 and are lower for the poor than for the rich in 2010 (albeit a very small difference).

When we analyse the impacts by region, the results are interesting and have strong implications for the regional development plan. Although the average farmer in China will gain from trade liberalization, the farmers in western and northern China are negatively affected. Indeed the gains estimated for China as a whole are mainly due to the positive effects in southern and coastal provinces. Agricultural output value per household will decline by as much as 100-340 *yuan* (or 1-4.5 per cent of output) in the north-west and north-east of China, while it will increase by 100-500 *yuan* (1-8 per cent) in the south. This should not come as a surprise as the production structures differ significantly across regions. The provinces with positive effects from trade liberalization are those that produce more exportable than importable commodities.

7.1.10 Environmental impacts

The study of environmental impacts mainly focuses on chemical inputs, greenhouse gas emissions, and water resource consumption.

While studying the impacts of China's WTO accession on chemical input applications, we obtained different conclusions on different assumptions for determinants of input use.

In the first scenario we considered that the impacts of WTO accession on fertilizer use are determined by the changes in output and input prices, which together with free rice trade induced a change in the acreage of the rice growing area. Fertilizer demand is projected to increase with trade liberalization, but the impacts are minimal. The increases in fertilizer use come from both crop structural changes and higher application rates. The impact on fertilizer use also varies across regions. In some south-east coastal provinces, such as Shanghai, Guangdong and Hainan, the demand for fertilizer in crop production is projected to rise after WTO accession. Rice is the most important crop and accounts for the largest amount of fertilizer use in China. For the country as a whole, trade liberalization will increase fertilizer use in rice production by 2.2 per cent in 2005 and 3.7 per cent in 2010. More than half of the rise comes from an increase in intensive use (i.e. kg/ha) of fertilizer due to the rising price of rice and declining price of fertilizer. The impacts from changes in the amount of input per hectare combined with the impacts due to changes in the rice growing area will be a total increase of 178 thousand tons of fertilizer applied in 2005 and 288 tons in 2010. This represents about half of the net increase of total fertilizer use for all crops in 2005 and 23 per cent in 2010. Therefore the impacts of WTO accession on fertilizer application in rice production have significant implications for overall changes in fertilizer use and this is particularly true for the major rice production provinces such as Jiangxi, Hunan, Zhejiang, Jiangsu, and all provinces in southern China (e.g. Guangdong, Fujian and Guangxi).

The analyses show that the impacts of trade liberalization will have more impact on pesticide

use than on fertilizer use. Liberalizing the pesticide sector will lead to reductions in pesticide prices of about 1 per cent per year in 2002-2010 as a result of imports of cheaper and better pesticides over time. Declines in pesticide prices and price increases for horticultural crops and rice (the crop with the most intensive pesticide use within the grain sector) will significantly increase pesticide demand. Our study shows that trade liberalization will raise pesticide use by about 3.2 per cent in 2005 and 5.7 per cent by 2010. Regarding the impacts of WTO accession on pesticide use in rice production we estimate a rise of 1.6 per cent in pesticide application in 2005 and 2.5 per cent in 2010. About 62 per cent of the increase in pesticide use in 2005 will be due to changes in the rice growing area and this share will decrease to 54 per cent in 2010. The percentage increase in rice production is less than the overall changes for all crops.

For the second scenario, the field survey in Heilongjiang and Hubei provinces shows that most of the farmers in the two case sites would not modify their chemical input per unit as a result of the change in the price of the input. Changes in the rice growing area due to price changes for outputs and grain support policy adjustments associated with WTO accession are the main drives to the changes in chemical input use in rice production. It can thus be assumed that changes in the use of chemical inputs in rice production are mainly a result of changes in the rice growing area, and the price-demand elasticity of chemical inputs is neglected.

In the second scenario, the results show that, except for the decrease of fertilizer and film use in central and southern China, most of the other areas will undergo an increase in fertilizer and film use, especially in north-east and south-west China, and in Henan, Jiangsu and Anhui provinces. Overuse of fertilizers may cause more serious eutrophication of surface water quality, deterioration of soil quality, and air pollution. Continued accumulation of films would form an obstructive layer in the soil, which is harmful to soil quality in terms of its capacity for ventilation, permeation, and so forth.

The situation is different with pesticide use. The areas with a high level of pesticide use in rice production mainly lie in southern China, and rice production in most of these areas will experience slightly positive or negative impacts from rice trade liberalization. Though WTO accession could push rice growing in north-east China, the rise of pesticide use can be offset at the national level. This is helpful to alleviate harm to biodiversity and farmer's health in most provinces in central and south-east China.

Based on our estimation, the change in the paddy rice growing areas as a result of free trade is favourable to decreasing overall greenhouse gas emissions. Methane emissions will be reduced mostly in southern China, e.g. Hubei, Jiangxi, Fujian and Guangdong provinces, offsetting the increasing emissions in northern China, especially in the north-east.

The pressure on water requirements in China would increase with the expansion of rice production as a result of trade liberalization, especially in the north. The areas north of Qinling Mountain Range and Huaihe River, especially north and north-west China, have experienced quite intensive water supply and demand conflicts in recent years. If the cultivated area increases due to trade liberalization, pressures on the local water resources will be even greater. Although water resources in the north-east are richer compared to other regions in the north, the additional water requirements resulting from the extension of the rice growing area due to trade liberalization will obviously place greater pressures on the water resources. Single-harvest rice in the central area that lies north of the Yangtze and Qiantangjiang Rivers and to the south of Qinling Mountain Range and Huaihe River, requires less water. However, under the influence of trade liberalization, both expansion of the japonica rice growing area and a decrease in the indica rice growing area occur simultaneously in the respective regions, so the overall water requirements do not change much. In the area that lays south of the Yangtze and Qiantangjiang Rivers the pressure on water resources would be slight despite the push of trade liberalization on rice production

because of the abundant water resources in that area, especially in coastal provinces such as Guangdong and Hainan.

The north-eastern, middle and low reaches of the Yangtze River Valley are major wetland regions in China. In the north-east, the “return cropland to wetland” project will be negatively affected by pressure from the expansion of rice production, while in the middle and low reaches of the Yangtze River Valley the declining trend in rice production will be favourable to the “return cropland to wetland” activities.

7.1.11 Concluding remarks and policy implications

In analysing the impacts of China’s WTO accession on the country’s rice economy and farmers’ incomes, it is concluded that on the whole the positive impacts are greater than the negative. On the one hand our findings on the Nominal Rates of Protection (NPRs) show that China’s accession to the WTO will lead to price increases, which is encouraging farmers to adjust their agricultural production structure towards products with greater comparative advantage such as rice. On the other hand, adjustments in support policies associated with WTO rules are helpful to improve farmers’ incomes from rice production. Through the research, it was also found that the impacts on the rice economy and farmers’ incomes differ widely between provinces. The beneficial impacts are mainly centralised in japonica rice production areas, including the provinces of the north-east, and in Jiangsu and Anhui provinces. Conversely, the impacts on the provinces with pure indica rice production would be less positive and even negative under more intensive competition.

In order to balance the economy and farmers’ incomes, China’s policy makers should pay more attention to enhancing the competitive capability in indica rice areas. The measures could include accelerating the structural adjustment to more competitive crops, improving rice quality, and promoting green food production.

While studying the impacts of China’s WTO accession on chemical input applications different conclusions were reached on different assumptions for determinants of input use. Considering that the use of chemical inputs is determined by a combination of changes in the prices of inputs and outputs, both fertilizer and pesticide applications are projected to rise with trade liberalization, and the latter will increase more than the former. At provincial levels, the percentage increases in fertilizer and pesticide applications in rice production are higher in the north than in the south. This is because indica rice is grown in the south and japonica rice is grown in the north.

However, assuming that the input per unit area is stable we obtain another result indicating that, overall, pesticide applications will decrease and fertilizer and film applications will increase. The reason for the overall decrease in pesticide use at the national level is that trade liberalization caused an expansion in rice growing mainly in areas with a lower rate of pesticide use, whereas the areas where the rate of pesticide use is traditionally high are mostly located in the south where the rice growing area is projected to shrink, so the increase in pesticide use in the north could be offset by the decrease in the south.

Because the environmental impacts of chemical applications are negatively associated with rice production, it is important for the Chinese Government to ensure compatibility between the economic and environmental objectives of rural development policies and institutional changes under trade liberalization. There are many alternatives that China may consider in dealing with excessive use of chemicals in crop production under a more liberalized economy.

First, more economically rational application rates of crop inputs and wider use of IPM and other new technologies could substantially mitigate application rates, total usage and environmental concerns. A recent study by CCAP shows that nitrogen fertilizer use in rice farming could be reduced by 20-30 per cent without yield loss through site-specific nitrogen management (SSNM).

But extension of SSNM requires substantial investment in training and agricultural extension services. Other recent studies by CCAP show that GM rice reduces pesticide use by more than 90 per cent in rice production and Bt cotton reduced pesticide input in cotton production by about 65 per cent.

Second, raising the price of chemical inputs and converting financial support for chemical inputs to other production factors, including super seeds and machines, can limit the chemical input applications without harming farmers' enthusiasm.

Third, the Government could ensure an increase in farmers' incomes from rice trade liberalization by helping farmers to improve their product quality. This could be achieved through Government investments in scientific research to accelerate green food production and super quality rice development.

Based on our estimations, changes in the rice paddy growing areas resulting from free trade is

favourable to an overall decrease in greenhouse gas emissions. The methane emissions would be reduced mostly in southern provinces such as Hunan, Jiangxi, Fujian and Guangdong, thus offsetting increasing emissions in the north.

Water resources will be under greater pressure in the north than in the centre and south. The unevenness of water resource distribution in China and the increased demand for water in rice production in the north will magnify the distribution inequality. In order to balance the water conflicts, it is suggested to increase the price of irrigation water in the north to encourage farmers to adopt water saving irrigation technologies voluntarily.

In north-east China, wetlands were converted into rice paddy fields on a large scale. If rice growing becomes attractive, the nation should take effective measures to limit wetland exploitation to protect habitat and biodiversity.

7.2 Colombia

7.2.1 Background

Colombia is located in northern South America and has a population of 42 million. Its total surface area is about 1.1 million sq km. It is the only country in South America with coasts on both the Caribbean Sea and the Pacific Ocean. The Andes Mountains dominate the central and western parts of the country. East of the Andes, 60 per cent of the country consists of portions of the llanos (grasslands) and selva (rainforest). The mountains are separated by high plateaux and fertile valleys where most of the rice is grown. Colombia lies almost entirely in what is known as the Torrid Zone. The climate, however, varies with elevation. Throughout the year, three-month periods of rain and dry weather alternate.

Rice and maize are two of the main short cycle crops and the most important food sources for the Colombian population, especially in low-income households. Rice consumption in Colombia decreased during the 1980s from 40 kg per capita to 21.8 kg per capita in 1997 but increased again to 41.5 kg per capita in 2003.

A comparison of short cycle crops for the years 1990 and 2000 indicates that the total cultivated area was maintained for potato, and increased for rice and vegetables. For all other crops the cultivated area decreased. The total rice growing area is 480,000 hectares, second after maize (600,000 hectares). In terms of production value, however, rice is the most important crop and is cultivated in 20 of the 32 Departments. In 1999 the average rice production unit was 13 hectares, although 55 per cent of the producers cultivate less than three hectares, which, by national standards, is subsistence level.

Rice production in Colombia is divided into four production zones: Cauca River Watershed, Centre, North Atlantic Coast and the Eastern Plains. There are two distinct production systems in the country: mechanized and traditional upland (manual). The

mechanized rice production system represents 95 per cent of the rice growing area and 98 per cent of production. However, the traditional upland rice production system has a social value in specific regions of the country because 47 per cent of the rice producers in the country are found in this system.

Average yields of the mechanized system are 4.8 metric tons per hectare, which in turn is divided into irrigated (63 per cent of the rice area and yield of 5.4 metric tons/ha) and rain fed lowlands (yields of 4.2 tons/ha). The latter differs from the former in that it depends on rainfall, which is generally concentrated in a few months of the year, thereby determining the very market-cyclical nature of production in this system.

Rice cultivation generates 36 working days per crop, per hectare, per season, and in the production zones it is also the main source of income for transporters, the metal-mechanic industry and all service activities such as banks and commerce. The effect of this activity is very important in Colombia's tropical zone. Rice cultivation also contributes about 4 per cent of Colombia's agriculture GDP.

Meanwhile, Colombia has evolved from being a net exporter in the 1980s to importing about 5 per cent of its annual consumption in the 1990s. The rice sector was reactivated as a result of syndicate efforts to improve productivity and Government cooperation and achieve price stability with storage subsidies and protection from Andean countries and third parties. However, the growth of rice activities in Colombia has implied a reordering of land use, changes in producers' income, intensive use of natural resources (land, water) and greater use of agro-chemicals.

7.2.2 Project objectives

The main objective of this study is to carry out an integrated evaluation of the social, economic and

environmental impacts of trade liberalization in agriculture, with a focus on the rice sector. Specific objectives are to:

- improve the national level of knowledge and understanding with regard to the impacts of trade liberalization on the environmental, social and economic aspects of rice cultivation.
- improve analysis of trade topics within the agriculture sector.
- develop methodologies to evaluate future trade agreements.
- formulate policies to mitigate the negative effects of trade liberalization and maximize the positive aspects.

7.2.3 Trade liberalization

In the last decade of the twentieth Century, Colombia's agricultural sector has been transformed by the adoption of a 'free trade' model that has had a significant impact on every sector of the economy. The average tariff fell from 44 per cent in early 1990, to only 11.8 in March 1992. The exchange rate was overvalued during the same period, partly because of large inflows of capital (private investment and drug money). The combination of the strong peso and trade liberalization has hurt farmers, and the whole process has affected the agricultural sector in general.

This impact can be assessed by the increase in food imports from 810,000 tons in 1991 to 3,989,000 tons in 2001 and the overall decrease in crop cultivation in the country. The area used to cultivate short-cycle crops fell by 632,153 hectares while the area on which permanent crops are cultivated grew by 63,060 hectares, i.e. just 10 per cent of the total area lost. The net result was a loss of 569,093 hectares. Short-cycle crops include cotton, cereals and vegetables, and these are an important source of employment for non-qualified labour. Permanent crops include sugar cane, flowers, palm oil, bananas and coffee.

Trade liberalization began during the late 1980s, was consolidated in 1991, and is still ongoing. It was constituted unilaterally as was common in those

days and consisted of tariff reductions and frontier restrictions for all imported goods but mainly food. This study covers the period 1990-2003.

After Colombia signed the WTO AoA in 1995, national dependence on imports increased, mainly on those from the USA and more recently from the Andean Community countries. Currently, the tariffs applied are lower than those consolidated by the WTO, and a zero tariff is applied for trade with Andean countries. The growth of subsidies in the main exporter countries and the decrease of international quotas have caused Andean countries to establish a mixed tariff structure, and national governments have established production protection mechanisms such as safeguards, absorption contingents, trade agreements to determine volumes and dates of imports.

The latest issues for Colombian trade are related to the imminent bilateral negotiations with the USA, and plans for a new free trade zone between Andean countries and the Mercado Común del Sur (MERCOSUR).

7.2.4 Process and capacity building

In Colombia, a multidisciplinary team of private, public, and official consultants was enrolled to develop the project. The rice production chain was represented by FEDEARROZ, the producer association; Induarroz and Moliarroz, the industrial associations; Usocoello, the irrigation district of Coello River association; and SAC. The Ministries of Agriculture, Environment and External Trade represented the Government sector. Other Governmental institutions that participated in this research were the Departamento Nacional de Planeación, CORPOICA and La Bolsa Nacional Agropecuaria.

The process was supervised by a Steering Committee consisting of the Project Director, FEDEARROZ's CEO and a representative from the Ministry of Agriculture. The project was financed by UNEP and FEDEARROZ, with additional resources from Cuota de Fomento Arrocero.

A first international meeting was held in Geneva on 19-20 February 2003 involving the seven countries

taking part in these studies and other members of the international working group on rice set up by UNEP to guide and implement the projects and provide comments (members of this working group are listed in the Acknowledgements). This meeting helped shape the study and redirect project objectives, especially in relation to the methodology, and the participating countries learned from each other's methods.

The project adopted a multidisciplinary approach involving stakeholders from throughout the production chain to discuss sectoral problems. The agricultural and environmental Ministries participated in the whole process with two permanent researchers on the Technical Committee.

Two stakeholder workshops were held, with the participation of producers and representatives from industry, irrigation districts, universities, NGOs, international institutions, and the Agriculture and Environment Ministries. The first stakeholder workshop was held in Bogotá and involved a brainstorming on the diverse impacts of trade liberalization on every link in the rice production chain. The Technical Committee developed the project, dividing the research topics into environmental concerns, socio-economic issues, production costs and production analysis. The second stakeholders' workshop analysed and qualified the preliminary results from the Technical Committee with the participation of the Agriculture Minister.

The draft final report that was presented at the second international meeting in Geneva on 18-20 November 2003, following which written comments were sent by UNEP to the respective study team leaders for incorporation as far as possible into the studies.

7.2.5 Methodology

The data used in this study was obtained from the 1989 and 1999 Rice Producers' Censuses¹ to study

general aspects of the rice producer sector. The Periodical National Rice Survey (180 rice producers, 1990-2003) information generated by FEDEARROZ was used for the analysis. Price information collected weekly by FEDEARROZ from the principal centres of production, industry and consumption for the period 1980-2003 was also consulted. Furthermore, information on rice producing areas, production and semi-annual yields, and quarterly consumption came from DANE. Policies and information on the environmental impacts of rice cultivation were obtained from related studies at the Agriculture and Environment Ministries.

Social and economic evaluation included *ex ante* and *ex post* analysis using quantitative methods to analyse the impact of subsidies on international prices, with regression analysis to explain the relationship between rice and its substitutes. Co-integration analysis was used to determine the relationship between Colombian and international rice prices. This was done to test the relationship between the national price of rice and the international price of wheat, and between the international prices of rice and wheat (in US dollars), to verify any possible substitution relationships.

To evaluate the environmental and some of the social and economic impacts, production costs were calculated by system, per semester, to identify any trends in the level of inputs used before and after implementation of the trade liberalization policy.

Finally, to measure productivity changes and technical changes, Transcendental Logarithmic Cost Functions and Tornqvist indexes were used. With this methodology it is possible to estimate differences in productivity between production systems and the level of inputs used in order to recommend more environmentally friendly practices to improve sustainability of the rice sector.

¹ DANE-FEDEARROZ, I y II Censo Nacional Arrocerero, Bogota.

7.2.6 Integrated assessment results

7.2.6.1 Environmental impacts

Unexpected food imports during the 1990s resulted in vast semi-annual crop-growing areas being left idle, so rice cultivation occupied some of those areas. Displaced labour turned in part to rice production activities and partly to the production of illegal drugs.

In order to determine the links between technological change, factor substitution, productivity measures and production patterns, Tornqvist productivity indexes were calculated. Firstly, a decrease in the effectiveness of the agro-chemicals used intensively during the 1981-2001 period was found, so producers needed increased quantities of agro-chemical inputs to solve the growing weed problems. Secondly, the increase in the number and proportion of rice producers that rented land, and in the total rice-growing area showed an exhaustive use of natural resources compared to when rice producers owned the land they used.

Since the number of rice producers and the amount of land that was rented increased, the average size of plots decreased. The practice of monocultivation increased, which meant that rice was no longer rotated with alternative crops such as cotton, soy, sorghum and maize, because of the lack of opportunities in marketing these crops. Monocultivation results in biodiversity loss and requires increased use of agro-chemicals. The continuous use of herbicides generates resistance in weeds, thus requiring increasing amounts of herbicides to control the problem, and the inadequate and excessive use of agro-chemicals in general modifies soil characteristics.

About 54 per cent of rice producers do not own their land. This can have negative environmental consequences because producers do not manage rented land in the same way they would if they owned the land, since landowners have an interest in preserving resources such as water and soil over the long-term, whereas the principal motivation of farmers who rent their land is to extract the maximum resources in the shortest time to make rental costs more profitable.

Given the minimal use of deep-lying ground water in irrigated systems for rice cultivation, there is currently no conflict between its availability and demand. For the time being the magnitude of the effect is thus considered low. This may increase, but the capacity at present to mitigate negative effects is medium to high. Mitigation measures may include more rational consumption, improved knowledge on the requirements and current consumption in rice cultivation, recycling of used waters and better use of rainfall and superficial water.

Construction and land preparation affect land resources, causing the soil to become more compact. As soil becomes more compact, its physical and chemical characteristics are altered because of the lack of permeability and infiltration, which makes it more prone to superficial erosion, nutrient wash and contamination by management practices.

Widespread deforestation to facilitate air fumigation, water distribution and drainage has had negative environmental impacts including micro-climatic deterioration with longer periods of drought, which has affected production, yields and the sanitary levels of crops. However deforestation is attributed more to the growing of illegal crops, corn and grasses, rather than to rice production.

The inadequate disposal of crop residuals causes contamination in some zones. The uncontrolled burning of wastes destroys vegetative covering and alters the micro-fauna. Some of these negative impacts can be reduced by incorporating the organic waste, especially crop residuals that are rich in nitrogen and potassium, back into the soil or through other alternative techniques, and thus improve the organic content, fertility and biodiversity of the soil.

Anaerobic conditions of flooded lands in irrigated systems alter soil characteristics. Although soil micro-organisms normally only exist in very small amounts they are essential to soil fertility. In general, flooded soil can be recovered through management practices to achieve positive microbial activity and adequate physical and chemical conditions.

Air quality has also been affected by rice activities. The application of agro-chemicals liberates harmful gases and unpleasant smells. In the milling industries, the burning of large volumes of husks releases ash and other volatile particles that are transported by the wind and leave deposits on crops, soil and surface waters. The construction of mills and other infrastructures generates solid particles that are released into the atmosphere, and noise from the machinery.

7.2.6.2 Advances related to environmental management

With the purpose of analysing and evaluating the environmental effects associated with the management of rice cultivation, different production activities were valued throughout the production chain, from infrastructure development to product commercialisation. The use and management of inputs, wastes, potential conflicts and benefits on the resources were also analysed. A matrix showing natural resources and the effects of various practices was developed to identify the environmental impacts. Environmental legislation was also analysed, and it was concluded that while there are sufficient environmental protection laws, this does not mean they are effectively implemented.

Different environmental strategies to mitigate the impact of crop cultivation on resources have been developed. For example, IPM techniques minimizing the use of agro-chemicals have been applied. In addition, the Environment Ministry, FEDEARROZ and SAC developed an Environmental Guide for the rice sub-sector to promote environmentally friendly practices.

An Agreement for Cleaner Production within the rice mill sub-sector was subscribed as a national policy application strategy. The rice mill sub-sector also subscribed an agreement between its associates and the regional environmental authority of the Tolima Department with the purpose of improving productive processes, reducing and controlling the generation of residuals, and developing more environmentally friendly technologies.

All actors in the rice sector signed a Competitiveness Agreement of the Rice Chain. The Agriculture and Rural Development Ministry, the industrial companies and CEOs of rice producing companies proposed this mechanism in order to guarantee the sustainable economic and social development of the sector. At the same time, all actors agreed to execute short, medium and long-term actions to improve the production conditions and increase the competitiveness of the chain.

Rice production in Colombia requires the development of an infrastructure of irrigation and drainage to ensure the availability and quality of water resources, taking into account environmental variables. Reality shows that, during the last decades, investment has not been focused on improving, maintaining and modernizing this infrastructure to guarantee the availability of water to cultivated areas and their possible expansion. What's more, the high rate of deforestation in the basins and the development of inadequate cultivation practices have had a negative impact on water flow. Consequently the sector has defined a number of actions to protect the basins. These include a project with the Association of Users of the Chipalo River, the Ibagué Municipality, the Public Services Company of Ibagué and Cortolima to evaluate the benefits of re-using the treated municipal waters of Ibagué city for the irrigation of rice farms. Based on the results, it is hoped to replicate this pattern in other municipalities of the country.

Because of the importance of the rice sector it is considered essential to improve its competitiveness and sustainability through measures that mitigate negative environmental impacts and preserve natural resources, taking into account social, environmental and economic aspects. Alternatives for sustainable environmental management of the Colombian rice sector include:

- carrying out environmental evaluations of specific projects within the rice sector (watering and irrigation facilities, mills, agro-chemical plants, air fumigation, etc.) in the development planning programmes.

- planning and designing new irrigation facilities within environmental norms through hydro-basin conservation programmes.
- developing technical packages to promote IPM and Integrated Soil and Water Management to rationalize plaguicide and fertilizer use.
- developing programmes to promote the efficient use and reuse of waters.
- strengthening training programmes on the safe use of plaguicides and their residuals.
- developing programmes for the recycling of cultivation and milling by-products such as crop residuals and husks.
- optimising irrigation, drainage and the use of fertilizers.
- developing community reforestation programmes, especially in basins where water springs are found.
- optimising mechanised farming and ploughing programmes for land preparation.
- establishing plans and programmes for integrated development at the municipal level (urban and suburban) with a view to satisfying basic needs in terms of housing, drinking water, health, education and recreation for low-income sectors (operators).

7.2.6.3 Economic impacts

The main economic impacts of trade liberalization on Colombia's rice sector are evident in the 38 per cent price decrease in real terms, and a 28 per cent cost reduction per hectare (or 34 per cent per metric ton) due to productivity advances, including the introduction of a new variety of rice (Fedearroz-50) that increased the national average yield from 5.2 to 5.8 metric tons per hectare of green paddy. These results reflect the efforts of the rice sector to improve its competitiveness and mitigate the negative effects of the trade liberalization process.

However, after 12 years and despite the aforementioned cost and price decreases, competitiveness decreased in absolute terms because during the

same period international prices decreased by 50 per cent and the USA increased its subsidies by 285 per cent. The USA is the key exporting country with the greatest effect on international prices, pushing prices down because of subsidy increases. This undermined Colombia's competitiveness and makes it impossible for Colombia to compete on the international market in the short, medium and long term.

Primarily, the negative aspects of open trade affected the rice sector until 1996 with an average increase of imports of 200,000 metric tons per year and a 33 per cent reduction of the rice growing area. The Government then started applying protection mechanisms such as safeguards, storage subsidies and trade agreements with Venezuela and Ecuador in an attempt to reactivate rice cultivation. In 1999, Colombia reached its highest ever level in terms of rice growing area. However, real prices kept on decreasing. In searching for a logical reason for this economic phenomenon it was found that there is a strong substitutability between rice and wheat products (e.g. bread and pasta). Thus, while international wheat prices continued to decrease during the period 1990-2001, this trend contributed to pushing down the price of rice on the Colombian market. Colombia imports 95 per cent of the wheat it consumes, which is why international price variations are transmitted directly to the domestic market. As wheat prices dropped on the world markets, rice prices were dragged down because of the high substitution elasticity between these two products found in the econometric study.

In addition, the income of producers who rent their land is affected by the continuously increasing land prices, whilst for landowners land is becoming a low-risk form of investment. The social consequence of a concentration of land ownership among a restricted number of hands is a less equitable distribution of income and wealth.

7.2.6.4 Social impacts

Even though employment in the rice sector has not been significantly affected, trade liberalization has

been tragic for rice rotation crops such as cotton, sorghum, soy and maize, reducing wealth and welfare in Colombia's tropical zones where agriculture is the most important activity. In turn, the multiplying effect of those productive activities is especially important because it is directly transferred through income onto other sectors such as commerce and industry.

The increase in unemployment in transitory cultivation (cotton, sorghum, soy, maize) was due to the 800,000-hectare reduction during 1990s. Transitory cultivation was the highest source of non-specialized labour, and the production decrease in this sector contributed to an increase in the cultivation of illegal crops. Despite the low price of imported foods, this has resulted in a decrease in the quality of life and welfare in the rice production regions where cotton, sorghum, soy and maize were grown because of the dramatic increase in drug-related crime and violence and the widespread practice of extortion and kidnapping.

Colombia's expanding urban sector now accounts for nearly 62 per cent of the total population. Urban unemployment has increased from 4.6 per cent in 1988 to 10.9 per cent in 1999. This is partly a result of the rural-urban migration following the loss of jobs in transitory cultivation.

7.2.6.5 Integrated impacts

The agricultural sector in Colombia saw a 25 per cent decrease of its cultivated area during the 1990-2002 period, which has affected the employment level and the purchasing power of non-qualified labour. Rice cultivation has seen a reactivation since 1996 and rice became the most profitable short-cycle crop, but this has also meant an increase in monoculture with all the consequences in terms of environmental impacts because of the increase in mechanized methods of land preparation and an increase in pest-related problems due to the lack of crop rotation. Furthermore, the productivity of agro-chemicals has decreased as a result of their continuous use.

Consumers may appear to have benefited in abstract terms from the new low prices of imported

foods, but in real terms consumers have been hurt as a result of the high unemployment and consequent inability to generate income to buy the cheap food.

7.2.7 Policy recommendations

New challenges must be imposed on the rice production system with the incorporation of new environmental variables and production practices in order to guarantee the sustainability of this activity.

The following proposed recommendations could mitigate the negative environmental impacts of rice production practices that have resulted from trade liberalization:

- An environmental evaluation of the rice sector must be the first step in the production chain to measure and understand the current environmental situation; assess the impact of programmes to mitigate the impact of intensive rice production; and to plan future actions and responsibilities.
- A crop-rotation policy to promote commodities such as cotton and maize with monetary incentives such as minimum prices and subsidies for storage, to move away from the practice of monoculture and prevent weed infestation and all other associated problems.
- To prevent environmental degradation resulting from the misuse of agro-chemicals, it is proposed to enhance training programmes to improve the application of pesticides and encourage the practice of IPM by persuading rice production leaders. This may also be done through field demonstrations at work.
- At the producer level it is proposed to develop programmes that focus on the recycling of sub-products such as crop residuals. This would avoid the practice of burning them after the harvest, resulting in improved air quality around farms. In the same vein, it is proposed to find alternative uses for the husks, for example in the making of bricks and other construction materials.
- It is proposed to promote the use of laser levelling to reduce water lamina per hectare,

decrease water usage per hectare and decrease weed infestation while preventing overuse of herbicides.

- To improve social welfare in the production areas it is proposed to establish integral development plans jointly with local Governments to improve living standards, drinking water, public health and recreation conditions for low-income households, as has been implemented through the rice-producing communities in the Central Zone of Colombia by local rice-producing committees.
- To control implementation of the environmental policies proposed above, it is recommended to establish an “operative committee” composed of institutions from the rice production chain.

To address the economic impacts, policy measures on further trade liberalization must focus on the search for a mechanism to tie the decrease of protection for domestic rice production in developed countries to the decrease of import taxes in Colombia, mainly in relation to the new bilateral agreements with the USA which has dramatically increased its subsidies in rice production during the last 5 years. Such a mechanism should improve the competitiveness of the Colombian rice sector in the international market.

The connection found in this study between Colombian rice and imported wheat prices, suggests that the same mechanism of protection must be implemented with substitute products, to ensure the effectiveness of any trade agreement.

7.2.8 Main lessons learned

The main lesson learned for the future from this study is in terms of the great fragility of the agricultural sector, which is the main source of income for the country’s low-qualified or unskilled labour force. For future trade agreements compensation mechanisms need to be developed to protect national producers from the market imperfections induced by the subsidies and internal support provided by governments to agricultural producers in developed countries.

There is currently a major ongoing debate regarding the possibility of creating an American Free

Trade Area, ALCA. There are also ongoing talks on the creation of a free trade area between Andean countries and MERCOSUR. Different sectors are putting forward their positions based on their studies. The agricultural sector, which is very important in Colombia in terms of social policy, has not yet assumed its position. This study clearly shows that the Colombian rice sector cannot be competitive unless the subsidies of the main exporting countries are dismantled. In anticipation of this discussion, the study provides researchers and negotiators with some tools to focus the debate.

Today, several of Colombia’s agricultural sectors have contracted similar studies and the Ministry of Agriculture is conducting a study on the main crops to support its position in the negotiations starting in April 2004. The committee debate leaders from the Ministry of Agriculture are the same as those who participated in the executive committee of this project. Besides, the Ministry of Agriculture formed a special group of professionals to participate directly in the Free Trade Agreement negotiations with the USA, giving more space to the same group of researchers and allowing the private sector to advise them at the “Next Door Room”. FEDEARROZ is participating directly in this instance as a result of the interest generated since its participation with UNEP in the evaluation of the impacts of trade liberalization.

In the course of the stakeholder workshops there was innovative and rich discussion on the project proposal, the methodology and the results. This was especially evident when the Agriculture Ministry participated in the last workshop in September 2003, to listen to the results and confirm participants for the Executive Committee working group.

For the rice production sector, the results of this study provide the main tool to present Colombia’s case in discussions on the new trade agreements. It provides the arguments to start making an issue around the social costs and environmental implications of increasing the import of foods already produced in Colombia.

7.2.9 Suggestions for follow-up

Two major projects will soon be implemented with the participation of rice producers, the industrial sector and some Governmental agencies. The first is to develop a methodology to measure the socio-economic impacts of rice activities at the municipal level. This methodology will then be implemented within the rice production zones. The purpose of this is to gain more support from the politicians.

A second project is related to quantifying the more feasible production, industrial and commercialisation improvements within the next ten years to improve competitiveness in the rice sector and provide agriculture negotiators with better knowledge about the offers they can make and the limits in their proposals. On the other hand different negotiation scenarios will be studied to determine possible positions at the negotiation table.

7.3 Côte d'Ivoire

7.3.1 Introduction

The rice sector of Côte d'Ivoire has been operating in a more or less open-economy context since the major economic policy reforms and domestic trade liberalization measures were implemented in 1994 within the frameworks provided by the Structural Adjustment Programme of the World Bank and IMF, the WTO AoA, and the Common Agricultural Policy of WAEMU.

The aim of this study is to assess the economic and environmental impact of these policy reforms, domestic trade liberalization measures and world trade liberalization on the rice sector of Côte d'Ivoire. The specific objectives of the study are to:

- review the structure of the rice economy and the evolution of rice development policies including the initiated national, regional and international policies that have affected Côte d'Ivoire's rice sector;
- assess the impact of domestic and WTO trade liberalization measures implemented since 1994 on domestic rice supply and demand, the welfare of local rice consumers and growers, deforestation, and rice biodiversity;
- formulate policy recommendations for mitigating the negative impacts of liberalization and enhancing the positive ones.

The agricultural sector plays a major role in the economy of Côte d'Ivoire, accounting for about 30 per cent of the GDP, which stood at US\$ 11.7 billion in 2002 with a per capita GDP of US\$ 620.² Coffee and cocoa alone represent nearly 15 per cent of the GDP and rice about 5 per cent. According to the UNDP Human Poverty Index, poverty in Côte d'Ivoire is fundamentally a rural

problem with almost 42 per cent of the rural population living below the poverty line, compared to 23 per cent in urban areas. The 1996 ANADER national survey estimated the total number of farm households in Côte d'Ivoire at 2,300,000, of which about 476,000 were rice farmers.

Côte d'Ivoire has been unable to keep up with the rapid growth in demand for rice (Figure 1) despite its great potential in rice production. This growing demand is being fuelled by a combination of high population growth rates and rapid urbanization.³ Domestic rice production only covered about 60 per cent of the roughly 1.2 million tons of rice consumed in Côte d'Ivoire in 2000. Rice imports have been growing steadily since independence (from 39,000 tons in 1961 to 641,000 tons in 2001). Côte d'Ivoire ranked as the fifth largest rice importer in the world in 2001 with more than 80 per cent of the rice imported from five Asian countries: Thailand (26 per cent), China (25 per cent), Pakistan (14 per cent), Viet Nam (13 per cent) and Japan (10 per cent).

The slow growth in domestic rice production in Côte d'Ivoire is due to the very low yield achieved in rain fed rice farming in upland and lowland ecologies (1.3-1.7 tons per hectare in the forest zones and 0.75-1.5 tons per hectare in the Savannah zones).⁴ Rain fed rice cultivation accounts for up to 93 per cent of the total rice-growing area and is grown mostly for home consumption using traditional practices and low-yielding rice varieties. Rain-fed rice farms are often small, exposed to climatic hazards (drought notably) with labour generally consisting of family members and

² World Bank (2004) *World Development Indicators*, Washington, D.C.

³ Matlon, P., T. Randolph. and R. Guei (1996) "Impact of rice research in West Africa", paper presented at the International Conference on the Impact of Rice Research, Bangkok, Thailand, 3-5 June 1996.; Reardon, T. (1993) "Cereals Demand in the Sahel and Potential Impacts of Regional Cereals Protection", in *World Development*, 21(1):17-35.

⁴ Matlon, Randolph, and Guei, 1996 (ibid.).

intensification limited due to the high cost of fertilizers and pesticides.

In contrast, irrigated rice cultivation, which occupies only 7 per cent of the rice area, achieves average yields of up to four tons per hectare in both forest and savannah zones. Irrigated rice farmers tend to be more commercially oriented and are more willing to adopt modern rice cultivation practices with high-yielding modern varieties, with levels of fertilizer, pesticide and herbicide use close to that recommended by research. Because of its higher yield, irrigated rice is financially more profitable than rain fed rice despite the much higher cost of inputs involved in the former. However, the doubling of the cost of the inputs since the FCFA currency devaluation has significantly reduced its profitability.

Most of the rice produced in Côte d'Ivoire is destined for home consumption. Only 43 per cent of the total production was marketed in 1994.⁵ The proportion of rice output marketed varies from one region to another depending on whether the region is a traditional rice-producing region or not. In general, farmers in the central and western regions produce the rice surpluses that are marketed within and outside their regions. The north-west is generally rice-deficient despite being a traditional rice-growing region. Also, upland rain fed rice production is largely for home consumption in the forest zones while being a complementary source of cash income in the cotton-producing regions of the savannah zones. Coffee and cocoa plantation workers also see rice production as a complementary source of cash income.⁶

Côte d'Ivoire began to completely liberalize its rice sector in 1995 within the frameworks provided by the Crédit de Relance Agricole (CARE) and the Crédit d'Ajustement du Secteur Agricole (CASA) programmes that came with the Structural Adjustment Programme of the World Bank, the IMF, the

WTO AoA and the Common Agricultural Policy being formulated by the WAEMU.

The WTO and WAEMU trade liberalization measures were implemented together with the policy and institutional reforms of the CARE and CASA programmes, which were most significant. They included the following measures:

- transfer of rice import activities to the private sector in July 1995 (deluxe rice in August 1994, cargo rice in January 1995 and large consumption rice in January 1996);
- dissolution of the Caisse Générale de Péréquation des Prix (CGPP) in March 1995;
- liberalization of the price of large consumption rice in March 1996;
- modification of the protection tariffs on imported rice in 1996 (the rates were 10 to 15 per cent of the CIF value);
- creation of the PNR in July 1996 with the mandate to participate in the development of policies and strategies for rice production and to organize and manage a rice information system that would enable the monitoring and evaluation of all the rice production, importation, transformation and marketing activities;
- suppression of the annual import quotas in January 1997.

7.3.2 Study process and capacity building

This study was conducted by WARDA in collaboration with the REI. A national stakeholder committee guided the implementation of the project and provided technical support. The stakeholder committee included members from REI's steering committee and representatives from the following institutions and organizations: the Ministry of Agriculture, the Ministry of Interior Trade, the

⁵ CIDV (1993) "Enquête de Base sur la Production de Riz en Côte d'Ivoire" République de Côte d'Ivoire, Ministère de l'agriculture et des ressources animales, Compagnie Ivoirienne pour le Développement des Cultures Vivrières (CIDV), p. 31; Abidjan, Côte d'Ivoire.

⁶ Sylla, K. (2003) "Impact de la dévaluation du franc CFA sur la performance des cultures café, cacao et riz en Côte d'Ivoire" in Ben Hamouda H. et Kassé M. *L'avenir du franc CFA: perspective africaine*. Harmattan, Paris, France.

Ministry of External Trade, the Ministry of Environment, the Bureau National d'Etudes Techniques de Istry Développement (BNETD), the Programme National de Gestion des Terroirs (PNGTER), ANADER, CIRES, l'Association Nationale des Riziculteurs de Côte d'Ivoire (ANARIZ-CI), l'Association Nationale des Organisations Professionnelles Agricoles (ANOPACI), PNR Organisation des Volontaires pour le Développement Local (OVDL, an NGO working in rice producing communities) and WARDA.

A national stakeholder workshop presided by the Minister of Agriculture was convened on 22 January 2003 to launch the project. Unfortunately, however, the stakeholder committee did not hold any subsequent meetings because of the political situation prevailing in Côte d'Ivoire since 19 September 2002 that severely limited the scope and process of the study. Nevertheless, the results and conclusions of the study have been used by the Comité National Interministériel Consultatif (CIC) des Négociations de l'OMC to refine and support the position of Côte d'Ivoire in WTO negotiations.

7.3.3 Methodology

The study used a PEM to quantify the economic and environmental impact of domestic and WTO trade liberalization on Côte d'Ivoire's rice sector. The model is based on a set of econometric models of determinants of domestic rice consumer and producer prices, determinants of rice variety choice and surfaces cropped by rice and coffee/cocoa growers, which are combined with estimates of supply and demand elasticities for local and imported rice. PEMs and CGE are the tools most commonly used to quantify the economic and environmental impacts of trade liberalization.⁷

The analysis uses both time series data compiled from various sources (including the National Statistical Institute, the Custom Office, the Ministry of Agriculture, the Ministry of Finance, and the FAO's database) and survey data. The time series database was used in the analysis of the impact of trade liberalization on domestic rice prices, supply and demand and on consumer and producer welfare. The survey data comes from two sources. The first source is the nationwide farm survey conducted in 1996 by ANADER (the main agricultural extension structure in Côte d'Ivoire). This was a large survey covering a randomly selected sample of 10,000 farmers distributed over 250 sites across the whole country. The information collected encompasses all aspects of the livelihoods of agricultural households. This database was used in the analysis of the impact of trade liberalization on deforestation. The second data source is the database resulting from the farm household survey conducted by WARDA in 2000 and 2001 conducted in 50 villages in western and northern Côte d'Ivoire districts that cover about 60 per cent of the country's rice-growing area. The analysis of the impact of trade liberalization on rice biodiversity was based on this data set.

There are two distinct channels through which the WTO AoA impacts the rice sector of Côte d'Ivoire. The first channel is through the domestic trade liberalization measures undertaken by the Government of Côte d'Ivoire since 1994 in order to comply with the terms of the AoA. The second channel is through world trade liberalization, i.e. the trade liberalization measures undertaken by other countries in compliance with the same agreement. To estimate the impact through the first channel we include in each estimated equation a dummy variable for the post-liberalization period (1994 to 2000) in addition to a time trend and a set

⁷ For recent applications see, for example: Diao, X., A. Somwaru and T. Roe (2001) "A global analysis of agricultural reform in WTO member countries" in M. Burfisher (ed.) *The Road Ahead: Agricultural Policy Reform in the WTO, Agricultural Economic Report*, No. 802, Economic Research Service, USDA, Washington DC.; Dimaranan, B., T. Hertel and R. Keeney (2003) *OECD Domestic Support and the Developing Countries*, GTAP Working Paper No.19, 22 January 2003, West Lafayette, Indiana; Soledad Bos, M. (2003) *The Impact of OECD Members' Agricultural Subsidies on Welfare and Food Security in Sub-Saharan Africa: The Case of Maize*, report submitted to The Hunger Task Force of the Millennium Project, Goldman School of Public Policy, University of California, Berkeley, USA.

of relevant aggregated time series variables. With the inclusion of a time trend, the coefficient of the post-liberalization dummy variable measures the direct impact of all unobserved policy and non-policy events that have taken place during the period 1994 to 2000. The unobserved policy events include the 1994 devaluation of the FCFA currency, the policy and institutional reforms implemented under the CASA and CARE programmes and the domestic trade liberalization measures implemented to comply with the WTO AoA and the WAEMU agreements. For simplicity we will refer to the impact identified through this channel as the direct impact of domestic trade liberalization.

As far as impacts relating to the second channel are concerned, it is assumed that the liberalization of world trade affects the rice sector of Côte d'Ivoire through its impact on world market prices for rice. It is generally impossible to estimate the actual impact of world trade liberalization on world prices because little information is available on the level of compliance of most WTO members with respect to the AoA.⁸ This has led researchers to assume various alternative implementation scenarios in order to obtain some estimates of the impacts of world trade liberalization on selected economic and environmental outcomes. We obtain estimates of the impact of world trade liberalization on world market prices from the study by Diao, Somwaru and Roe⁹ which simulated the impact on world market prices of four alternative world trade liberalization implementation scenarios: elimination of (i) full policy distortions, (ii) global tariffs, (iii) global export subsidies, and (iv) Organization for Economic Cooperation and Development (OECD) export subsidies. The simulated results showed a

general increase in the world market prices of all agricultural products under almost all scenarios. The estimated impacts on the world market price of rice under the four scenarios are 10.1, 5.9, 2.4, and 1.5 per cent respectively. Of course, none of the four scenarios corresponds to what has been implemented by WTO member countries. Indeed, according to Burfisher¹⁰ and the WTO,¹¹ trade barriers remain high, and both domestic support and export subsidies have increased after an initial decline. Significant progress has only been made in the conversion of non-tariff barriers to their tariff equivalents and on the reduction of applied tariff rates.¹² Nonetheless, the results should provide a good indication of the range of impacts of the world trade liberalization measures implemented since 1994, with the 'full policy-distortion elimination' and the 'OECD export subsidies elimination' scenarios providing the high and low end impact estimates respectively. But, given that the implemented world trade liberalization measures have so far consisted mostly of applied tariff reductions, the true impact should be closer to that of the global tariff removal scenario.¹³

Before presenting the results of the partial equilibrium analysis, it is appropriate to recall the correct interpretation of estimated impacts in a quantitative impact assessment like this one. For each selected economic or environmental indicator, the estimated impact measures the difference between its value under the current observed regime of trade liberalization and what its value would have been if trade liberalization had not taken place (i.e. its value under the unobserved counterfactual). In other words, the estimated impacts measure the differences in outcomes with and without trade liberalization (which is not the same as the difference in out-

⁸ WTO (2002) Overview of Developments in the International Trading Environment, Annual Report by the Director-General, Geneva.

⁹ Diao, X., Somwaru, A. and T. Roe (2001) (ibid.)

¹⁰ Burfisher, M. (ed.) (2001) "The Road Ahead: Agricultural Policy Reform in the WTO" in *Agricultural Economic Report*, No 797, January 2001, Economic Research Service, USDA, Washington DC.

¹¹ WTO, 2002 (ibid.).

¹² WTO, 2002 (ibid.).

¹³ Moreover, it has been estimated that the impact of tariff reductions on world market prices and welfare are far greater than that of export subsidy and domestic support eliminations (Dimaranan, Hertel and Keeney, 2003, ibid.); Burfisher, 2001 (ibid.).

comes after and before liberalization).¹⁴ Thus we may find, for example, the impact of liberalization to be a reduction in rice imports even if we observe rice imports to have increased during the period that coincides with trade liberalization (the period 1994–2000). In this case, the estimated reduction in rice imports caused by liberalization means that without trade liberalization the observed increase in rice imports during that period would have been much higher (by an amount equal to the estimated reduction, to be precise).

7.3.4 Environmental and economic impacts of domestic and world trade liberalization

Increasing domestic rice production to satisfy growing rice consumption and reduce rice imports has been a top priority for Côte d'Ivoire since its independence. Investments in the rice sector increased rapidly from 12 per cent of total agricultural investments in 1960 to 47 per cent in 1966 before stabilizing 1970s to about 40 per cent up to the end of the 1970s. However, nearly all the investments in the rice sector (90 per cent) went towards setting-up and maintaining irrigated rice schemes in the northern part of the country (until 1963) and in the southern part (from 1967). Yet, irrigated rice cultivation contributes only 15 per cent to national rice production compared to 85 per cent for rain fed rice.¹⁵

One of the major rice policy initiatives of the Government of Côte d'Ivoire was the creation in the 1970s of the Société de Développement de la Riziculture (SODERIZ), a parastatal established to exploit the great potential for rice production in Côte d'Ivoire and achieve rice self-sufficiency. SODERIZ was in charge of the development and

management of irrigated rice schemes and assistance for upland rice production. The activities of SODERIZ included the organization of farmer cooperatives and the distribution of inputs (seeds, fertilizers, herbicides), which incited farmers to use high levels of inputs.¹⁶ SODERIZ was also in charge of the purchase, transformation and marketing of the local production. Thus, by 1976 SODERIZ had modern rice milling facilities with a total installed capacity of 150,000 tons to process the paddy bought from farmers at guaranteed prices. With the 1973 oil crisis and the soaring prices on the world rice market, SODERIZ increased the paddy producer price from FCFA 28/kg to FCFA 65/kg – an increase of 132 per cent (Figure 3). The price increase incited producers to boost local rice production by expanding into lowlands of central-western and north-western parts of the country. The supply of paddy to rice millers rapidly increased to 115,000 tons in 1975 (from less than 15,000 tons in 1972) while the volume of imports fell from 150,000 tons in 1973 to 2,000 tons in 1976. Thus SODERIZ reached its objectives beyond expectation, which were initially considered too ambitious.¹⁷ Côte d'Ivoire even exported 32,000 tons of milled rice during this period called the “Golden Age” of Côte d'Ivoire's rice economy.

However, the high financial costs of the operation could not be sustained. To cover the costs of paddy collection and transportation, and rice processing and distribution, SODERIZ needed a subsidy of at least FCFA 52/kg on the basis of the wholesale price that was fixed at FCFA 87.¹⁸ But, the total subsidy provided by the CGPP, the parastatal in charge of running the rice cross-subsidization scheme, was insufficient to cover the large quantities of paddy supplied by farmers.

¹⁴ By definition, the outcome under the counterfactual is never observed, but the statistical method used to analyse the time series data that spanned both the period before and after liberalization allows estimation of the differences in outcomes in the selected indicators despite the fact that the period for the counterfactual is the same as that of liberalization.

¹⁵ Estimates based on the nation-wide survey conducted by ANADER in 1996.

¹⁶ Diomande, K. (1995) *Dévaluation et Autosuffisance Alimentaire: le Cas de la Filière Riz en Côte d'Ivoire*, p. 77, CIRES, Abidjan.

¹⁷ Zoungrana, P. (1990) “Les soubressauts de la politiques rizicole en Côte d'Ivoire”; in *Cahier du Centre ivoirien de recherche économique et sociale* (CIRES), CIRES, Abidjan, Côte d'Ivoire.

¹⁸ Zoungrana, 1990 (ibid.).

This created great financial difficulties for SODERIZ, which had accumulated a debt of FCFA 26 billion in 1977. In addition, rice wholesalers colluded with rice importers to create artificial rice shortages in local markets despite the accumulation of important stocks of rice in SODERIZ's warehouses.¹⁹ SODERIZ was finally dismantled in 1977 after being blamed for the artificial rice shortages.

With the dissolution of SODERIZ, rice production and the marketing policy became uncertain from 1979 to 1981, with no clear orientation. Domestic rice production began to decline during this period, paving the way for the importation of large quantities of rice to satisfy the still-growing demand. Rice production started to recover in 1983 with the help of a World Bank funded project, but with the collapse of world market prices for rice in 1984 the Government opted for the importation of cheap rice, thereby putting on hold its objective of promoting local rice production.²⁰ Meanwhile, a new rice policy was implemented from 1982 with the operation of industrial rice-processing complexes being contracted out to private companies. Under the contract agreements the Government paid a premium above operational and fixed costs to the private operators who took responsibility for all the activities related to the collection, transportation and processing of the paddy and the distribution of the processed rice. The industrial millers were also allowed to process imported cargo rice from the United States in order to increase the utilization of their largely unused processing capacity. The CGPP had the monopoly for all rice imports under the new policy.

Facing a growing financial crisis, the Government ended the contract agreements with the private operators in 1990 after having accumulated about FCFA 10 billion in arrears in the payment of premiums. At the same time it abolished the paddy collection zones and liberalized paddy producer prices, maintaining only a floor price. The 50 per

cent devaluation of the FCFA in 1994 made it even more difficult for Côte d'Ivoire to maintain the consumer rice price (local and imported) at FCFA 175 (compared to FCFA 160/kg before the devaluation), as this required a significant subsidy. Thus, the average price of rice for general consumption rose to FCFA 269 in 1995 when the subsidy and price control regime was ended (Figure 3). The FCFA devaluation has enhanced the price competition between local and imported rice but has also, unfortunately, substantially increased the cost of the tradable inputs used in paddy production, transport and processing.

One can conclude from this brief review of the evolution and development of the rice policy in Côte d'Ivoire that the sector has been characterized over the years by frequent institutional changes and lack of continuity in the policies implemented. It also appears that the special attention paid to irrigated rice, which has attracted most of the investments in the rice sector, did not help upland rice production despite the fact that the latter is the most important system. The creation of the various parastatal rice development and marketing structures, CGPP (1955-1995), SODERIZ (1971-1977), CIDV (1988-1992), in addition to the FCFA devaluation in 1994 and the liberalization of the rice sector in 1995 seem to have had the greatest influence on the development of the entire sector.

An important development with environmental implications that took place after the domestic trade liberalization and policy reforms has been the decrease of public resources allocated to investment in and the maintenance of irrigated perimeters. This has accelerated the pace of their abandonment or degradation to such an extent that, to date, 80 per cent of the local rice production remains dependent on annual rainfall. The development of rain fed rice production through area expansion rather than through yield increases also occurred during the 1994-2000 liberalization period.

¹⁹ Dozon, J.P. (1979) *Impasses et Contradictions d'une Société de Développement: l'Exemple de l'Opération Riziculture Irriguée en Côte d'Ivoire*, cahiers ORSTOM, Volume 16, Abidjan (cited by Zoungrana).

²⁰ Diomande, 1995 (ibid.).

7.3.4.1 Environmental impacts: impact on deforestation and rice biodiversity

The expansion of the rain fed rice production systems has implied either the clearing of new land or, more likely, a reduction in the duration of fallow periods within the cropping system, since arable land is increasingly situated further away from the villages and the amount of arable land continues to decrease. The total land cleared for cultivation (all crops) in Côte d'Ivoire showed a downward trend over the period 1960 through 2001 (Figure 2). It was relatively high during the first decade (1960-1970) of independence (about 100,000 ha per year on average) compared to the 48,000 hectares cleared in 1993, just before liberalization. However, the decrease in land cleared for cultivation was not continuous since the average amount of land cleared became important again during some periods. This is the case for example of the 'cheap rice imports' period (1982-1993) during which the average total land cleared amounted to about 105,000 ha. The reduction in the duration of fallow periods puts at risk the sustainability of the rain fed production systems, as land fertility cannot be maintained with the very low or inexistent use of fertilizer which characterizes rain fed rice farming. Also, slash-and-burn land clearing practiced by the majority of farmers of rain fed rice year after year accelerates deforestation and soil erosion.

In general, the environmental impact of trade liberalization relating to a particular crop depends on the induced changes in the crop's production patterns and locations, as well as on the pattern of production substitution between that crop and other crops produced in the country. It also depends (through adjustment in world market prices) on the trade liberalization measures taken by other countries implementing the WTO AoA. If, following trade liberalization, higher producer prices lead to production increases through more intense use of

inputs, then ground and surface water pollution may increase due to fertilizer and pesticide leaching.²¹ Loss of ecological and crop varietal biodiversity may also take place due to the increase in pesticide use and the increased incentive to practice monoculture. Changes in the relative prices of crops, which may lead to some crops being substituted for others, may have a positive or negative impact on the environment depending on the relative intensity of input use. On the other hand, if the production increase is achieved through the expansion into new virgin forestland then deforestation, soil erosion and loss of ecological biodiversity may be the end result. Also, the removal of location-specific investments, input subsidies (irrigation water for example) or price support programmes can shift the production of a crop from one region or ecology to another.

The scant evidence available suggests that environmental problems caused by rice production in Côte d'Ivoire are in terms of deforestation and soil erosion due to expansion of rice cultivation at the expense of virgin forestland (and possible loss of rice varietal biodiversity due to the diffusion of high-yielding modern varieties) rather than in terms of pollution and loss of ecological biodiversity due to fertilizer and pesticide use. Common cultural practices in upland rice production such as bush fires, excessive clearing of forests and insufficient practice of fallow land, as well as leaching due to repeated labour all contribute to environmental degradation. Although surface and ground water pollution are also potential environmental problems that can result from heavy fertilizer and pesticide use, this is unlikely to be significant in Côte d'Ivoire except perhaps in the very few irrigated schemes in the savannah zones of northern Côte d'Ivoire. Indeed, as discussed above, fertilizer and pesticide use in rain fed rice farming, which concerned up to 93 per cent of the total rice-growing area in Côte d'Ivoire in 1996, is very low. Hence, the assessment of the environ-

²¹ Hara, Mariko (2002) *Environmental Interests in the Negotiation of the Agreement on Agriculture: Country Positions, Policy Implications and Assessment*, UNEP/ETB, Geneva; Lankoski, J. (1997) "Environmental Effects of Agricultural Trade Liberalization and Domestic Agricultural Policy Reforms", Discussion Paper no. 126, UNCTAD, Geneva.

mental impact of domestic and world trade liberalization is focused on the two environmental indicators, which are deforestation and rice biodiversity.

The results of the analysis show that among the price determinants of the areas cultivated with rice, only the consumer price of local rice has a positive and significant lag effect on areas under irrigated rice. But more importantly, the analysis shows irrigated rice to be a substitute for rain fed upland rice in the sense that an increase in the areas under irrigation reduces significantly the amount of forestland cleared for cultivation. Thus, the positive effect that an increase in the area under irrigated rice has on slowing deforestation combined with the positive effect of the consumer price of local rice on the total area under irrigation lead to a beneficial impact of domestic and world trade liberalization in terms of slowing deforestation. Indeed, the results show that while the immediate impact of domestic trade liberalization is nil in the first two years (1994 and 1995) it resulted in a reduction in the amount of forestland cleared for cultivation by 5,573 hectares in the third year (1996). In other words, 5,573 hectares of forestland would have been cleared for cultivation in 1996 if the domestic trade liberalization measures had not been implemented in 1994. The saving in forestland was made possible by an increase of 4,251 hectares of the total irrigated rice areas in response to the 28 per cent increase in the consumer price of local rice. World trade liberalization also helped save forestland in 1996, although to a much lesser extent (less than 300 hectares). No significant impact of trade liberalization on biodiversity was found.

7.3.4.2 Economic and social impacts

One of the most noticeable developments that have taken place during the liberalization period has been the diversification of the supply sources, which has led to the importation of a greater number of types of rice (including a cheap type of broken rice) and a subsequent modification in rice consumer preferences (see Figure 4). The easier

access to homogenous imported rice types has also increased consumer rice quality expectations in terms of cleanliness and homogeneity. Liberalization of the rice sector also resulted in the dismantling of parastatal marketing structures, which led to a rapid growth of small processing units in substitution of the industrial units, but made it more difficult to find marketing outlets for local rice production. This apparent paradox of low marketability of locally produced rice in the face of rising rice imports is due to the lack of competitiveness of locally produced rice in terms of quality and price as discussed above. Improving the quality of locally produced paddy and reducing the cost of its processing into white rice remain prerequisites for greater competitiveness of local production compared to imported rice.

Impact on domestic rice prices

The results of the analysis show that, of the 48 per cent average increase in the consumer price of local rice observed for the period 1994-2000 (Figure 2), 28 per cent was due to the domestic trade liberalization and policy reform measures implemented since 1994. Based on the discussion above regarding the rice prices cross-subsidization scheme in place before liberalization, the removal of the subsidy on processing costs of local rice should indeed raise its consumer price (and lower its demand).

The domestic trade liberalization measures were found to have no statistically significant impact on the domestic producer price of paddy and on the consumer price of imported rice. For paddy producer prices, the abandonment of the practice of setting an official guaranteed price should, all else being equal, lead to lower paddy producer prices. But the guaranteed paddy producer prices were nominal and fixed for long periods (Figure 2). Hence, the results suggest that their real values have been eroded by inflation to the point that they were already at or below the free market levels at the time of liberalization. Domestic liberalization should also have led to lower prices for imported rice (all else being equal) since it was taxed to

support the price subsidization scheme. The findings suggest that either the tariff regime changes did not affect the level of taxation, or importers and retailers did not pass on to consumers the benefits of the lower taxation and removal of restrictions on imported rice.

All three domestic prices are found to be positively and significantly impacted by world trade liberalization although the impact is much lower compared to the impact of domestic liberalization on the consumer price of local rice. Under the 'full policy distortion elimination' scenario, domestic consumer prices for local rice are estimated to increase by only 1.7 per cent compared to 5.4 per cent and 4.7 per cent for the consumer price of imported rice and for paddy producer prices respectively.²³ Domestic liberalization combined with world trade liberalization increased the domestic consumer price of local rice by as much as 35 per cent.

Impact on local and imported rice consumption

The domestic trade liberalization and policy reform measures resulted in a reduction of 28 per cent in local rice consumption. Hence, the results of the analysis indicate that, all else being equal, without the domestic trade liberalization measures the observed 52 per cent average increase in the consumption of local rice for the period 1994-2000 would have been much higher (up to 80 per cent). The reduction in local rice consumption due to the domestic liberalization measures increased steadily from a low value of about 133,000 tons in 1994 to reach a peak of about 244,000 tons in 1997 before declining again to 220,000 tons in 2000.

In comparison, the reduction in local rice consumption due to world trade liberalization is much lower under the four world trade liberalization scenarios. In percentage terms, the consumption of local rice would have been less than 2 per cent higher compared to actual levels if none of the world trade liberalization scenarios had been

implemented. The reduction in quantities under the full policy distortion elimination scenario ranges from a low of 8,000 tons per year in 1994 and 1995 to a peak of 14,000 tons in 1997. Overall, however, without the combined effects of the implemented domestic and world trade liberalization measures, the consumption of local rice would have been higher by as much as more than one third of their actual levels.

Because domestic trade liberalization measures have no statistically significant impact on the domestic price of imported rice, the consumption of imported rice has only been impacted by the world trade liberalization measures through their impact on world market prices for rice. Without world trade liberalization the consumption of imported rice would have been higher compared to actual levels for the period 1994 to 2000 only by about 3 per cent under the 'full distortion elimination' scenario. The absolute reductions in the quantities of imported rice consumed display a trend similar to that observed in the case of local-rice consumption. For the 'full distortion elimination' scenario, reductions in imported rice consumption range from 9,000 tons (1994) to 19,000 tons (1998).

Impact on domestic paddy production

Like imported rice, local paddy rice supply has been impacted only by world trade liberalization without which domestic paddy supply would have been up to 4 per cent lower than its actual level throughout the period 1994-2000 that was on average 52 per cent higher than in 1993. The increase in the quantities of paddy supplied follows a trend similar to the ones for local and imported rice consumption starting from the lowest values of 26, 16, seven, and four thousand tons in 1994 to reach peak values of 48, 29, 12 and eight thousand tons in 1997 respectively under the four considered world trade liberalization scenarios (full policy distortion elimination, global tariff removal, OECD domestic

²³ Regardless of the product, the impacts under the global tariff removal, the OECD domestic subsidy removal, and the global export subsidy removal are, respectively, about 60 per cent, 24 per cent, and 15 per cent of that under the full policy distortion elimination scenario.

subsidy removal, and global export subsidy removal). Thus, domestic and world trade liberalization played a very small role on the observed substantial increase in paddy production observed during the period 1994-2000.

Impact on the welfare of rice consumers

Because the domestic liberalization measures only affected the consumer price of local rice, its welfare impact is limited to the consumers of local rice. On the other hand, the welfare of consumers of local and imported rice and that of producers of paddy rice is affected by world trade liberalization measures under all four alternative implementation scenarios. As measured by the reduction in consumer surplus, trade liberalization has had the greatest welfare impact on rice consumers. However, most of the impact stems from the 28 per cent increase in local rice prices, which was a result of the policy reforms and the domestic trade liberalization measures. Furthermore, if we recall that the domestic liberalization measures implemented since 1994 includes the 50 per cent devaluation of the FCFA currency in 1994, we can easily deduce that it is very likely that a large part of the decrease in consumer welfare is due to the currency devaluation alone. The consumer loss (in the local rice market) due to domestic liberalization measures alone amounts to an average of FCFA 51 billion per year for the period 1994 to 2000. In comparison, the combined consumer welfare losses resulting from the impact of world trade liberalization on the local and imported rice markets (under the ‘full distortion policy elimination’ scenario, which is greatest) averaged FCFA 9 billion per year for the period 1994 to 2000.

Impact on the welfare of paddy producers

The welfare of paddy producers has been positively affected by trade liberalization. However, the welfare gain, which amounts to a maximum average of FCFA 4 billion per year (under the ‘full policy distortion elimination’ scenario), is much lower compared to the welfare loss of rice consumers. This is because the producers’ welfare gains result solely from world trade liberalization since paddy

prices have not been affected by the domestic liberalization measures.

7.3.5 Conclusions and policy recommendations

In conclusion, the results of the quantitative assessment reveal that most of the increasing trends of domestic rice prices, paddy production, local and imported rice consumption and rice-growing areas that have taken place during the period 1994 to 2000 have not been due to the policy reforms and rice-related domestic and world trade liberalization measures implemented since 1994. Furthermore, the impact of the policy reforms and rice-related domestic trade liberalization has been greater than that of world trade liberalization which has, in most cases, been comparatively insignificant.

Urban rice consumers seem to have been the main losers of the liberalization measures with the increased consumer rice prices, while local rice traders, processors and importers have been the greatest beneficiaries with the removal of the price controls and trade restrictions. Paddy producers appear to have benefited very little from the limited increase in paddy producer prices.

With respect to the environment, the increase in the consumer price of local rice has reduced deforestation since the increase in rice production has been the result of more productive irrigated rice systems rather than through the extensification of low-yielding upland rain fed rice cultivation. The responses to the environmental challenges posed by rain fed upland rice production depend on both technical changes within the rain fed environment and an acceleration in the expansion of the lowland rice system area. The stabilization of upland rain fed rice would require additional investment in fertility management, either through organic and non-organic fertilizer application or through improved crop rotation. Investment in the more sustainable lowland system requires an adequate environment for farmer communities, in particular with respect to land tenure. However, the overall constraint for the development of sustainable rice systems remains the farmers’ capacity to transform

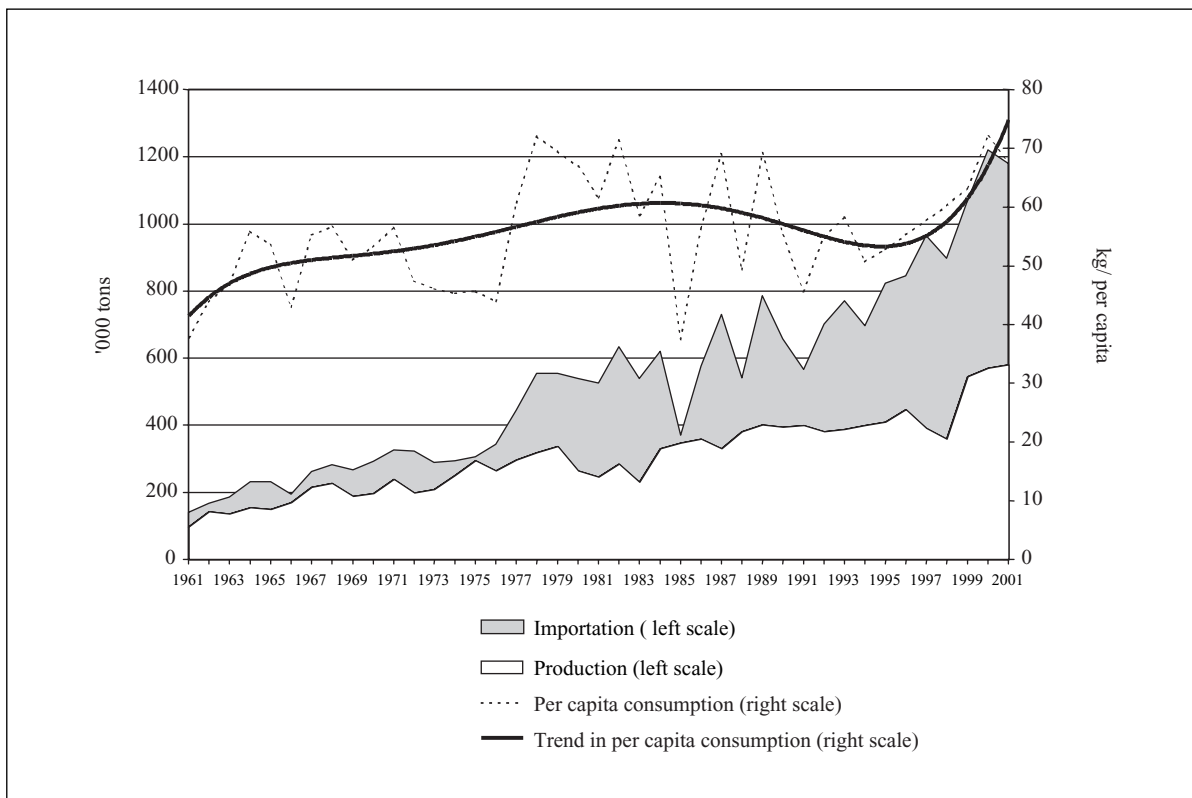
their production gains into additional income through adequate marketing and processing systems.

We can draw the following policy recommendations from the results of the analysis:

1. Review the system for rice imports to ensure that rice consumers benefit from domestic liberalization in general and the removal of import taxes in particular. This is especially important in the context of the removal of the value added tax on food items being considered by WAEMU countries.
2. Explore ways to better organize the rice producers' cooperatives and associations so that they can improve the quality of their paddy and sell their paddy rice at better prices. In particular, the PNR should integrate post-harvest and processing issues in its rice sector development strategy.
3. Review the structure of and conduct within rice markets to ensure better price transmission through all levels of the rice marketing chain. The Office de la Commercialisation des Produits Vivriers (OCPV) and the PNR should work together and involve the producer associations to ensure that the price information they are collecting is widely disseminated.
4. Promote more productive irrigated and lowland rice production systems in the context of the National Irrigation Plan that is being elaborated, as these appear to have lower environmental costs and slow down deforestation.
5. Commission a study on the potential impact of intensification of irrigated and lowland rice cultivation on surface and ground water pollution and on the mining of soil nutrients.
6. Set up an observatory for the rice sector involving all the various rice-related stakeholders in order to monitor the evolution of the impact of the liberalization measures (WTO, WAEMU and AGOA) and, if necessary, recommend measures to mitigate their negative effects.

Note: The full country study could not be finalised because of the political situation prevalent in Côte d'Ivoire since September 2002 and the bibliography is exceptionally included at the end of this report, p. 116. For the other country studies please refer to the full published studies.

Figure 1: Rice trends in Côte d'Ivoire



Source: USDA data (<http://worldfood.muses.tottori-u.ac.jp/graph/num.cgi>)

Figure 2: Evolution of forestland cleared for cultivation in Côte d'Ivoire

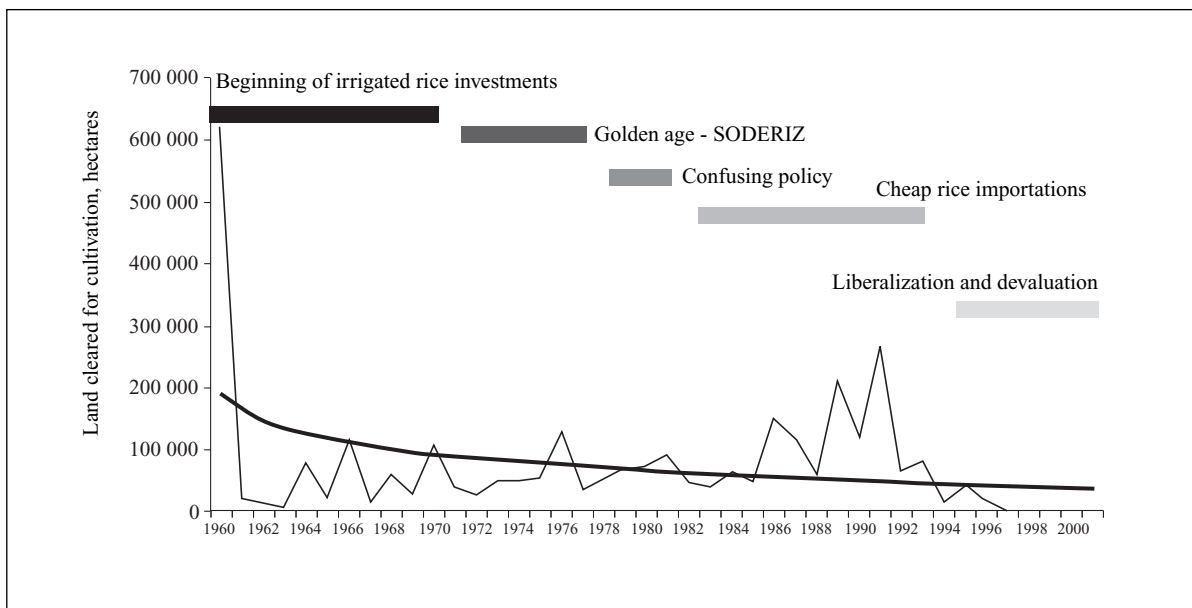


Figure 3: Evolution of domestic rice consumer and producer prices

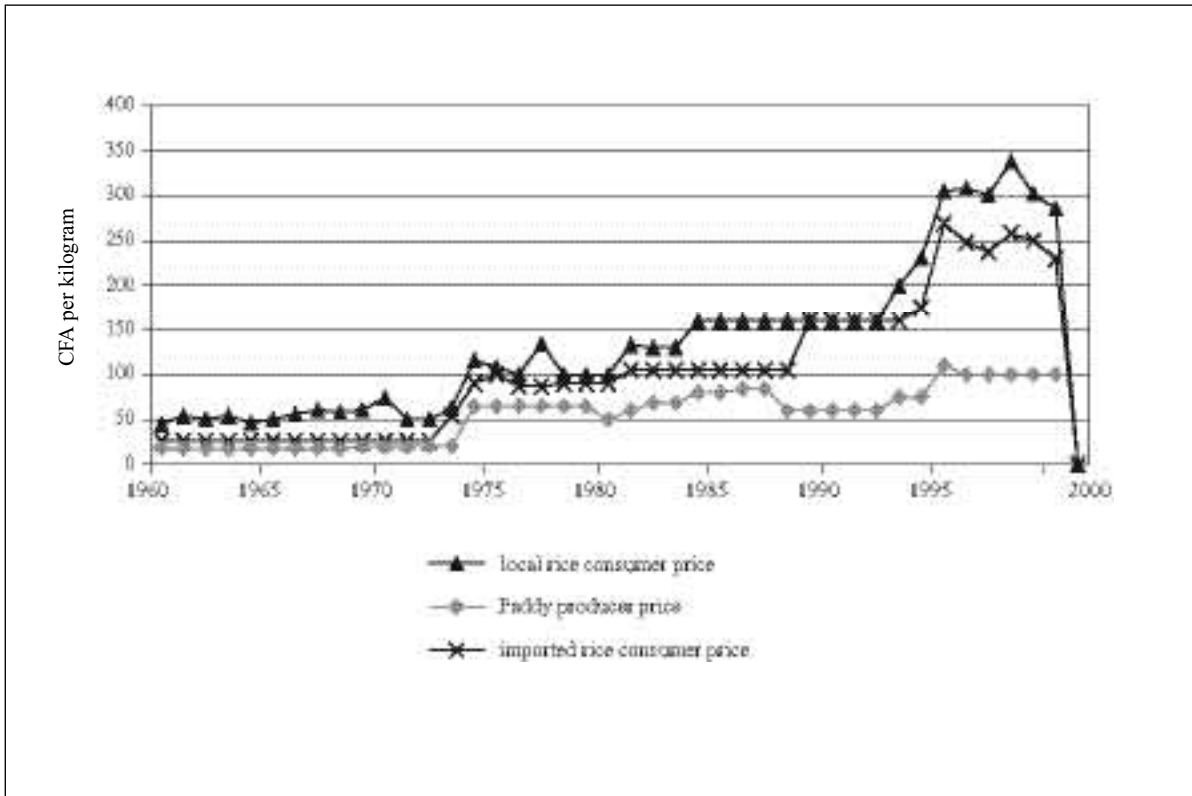
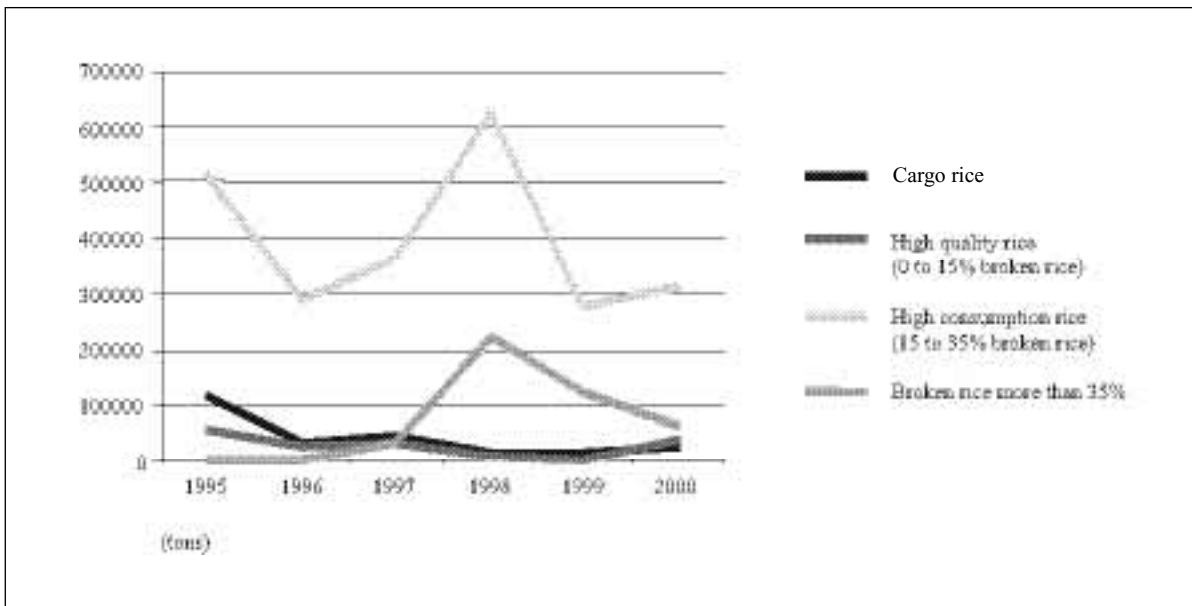


Figure 4: Type and quantities of rice imported into Côte d'Ivoire, 1995-2000 (tons)



7.4 Indonesia

7.4.1 Background

Indonesia's rice-growing area is ranked fourth highest in the world. About 56 per cent of Indonesia's rice is grown on Java where just over 50 per cent of the rice farmers cultivate landholdings of less than one quarter of a hectare each. Whilst in many areas traditional rice varieties are still being used, especially by the small-scale rice farmers, some larger-scale farmers are using new rice varieties to increase yields and production. IPM has led to a reduction in the use of pesticides; however, in most cases chemical fertilizers are still being used instead of organic fertilizer, mainly because the latter is difficult to process and handle, is not available in sufficient quantities, and is perceived to be less efficient than chemical fertilizers.

Indonesia's food security and rural development are based on rice production, which provides the bulk of farm incomes and agricultural employment. In 2002, some 23 million families out of a total of 52 million in the country were involved in rice production. For many communities rice farming is a way of life that they wish to preserve, so rice production has a cultural or social value. Rice also plays an important role in the economic and political stability of the country and its price has acted as a barometer in the Indonesian economy, for example when the rate of inflation was especially high in the 1960's. This is because rice is the main staple food and by far the most important source of calories and protein for the Indonesian population. Its per capita consumption is high (about 130 kg/annum in 2002). About 21 per cent of household budgets are spent on staple foods, mainly rice, indicating that people are still living at subsistence level. Approximately three quarters of Indonesia's poor people lived in rural areas in 2001.

Indonesia could have reached its food self-sufficiency target in 1984, and was a net exporter

of rice from 1985 to 1987 and in 1993. Indeed, prior to trade liberalization the Government encouraged significant rice production increases through the construction of dams and irrigation infrastructures and the provision of other agricultural services and subsidies. However, since 1988 production has mostly been unable to meet total demand and the country has gone from being a net exporter to a net importer of rice. Although per capita production, which fluctuated around 132 to 151 kg per year between 1983 and 2002, could theoretically cover per capita end-consumer demand, part of the seeds are saved for the next sowing season, some of the production is lost due to improper post-harvest handling and transportation, and some of the local production is used as an input by the rice milling industry.

One of the important findings of this study has been the important environmental role and multi-functionality of rice fields in controlling floods, retaining water and preserving its quality, preventing erosion and land slides and controlling air pollution.

Three distinct periods are covered in this study: 1990-1994 when the Government still provided strong support and subsidies; 1995-1997 when the Government of Indonesia began implementing the AoA; and 1998-2001 as a period of radical trade liberalization. The study examines the economic, social and environmental impacts of trade liberalization on the rice sector. A summary of the process, methodology and findings is presented hereafter. It should be noted, however, that isolating the effects of trade liberalization from the effects of other policies has been difficult. Furthermore, the impacts of trade liberalization are different in Java compared to the outer islands in view of different social and environmental conditions that offer different opportunities and limitations. This study focuses on the impacts on rice farmers from West and

Central Java, and the findings may not be applicable to other areas.

7.4.2 Project objectives

To direct policy-making and conduct current and future negotiations in rice trading and production with the goal of sustainable development, the inter-linkages between international trade and sustainable development must be understood clearly. If the economic, social and environmental impacts of trade liberalization are not fully understood there is little chance of convincing policy makers to adopt measures that might require sacrificing income for environmental gains.

This study is an integrated assessment of the economic, social and environmental impacts of the WTO AoA and other trade-related policies on the rice sector. Stakeholder participation was an important part of the process. Rapid rural appraisals (RRA) and interviews with farmers provided the primary data used in this study. In view of the economic, social and environmental importance of Indonesia's rice sector, an integrated assessment of the impacts of trade and trade-related policies was essential.

The main objectives of this study were thus to explore the trade-environment-development linkages and determine how the AoA and other trade-related policies have affected the environment, society and the economy. More specifically, the study aims to determine whether or not trade liberalization results in a decrease in the price of rice and causes farmers to suffer economic losses and convert their land to other agricultural or non-agricultural uses. It examines the inter-sectoral linkages, and whether the decrease in the price of rice causes an increase in rice imports – and if so, by how much – as well as the impact of the decreasing price of rice on poverty and employment. It also explores environmental effects in terms of resource use, water supply, water quality, flood damage, health, and air quality and values the net costs and benefits of adopting the AoA.

The end goal is to develop policy packages based on the findings of this study to mitigate the

negative effects of trade liberalization and trade-related policies and promote the positive ones. It is also expected that the process will help build national capacity in (i) carrying out integrated assessments of trade-related policies; (ii) elaborating country and sector specific methodologies to assess impacts; (iii) understanding the implications of multilateral trade rules; (iv) negotiating on trade-related issues; (v) establishing long-term development policies and processes that address environmental as well as socio-economic concerns, including poverty reduction; and (vi) coordinating between national entities as well as the private sector.

7.4.3 Process and capacity building

A research team consisting of researchers from Jenderal Soedirman University (five economic faculty members and one agricultural faculty member), one researcher from the State Trading Enterprise, BULOG, and one researcher from the Ministry of Agriculture conducted this study. The project was also supported by a group of 12 students from Jenderal Soedirman University who conducted interviews with farmers.

The study was launched in Indonesia on 22 November 2002 with a meeting involving stakeholders from the rice sector. About 30 participants from different institutions and a senior member from UNEP attended the meeting. The participants included technical staff from the Ministry of Agriculture, Ministry of Industry and Trade, Ministry of Environment, the State Food Logistic Agency, the Jenderal Soedirman University, the Farmer Organization, the Indonesian Pesticides Analytical Network (PAN), the Land Research Institute, and the Research and Training Institute. Discussions focused on the role of the WTO AoA in relation to the Indonesian rice sector as well as on the methodology to approach the problems of the study, determine the sample villages and define the analytical methods to be adopted.

While the study team was reviewing references and gathering secondary data, they also visited two *kabupatens* (districts) in West Java and Central Java, talked to the Government services and the

regional development board. Following the discussions at the *kabupaten* level, the team went to four villages in four districts of the two *kabupatens*. The primary data was collected using RRAs that were conducted separately with groups of farmers in each of the villages, groups of traders and groups of village officials. In total, 261 rice farmers from the selected villages were interviewed.

On 19-20 February 2003, an international meeting was held in Geneva involving the seven countries taking part in these studies and other members of the international working group on rice set up by UNEP to guide and implement the projects and provide comments (members of this working group are listed in the Acknowledgements). This meeting helped shape the study and redirect project objectives, especially in relation to the methodology, and the participating countries learned from each other's methods.

Following this meeting a steering committee was formed in Indonesia to discuss and improve the form and methodologies of the study. The steering committee consisted of the Deputy of the Ministry of Environment, the Deputy of the Ministry of Planning, the Director of the Mass Guidance and Rice Security Agency of the Department of Agriculture, the Director General of the Ministry of Foreign Affairs, the Expert Staff to the Minister of Trade and Industry, and the Rector of Jenderal Soedirman University.

The completed draft report was then discussed during a national technical meeting, which allowed the study team members to improve their understanding regarding the linkages between the rice economy and the environment. In addition, the farmers, rural village representatives and the regional Governmental services in the villages, districts and *kabupatens*, improved their understanding of the rice economy and its related environmental aspects. The study team feels that they have improved their own capacity in conducting such an international research including writing methodology.

The draft final report was presented at the second international meeting in Geneva on 18-20 Novem-

ber 2003 attended once again by the seven participating countries and the international working group on rice. Following this meeting, written comments were sent by UNEP to the respective study team leaders for incorporation as far as possible into the studies. This Executive Summary was also presented at a seminar on Natural Resource Accounting on 12-14 December 2003 in Indonesia and many comments and suggestions were received on that occasion.

This study has encouraged staff from different ministries to focus their attention on similar subjects, and it was recently decided that a group of economists in Jakarta would meet monthly to discuss methodologies for natural resource and environmental accounting and valuation, although these discussions will not be limited to the rice sector alone.

7.4.4 Methodology

Separating the effects of trade liberalization from the effects of other development policies is difficult. The study attempts to define the effects of trade liberalization in connection with the structural adjustment policies on rice production and its related economic, social and environmental impacts, especially during the period 1997-2002.

In examining the economic impacts of trade liberalization, the study takes into account effects on the price of rice, production costs, imports, the import dependency ratio (IDR) and the self-sufficiency ratio. The study also investigates how farmers reacted to these combined factors in terms of land conversions, agro-chemical use and farming practices in general, and how these elements have, in turn, affected overall rice production and the economy. An Input-Output table was used to visualize the inter-industry relationships, incorporating backward and forward linkages resulting from the changes in rice production. The direct impact was computed from a change in the value added caused by a change in rice production.

The evaluation of the social impacts of trade liberalization considers the effects on urbanization,

poverty, employment, but also the role of education on poverty and the cultural importance of rice farming.

Environmental impacts were computed based on the multifunctionality of rice fields in preventing floods, landslides and erosion, retaining water and improving its quality, recycling waste, and maintaining air quality. The approach involved adopting the findings of other researchers, which were based on prevention costs combined with the ‘willingness to pay’ and ‘willingness to accept’ methods.

At the beginning of the study, several assumptions and hypotheses were made, which were then verified against the data collected. These hypotheses were that:

- there was no interrelationship between the AoA and the structural development policies in terms of effect on the rice economy in Indonesia;
- there were no economic, social or environmental impacts of the AoA;
- trade liberalization did not affect the price of rice or cause farmers to switch from rice farming to non-rice food crops or convert their lands to non-agricultural uses;
- the decrease in the price of rice did not cause farmers to suffer economic losses or cause an increase in rice imports
- the impact of the decrease in the price of rice on poverty and labour absorption was statistically insignificant;
- the decrease in the price of rice had no impact on the environment in terms of resource use, water supply and quality, flood damage, health or air quality;
- the net benefit of adopting the AoA would be nil.

7.4.5 Trade liberalization and the economic crisis

Indonesia began liberalizing trade in 1995 when it started implementing the AoA. The latter required Indonesia to reduce and abolish its subsidies on agricultural inputs such as pesticides and fertilizers, which increased production costs and affected farmers’ net incomes. Indonesia’s trade

liberalization was mainly guided by the IMF’s structural adjustment programme in response to the country’s economic crisis. Initially, rice imports decreased from over three million tons in 1995 to 406,000 tons in 1997. However, in 1998 Indonesia’s domestic rice production declined, and the economic crisis was accompanied by a major social conflict. The drop in domestic production can be attributed in part to the economic crisis, but also to the severe drought related to the “El-Nino” phenomena in Indonesia. It is estimated that the drought alone accounted for a 4-5 per cent reduction in domestic rice production. The shortage of rice caused prices to flare temporarily and, in view of the importance of rice in the Indonesian diet, the combined effect of high prices and low supplies engendered social panic and conflict. At the same time many people fell into the poor category, whereas prior to the economic crisis the poverty rate had been decreasing. The Government knew from previous experience that sufficient rice supplies could mitigate the social panic so, in line with the IMF’s advice, Indonesia entered a period of radical trade liberalization. Prior to trade liberalization, BULOG had the monopolistic right to import rice. With radical trade liberalization the Government abolished BULOG’s monopoly and authorized private sector enterprises to import rice as well. Furthermore, the Government waived the quota system and applied a zero tariff for rice imports. Imports peaked to over six million tons in 1998 and over four million tons in 1999, averaging almost three and a half million tons per year between 1998 and 2002.

The increased supply of cheaper imported rice on the domestic market caused the price of domestically produced rice to fall. In addition, rice consumers showed preference for the better-quality imported rice. Combined with the increase in production costs due to the suppression of input subsidies, the decrease in the price of rice constricted farmers’ net incomes even further. The Government subsequently applied a tariff of about 30 per cent of the FOB price for imported rice in an effort to protect local production.

In 2003 about 83 per cent of commodities produced in Indonesia were subject to tariffs of 0-10 per cent. Due to Government budget constraints Indonesia has also significantly reduced domestic support, particularly market price support for agricultural products.

As of 1 January 2002 Indonesia has also been implementing the regional trade agreement among members of the AFTA, which effectively involves applying a 0-5 per cent tariff for agricultural products by 1 January 2010. However, rice is included in the list of sensitive products that benefit from a longer period before the tariff has to be reduced to 0-5 per cent.

Although it is difficult to isolate the economic, social and environmental impacts of trade liberalization alone, it can be said that trade liberalization has increased Indonesia's import dependency on rice, decreased its self-sufficiency ratio and generally affected rice production in Java. Productivity growth of agricultural commodities, particularly food crops such as rice and sugar, has been stagnant or even negative and the area of land allocated to rice production in Java has been declining. Farmers have reacted to the unattractive price of rice and declining net revenues by converting their rice fields to non-agricultural uses such as housing, manufacturing, trade and infrastructures. Some richer farmers attempted to switch to other agricultural crops but many were unsuccessful due to the lack of technology, capital, adequate marketing systems or Government support. Although converting to non-agricultural activities seems profitable from an economic point of view in the short-term, it will certainly have negative social and environmental impacts.

7.4.6 Integrated assessment results

7.4.6.1 Economic impacts

Indonesia has become a high-risk country in terms of food security due to the heavy rice imports, lack of foreign exchange, large foreign debt and instability of the domestic currency. During the period 1998 to 2000 net food imports totalled about

US\$ 863 million per annum. The average IDR for rice more than doubled from 5.1 per cent during the period 1995-1997 to 10.3 per cent for the period 1998-2002, whereas for sugar it increased from 30 to 47 per cent.

Whilst net rice consumers have benefited from the lower price of rice, rice farmers have been the main losers since their net income from rice production has declined. Lower net revenues have acted as a disincentive to produce rice, and rice production has been stagnant in Java since 1999. On the other hand, the interviews revealed that a large majority of Javanese farmers continued to grow rice despite the lower revenues, and the few small-scale farmers who attempted to grow other crops mostly reverted to rice production. There are several reasons why farmers have continued to grow rice despite higher costs and declining rice prices. First, rice is often grown as a subsistence crop and a large part of the harvest is used for the farmer's household consumption. Second, rice farming is a way of life for many communities, so these farmers will continue to grow rice irrespective of the price of rice. Third, there are difficulties and risks involved in the production, marketing and transport of other crops such as fruit and vegetables, and generally small-scale poor farmers have neither the technical knowledge nor the financial resources to tackle these problems. Finally, the small landholdings of less than one quarter of a hectare that are characteristic in Java make diversification problematic, especially in the case of conversions to tree crops since the latter require long gestation periods of three to seven years and poor farmers without other sources of income could not survive during that time. This is aggravated by the fact that unemployment is high in Java and the Government does not have the financial resources at present to support farmers while they convert to other crops.

The hypothesis that trade liberalization has decreased the domestic price of rice produces a non-rejection when tested against the facts. Using real-price data, the real price of rice did decrease since the application of a zero tariff and thereafter. The hypothesis was thus not rejected both for the short-term period immediately after the opening of

the economy when the tariff for rice was zero and also in the longer term, after the tariff was increased to about 30 per cent of the FOB price. The trend indicates a decrease in the domestic real price of rice from Rp 1,316 in 1999 to Rp 996 in 2003. The nominal price of rice increased until 2002, but then decreased slightly in 2003. This is perhaps a result of the fact that domestic rice production plus total imports just matched rice demand so there was never less demand than supplies.

An Input-Output table was used to visualize inter-industry relationships and backward and forward linkages. On the whole, the rice production industry (PI) has contributed to pulling agro-chemical and other industries that supply inputs for rice production and pushing industries that use rice as a raw input. In turn, the rice milling industry (RMI) has contributed to pulling rice production and pushing other industries that use milled rice as an input. More precisely, the PI is estimated to have contributed almost 97 per cent to pulling other industries such as the rice sector itself (87 per cent), fertilizer and pesticides (3 per cent), finance (2.26 per cent), other crops (2 per cent), livestock (1.47 per cent), and trade (1 per cent). The RMI has contributed almost 96 per cent to pulling other industries, notably the rice sector (38 per cent), rice milling (52 per cent), fertilizer and pesticide (1 per cent), financial institutions (2 per cent), trade (1 per cent), and livestock and poultry (1.47 per cent). Together, the PI and RMI have contributed to pushing other industries with high contributions of 97 and 93 per cent respectively. For RMI these include the rice sector (85 per cent), restaurant and hotel (3 per cent), other food industries (3 per cent) and livestock (3 per cent).

These inter-industry linkages highlight the importance of the PI and RMI in terms of increasing production and value added, generating employment, promoting economic development in rural areas, preventing a high rate of urbanization and thus providing a bumper strategy for social unrest in urban areas. However, the development of the PI depends heavily on the demand for rice from the RMI, while the RMI depends significantly on the

demand for domestic rice. It follows, therefore, that rice imports, which tend to lower rice prices, might have a negative impact on economic development in general and on rural employment in particular.

Declining prices and increased production costs discourage farmers from adopting new technologies and maintaining rice crops so yields have been declining. Yet the strong forward and backward linkages of the rice sector mean that changes in rice production have impacts on other industries, particularly rice mills, rice trade, and livestock and poultry that are fed on rice bran, a side-product of the rice mills.

7.4.6.2 Social impacts

Trade liberalization appears to have had a wide social impact. Although trade liberalization should have enabled the Indonesian economy to profit from increased trade since a greater variety of commodities become available on the market at lower prices, it also affects poverty in terms of the economic variables that affect both income and expenditure of households.

On the bases of a CGE model for Indonesia called WAYANG, it was predicted that the complete removal of all tariffs and tariff-equivalent import licenses would reduce poverty and improve the welfare of households, although the wealthier households might benefit more than the poor ones, thus widening the income gap between households in each socio-economic group. However, the findings contradict the empirical evidence that shows that rural poverty actually increased during the trade liberalization era. Nevertheless, it can be argued that (i) the WAYANG model did not incorporate the assumption that trade liberalization in Indonesia occurred at the same time as the economic recession and (ii) using international prices as benchmarks for economic efficiency may not be realistic. It is evident that, at present, Indonesia is facing an artificially low price of rice on the international market, which acts as an economic disincentive for Indonesian farmers to produce rice and has a negative impact on poverty in rural areas. The declining incentive to plant food crops

such as rice could encourage farmers to convert their rice fields to other uses, or to sell their land and become even poorer, since they may not find other sources of income in view of the high unemployment rate.

Based on observations of national employment data, it can be argued that the level of unemployment was increasing during the coexistence of trade liberalization and the economic crisis in Indonesia. Most displaced labourers, particularly from industrial and urban sectors, were initially absorbed by the agricultural sector. However, the absorption of displaced workers by the agricultural sector can be viewed as temporary relief since in the longer term the high rate of labour absorption in agriculture would generate more poverty in rural areas.

Prior to the economic crisis the overall number of poor people decreased from about 40 per cent in 1976 to 17.7 per cent in 1996, with a slightly higher decrease in the number of rural poor. In 1998 that figure increased to 24.2 per cent (21.9 per cent in urban areas; 24.7 per cent in rural areas). The overall figure decreased again in the following years, however the recovery was mostly in urban areas. In 1993 the percentage of poor was more or less the same in urban and rural areas, whereas in 2001 the percentage of poor was 9.8 in urban areas, compared to 25 in rural areas. This indicates that the impacts of trade liberalization and trade-related policies have had a more negative impact in rural areas than in urban areas.

Low productivity and high poverty actually encouraged many rural people to move to urban areas to find more lucrative employment, causing urban congestion, which increased social unrest since the Government was unable to provide adequate infrastructures, such as housing, public transport, sufficient clean water and waste disposal due to the lack of financial resources.

7.4.6.3 Environmental impacts

In general, effects that can be expected from the implementation of trade liberalization are catego-

rized into product, technology, scale, structural and regulatory effects. The present study found that trade liberalization brought no product, technology or regulatory effects in Indonesia, but it did result in structural and scale effects.

The increase in rice imports did not have any product effects because the imported commodity or product did not affect the environment directly. Neither did it have any technology effects because farmers did not modify the technology they used in rice farming, including the use of chemical fertilizers, since they could not find adequate substitutes for chemical fertilizers. So far, trade liberalization has not changed regulations in rice production, trade and environmental management, except that after 1998 BULOG's monopoly right to import rice in Indonesia was abolished and private enterprises were also allowed to import rice.

Structural effects appear to be in the form of changes in land use. Some rice fields were converted to non-rice farming and others to non-agricultural uses such as offices, schools, real estate, and for the supply of raw materials for the roof-tile and brick industries. These conversions have had negative environmental impacts. For example, the quality and quantity of water decreased, especially when rice fields were converted to industrial and other non-agricultural uses, and floods and erosion increased. However pollution from pesticide and fertilizer use decreased.

Scale effects occurred when economic growth, based on the increase in national production, determined changes in the use of natural resources and in the general environment. Thus, a positive scale effect occurs when economic growth fosters a demand for environmental improvements and the internalisation of environmental costs. On the other hand, a negative scale effect occurs when economic growth generates environmental degradation and the depletion of natural resources. In the case of rice production, trade liberalization encouraged rice imports, which depressed rice prices and encouraged land conversions from agricultural to non-agricultural uses in Java because of the reduced revenues from rice farming. This fostered

the development of other economic sectors, and the availability of staple foods, especially rice, at cheap prices and in greater variety mitigated social panic and helped stabilize the economy.

Environmental impacts were computed based on the multifunctionality of rice fields in preventing floods, erosion and landslides, retaining water, improving water quality, recycling waste and maintaining air quality, but also in terms of the negative aspects of rice production, including pollution and health effects resulting from the use of agro-chemicals. One of the important findings of the study was that, when valuations were made of the various environmental impacts of rice farming, the benefits derived from the multifunctionality of rice fields far outweighed the costs resulting from the use of agro-chemicals. However, the environmental functions of rice fields are still inferior compared to those of forests.

Conversion from rice to other crops such as fruit trees (e.g. mangoes) has taken place in some areas but is only applicable to farmers with land holdings of 1.5 hectares or more. Conversion patterns are usually gradual. If the Government were to provide enough support to small farmers, it is believed the latter would be willing to convert their lands to other agricultural uses, but the Government would require the financial resources to do so.

However, the on-going conversion of rice fields to non-agricultural uses means that a huge value in terms of environmental services is being foregone annually since the value of the multiple environmental services provided by rice fields is considerably higher than other land uses, except forests. However, the conversion of rice fields to forests seems impossible in Java because most rice is grown on irrigated, low, flat land that is unsuitable for forests and agroforestry and would thus require converting wetlands to dry land. Not only would such a conversion be costly, it would imply a huge waste of the Government's investments for irrigation development over the last thirty years. Thus, while converting rice fields to forests should have positive environmental impacts, it could result in negative economic and social impacts and would

require strong Government programmes and financial support.

The conversion of rice fields to other uses to the extent that it causes rice farming to disappear completely would also have net costs rather than benefits. The benefits of switching from rice production to non-agricultural land use would reduce the amount of chemical fertilizers and pesticides being used, which amounts to savings of about Rp 350.77/ha (equivalent to US\$ 0.04/ha of rice field) in health costs as well as a reduction in absenteeism of farmers from work, the value of which is estimated at US\$ 0.97/ha of rice field. So the total benefit of converting rice fields to non-agricultural uses would be US\$ 1.01/ha.

The costs of converting rice fields to other uses would include the loss of the economic and social functions of rice production as well as the multifunctionality of rice fields in (i) preventing floods, erosion and land slides, (ii) retaining water so that sufficient supplies of ground water are maintained, and (iii) controlling the quality of the air.

Between 1990 and 2000, the average annual rate of land conversion from rice fields to other uses was around 6.91 per cent (22,276 hectares). By subtracting the costs from the benefits, it is evident that the conversion of rice fields to non-agricultural uses results in an environmental loss of US\$ 2,100.11/ha of rice field, and an overall net loss of about US\$ 3,926.63/ha/year, which represents a total of US\$ 87.47 million/year for an average land conversion of 22,276 ha/year. In other words, the net economic value of rice fields in Java in 2002 would be US\$ 22,020.65 million, while for Indonesia this would be US\$ 45,766.68 million. These figures are lower than for 2000 (i.e. about US\$ 22,592.08 million for Java and US\$ 46,308.01 million for Indonesia) due to the decrease in the amount of land on which rice is grown. In terms of the GDP of Indonesia, the economic value of rice fields was US\$ 148,813.88 million in 2000, representing 31.11 per cent of the total GDP.

If the aforementioned land conversion trend were to continue at the same rate it is estimated that in

less than 20 years the whole of Java's agricultural lands would be converted to non-agricultural uses, e.g. housing, offices, schools, shops and manufacturing plants. Although a Government regulation prohibits the conversion of fertile rice fields to other uses, this has not been effective in practice since the Government cannot guarantee that rice farmers will earn higher incomes if they do not convert their land to other uses. These land use conversions will cause overall rice production to decrease, but will also result in the loss of the multifunctionality of rice fields. Furthermore, the conversions are permanent and irreversible.

The study has been unable to provide an answer as to whether trade liberalization alone results in any environmental improvement or degradation in relation to changes in rice farming practices because the latter were influenced by several factors. The size of farms has remained more or less the same but rice farmers have spent more on agricultural inputs since agro-chemical use has remained more or less constant despite the suppression of subsidies, so the farmers' net incomes have decreased. To maintain the overall net incomes of households at the same level as before trade liberalization, farmers had to earn a higher proportion of their income from jobs outside the agricultural sector. As already mentioned above, farmers had a variety of reasons to continue with rice farming despite its declining net revenues.

The impact of trade liberalization on farmers outside Java paints a different picture since rice is not the main crop there and farmers have the opportunity of planting tree crops. Furthermore, the smallest land holdings outside Java are at least 2.0 ha/farmer, while in Java they are only 0.25 ha/farmer.

Since the 1970s Indonesian rice farmers, especially larger scale farmers, have grown new rice varieties to increase yield and production and, together with improved irrigation facilities, have been using large amounts of chemical fertilizers. The impact of continuous application of chemical fertilizers has been the deterioration of soil quality. At first, the

application of chemical fertilizers produced tremendous yield increases in rice, but this cannot be maintained in the long run. Indeed, the continuous application of chemical fertilizers on monoculture crops such as rice has resulted in the reduction in the amount of organic matter in the soil, destruction of the soil structure, and solidification of the soil. The ensuing result has been that the soil's capacity to retain water has decreased, and root activity of the plants and the tying of nitrogen are hindered.

7.4.7 Limitations of the study

This study faces limitations in assessing the economic, social and environmental impacts of the AoA because other factors such as the structural adjustment to stimulate growth and combat the economic crisis happened at the same time as the implementation of the AoA. Indonesia is a vast country consisting of about 18,000 islands. While rice is planted in many islands, this study mainly discusses the rice economy in Java because this is where approximately 56 per cent of the rice is produced. The field survey only involved 261 rice farmers in four villages in two *kabupatens* of two provinces in West Java and Central Java, so replicating the findings and recommendations outside Java might be limited.

The impacts of trade liberalization on rice production and the environment have still not been clearly understood. It was thought that the impacts could be traced out through the changes in rice prices. More specifically, for rice importing countries such as Indonesia, it was thought that trade liberalization – which involved eliminating subsidies and the quota system and lowering the tariff imposed on rice imports – might result in an increase in the volume of rice imports and, in turn, a decrease in the price of rice in domestic markets.

7.4.8 Proposed policy responses

Despite the limitations, a number of policy implications can be formulated based on the findings of this study. The policy implications are presented below.

1. The Government of Indonesia should develop a new agricultural policy promoting an increase in domestic rice production and yield as this would help ensure food security and self-sufficiency, reduce poverty, lower the country's rice IDR, and allow foreign exchange savings. Increasing production and productivity of food crops that have a comparative advantage may also have a significant impact on food security and poverty reduction.
2. Although trade liberalization facilitates the increase in rice imports so that more rice is available for the poor at a reasonable price, the lower prices create a burden for a large part of the population that depends on rice production for its livelihood. The Government should therefore develop policies that have a double function in helping poor consumers whilst protecting the livelihoods of farmers and rice producers. This involves maintaining a certain level of tariff to protect domestic rice producers, and designing a direct subsidy policy to support poor rice consumers.
3. The Government should develop a policy that encourages Indonesians to diversify their diet and thus reduce the per capita consumption of rice. This would help Indonesia reduce its increasing dependence on rice imports and save foreign exchange.
4. The Government should also develop rice-marketing infrastructures to reduce marketing costs so that farmers can benefit from a higher share of the income.
5. The Government should promote small-scale, post-harvest technology and management to reduce losses and increase farmers' income.
6. The practice of giving input subsidies to reduce production costs in rice farming should be allowed by the AoA, since rice in Indonesia is not produced for export but to ensure the country's and especially farming households' food security. In particular, new technologies should be developed to increase the availability, improve the quality and reduce the costs of organic fertilizers. The Government should also continue to support the development and application of IPM and soil and water conservation technologies to promote sustainable agricultural development.
7. Increasing rice production and achieving self-sufficiency should be based on increased rice yields in the outer islands because rice yields seem to have reached their uppermost level in Java.
8. The Government should encourage the development of small-scale industries and improve marketing facilities and infrastructures to provide opportunities for unemployed labourers in case farmers are required to leave their farms for some time to maintain the quality of the land or develop agroforestry in rural areas.
9. As a long-term strategy, Indonesia should engage in policies that support the development of an environmentally friendly agricultural sector for sustainable development. Attention should be given to other islands outside Java to promote the production of food and other agricultural products whilst protecting the environment.
10. The structural adjustment and liberalization policies should be continued by correcting the macroeconomic deficiencies, and they should lead to a more liberalized market. However, these adjustments and policies should affect rice production in such a way that it makes use of less natural resources (e.g. land and water) and chemical inputs.
11. It is recommended that the Government consider the environmental costs of land conversions – whether from forests to rice fields or from rice fields to other uses – when issuing permits for such conversions. Taxes should be used to discourage unsustainable land use, taking into account the multifunctional benefits of rice fields compared to other land uses. The study recommends funding further research on the biodiversity value of both forests and rice fields, in view of the current gap in available data in this area.

7.4.9 Main lessons learned

This project has educated the researchers by developing their understanding of the connections between trade liberalization and economic, social and environmental impacts. The researchers have also learned more about the methodology of approaching the impacts of trade liberalization and the changes in economic structure on the environment. The 12 students from Jenderal Soedirman University learned how to interview respondents and collect data, as well as how to process the data derived from the questionnaires. These were very productive experiences and lessons for the students.

Furthermore the researchers and the rice sector stakeholders now have a clearer understanding about the multifunctionality of rice farming, not only to produce rice and generate rural employment, but in terms of its many valuable environmental functions.

This project has also improved the collaboration among Governmental agencies in understanding how to manage the rice economy and the environment. The University and the Government Ministries have developed a closer collaboration for studying the environmental impacts of many other activities outside of the rice sector.

In summary, the main lesson of this study is that it has greatly contributed to capacity building in Indonesia. However, this kind of study should also be applied to other sectors and involve many other researchers.

7.4.10 Suggestions for follow-up

1. Increasing rice production and becoming self-sufficient is necessary and should be based on increased rice yields in the outer islands because rice yields appear to have reached their highest level in Java. In this connection, as a long-term strategy Indonesia should engage in policies that support the development of an environmentally friendly agricultural sector for sustainable development. The Agricultural Ministry, Ministry of Forestry, Ministry of Interior and Ministry of the Environment should be responsible for the implementation.
2. The structural adjustment and liberalization policies should be continued by correcting the macroeconomic deficiencies and lead towards a more liberalized market. However, these should affect rice production in such a way that it uses less natural resources (e.g. land and water) and chemical inputs. In this case the Ministry of Planning, Ministry of Trade and Industry, and the Ministry of Finance should be involved in the implementation of the policies.
3. Since it is understood more clearly that rice farming has economic, social and environmental functions, converting rice fields to other uses (except forestry) will cause big losses. Consequently the conversion of rice fields to other uses should incorporate the foregone environmental values into the price of the land being converted, and the Government should capture those values when it issues permits for land conversions. The local Government administration and also the National Land Agencies must be responsible for conducting the new policy.
4. A study should be conducted to examine the inclusion of environmental values into the price of the land due to be converted. The price of rice farmlands that are to be converted into a national park or protected area for example, should be different to the price of lands due to be converted to housing or industrial areas. The difference between the market price and the estimated value of the multifunctionality of the land should be paid to the Government as a source of funding for environmental conservation of the said areas.

7.5 Nigeria

7.5.1 Introduction

Nigeria is the most populous country in Africa and agriculture is the central activity of its people. The food sub-sector of agriculture includes a large array of staple crops, made possible by the diversity of agroecological production systems and the climate. The major food crops are cereals (sorghum, maize, millet and rice); roots and tubers (yam and cassava); legumes (ground-nut and cowpeas); and others (fruits and vegetables). These commodities are of considerable importance for the food security, expenditure and income of households.

Of all the staple crops, rice has risen to a pre-eminent position in Nigeria. At independence in 1960, rice was merely a festival food consumed mostly in affluent homes at Christmas and other religious festivals. However, since the mid-1970s rice consumption has risen tremendously (+10.3 per cent per annum) as a result of the accelerating population growth rate (+2.8 per cent per annum) and increasing per capita consumption. The consumption of rice has been increasing at a much faster rate in Nigeria than in other West African countries since the mid-1970s. For example, during the 1960's Nigeria had the lowest annual per capita consumption of rice in the subregion (average of three kg). Since then, the per capita consumption levels have grown significantly at 7.3 per cent per annum, reaching an average of 18 kg during the 1980s and 22 kg in 1995–1999. The increase in rice consumption has been triggered by several factors, including rapid urbanization, ease of preparation that fits conveniently within the urban lifestyle of workers, and its general availability among food vendors and restaurants located in and around work places in urban areas. Rice is a major source of calories for the urban poor. The poorest third of urban households obtain 33 per cent of their cereal-based calories from rice, and rice purchases

represent a major component of cash expenditures on cereals.

Rice production in Nigeria also expanded during the same period (+9.3 per cent per annum), particularly as a result of a vast increase in the rice-growing area (+7.9 per cent per annum) and to a lesser extent through yield increases (+1.4 per cent per annum). However, the production increase was not sufficient to match the consumption increase, and rice imports have been making up the shortfall. Quantities imported have oscillated widely over this period, but have surged from 300,000 tons in 1995 to about one million tons in 2001. These imports currently cost Nigeria about US\$ 1 billion annually.

Trade liberalization was part of economic adjustment measures implemented in Nigeria between 1986 and 1993. The measures were motivated by the desire to remove all restrictions to free trade and make Nigerian producers, including farmers, competitive in both the domestic and external markets. However, Nigeria has also employed various trade policy instruments such as tariffs, import restrictions and, at times, outright bans on rice imports. Generally, rice policies have not been consistent. For instance, in the 1970s different tariff rates were imposed on imports. In the early 1980s, import license and quantitative restrictions dominated the rice import policy. From 1986 to the mid-1990s rice imports were banned. In 1995 the import ban was lifted but a 100 per cent tariff was then imposed. In 1996 the tariff was reduced to 50 per cent. In April 2002, the tariff on imports was raised again to 100 per cent and by 2003 a 150 per cent tariff was imposed on imports. This erratic policy reflects the dilemma of securing cheap rice for consumers as well as a fair price for producers, while also avoiding spending scarce foreign exchange earnings on avoidable imports.

Nigeria is a member of the WTO and has been participating in WTO negotiations. Its negotiating position is aligned with that of the great majority of African countries, particularly the Economic Community of West African States (ECOWAS), and takes into account not only issues of market access but also food security, self-sufficiency goals, poverty reduction, rural development, the role of agriculture in national development and other non-trade issues which are of importance to developing countries. The reduction in market access barriers as a result of WTO Agreements has potentially positive implications for expanding international trade.

7.5.2 Process and capacity building

At the country level, NISER, Nigeria's foremost policy research institute founded in 1950, lead this project and set up a multidisciplinary team drawing on the resource personnel available at NISER and the academic and research community in Ibadan, particularly from the University of Ibadan, the International Institute of Tropical Agriculture (IITA) and WARDA. The principal research team is made up of five members: Tunji Akande, Professor of Agricultural Economics specializing in food commodity studies and agriculture and rural development policy analysis (team leader of this study); Femi Olokesusi, Professor, Environment and Natural Resource Management; Mrs. Bola Akanji Snr., Research Fellow, Agricultural Economist with considerable experience in rural sociology and gender analysis; Godwin Akpokodje, Research Fellow, Economist, specialized in quantitative analysis and modelling; Jire Adeoye, Reader, Soil Scientist, University of Ibadan/IITA. NISER also lead the team in conducting research for literature and assembling published materials and documents on every aspect of the rice economy in Nigeria and on methodological approaches to analysing trade policy issues. This also involved literature sourced from UNEP, including its manual for integrated assessment of trade-related policies.

Stakeholders throughout the rice sector (private and public sector officials) participated in deter-

mining the objectives and designing the investigative methodology.

The process was largely participatory and inclusive, involving a wide range of stakeholders from private and public sectors, including rice farmers, processors, marketers, consumers, research institutes, policy makers, input suppliers and service providers. The study was launched with a national stakeholders' workshop to introduce the project, define the project objectives, approach and process, and prepare a work programme. The participatory process was adopted to ensure that the findings and recommendations emanating from the project would not only receive inputs from stakeholders, but would also make them generally acceptable for implementation by policy makers. Continued interaction with stakeholders was facilitated through five meetings, two workshops and many consultations.

An international meeting was held in Geneva on 19-20 February 2003 involving the seven countries taking part in these studies and other members of the international working group on rice set up by UNEP to guide and implement the projects and provide comments (members of this working group are listed in the Acknowledgements). This meeting helped shape the study and redirect project objectives, especially in relation to the methodology, and allowed the participating countries to learn from each other's methods.

A National Steering Committee was formed to oversee the running of the study. The team prepared the study instruments and defined the study areas and coverage, and then conducted the field survey. The collected data were subjected to a series of analytical techniques, and the analysis and interpretation of the results were summarized in a draft report along with inferences and conclusions.

The draft final report was presented at the second international meeting in Geneva on 18-20 November 2003, following which written comments were sent by UNEP to the respective study team leaders for incorporation as far as possible into the studies. Whilst UNEP's Economics and Trade Branch (ETB) is the motivating force behind the project in

terms of conceptual ideas, financing and technical support, and has been helpful in guiding the progress of the project, full responsibility for the content of this study remains with the authors.

7.5.3 Methodology

The research component of the study involved two main groups of activities: (a) technical analysis and (b) economic, social and environmental impact analysis. Technical analysis involved chemical analysis of water, soil and plant samples taken from rice producing centres with the purpose of determining the concentration of chemicals and agro-chemical residues in the surrounding water, soil or plants, and deducing the implications for environmental and production sustainability. The soil and environmental scientists took up this responsibility and carried out field exercises and laboratory analysis. The scientists also assessed soil erosion, soil degradation and the effects of water logging as well as other physical features in rice producing areas.

Socio-economic analyses essentially focused on the economics of rice production, processing, trade and consumption. The motivation and involvement of different participants in the rice sector, and issues of poverty, self-sufficiency, nutrition, profitability and enterprise substitution were examined and analysed using primary and secondary data.

Primary data were sourced from producers, processors, traders and consumers. Different sets of questionnaires addressing economic, social and environmental issues were prepared and applied to the different categories of respondents. The survey was conducted in areas of intense rice activities identified in Ekiti, Benue and Niger states. To complement formal surveys, participatory methodologies (focus group discussions, key informant interviews and participant observations) were also applied.

Secondary data were obtained from statutory institutions: Federal Office of Statistics (FOS); the Central Bank of Nigeria (CBN); the Federal Ministry of Agriculture and Rural Development (FMARD); the Federal Ministry of Environment (FME); the Federal Ministry of Commerce (FMC);

and regional offices of international organizations (FAO, USAID, UNDP and the World Bank).

Various analytical tools were applied to elucidate the different aspects of the study. Regression analysis was carried out to examine trends in rice output. Gross margin analysis was used to examine issues related to profitability, while CBA was conducted to depict justification for use or non-use of agro-chemicals from the point of view of farmers and society. Summary statistics (means, frequencies and percentages) were also used to characterize assembled data.

However, isolating impacts due solely to trade liberalization from other general economic development policy measures is a difficult exercise and environmental impact analysis may be imprecise because of measurement problems. This limitation was addressed by adopting the participatory methodologies and simple analytical techniques mentioned above.

7.5.4 Integrated assessment results

7.5.4.1 Environmental impacts

The increases in rice production noticed in recent years have resulted from substantial extensification (expansion) and limited intensification. Both extensification and intensification processes constitute potential pressure on the natural resource base and its quality. Clearing and cropping of new forest lands were noticed in the study areas, particularly in Ekiti State where rice farming is assuming greater importance. Expansion also takes place in wetland areas where mostly swamp rice is cultivated. Extensification tends to expose fragile lands in these areas to soil erosion. The washing away of topsoil and subsequent deposits into rivers and streams could create further ecological problems such as siltation. Farming of hillsides as noticed, again, in Ekiti State increases the vulnerability of low lands to soil erosion and flooding. When trees are destroyed their carbon sequestration function is lost, exacerbating the greenhouse effect and global climate change phenomenon. Felling of trees for farmland also results in the loss

of biodiversity (both floral and faunal) and watershed protection. Intensification in a significant proportion of rice-growing areas has resulted in shorter fallow periods with concomitant loss of soil nutrients and organic matter. This situation, coupled with low external inputs, is responsible for the stagnation in rice yields. Survey results indicate that rice farmers were not using sufficient quantities of nutrients and organic matter to maintain soil fertility.

The country's poor irrigation system predisposes irrigated rice farming to discontinuity and unsustainability because intensive use of irrigation water under poor drainage conditions usually leads to waterlogged soils followed by a rise in the water table. Under dry and humid conditions salt build-up occurs (salinization) thus reducing yields. In this study 72.8 per cent of the respondents opined that the quality of farmland had declined, while almost 32 per cent confirmed that soil erosion has been a problem. In terms of soil resources, there are problems of soil depletion, soil erosion and salinization.

Land preparation and planting is mostly manual in lowland rice cultivation, with women and children carrying out the dibbling with hoes and broadcasting of seeds. However, in the upland large-scale farms, tractors are used for ploughing and double harrowing in land preparation. Rice seeds are broadcast during the second harrowing. This implies that not much ecological disturbance occurs except during slash and burn land clearing which generates oxides of carbon that deplete the ozone layer and contribute to global warming. Much needed nitrogen and sulphur are lost during the bush burning process. Yet these organic materials could be incorporated into the soil to aid organic recycling and restore soil fertility. Methane and nitrous oxide are two greenhouse gases produced in paddy wetland farming systems. Similarly, other pollutants such as oxides of carbon, nitrogen and organic gases are produced in the process of burning rice husks. Agricultural wastes are improperly managed on the field after the harvest and at rice mills, and are either dumped or openly

incinerated. Incineration generates a lot of smoke and ash, and the milling engine exhaust soot pervades the air and forms deposits on adjoining farmlands. The losses from field paddy husk and ashes are estimated to be as much as: 0.3 per cent potassium, 0.12 per cent calcium, and 0.7 per cent nitrogen. The paddy husk has a high level of potassium, an element required for grain fixation, and both paddy husk and rice bran are a potential source of organic fertilizer.

The soil surveys and analyses that were conducted show that the soils are generally acidic or slightly acidic (pH ranges from 4.5 to 6.3), which is potentially good for rice production. Most of the farms sampled showed deficiencies in nitrogen, phosphorous, exchangeable bases, etc. indicating under-fertilization, which could be attributed to the farmers' lack of financial resources to purchase the mineral or organic fertilizer or unavailability of the latter. The results of soil analyses further show that the soil is undergoing "nutrient mining". Visual observation in most of the farms indicated obvious nutrient deficiencies and "hidden hunger". For example, the organic matter levels of the surface soil ranged from 0.3-4.4 per cent, but over 80 per cent of the soil contains less than 2 per cent organic matter. Since organic matter is the storehouse of exchangeable cations, it is obvious why key elements such as calcium, magnesium, potassium and sodium in most soils fall within the low range. With this very low exchangeable base reserve, there is a high nutrient imbalance pre-disposing production to low yield and poor quality.

A critical issue in Nigeria's rice expansion programme is the effect on biodiversity. Loss of biodiversity associated with rice production is of two types: wild biodiversity and agrobiodiversity. Wild biodiversity is affected by rice cultivation when forests and other vegetation are cleared for land cultivation. Hardwoods such as mahogany and softwoods such as chestnut, which are used in construction, may be felled to make way for rice fields. Wildlife such as grass cutter, antelopes and squirrel may also be displaced. The dependence of Nigeria on biodiversity is barely captured in

economic statistics and the national accounting system, a situation that reduces the adequate perception of the significance of biodiversity in national development. The management of habitats that have been modified for human activities and needs such as farmland is important. Information available from the FME and the World Bank indicates that human activities and natural changes have had a negative impact on biodiversity. For instance, out of the 274 species of mammals available in 1996, at least 27 were classified as being under threat of extinction in 2002. Similarly, out of 681 bird species, nine were threatened by 2002. In respect of plants, 37 species out of the estimated 4,715 are under the threat of extinction too. It is therefore important that these considerations serve as a guide for Nigeria's rice production expansion programme by ensuring that the opportunity cost of production expansion is minimal and does not involve irreversible damage to the existing biodiversity.

Rice-growing communities in Nigeria are culturally tied to their genetic biodiversity. In this context agrobiodiversity centres on the numerous rice varieties ranging from traditional *Oryza sativa* that is quite popular in the country and inter-specific hybrids such as *Oryza glaberima* and those varieties developed by IITA and WARDA. Natural factors such as drought, flood and fire have been blamed for the gradual genetic erosion of African rice varieties. Another pertinent factor is the adoption of modern varieties especially by educated farmers. Field investigations revealed that farmers and rice researchers are concerned about the displacement of indigenous varieties by "terminate technology" whereby the improved varieties are not viable for replant so farmers have to buy new seeds at every cropping season. Farmers have enjoyed the culture of raising their own seeds over the years. African rice has adapted to the environment over 3,500 years but has poor yield. Asian rice, which was introduced about 500 years ago, has much higher yield potential but falls prey to many of Africa's indigenous crop production problems such as pest attacks. The New Rice for Africa (NERICA) varieties developed from crosses between indigenous African rice (*Oryza glaberima*) and the

introduced Asian rice (*Oryza sativa*), combine the best of both into a single plant to produce high yield, vigorous early growth that helps smoulder weeds, short growth duration that reduces the amount of labour required to grow the crop, high protein content, resistance to pests and diseases and tolerance to drought. The potential for immediate NERICA production in Nigeria is about half a million hectares. Since NERICA is being proven in various agro-ecologies in Nigeria as the answer to rice self-sufficiency for domestic consumption, the challenge is how to sustain its production in terms of management practices, availability of inputs and consumer acceptance.

7.5.4.2 Health impacts

The application of agro-chemicals has an impact on rice producers' health. Gaseous pollutants from parboiling, winnowing and milling also constitute health hazards. Some of the farmers interviewed reported contracting diseases such as skin rashes and respiratory infections. In addition, there is the psychological disorientation caused by the foul smells from the high piles of rice dust, rice husk and wastewater from processing activities. Waist pains, guinea worm, filariasis and malaria are also associated with swamp rice production.

7.5.4.3 Economic impacts

The economic impact of rice activities in Nigeria is felt at five main levels, namely production, processing, marketing, food vending and external trade levels. The main economic impact is in respect of income and employment generation for those operating at each of these levels. At the production level the participants are farmers, waged labourers and suppliers of inputs (seeds, fertilizers, herbicides and pesticides). All derive food, income and/or employment from their involvement in rice production. Trade liberalization is anticipated to boost rice production and, consequently, increase farm income. An analysis of the costs and returns of one hectare of rice farm shows that the aggregate cost of production increased from N 7,452 before liberalization to about N 54,125

after liberalization, i.e. an increase of about 626 per cent. This was as a result of significant increases in the prices of agricultural inputs. For instance, fertilizer prices rose by more than 800 per cent and the farm wage rate rose by more than 233 per cent. Similarly, the returns per hectare of rice rose from N 10,840 pre-liberalization to N 73,590 after liberalization, i.e. a rise of about 600 per cent. The gross margin rose from N 3,388 in pre-liberalization to N 19,465 after liberalization, an increase of about 475 per cent. This means that trade liberalization has engendered a substantial increase in the returns to rice producers. However, the farmers could earn higher incomes with higher yields and better quality local rice.

The income generated from rice processing before and after trade liberalization in the various agro-ecological zones also shows an enormous increase. On average, rice-processing income rose from N 32,316 pre-liberalization to N 136,200 post-liberalization. Income derived from rice marketing rose from N 46,800 pre-liberalization to N 104,866 post-liberalization. This indicates a greater commercialisation of the rice economy in the post-liberalization era.

About 350,000 farmers currently grow rice. Young school leavers are being encouraged to go into rice production and the number of rice farmers in Nigeria is bound to increase in future with the attention currently being paid to rice cultivation. The level of employment in the typical rice-processing mill varied in the study area. In Benue, the typical mill had only seven employees before trade liberalization while Niger and Ekiti had one and 12 employees respectively. However, since trade liberalization, the number of labourers employed by the mills increased to 21 in Benue and 36 in Ekiti. It could be concluded from these observations that trade liberalization has led to the creation of more jobs in the rice-processing sub-sector. This obviously would have diverted labour away from less competitive crops.

Large-scale rice imports over the years has created employment and trading opportunities for several firms and hoards of wholesalers and distributors

across the country. Participants involved in the over US\$ 1 billion a year rice-import business also include transporters, daily paid workers and various categories of service providers. Local production is aimed at eliminating these imports and conserving foreign exchange for other development purposes.

With improved organization at the production, processing and marketing levels, the rice sector could potentially have a significant impact on various categories of participants in the rice sector. Improvement in yield is desired and rice quality could improve with better processing and milling to eliminate foreign bodies and reduce the quantity of broken grains. The current challenge is to make the local producers much more competitive than they are at present so that they can compete more effectively with imported rice. Presently local rice is not graded, but once the country starts to produce surpluses, differentiation by grade and quality will be needed.

7.5.4.4 Social impacts

In terms of the social impacts the study aims to determine how the quality of life of participants in the production system has changed as a direct and indirect effect of rice production. The social well-being of rice-farming households and communities was compared with the national situation, focusing on quality-of-life indicators such as employment, literacy, health, social cohesion and the sustainable livelihood impact on the population. The indicators include the literacy rate (as shown by primary and secondary school enrolment), the rural unemployment rate as a measure of employment effects, disease prevalence, and social cohesion measured by migration patterns and the formation of social institutions to promote the interests of rice entrepreneurs. If the indicators in the rice producing states show a different pattern from the national indices, then the rice economy can be seen to have had a positive or negative impact as the case may be. Apart from using national level secondary data for the social impact assessment, focus group discussions were also conducted in rice producing areas to reveal the community perspectives on life-pattern changes

that might have accompanied increased rice production following trade liberalization.

Analysis results indicate that participants from the rice sector experienced significant improvement in employment as more people were engaged in rice farming, processing and marketing. Rice became a major food item in rural families, rice income was used primarily for the education of children and rice business provided intense social interaction in rural markets and at rice milling centres. However, rice-related activities have also resulted in some health problems and created gender differentiation with women participating mainly as farm hands and wage earners, even though some of them owned their farms. The level of technology also varied by gender. While male rice farmers patronized modern processing centres, female rice producers carried out parboiling at home, making use of their own labour and that of other family members.

A major impact of trade liberalization is the high output prices it has engendered in the rice sector. For most of the 1990s, the average growth rate in retail prices of local rice in urban centres was about 22.5 per cent, and 15.5 per cent in producing areas. Thus, while all categories of consumers have had to pay more for rice over the years, urban-based consumers faced higher price growth rates than rural-based consumers, which must have created some degree of equality between the two, given that wages are relatively higher in urban areas than in rural ones.

The major social problem associated with rice is the consumer preference for imported rice, which is perceived to be of better quality than local rice because of the impurities in the latter, thus making rice importers and marketers clear winners or beneficiaries of trade liberalization, as they have been able to dominate and control a substantial share of the rice market. While local rice producers are not necessarily losers in view of their higher incomes from rice, they could improve on their market share by improving the quality of the rice they produce. Local rice milling should therefore ensure that no stones or other foreign bodies are present in milled rice.

7.5.4.5 Integrated impacts

Trade liberalization is a macroeconomic intervention that has more of a ramifying impact on micro-level issues than changes in demography, consumption patterns, food security policies and other factors. It is important to note that poverty-related environmental problems and natural resource degradation are ultimately a result of national development processes such as those intended by trade liberalization measures.

The environmental, economic and social impacts of trade liberalization need not be considered as discrete events or outcomes; rather they should be perceived as being integrated and interacting to produce a generalised outcome. The production decisions and practices of rice farmers generate significant environmental, economic and social linkage effects. In an attempt to reap the benefits of the opportunities accompanying trade liberalization, rice producers may elect to adopt improved production practices that lead to high yield and increased income. However, the desired production efficiency and improved practices involve intense land tillage, reliance on irrigation water, the adoption of monoculture practices with specialization in rice cultivation, and use of agro-chemical inputs. Any of these actions elicits a chain of effects. For instance, the use of fertilizers and other agro-chemicals may impair water resources, which in turn may affect human health, leading to reduced productivity and income and aggravating poverty. The loss of wild biodiversity to make way for rice cultivation is critical because the livelihoods of a significant proportion of the population depend on free and open access to a great variety of biological resources for food, fuel, housing materials and economic security. For example, plants such as *Albizia zyia*, *Sosbania grandiglora* and *Parkia biglobosa*, the leaves and pods of which are consumed as vegetables and condiments by Nigerians, may be lost if fields on which these plants grow in the wild are converted to rice fields.

Economic and social impacts are quite significant for all participants in the rice sector, particularly farmers. The poor farmer is embroiled in a struggle

for survival on a day-to-day basis, which makes it impossible to undertake anticipatory or forward planning such as investments in natural resource conservation. Extensification necessarily affects the environment negatively, however rice farmers have limited alternatives to having an impact on the environment on account of their need to produce rice. A major approach to avoid uncontrolled extensification would be to improve land-use planning. Reducing the negative impacts of intensification and improved yield by adopting environmentally friendly practices such as organic farming and application of manure must be beneficial, otherwise economic gains in response to market demands may occur at the expense of environmental degradation. But while environmentally friendly measures are desirable, it must be noted that they require considerable investment and training.

It is also important to note that trade liberalization may inadvertently expose Nigerian consumers to substandard rice or dumping, irrespective of the tariff level imposed on imports. Quality control of imported and local rice could improve the quality of rice for sale on the Nigerian market. Trade liberalization not only offers opportunities for improved production practices but also for improvements in the quality of the produce if local producers are to be competitive. Nigeria does not participate in any regional agreements on rice trade, and the impact of the WTO AoA is minimal since the country is a net importer of rice. Besides, the tariff regime on rice is within the tolerance level of WTO agreements.

7.5.5 Main lessons learned

This project has generated considerable experience and perception in several ways. The entire project has been quite innovative in the conception, execution and application of findings. It is a desirable new thrust in research activities, particularly those with significant implications for development. The participatory nature of the study drew a wider perception and ideas on the issues of environment and sustainable development, and accentuated the divergent interests that stakeholders

pursue and how each tries to maximize his gains and pass off negative outcomes to others. However the study also demonstrates that consensus can be reached when it is based on the understanding and appreciation of the concerns and points of view of others, and when each group of stakeholders is able to perceive the implications of a certain course of action and its effects on corporate interest and welfare. The interaction helped to consolidate existing alliances and broaden the consultative mechanism needed to ensure effective development and realize stated objectives, namely in preventing or ameliorating the negative consequences of expanding rice production in view of achieving self-sufficiency. The study has been helpful in designing stakeholder participation in planning, executing and implementation of development policy research. However the project experience also revealed that rice producers still have reservations regarding the Government's expansion plans due to the historically unstable nature of Government policies, and the fear that insufficient incentives (inputs, services, etc.) will be provided to guarantee profitable rice production.

The study revealed the importance of rice as a source of food as well as a provider of income and employment. It is significant that Nigeria is the largest producer of rice in Sub-Saharan Africa, with increasing numbers of farmers diversifying into rice cultivation. However, the analyses have shown that the environmental impacts of increasing rice production call for serious considerations and ameliorative measures since the cumulative impact of the activities of numerous farmers, irrespective of technological practices, could affect the biodiversity in a way that makes rice production unsustainable.

Improvements in infrastructures are also necessary to raise the living standards of rice producing communities, reduce post harvest losses, and improve the quality of domestically produced rice. But the study also revealed that current available data is irregular, divergent and inconsistent and needs to be cleaned up so that it more adequately reflects developments in the rice sector.

Finally, the project has also highlighted the need for further studies on trade effects and domestic production policies on agricultural output in Nigeria. In the past 20 years, Nigeria has also imported staggering volumes of rice to meet consumer demand, so rice has significant implications for trade, production and diversification issues in the Nigerian economy. There is thus a need for more enlightenment on the role of the WTO in international trade and how WTO disciplines affect Nigeria's efforts and drive towards achieving domestic food self-sufficiency and food security.

7.5.6 Policy implications

The findings of this study informed a package of policies to strengthen the positive environmental impacts of rice production on the environment and mitigate the negative ones. The proposed policy measures aim to ensure sustainable production to enhance the socio-economic benefits and improve environmental management. It is equally important to secure legal and institutional frameworks that can guide activities in the rice sector, particularly the import and export of rice-related inputs and outputs.

Nigeria faces two sets of challenges in respect of her rice sector: (i) meeting the self-sufficiency goal, reducing poverty and solving the problems of poor nutrition and unemployment at the grassroots level, and (ii) joining the league of rice exporters to earn foreign exchange, broadening the economic supply base in the process. Both sets of challenges have implications for the environment and sustainable development within the rice sector. Current production practices have not yielded self-sufficiency let alone surpluses. Nonetheless they are largely damaging the environment and natural resources. The main negative environmental impacts identified include increased land conversion for rice cultivation and expansion into marginal lands; deforestation and land degradation; loss of biodiversity; emission of air pollutants; salinization and soil nutrient degradation; and human health effects. These economic, social and environmental costs can be traced to market, policy and institu-

tional failures, which must be addressed in order to harness the benefits associated with sustainable production practices. The instruments of policy intervention to mitigate the negative impacts and enhance the positive impacts consist of market-based and non-market-based measures directed at the entire life cycle of rice production, i.e. land use planning, production, processing and consumption. The following policy considerations are, therefore, akin to promoting sustainable development of the rice sector in Nigeria.

Land use planning: Policies to prevent misuse of land and encroachment on marginal lands must be developed. For instance, land-use taxes and soil-conservation levies may be considered to make cultivation of marginal lands unprofitable. The problem here, however, is the mechanism for collecting such taxes or levies in predominantly illiterate farming communities where land is considered a gift of nature and, therefore, a public good. Regulatory measures, which have already been deployed in the past, should be more effective in setting standards. In order to contain extensification practices among rice farmers, particularly emerging large-scale commercial farmers, specific regulatory measures such as land zoning, mandatory forest conservation, development programmes and soil conservation practices should be imposed.

Production: The production practices must be improved to increase productivity and achieve high quality rice while avoiding negative environmental effects. Increased land conversion and associated problems of deforestation, land degradation and loss of biodiversity may be curtailed if farmers are able to adopt integrated soil-fertility management techniques. Such techniques include a combination of chemical fertilizers with crop residue recycling, application and adoption of green manure, fodder crops, *mucuna* fallow or intercropping. Crop rotation, involving alternating rice (in the wet season) with vegetables (in the dry season) particularly on the *fadamas* will not only raise land productivity but also enhance land quality and conservation. Furthermore, IPM techniques will need to accompany intensification of rice production. The overall challenge is the need for fundamental adaptations

of agricultural policies likely to encourage farmers to invest in both integrated soil fertility management and IPM techniques and for the private sector to also invest in the development and distribution of agricultural inputs. The resultant increases in output and better quality rice should more than offset the increases in production costs associated with these investments.

Processing: In order for rice production activities to generate higher incomes and more employment and to reduce poverty the quality of local rice must be significantly improved. This will require efforts from individual participants in the rice sector and, indeed, a tripartite collaboration among farmers, processors and traders to set and ensure quality standards. Improving quality will make local rice competitive with imported rice and better able to attract similar prices. This means that foreign bodies must be absent from milled rice and the percentage of broken grains must be minimized. Higher prices from good quality rice will boost the incomes of rice farmers and all others involved in downstream activities such as parboiling, milling and marketing. The management of effluents and wastes in and around rice processing mills also deserves attention and regulatory measures. Rice millers must meet environmental and sanitary standards or be made to pay levies to be used towards achieving environmental standards. Since rice mills are generally located in designated areas, it should not be too difficult to collect levies and apply the funds to pay for environmental management and pollution control.

Consumption: Quality control measures including the establishment of standards for imported and locally produced rice should be considered. The purpose is to differentiate rice by variety, grade and quality and encourage consumers to pay for quality and standard. An added incentive to local producers and rice traders is the judicious use of tariff rates on imported rice. Since the Nigerian currency is kept floating and is thus subject to devaluation against major world currencies, the Government is justified in imposing a substantial tariff on imported rice to enhance the competitiveness of local

producers. The WTO tenets provide some corridors for developing countries to apply tariffs that do not lead to competitive trade disruptions. In any case, the introduction of NERICA rice varieties acclaimed to have significant nutritional and conservation qualities may readily enhance competitiveness of local rice to the extent that they would make import tariffs unnecessary. Meanwhile, rice producer associations, traders and the Government should jointly organize consumer awareness campaigns that emphasize the nutritional value of local rice varieties with the purpose of strengthening demand for local rice. Competitive pricing could also be employed to tilt demand in favour of local rice.

Nigeria should deploy its existing institutional capacity for environmental management to establish a monitoring and policy implementation body. This body should include Government institutions as well as other stakeholders. The tasks of this body would include, *inter alia*, reviewing the various policy proposals of this study and initiating plans for their implementation.

7.5.7 Suggestions for follow-up

Institutional initiatives to enhance environmental integrity in relation to rice production should be established. The idea is to harmonize the various activities and programmes of different institutions and agencies working to enhance socially, economically and environmentally sustainable rice production. It is realized that Nigeria has considerable institutional capacity for environmental management. A regulatory body, the Federal Environmental Protection Agency (FEPA), was created as far back as 1988 and is today the FME. A full-fledged ministerial institution underscores the importance the Government attaches to the issues of Nigeria's physical environment. A National Policy on Environment already exists and this is the main working document for the preservation and protection of the Nigerian environment. However, it is proposed that an inter-ministerial monitoring and policy implementation body should be set up to undertake implementation and execu-

tion of the policy initiatives recommended in this study. The FME should be the focal point of the body because it is the statutory institution in charge of environmental matters, including policy formulation, planning, monitoring, enforcement of standards and regulations and general administration. The FME should also take on the responsibility for organizing the body and running its activities. The inter-ministerial nature of the proposed body will enhance cooperation and implementation effectiveness. For instance, the FMARD, which is directly in charge of rice production as an agricultural activity, would be expected to play a prominent role in mobilizing resources and encouraging farming communities to participate in the programme. The Agricultural Development Projects, NGOs and community-based organizations would assist the FMARD in this role. The National Cereal Research Institute (NCRI) will provide technical knowledge while NISER will undertake all socio-economic research and policy analyses. The mass media will be responsible for the dissemination of information on the environment and activities of the body.

One of the first things to do would be to work out in detail some of the policy recommendations into fundable programmes and plans that can be proposed to the Government and donors for implementation. For instance, a programme may involve organization of rice farmers into producer groups

or cooperatives so as to facilitate the supply of inputs, micro-credit, information-sharing and collective management of the negative environmental impacts of rice cultivation. Another programme could be an arrangement for a public-private partnership in irrigation-water management so that Government irrigation schemes that are currently not well managed could be made more efficient and effective. The management of effluents and wastes from rice mills could also engage the attention of this body. There is also need for a programme to provide infrastructures (feeder roads, processing mills, storage, schools, health centres and marketing services) in rice producing communities to ensure social integration and facilitate commerce between rice-producing and rice-consuming communities.

The funds for implementing the proposed plan should come from the Government (via the various ministries and departments), overseas development assistance (ODA) and grants from development partners and agencies including UNEP. A broad-based financial support would be necessary given the financial implications of organizing meetings, training, on-farm demonstrations and movement across the landmass of the Nigerian federation. Estimates indicate that between US\$ 250,000 and US\$ 500,000 might be required annually to cover the cost of implementing the activities of the implementation agency.

7.6 Senegal

7.6.1 Background

Senegal is located on the westernmost coast of Africa and has a population of about 10.5 million. It has a total area of 196,190 km². Since independence in 1960, the per capita income has remained low at around US\$ 560. About 54 per cent of the population lives below the poverty line, 70 per cent of which live in rural areas. The average daily per capita food consumption is 2,400 calories. Weak levels of savings and investments, decreasing revenues and low global and regional integration characterize the country.

The agricultural sector as a whole plays an important role in Senegal's society and economy, employing nearly 70 per cent of the country's workforce, and representing the primary source of income in rural areas. However, in 2000, agriculture accounted for only 17 per cent of the GDP, which explains why such a large proportion of the poor are located in rural areas.

Over the past 40 years Senegalese agriculture has focussed on export crops such as groundnuts (oil and grains), cotton and gum arabic. In general, cereal production has declined as a result of the hegemony of groundnut production, and has taken place on a vast scale in arable lands. Land degradation has had negative socio-economic impacts on the groundnut sector. As a cash crop, groundnut represents the main source of income in the rain fed areas, and cereal crops have been abandoned in its favour.

The Senegalese agricultural sector is multifunctional, but is vulnerable since it is characterized by small family landholdings. Development of the rice sector will help to ensure food security, reduce poverty, achieve rural development objectives and meet growing national demand for rice, which constitutes a great potential market for Senegalese rice production. The water-related infrastructures built on the River Senegal in the north and in Casamance in the south will promote the use of

irrigation systems to supplement rainfall and pave the way for developing the rice sector, but they have also had some negative environmental and social consequences.

The Senegal River Valley (regions of St-Louis, Matam and Tambacounda) and the regions of Kolda and Ziguinchor constitute the three main rice production zones in Senegal with very different production systems. The Senegal River Valley and the Anambé basin are irrigated systems with perfect water management; the region of Ziguinchor and part of the region of Kolda are rain fed systems. Productivity is still relatively low but could potentially be increased in both irrigated and rain fed systems with new technologies.

Casamance in the south represents 61 per cent of the national rice growing area but accounts for only 29 per cent of national production. Most of the rice is produced in the River Senegal Valley, particularly the Delta region that represents 62 per cent of the irrigated area and accounts for 71 per cent of rice production in the Valley. The soil, salinity and climate of the Delta region make it especially favourable to rice cultivation, and average yields are around 5.5 tons/ha. In addition, landholdings in this region are larger and production systems more mechanised. In the Anambé region yields are around 2-3 tons/ha, which highlights the low technological capacity of producers and their weak application of recommendations in terms of cultivation practices.

National production levels have evolved unevenly. They quadrupled in the irrigated areas of the River Senegal Valley between 1981 and 1991, mainly due to extensification, but also intensification. Yields increased from an average of 3.3 tons/ha in 1979-1981 to 5 tons/ha in 1989-1991. However, total national production of paddy rice has generally remained below 200,000 tons a year,

whereas domestic demand for white rice is estimated at around 600,000 tons per year.

Despite research and development efforts and considerable investments in hydro-agricultural infrastructures, intensification of rice production faces a number of pre and post production challenges, namely the lack of access to credit, insufficient seasonal workforce, poor water and land management, unavailability of varieties allowing double cropping, and problems relating to the quality and processing of the rice. Yet, if all the factors favourable to rice cultivation were to be implemented, the potential for yield increases would be considerable.

In general, rice produced in the Delta regions is sold on the market whereas rice produced in the middle and upper valley is mainly destined for home consumption. Irrigated production in the Anambé region remains marginal and rice produced in the rain fed and lowland systems is still mainly destined for home consumption. Overall, around 30 per cent of domestic production is consumed by the producer households themselves.

Rice represents 34 per cent of the overall volume of national cereals consumed, 54 per cent in urban areas and 24 per cent in rural areas. It is estimated that, on average, 25 per cent of household budgets are spent on rice purchases in rural areas and 18 per cent in urban areas. Domestic demand for rice has been growing constantly from 1995 to 2002 and is much higher than current domestic production levels, so the need to import huge quantities of rice has increased.

Senegal is the second largest importer of broken rice in West Africa after Nigeria. Rice imports have created an important deficit in foreign currency of approximately FCFA 100 billion per year. From 1995 to 2002, rice imports increased by about 63 per cent, from 435,500 tons to 709,575 tons (from FCFA 59 to FCFA 110 billion). Domestic production covers around 20 per cent of national consumption (depending on the years). Senegal imports as much rice as it

produces in cereals (millet, sorghum, maize, rice, and fonio (a local cereal in the Sahel)). Rice is the second most important in terms of cereal production after millet but only represents 20 to 30 per cent of national cereal production.

Considering the importance of rice in the Senegalese diet, increasing domestic rice production should be supported to ensure food security and reduce poverty, as well as to decrease Senegal's dependence on imports, since sharp increases in the international price of rice could make this commodity unaffordable to many Senegalese consumers.

As a member of the WTO, Senegal's reforms in the agricultural sector are largely guided by its commitments under the WTO AoA, but also by regional integration policies. Following these reforms, Senegalese rice production has suffered some market difficulties due to institutional problems, lack of competitiveness compared to imported products, and shortcomings in the organization of its distribution channels.

7.6.2 Process, methodology and capacity building

This project has involved numerous specialists, institutions, Government Ministries, NGOs, unions, people organizations, farmers, traders, and other stakeholders from throughout the rice sector. The study is based on an open and participatory approach with stakeholders at all levels, and has benefited from inputs from a wide variety of professionals and academics.

The Institute of Environmental Science (ISE) of the Faculty of Science and Technology of the Cheikh Anta Diop University of Dakar (UCAD) is the main national institution in charge of carrying out this study. The Department in Charge of Analysis, Forecasting and Statistics (DAPS) of the Ministry of Agriculture and Hydraulics and the inter-professional committee on rice (CIRIZ) have also contributed to the formulation and implementation of this project.

The study was launched at a national seminar and is founded upon an open and participatory approach. Three additional national stakeholder workshops involving rice producers, decision makers, consumers, importers and traders were convened, and additional studies and data collection were carried out in the field. Five working groups have reviewed and refined the different reports submitted by the team. A final national workshop was held on 14 December 2004. Trade unions, NGOs, community-based organizations and associations, the private sector and parastatal bodies, as well as the Government and local authorities were all fully involved in the study.

A Steering Committee was established to supervise the national study process and was chaired by a peasant leader of CIRIZ. The study has also benefited from the invaluable contribution of expertise and advice from: the company in charge of developing and promoting lands in the River Senegal delta and the valleys of the Rivers Senegal and Falemé (SAED); the company in charge of agricultural and industrial development in Senegal (SODAGRI); the inter-professional training centre in agricultural fields (CIFA); the information agencies in charge of monitoring the rice sector; the national rice watchdog in Senegal (ONRS); the agency for market regulation (ARM); the ministries in charge of commerce, environment, and finance; the regional rural development directorates (Fatick, Kaolack, Kolda, and Saint Louis); the private sector; farmers' organisations; traders; importers; NGOs; the Senegalese Institute for Agricultural Research (ISRA); the Association for the Development of rice cultivation in West Africa (ADRAO); and the Centre for Ecological Monitoring (CSE).

The research team consisted of an international trade specialist, an environment and trade specialist, an economist, a civil engineer, a sociologist, an environmentalist, and resource persons including statisticians, agro-economists, socio-economists and doctoral students, all of whom provided useful information and necessary data for the study. The project also benefited from a scientific committee made up of academics and researchers.

The methodological approach was to undertake an integrated economic, social and environmental assessment of policies and agreements related to trade in the rice sector. Although the rice sector is well studied in Senegal, integrated impact assessment is new. Assessment to date has been conducted separately on rice cultivation practices, economic growth and environmental issues. Technological and socio-economic impacts are known but the environmental impacts of trade liberalization have received less attention. In order to overcome the difficulties of carrying out an integrated analysis of the environmental and social impacts of rice production and trade liberalization, it was necessary to combine environmental integrated assessment (EIA) and cost-benefit analysis (CBA) methods with partial equilibrium models (PEM) and to mix qualitative and quantitative approaches. The analysis focuses specifically on the following significant effects:

- *environmental aspects*: water-related infrastructures, changes in cultural patterns, human health, pesticide pollution, biodiversity decline, soil degradation, water quality, intensification.
- *economic aspects*: poverty reduction, employment and income, prices and tariffs, investments, technology;
- *social aspects*: land tenure, migration, equity and gender, consumption and behaviour patterns, innovation and technology, capacity building, education and training;

Screening and a preliminary assessment of the environmental, economic and social impacts of trade liberalization in the rice sector were conducted using participatory rural appraisal (PRA) techniques (Delta, Anambé and region of Fatick), a four-day stakeholder workshop and individual interviews (Dakar, Kaolack and Saint-Louis regions). The workshops also included an analysis of stakeholder 'winners' and 'losers' in the rice sector, as well as a needs analysis of those involved in rice production and trade. They provided an important opportunity for the associations and local rice producer organizations from the north and south of the country (from both irrigated and rain fed areas)

to meet and discuss with decision makers, consumer associations and communication actors.

The Policy Analysis Matrix (MAP) approach helped identify farmers' costs and benefits in relation to the most efficient way of allocating resources. Two types of environmental effects were considered: external effects and use-related effects.

The analysis involved assessing policy measures to encourage national rice production and to stimulate internal and regional integration in order to suggest ways to mitigate the negative impacts and promote the positive impacts.

The conclusions and recommendations of the study could be useful to stakeholders throughout the rice sector in terms of promoting sustainable national rice production and defining a plan of priority actions within the framework of trade liberalization.

7.6.3 Project objectives

The overall objective of the project is an integrated assessment of the environmental, economic and social impacts of trade liberalization and the WTO AoA on the Senegalese rice sector. The study aims to determine the direct and indirect effects of trade liberalization on the rice sector and the population, understand the changes that have taken place in the rice market, and assess farmers' use of commercial inputs, services and local resources in rice production. These aspects are important for Senegal to formulate an informed negotiating position that integrates environmental concerns in the context of the Doha round of negotiations.

Specific objectives include: evaluating the environmental, social and economic implications of the AoA in the Senegalese rice sector; analysing the environmental, social and economic consequences of the Government's policy to increase domestic rice production and reduce rice imports; and develop policy proposals to mitigate the negative effects of trade liberalization and the AoA.

7.6.4 Trade liberalization

The various macro-economic policies adopted since 1960 by the public sector, and which affect

the rice sector, have progressively developed before and after liberalization of the agricultural sector. Prior to liberalization, Senegal's policy was largely interventionist and protectionist, and included tariff and non-tariff barriers as well as macro-economic policies and internal interventions to regulate prices. From 1964 to 1984, the State substantially subsidised agricultural exports through credits for inputs and equipment, but without investing in adequate rural development and infrastructure. However, persistent droughts limited agricultural development and incited the Government to develop policies related to water management, so from 1984 to 1987 Senegalese policy focussed on investments in irrigation schemes as well as the continued provision of all inputs and services used in agriculture.

However, during the 1980s Senegal and its development partners realised that these policies had failed and resulted in the stagnation of agricultural production and an increase in food imports. Transitory agricultural liberalization reforms took place during the period 1987-1994, followed by the complete liberalization of the agricultural sector in 1996, including complete withdrawal of the State from activities related to the rice sector. Subsidies on transport, inputs and prices were abolished and rice imports were completely liberalized, although surtaxes are still applied to imports of sensitive products such as rice.

At the same time, Senegal set up sub-regional integration policies, and as a member of West African Economic and Monetary Union (WAEMU), Senegal is working towards greater regional integration with a unified external tariff. The simplification of the tariff structure and the reduction of trade barriers resulted in a tariff system that is in harmony with the adoption in 1999 of the *Tarif Extérieur Commun* (common external tariff, TEC) of the WAEMU.

Despite structural issues linked to groundnuts, energy and a high incidence of poverty, the reform of Senegal's economic policy has led to more transparency and openness, and since the 50 per cent devaluation of the national currency (FCFA)

in 1994 the country's macro-economic performance has improved, with real growth in GDP averaging 5 per cent annually from 1995 to 2002.

In terms of environmental legislation, Senegal has already put in place a framework to combat problems such as air, water and land pollution and industrial risks, and has signed and ratified numerous international conventions related to environmental and wildlife protection. This raises questions regarding the compatibility between commercial and environmental interests in the context of the Doha declaration.

7.6.5 Integrated assessment results

National leaders attach great importance to the development of rice production to satisfy growing national demand and reduce dependence on the international market. The objective is thus to take advantage of all potential factors that can contribute to increasing productivity. In the south this involves building infrastructures to hold back salt or rainwater and reduce salinization. In the north, the new Diama and Manantali dams should improve the availability of water throughout the year, which will be favourable to rice production.

The MAP was used to measure the impact of the Government's policies on the profitability of agricultural systems and the efficiency of resource use.

7.6.5.1 Environmental and health impacts

The distribution of natural resources among the various agricultural activities has changed following the liberalization of the rice sector. Whilst it was difficult to quantify precisely the environmental costs of trade liberalization, qualitatively the costs of developing rice production include land degradation and pollution, water pollution, increased salinization of soils, deforestation, changes in the biodiversity, and disruption of traditional production systems. Water and land (usage and property rights) are the main source of concern, and the impacts of reforms on these natural resources are of great significance for health and biodiversity.

A chronic and persistent decline in rainfall has led to a drastic weakening of agricultural production. In the rain fed rice-growing areas of the south the decline in rainfall has largely contributed to the increased salinization of soils. The measures taken by policy makers to reduce dependency on rainfall and reverse the desertification trend has involved building dams (Affignam, Anambé, Diama, Guidel and Manantali), thus ensuring water supply in irrigated areas and to local communities. However, these water-related developments have also had a number of negative environmental and social impacts, such as:

- the destruction of plant diversity and natural habitats
- disruption of traditional production systems in the River Senegal Valley that are based on the natural conditions of the river (crops grown in river beds when the water level drops, cattle-breeding, fishing)
- drop in continental and river fishing catches, disruption in the biological cycle of certain fish species
- risk of eutrophication
- risk of soil degradation (salinization, acidification, etc.)
- degradation of surface waters
- rise in the ground water level
- risk of increased sources favourable to the development of disease-carrying organisms (bilharzias, amoebas, gastric infections, etc.)
- lack of drinking water in land-locked villages.

Irrigation infrastructures disrupt migrant cattle breeding and are usually blamed for deforestation (building of banks and channels, ground-levelling). However discussions have also shown that reforestation is taking place on a large scale throughout the valley, and there is a desire to reintegrate stockbreeding and rice cultivation in view of the increased demand for meat and dairy products, which in turn is dependent on the availability of rice related sub-products (bran, straw, husks). Changes in the hydrological conditions due to irrigation infrastructures are responsible for the loss of certain species of fish whereas other species

have proliferated. Invasive aquatic plant species have also appeared. On the positive side, the combination of irrigation and adequate drainage can reduce salinization.

The continuous use of irrigation, pesticides, and fertilizers in rice cultivation contributes to the increase in harmful emissions of carbon gases, methane, nitrogen oxide and ammonia. Methane emissions mostly concern irrigated rice cultivation due to the long flooding period and the anaerobic decomposition of organic matter. In the case of rain-fed rice production systems, animal manure or manure made from a mixture of rice straw, animal excretion, household waste and ashes prepared by women are the most commonly used fertilizers, so the impact of inorganic fertilizers is minimal in this system.

Water

Water is the main input in rice production, from controlled flooding to the harnessing of water resources, and various users compete for its use. Increasing rice cultivation raises the question of water availability, and while it is not a real constraint for the time being, water needs in the medium and long term for the irrigation, navigation and electrification programme of the Organisation pour la Mise en Valeur du Fleuve Sénégal (OMVS) will call for political and economic arbitrations. In addition, water is a vital environmental barometer.

Land and property rights

The issue of land ownership is a decisive factor for the promotion and development of investments in water-related equipment for irrigated agriculture. The land tenure system (law 64-66) distinguishes four categories: urban zones, classified zones, pioneer zones and lands. The land distribution policy is based on the principles of development and appropriation of lands devoted to rural areas. Irrigated lands have gone from a 'pioneer' status to that of lands for agricultural production managed by a rural council by virtue of the powers transferred by the Government to local communities.

The availability of land is high and the potential is far from being used, even in the Delta area where irrigated rice is most concentrated. In the various rice growing areas property rights are not well established and the land market is not ruled as an institution. Nevertheless, the number of transactions has increased since the rice sector was liberalized and power for land allocation was transferred to local counsellors. While the potential of intensification is no longer realized, extensification has not yet degraded the cultivated area to any great extent. However, the need to improve the drainage system is stressed in the Delta and Anambé regions.

Health

Drainage waters from irrigated lands may pollute watercourses with dangerous residues from pesticides, thereby endangering human, animal and plant health. In some cases drainage water is used for domestic activities such as dishwashing, laundry and bathing. Current observed water-related health impacts include the lack of clean drinking water, sanitation and the formation of disease-carrying organisms (bilharzias, diarrhoea, cattle intoxications). According to farmers' organizations the risk of bioaccumulation of pesticides in the food chain is, in practice, limited with regard to rice growing since the doses prescribed by research and monitored by agriculture extension services have not been exceeded.

Pesticides, fertilizers and GM crops

At present, the use of pesticides in reference to standards encouraged by agricultural services is undermined in irrigated rice cultivation. Inappropriate handling of agro-chemicals can have negative impacts on human health, however environmental problems related to the use of phytosanitary products and fertilizers are not so much due to over use but rather to the circulation of agro-chemical products originating from uncontrolled sources.

Genetically modified organisms (GMOs) are not currently used in rice cultivation in Senegal, but the use of modern varieties is spreading in irrigated

areas. Traditional farmers rely on the use of genetic diversity in production, the selection of seeds and the combination of different seed varieties as a coping strategy against drought, irregular rainfall and poor soils.

Potential environmental risks due to the intensification of rice production

Intensified rice production may result in conflicts in relation to access to lands in developed rural areas whilst the low capacity of farmers to make optimal use of the rice fields may lead to environmental degradation. The risk of residues in drainage waters contaminating pastures will increase. With the liberalization of imports the proliferation of inappropriate and uncontrolled chemical inputs on the national market is a hazard, and traders of such products may not have the technical capacity to advise farmers on correct usage. This can lead to direct poisoning through incorrect use, and indirect poisoning from the accumulation of chemical residues in the food chain.

7.6.5.2 Economic impacts

Effect of reforms on production

Reforms have involved the transfer of responsibility for rice collection and processing to producers or farmers' associations, and for imports to the private sector. This has particularly affected the rice production environment in the River Senegal Valley and, to a lesser extent, the Anambé basin because these zones are capital-intensive and highly commercial in nature. Casamance was less affected due to its relative isolation from rice markets.

Liberalization and the aforementioned reforms have led to greater efficiency in the distribution of inputs by the private sector and instigated initiatives at various levels to improve the productivity of the rice sector. Modern, highly resistant rice varieties have been introduced in irrigated areas and seed quality control is performed by agriculture extension services. On a very limited scale, some farmers have begun growing fragrant and

basmati rice and the results are promising in terms of the market in Dakar. However whilst private enterprises in rice production have resulted in an increase in the cultivated area, this was not accompanied by improved technical capacity and low yields have led to the abandonment of these lands.

Impact of reforms on consumer and producer prices

Despite a few attempts at protecting domestic rice production and helping reduce the impact of world price fluctuations on the local market, the vulnerability of domestic paddy rice has increased. In addition, despite lower world prices, traders have not been passing on these benefits to consumers. This situation made it urgent to create CIRIZ, which includes all the stakeholders (producers, industrialists, traders, service suppliers, funding institutions, SAED) around the Senegal River Valley, and to arrive at a compromise price through arbitration so the rice would be marketable.

Rice producers are penalised in terms of their production costs since they pay 18 per cent VAT on inputs but do not recover this tax on their producer prices since rice is not subject to VAT on the domestic market. This appears to be a disadvantage particular to rice producers since traders recover VAT directly on the retail price. Thus the process of recuperating and paying VAT to the State by various economic actors is interrupted at the rice producer level. This has important consequences on the production costs for rice and affects its competitiveness.

Impact of reforms on the market for inputs and services

The increase in rice production costs (inputs, equipment) following liberalization and the devaluation of the FCFA resulted in a 44 per cent decrease in the net margin per hectare. Combined with the difficulties of operating the credit system, this had a tremendous effect on the profitability of local rice production causing a reduction in the use of inputs. This is particularly true in the Anambé

region. Pursuant to the devaluation of the FCFA, labour costs increased by 30 per cent, notably in the River Senegal Valley. The labour market has tightened as a result of greater mechanization following an increase in the cost of services and also due to greater use of family labour. New and soft technologies compatible with family labour are being introduced in rice processing. Manual processing is fairly widespread in areas where rice is grown for home consumption.

Impact of reforms on rice marketing

One of the effects of liberalization is the diversification of supply sources and large-scale demand for high quality rice. Improving the quality of rice offered on the market has become a strategic marketing option and traders react favourably by offering a wide range of qualities and prices. Over the last few years a large section of the urban population has opted for fragrant rice.

Research has revealed that the transfer of the functions of marketing, intermediation and input supply from the Government to the private sector has improved access to land, capital and agricultural inputs, and has facilitated, in particular, the allocation of resources between rice cultivation and other non-agricultural activities. One of the results expected from these reforms is the increased efficiency of markets.

However, not only has liberalization intensified competition with imported rice, a large proportion of domestically produced rice is used for subsistence and is thus not marketed. Between 50 and 60 per cent of domestic production is marketed and consumed around the River Senegal Valley zone and only a small share is exported to other parts of the country.

Impact of reforms on by-product markets

Efforts to increase productivity gains from rice production through liberalization have resulted in better use of by-products, and there has been a rapid increase in the trade of straw, bran, flour, and rice husk. Stockbreeding is one of the sectors making use of rice by-products.

Impact of production system reforms: diversified activities

Dry cereal crop production decreased mainly as a result of adverse climatic conditions (droughts) so agricultural activities were re-oriented towards irrigated crops, especially rice. Double cropping could considerably increase farmers' revenues and would increase national production. However, the challenges faced by the rice sector make diversification a strategic option that will reduce the risks related to monoculture and will diversify, increase and secure revenues. The need to intensify rice cultivation does not decrease the legitimacy of diversification.

The point is not to change from one problematic sector to another high-risk one, so ensuring the profitability of diversified crops will require professionalism and training. In addition, the rice sector has a vast potential market of 600,000 tons annually (current level of rice imports).

Economic costs

Analyses revealed an aggregated cost of FCFA 13,173 per ton of processed rice. However this seems to be attributable mainly to the influence of sub-sectors located in regions that are not economically profitable. A financial analysis based on market prices showed a net profit of the overall rice sector of FCFA 4.83 billion for the period 2001-2002, but when the analysis is carried out based on reference prices, the rice sector presents a social cost of FCFA 1.90 billion for a total production of 144,640 tons of white rice, and the sector is on the limit of profitability.

7.6.5.3 Social and cultural impacts

It is important to note that the sector employs around 400,000 people and the economies of the River Senegal Valley are dominated by rice cultivation, which represents 89 per cent of the revenue of the region. Furthermore, the soil in the Delta region is particularly well adapted to rice growing.

Impact on rice producers

According to the MAP analysis, the Senegalese rice sector is not very competitive and there are

considerable production variations at the regional level. Small-scale producers yielding 1 to 3.5 tons/ha tend to be located mainly in the rain fed areas, and a few in the irrigated areas. Between 17 and 23 per cent of producers are large-scale with yields of more than 4.5 tons/ha. The sector as a whole receives a net transfer of FCFA 6.772 billion from the rest of the economy, and rice producers benefit from income revenues. However, as a result of the lack of protection of the domestic sector in the liberalization process, the producers are the losers. This situation is more visible among the small producers with yields below 4 tons/ha with the same generalized cost price for the paddy rice. This category of producers, representing about 20-30 per cent, is still undergoing the effects of liberalization.

The liberalization of imports has mainly penalised small family producers and weakened their opportunities despite State intervention between 1996 and 1998 consisting in the purchase of the locally produced rice. The small-scale producers with lands of less than one hectare are in a precarious situation because of their limited capacity to generate sufficient revenue to satisfy their food and other needs. They are thus vulnerable to poverty or inclined to migrate. Many small-scale rice farms have gone out of business or have changed hands and the overall rice growing area fluctuates annually. One of the main problems is the lack of access to credit following liberalization, which has repercussions on agricultural productivity, the use of new technologies, food security, nutrition, health and the overall wellbeing of rural households. Meanwhile large-scale rice producers have gained. For farmers to participate in the growth of the rural economy and to achieve social equity, it is important to define an adequate family farm size conducive to the competitiveness of locally produced rice.

Producers and professional associations

Many socio-professional organisations emerged following the liberalization of the rice sector because of the need to replace the services and structures previously provided by the State. There are around 2,000 organisations in the River Senegal

Valley alone. These organisations are mainly dominated by the *Groupements d'Intérêt Economique* (economic interest groups, GIE), which are progressively regrouping into federations, unions and federal organisations. Three structural levels can be observed among professional stakeholder organisations, namely basic farmers' organisations (GIEs, village sub-sections of cooperatives), intermediary organisations (unions, associations, cooperatives), and federal farmers' organisations, although these structures are constantly evolving. They are organised by sector and product, including many federal associations, and those providing professional services such as agricultural training. This type of socio-economic structure is considerably less developed in the Anambé region.

The expansion of irrigated agriculture around the River Senegal Valley has led to the emergence of institutions and mechanisms that further contribute to the restructuring of the socio-economic environment. In response to the occupation of lands by hydro-agricultural infrastructures breeders, hunters, fishermen, tourism promoters and other users of the irrigated area have begun to make their presence felt through various demands and actions. Women's organisations (GIEs, mutual credit associations and others) are fully engaged in rice sector activities, including production and marketing. Women's contributions to the rice economy are focused on labour, household decision-making and small enterprise management.

These associations are an attempt at replacing the functions no longer provided by Government, for example intermediary financing, marketing, supply of inputs, training, etc. However various constraints (credit, property rights) have prevented the producers' organisations from achieving the full potential offered by the GIEs, although they played an important role in structuring initiatives from individual farmers, autonomous farmers' groups, villages and local communities and continue to establish links and partnerships with research institutions and providers of technical support.

Not only has the evolution of the organisational structure of the rice sector resulted in the emer-

gence of different types of professional organisations, farmers' activities have expanded to include the collective management of production infrastructures and promotion of their product. The various issues debated during the national workshop in relation to producers' needs fall under four main headings: (i) marketing as one of the main problems of rice cultivation; (ii) production costs, profitability and competitiveness; (iii) guarantee of food and cash, and (iv) potential for progress.

Importers and traders

The number of Senegalese importers decreased from 43 to seven between 1996 and 2002 as a result of the accumulation of surplus rice stocks and competition among importers. There is no shortage of rice on the local market and there is a constant security stock of 100,000 tons. Imports are completely free and speculative and are seen as a market opportunity that is cost-effective compared to the import of other goods. Rice is also sometimes re-exported to neighbouring countries such as Mali, Guinea Bissau and sometimes The Gambia.

Senegalese rice importers are ordinary economic operators who are very passive in international trade and have no intention of investing in local rice production. Local traders strive to make consumers bear the costs and do not pass on the lower international market prices to consumers.

Consumers, service suppliers and others

The opinions expressed during discussions between representatives of consumer associations and communicators revealed gaps in the communication process and information sharing, and led to the following conclusions: supply is the main issue since demand already exists; the local rice market is disorganised. Local rice production still suffers from a lack of information and promotion at the national level. Labelling and marketing are ongoing issues. However, an attempt to sell local rice through a network of local associations or NGOs and merchants is in progress.

Winners and losers

Before liberalization of the rice sector, the main beneficiaries were the importers – referred to as

“quota owners” – and the Government. The quota owners consisted of a few Government clients with licences to import. At the time they benefited from the import restriction and their income was guaranteed by the state system. Taxes on imports represented an important source of income for the Government. Measures taken to reduce rice imports represented an indirect tax for consumers of imported rice, and an indirect subsidy for local producers in that it safeguarded their production. Producers also benefited from the sharing of profits from imported rice through investments in support and research structures (basic infrastructure equipment, support and advice).

The situation changed after liberalization. Analysis highlighted the weaknesses of the previous system and the difficulties of locally produced rice in relation to imported broken rice. Market reforms paved the way for increased competition and new importers arrived on the scene, but tough competition and surplus stocks finally excluded many of them, so the real winners became the seven remaining importers and those who dropped out are considered losers. The remaining importers form a cartel that benefits from higher profits, but the main beneficiaries are the local middlemen traders (some of whom made substantial profits) who benefit from the lower international prices (since the importers pass on the lower prices to the local traders) but do not pass them on to consumers. For example, in 2004 international rice prices saw a downward trend that was not reflected in consumer prices. The Government is both a loser and winner. Taxes still provide an important source of revenue for the State, but Government costly maintenance of heavy infrastructures in the Anambé region represents a loss since rice production in that region is not economically profitable and it would be cheaper to import, contrary to the River Senegal Valley and Casamance regions where it is more profitable to invest in rice production than to import, thus contributing to reducing the outflow of foreign currency from Senegal. Consumers are once again the main losers in that they continue to pay the same price for rice despite lower international prices. They could have been winners if the

market were more transparent since the expected outcome of competition is a reduction in prices. Whilst on the whole producers may appear to be winners because they are still benefiting from Government support in terms of infrastructures and research activities, the lack of protection and competitiveness in relation to imported rice makes local rice producers losers, especially small producers with yields below four tons/ha.

7.6.5.4 Integrated impacts

As explained in the section on economic impacts the results from the MAP demonstrated that the Senegalese rice sector is on the limit of cost effectiveness. However, this generality hides the disparities between the various rice production systems. Only the irrigated system of the Anambé is uncompetitive, which seems to be due to a number of factors, including the heavy costs of maintaining the infrastructures. Rice production in the River Senegal Valley and in the Casamance region is economically competitive in relation to imported rice. Whilst food security also depends on other cereals (millet, sorghum, maize), rice represents around one third of the overall national cereal consumption. Supporting rice producers is crucial for several reasons:

- Currently domestic production only covers around one fifth of national consumption, and Senegal must reduce its dependency on imports since increases in international prices could have dramatic effects on consumers for whom rice constitutes a substantial part of the diet.
- The actual average rice yield is about 5.5 tons/ha but the potential yield is about 89 tons per hectare.
- Double cropping in rice cultivation is currently not effectively practiced (15-18 per cent) due to the lack of credit and other management constraints, yet water resources and the infrastructures are available.
- Potential irrigated land in the River Senegal valley is about 240,000 ha, but only 67,000 ha are actually irrigated of which only 40,000 ha are used. Making full use of 60,000 ha of

irrigated area and implementing double cropping at an average yield of six tons/ha would already cover three quarters of the national demand for rice.

Consequently, Senegal needs more flexibility to apply urgent measures aimed at protecting the interests of small farmers against massive imports of rice and unfair commercial practices, mainly those that affect the production of key food products such as rice.

To attain national food security objectives, Senegal should make use of its full potential to hopefully promote national rice production to the benefit of both irrigated and rain fed areas. However, whilst improving the competitiveness of rice and its by-products is crucial, it cannot be undertaken at any price. Other factors such as protecting the environment, reducing poverty and harnessing alternative economic incentives must also be taken into consideration. The development of irrigated rice farming should involve the integration of fish farming, arboriculture and activities related to cattle feeding, sources of energy, IPM and ICM. Rice growing is an efficient economic and social production system that is compatible with crop diversification and contributes to realising food security and, consequently, increasing the level of farmers' welfare. Diversification also leads to a more sustainable production system and, when centred on rice speculation, is a significant option due to a possible competition between rice varieties. Information and the technical level of farmers need to be reinforced, as do the strategies producers adopt to overcome technical and socio-economic difficulties associated with production. Distribution and sales must also be revisited. Agricultural equipment is old and outdated.

Rice production can play a vital role in stopping the proliferation of poverty in rural areas, which can manifest itself in various forms of deprivation reflected by the low income levels, drop in consumption levels, difficulties in gaining access to credit, and minimum coverage from social services. The following measures aim to reduce negative social impacts:

- take advantage of, and improve if need be, local know-how and indigenous knowledge in the south zone
- promote health education of the people
- build institutional, organisational and operational capacity of all the stakeholders of the rice sector
- build the capacity and level of service providers.

7.6.6 Policy implications

In terms of food security and sustainable development, there is an urgent need to increase rice production to meet national needs and promote investment and trade in agricultural and rice products. Improving profitability will require efforts at different levels to increase productivity, efficiency, quality and competitiveness and thus obtain higher producer prices for paddy. This implies defining standards and quality control methods. Increased productivity also requires adequate incentives at the producer level (access to credit, land and inputs), a sound economic, institutional and social environment (price stability, adequate facilities, research and development, development of promotional services, etc.). In other words a complete reform of the rice sector is required if the agricultural sector is to act as a driving force in the economic growth of the country.

Institutional and regulatory measures have to be taken to improve the competitiveness of local rice in combination with environmental protection:

- *Marketing is the problem, not productivity:* Some organizations have opted to look after activities related to production (credit, purchase of inputs, agricultural work and marketing) and others to strengthen coordination between producers and other stakeholders. Cost-effective use of agro-chemicals is expected through input monitoring and the observance of environmental regulations.
- *Invest in social and environmentally sustainable production systems:* The new socio-economic context of Government disengagement and liberalization leads farmers' organizations and private producers to become increasingly involved in the management of irrigated systems. The Government has transferred the management of lands to decentralised local communities and production facilities, and the management of equipment to producers. A social, economic and environmentally efficient way to build sustainable livelihoods for rural populations is through a consistent investment in irrigated rice production in rain fed rice areas. The promotion of organic rice farming (SAED model of technical itinerary) has to be embedded in a diversified irrigated agriculture in the Delta. The rice sector could play a key role in Senegal's poverty reduction strategy. Irrigated rice farming should also integrate fishing, forestry, and other activities linked to stockbreeding and energy sources.
- *Reserve a proportion of the rice market for domestic production:* Winning back the domestic food market can only be achieved by limiting imports, improving the operations of agricultural market products, and by guaranteeing reasonable prices to consumers and good payment conditions to producers. This is necessary to achieve food security in recognition of the rights to food sovereignty.

In future, Senegalese agriculture should rely on the promotion of a modernised family farming system and the participation of a confident private sector in order to effect a transition from extensive production systems to diversified, sustainable and intensive ones. In Senegal, agricultural activities have been considerably diversified to include joint management of production infrastructures, and to control the over-development of products. Farmers' partners have also changed while new relationship patterns based on the market have emerged.

Following the various workshops that brought together producers, decision makers, consumer associations and communication professionals, a series of measures was proposed aimed at improving the entire sector (environment, production, market and consumption). The National Consulting Committee on the Rice Sector (CONCOFIR) and the national inter-professional committee for the rice sector (to be created) would play a key role with the

Government and decision makers in carrying out two significant regulatory measures, namely:

- *Protect or allocate to local rice production a part of the rice market:* a simple, continuous reduction of the proportion of the market occupied by imported rice constitutes a transfer of income to Senegalese rice producing farmers. Such a measure will contribute to reducing poverty by increasing income levels and stopping the drop in home consumption.
- *Create an efficient protection (flat discount of the TEC) on the valorisation of local products and the development of facilities.* Because of the uncertainties associated with the instability of the market price at the global level as well as with the recent agreement with the major Asian rice exporting countries, the main economic precautionary principle to take to regulate the market should be applied to the issue of food security; it is therefore important to rely on regional and subregional solidarity (complementary interplay with neighbouring countries) and on the creation of an efficient protection (flat discount of the TEC), on the valorisation of local products and the development of facilities.

Senegal defends the position of WAEMU member countries in the framework of the commercial negotiations. WAEMU's convergence pact of stability, growth and solidarity helps to harmonise macroeconomic and sector-based policies as well as tax regulations for the various member countries. The global objective of the WAEMU Agricultural Policy (WAP) is to contribute in a sustainable way to the satisfaction of the populations' food needs, the economic and social development of the member States and poverty reduction.

The sub-regional space must be protected from unfair external competition. The harmonisation of tax policies affects the agricultural sector and allows realisation of the convergence of taxation mechanisms and equal treatment of economic operators within the community space. Material and agricultural inputs are now subject to 18 per cent VAT. However, unlike other economic actors, Senegalese farmers have no means of recuperating the VAT and are therefore unfairly penalised.

In order to increase rice production, mainly in Senegal, producers should be protected at least temporarily, against external shocks and especially market fluctuations. Among the measures foreseen, the AoA allows subsidies for inputs. The African countries cannot use subsidies on credit, water and electricity if they do not go over the *de minimis* level. Moreover, the only protection that small producers can enjoy is the consolidated rates. These can be insufficient to meet global prices that are very low or even "falsified". Rice is a strategic product for the social well-being of households in both urban and rural areas. Pricing has always been a highly sensitive political barometer.

7.6.7 Lessons learned

The creation of inter-professional associations for information exchange and consultation represent an important step in building the capacities of those involved in rice growing. Such organizations provide a forum for all the participants in the production of rice (producers, industrialists, service suppliers, traders, input and credit suppliers, consumers, carriers). This study has demonstrated to all stakeholders the need to undertake integrated impact assessment in order to improve policy dialogue on the rice sector.

A needs analysis carried out through workshops and interviews with the different stakeholders (producers, traders, importers, consumers, communicators and decision makers) indicates an increasing demand to promote rice production through market relationships. The relative failure of the rice sector is on the market side and a policy shift is expected from the Government to reflect this. Community based organizations and NGOs demonstrate capacities to organize and supply internal markets. The study offered momentum for information exchange among stakeholders who have not yet exploited their potential to develop the rice sector.

ADRAO and ISRA played important roles in the quest for high yield and good quality seeds. This has helped increase local production. Other attempts were made (sensitising peri-urban areas,

reference stores, etc.), but production is still low compared to demand, even if this rice has its own market (or its own demand), which should be organised in an optimal way.

Academics (university and research) are called upon to serve in the Sub-committee on Trade and Environment within the National Committee for International Trade Negotiations, which is open to civil society. An extended understanding of integrated assessment in policies implicates a capacity building process where all stakeholders enhance their skills by means of an analytical framework. Integrated assessments of trade-related policies require full cooperation between departments to promote integrated policy-making. The Ministry of Trade is committed to building synergy with the Departments of Environment and Agriculture to conduct integrated policy design and implementation for sustainable development.

7.6.8 Suggestions for follow-up

Recommendations focus on implementing national policies to reduce negative outsourcing associated with trade liberalization, to optimise net profits and to formulate action plans for the execution of the recommendations.

Institutional measures:

- reactivate the National Consulting Committee on the Rice Sector;

- create a national inter-professional committee for the rice sector;
- other non-commercial measures that could create a synergy between trade and the environment, for example setting up an environmental assessment framework on trade negotiation rounds; the analytic framework would integrate environmental and social concerns in all the various stages of the negotiation process.

Follow-up measures:

- *Finance:* Study the possibility of annual funding of agricultural activities viewed from the angle of global operations; investigate mechanisms and credit lines in the long and medium term to provide funding for equipment and water-related agricultural development.
- *Capacity building for producers:* Support producer's organizations to set up input supply services, manage processing and commercialisation of agricultural products privately; respect the cultivation calendar; disseminate a technological package and a technical itinerary.
- *Information and education:* Provide information to operators on the choice of fertilizers and pesticides in order to incorporate social and environmental considerations during the production life cycle; introduce in the various on-going implementation or planned programmes integrated actions to fight dangerous parasites and rodents for better crop protection (IPM or ICM).

7.7 Viet Nam

7.7.1 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. It is the most important crop in the agricultural sector and it is difficult to overstate the importance of rice to the Vietnamese economy.

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”, the 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 trade liberalization policies according to Viet Nam’s commitments under the AFTA Common Effective Preferential Tariff scheme (CEPT) from July 1995, the Viet Nam-USA Bilateral Trade Agreement (Viet Nam-USBTA) signed in July 2000 and which became effective in late 2001, and as part of the negotiations to enter the WTO. Over the last two years, the Government has liberalized trading rights for all domestic firms. In addition, rice export quotas 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 brought, among other effects, an increase in agricultural income, an increase in 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 fertilizers and pesticides, degradation of the environment and loss of rice biodiversity from technology inputs.

This Executive Summary presents a summary of the results of an integrated assessment of the impacts of trade liberalization in the rice sector of Viet Nam. The assessment 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.

7.7.1.1 Background on Viet Nam's rice sector

Rice plays a central role in Viet Nam’s agricultural production and food consumption. Agricultural land planted with rice is 53 per cent of the total area or 64 per cent of the crop-growing area. In 2000, the rice cultivation area was nearly 7.7 million hectares, 1.3 times higher than the 1989 level, representing an average annual growth rate of 2.4 per cent. Productivity is 4.2 tons/ha, over 1.3 times higher than productivity in 1989. Rice output grew to 32.7 million tons in 2000, an annual growth rate of more than 5 per cent during the period 1989 to 2000. Rice production in Viet Nam accounts for 96.2 per cent of cereal production, and 61.7 per cent in terms of total value.

The central role of rice is highlighted in the Vietnamese diet. About 75 per cent of the caloric intake is in the form of rice. According to the

1992/93 Viet Nam Living Standards Survey (VLSS), 69.9 per cent of all Vietnamese households grow rice and 99.9 per cent consume rice. About 95 per cent of rural households, which represents 80 per cent of the total population, grow rice and almost half of them produce a surplus for sale. Rice production is the main source of income of the rural household, representing 44–51 per cent of household revenue.

Small, irrigated farms, multiple cropping, labour-intensive practices, and a growing use of inorganic fertilizer characterize rice production in Viet Nam, although there are differences between regions and rice ecologies. The Mekong River Delta is the rice bowl of Viet Nam, producing about half of the national output on farm sizes of about 1.1 hectares. The farming households in the Central Coast continue to grow traditional rice varieties in the rain-fed lowland conditions although irrigated rice is dominant. Farms of the Red River Delta average 0.25 hectare per household, and generate rice surpluses and relatively high net returns. Rice cropping intensity, at almost two crops per year, plays an important role in the country's rice production. However, results from recent studies²⁴ have indicated that farmers and the Government are now interested in diversification. The current trend is to reduce the share of income from rice in the total household income.

In terms of exports, rice brings the highest value out of exported agricultural and forestry products. In 2000, total export turnover of agricultural and forestry products was US\$ 2,894.4 million, of which rice accounted for the highest proportion at 23 per cent, coffee second highest at 17 per cent, and vegetables and fruit third at 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. Between 1989 and 2000 Viet Nam exported nearly 30 million tons of rice, a turnover of more than US\$ 7 billion. This contributed 4.6 per cent to the total export turnover, or

21.6 per cent of agricultural exports. During the last few years, Asia has remained the main importer of Vietnamese rice, accounting for over 50 per cent of total rice exports. Middle East countries such as Iran and Iraq are also substantial export markets for Viet Nam's rice. The volume of rice exported to Middle East markets in 2000 represented about 30 per cent of the total rice exported.

7.7.1.2 Trade liberalization in the rice sector

Trade liberalization in Vietnamese agriculture has proceeded in a number of steps under the reform process known as the *Doi Moi* Policy that directly and/or indirectly resulted in the liberalization of trade. The process started in the 1980s with the introduction of the “contract system”, in which farmers were allowed to use any extra amount over the planned production for their own purposes. It was accelerated in 1989 with decision-making given to farming households, and was complemented by a range of land law reforms and the liberalization of other sectors in the early 1990s. The liberalization of trade included taking the measures described hereafter.

Removal of domestic rice restrictions

These restrictions were originally put in place to ensure interregional equity in terms of security of rice supplies and to control illegal exports. The rice surplus region of the country is the Mekong River Delta whereas the rice deficit regions are in the north. Restrictions were enforced mainly in the form of fees, taxes, police checkpoints, permit requirements, but sometimes also explicit bans. These measures all acted as a tax on the internal rice trade because they increased the costs of interregional trade. Restrictions on domestic trade in rice were removed in 1997 by Government Decision No. 140 that abolished the licenses and controls on domestic food transport

²⁴ International Food Policy Research Institute (2000).

and allowed people to buy, process, transport and carry out business activities for domestic consumption.

Relaxing and removal of rice export quotas

The Government has controlled the volume of rice exports since it re-entered the international rice market in 1989. The quotas were set each year by the Ministry of Agriculture and Rural Development (MARD), the State Planning Committee and the Ministry of Trade (MOT) based on estimates of domestic supply and utilization. The rights to export rice under the national quota were allocated to the two regional state-owned trading enterprises and a number of provincial state-owned trading enterprises. Reforms in quota allocation in 1997 authorized the provincial Government to allocate the quota. The liberalization also allowed private companies to participate in rice exports. Viet Nam's revised Trade Law (1998) allowed foreign traders to engage in direct transactions, carry out trade deals and offer trade services; it did not yet allow them to export rice themselves, but they could act as agents for the provincial food companies. In 2001 the export quota was eliminated both for rice exports and fertilizer imports and the practice of directly nominating exporters and importers of these products was removed. Both state-owned and non-state-owned enterprises holding a license to trade food or agricultural commodities can now participate in rice exports. Along with the removal of the export quota, the Government of Viet Nam simultaneously introduced an export subsidy, i.e. an explicit Market Price Support measure. Rice exporters receive a subsidy of 180 Vietnamese Dong (VND) (about US\$ 0.012) per export dollar.

Export and import promotion

By 1998 the management of imports of most consumer goods shifted to tariffs rather than quotas or licensing, although eight categories of goods remained under quantitative restrictions. Customs tariffs were introduced in 1988 for the first time, and now the number of different tariff rates has fallen. The effective rate of protection for some

industries is quite high since tariffs on inputs and capital goods tend to be quite low while tariffs on consumer goods are high. Although the average tariff rates do not seem out of line with those in other developing countries, most of the items imported are in the high tariff bracket (between 30 and 60 per cent) and form the bulk of the state tariff revenues.

Similarly, the export tax structure is complex and suffers from frequent changes. In 1999 there were 12 tax rates ranging from zero to 45 per cent with an average rate of 14 per cent. Non-state companies were first allowed to engage directly in external trade in 1990/91 and the licensing procedure for enterprises was progressively simplified during the decade. In 1998 the MOT eliminated the requirement of licensing. This allowed 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 companies' ranges of goods remained limited by the scope of the activities recorded on their business registration certificates.

Abolishment of fertilizer import restrictions

Compared to other Asian countries, Vietnamese rice production is an intense user of inorganic fertilizers. However domestic production supplies only 13 per cent of total use, so fertilizer imports are critical. The MARD and the MOT used to determine the quantity and types of fertilizer to be imported each year, thereby controlling fertilizer imports. Quotas were allocated to the provinces based on expected provincial production. The provincial authorities then allocated the quotas to the enterprises under their management. Non-state enterprises have also received quota allocations subject to fulfilment of certain criteria. The fertilizer import quota used to be adjusted following mid-year reviews of the local supply and demand conditions. The Government operated a Price Stabilization Fund to monitor prices on fertilizer. The fertilizer import restriction was abolished in 2001 together with the liberalization in rice export quotas.

Viet Nam's international commitments on trade deregulation

Viet Nam joined the ASEAN in July 1995 and subsequently was committed to implement the CEPT for the realization of the AFTA from January 1996. Tariffs on a vast majority of 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 between zero and 5 per cent by the start of 2006 to complete the CEPT scheme.

The Viet Nam-USBTA was signed in July 2000 and became effective in late 2001. Viet Nam will reduce restrictions on foreign entry into numerous service sectors such as banking, tourism, telecommunications and others according to a road map agreed under the Viet Nam-USBTA. Also, the current process of licensing for foreign investments will be replaced gradually by a more automatic process of registration for foreign investments within seven years.

In the context of WTO accession, Vietnamese trade reforms to be undertaken during the coming years will build on the commitment to phase out WTO-inconsistent measures, publish laws and decisions governing issues in the agreement, establish administrative or judicial tribunals for review, provide the right of appeal and apply WTO-consistent protection for intellectual rights.

7.7.2 Process and capacity building

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 MARD.

The approach adopted was to involve all stakeholders, both private and public, in the rice sector. The process involved bringing together a multi-

disciplinary team of researchers including: from the Hue University of Agriculture and Forestry, Truong Van Tuyen (Community Development), Hoang Manh Quan, (Economist), Hoang Thi Thai Hoa (Agricultural Systems), Nguyen Vinh Truong (Agronomy), Le Quang Minh (Ecology), Le Duc Ngoan (Extension), and Hoang Thi Sen (Agricultural Systems); from the Hue University of Economics, Nguyen Dang Hao (Economist); from the Mekong Delta Farming System Research and Development Institute, Dang Kieu Nhan (Farming Systems); and from the Ha Noi University of Agriculture, Nguyen Mau Dung (Economist).

A stakeholder workshop was organized at the beginning of the assessment to undertake a strategic screening and to build up awareness of the impact of trade liberalization in the rice sector. The participants included the aforementioned team and representatives from various research institutes (Mekong Delta Farming System Research and Development Institute, National Institute for Plant Protection), universities (Hue University of Agriculture and Forestry, Ha Noi University of Agriculture, He University of Economics), Government ministries (MARD, MOT and Ministry of Natural Resource and Environment), local rice producers, traders, people organizations (farmers' union) and NGOs (Oxfam). The strategic screening and qualitative assessment focused on environmental impacts, which was identified as a gap in policy analyses undertaken so far.

The workshop also specified the methodology for the integrated assessments. Given that most team members were not familiar with quantitative methods and given the limited resources for consultation, a combination of different methodologies was adopted. This contributed to strengthening the capacities on assessment methods. The workshop also 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. Other meetings were organized locally in the Red River Delta, Central Coast areas and the Mekong River Delta to involve farmers, people organiza-

tions, local researchers, and local officers to assess and review the results. Assistance in policy consultation and dialogue was obtained from the Secretariat for the ISG to MARD for international integration. The ISG also provided steering support and its e-forum for assessment, collaboration and communication of the results.

7.7.3 Methodology

A range of methodologies was adopted, including both quantitative and qualitative, as well as *ex post* and *ex ante* analyses. For qualitative analyses, a field survey was conducted in the Red River Delta (northern Viet Nam) and the Central Coast area, involving a total of 194 rice farmer household respondents, of which 110 were from the irrigated rice systems and 84 from rain-fed lowland rice systems. A PRA exercise was conducted to validate available data and supplement with primary data on rice production. The PRA was conducted in the Mekong Delta (southern Viet Nam) in two selected provinces (Tien Giang and Can Tho). The PRA focused on 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 fertilizers.

For quantitative analyses, the assessment benefited from previous studies²⁵ to quantify the impacts of further trade liberalization on rice production, rice exportation, and rice price. The aim was to determine the economic impacts of the tariff reductions under the AFTA Agreement, implementation of the Viet Nam-USBTA and the WTO accession negotiations. The ISG to the MARD provided this analysis with the PEM. A modified PEM was also applied to quantify the impact of further trade liberalization on the use of urea fertilizer in rice production. These quantitative models allowed the incorporation of regression models for non-linear supply and demand functions as well as the simulations for trade liberalization with different

trade factors into a PEM. The quantitative framework included the following scenarios for analyses.

- Base scenarios to serve as a reference to compare other trade or policy options. The base scenarios were designed for the year 2005. In these scenarios the studied indicators (rice production/supply, rice exportation, rice markets, fertilizer markets, fertilizer production) were simulated at the same rate as for the year 2002 without further trade liberalization.
- Scenario options included the effects of further trade liberalization in quantifying the above studied indicators. Trade liberalization factors included in this study were the different options on the tariff reduction under the AFTA and Viet Nam-USBTA Agreements; the participation of non-state enterprises in exports and imports (resulting in decreased transaction costs); and the reduction of rice growing areas as part of diversification from rice.

The main data sources used for analyses came from the Government Statistic Office, the MARD, the MOT, the FAO and the International Rice Research Institute (IRRI) statistics. However, the limited availability of data and poor consultation sources in the country constrained the quantitative analyses and the ability to factor out the trade liberalization impacts.

7.7.4 Integrated assessment results

7.7.4.1 Environmental Impacts

Strategic screening of the environmental impacts

The strategic screening undertaken during the first workshop gave the overall impression that the socio-economic impact of trade liberalization in the rice sector was perceived as positive but environmental impacts were seen to be negative. The environmental impacts identified included the expansion of rice growing areas leading to clearing of forests or wetlands, both considered negative

²⁵ International Food Policy Research Institute (2000) and Economic and Environment Program for Southeast Asia (1997)

impacts. Rice intensification technologies such as improved irrigation, increased cropping intensity, high yielding rice varieties and high rates of fertilizer and pesticide use. Whilst these increase productivity they also cause soil degradation, water pollution, loss of agrobiodiversity and loss of habitat and wetlands. In addition, increased processing and transportation of rice were also expected to have negative environmental impacts. Overall, growth in rice production and exportation contributed to a larger scale of economic activity, which had negative environmental impacts.

However, positive impacts on forests were also expected since rice intensification provides jobs and improves local food supply, thereby reducing pressures on natural forest exploitation for food. In addition, there are also technologies available to mitigate the negative environmental impacts of rice farming. For example, IPM helps reduce pesticide use and the use of organic fertilizer helps reduce chemical fertilizer use. Also, trade liberalization and economic integration has stimulated the development of better environmental standards and laws since the 1990s. The new establishment of the Ministry of Science, Technology and Environment (MoSTE) and the issuance of environmental laws during the 1990s indicate increasing concern for the environment along with economic integration. Changes in organizational structures, regulations and environmental standards were appreciated for their positive environmental impacts.

Farmers' perceptions of the environmental impacts

The PRAs in the Mekong Delta revealed that farmers perceived the negative environmental impacts of the intensive use of agro-chemicals. They noted that the use of pesticides at present (2003) was higher than 10-25 years ago but lower than five years ago due to the application of IPM techniques and extension activities and the growing of pest-resistant varieties. However, even the decline in pesticide use could not counter the decline of water quality in common rivers or canals and the decline of natural fish resources, mainly due to the application of extremely toxic chemicals to kill the golden

snail. Most small and large farm owners indicated that the continuous increase in the use of chemical fertilizers was a consequence of declining soil fertility. Intensification without organic fertilizers seemed to be the main reason for soil degradation.

The survey conducted in the Red River Delta and Central Coast revealed that farmers perceived positive environmental impacts on living and water resources. The irrigation provided primarily for rice production also improved human water supplies. In general, the living environment within the settlement areas was much better due to irrigation for rice production. Improvement in water control and increased cropping intensity also made the soils easier to farm. However, pesticides have negative impacts on aquatic resources and on human health.

Agro-chemical use and quantifying the use of urea fertilizer

Available statistics and related studies at the national level indicated that chemical fertilizer use in rice production has increased dramatically since the 1980s. It was estimated that 75–80 per cent of overall fertilizer consumption was in paddy fields. Following the Government decision allowing farmers to make farming decisions, fertilizer use climbed from 376,000 tons (57 kg/ha) in 1983 to 544,000 tons (85 kg/ha) by 1990, and to about two million tons (280 kg/ha) in recent years. This growth was attributed partially to the increase in rice cropping intensity, liberalization of fertilizer imports, and a drop in urea fertilizer/paddy ratios (the price of urea fertilizer decreased while the price of rice increased). Farm surveys in 1996 showed that organic fertilizers were used by more than two thirds of the rice farmers in Viet Nam, but there were considerable regional differences. Farmers seemed to be aware of the effectiveness of organic fertilizer but say that local supply is insufficient and it is difficult to transport. Most rice farmers also used pesticides, and more than 80 per cent of rice farmers in the two deltas own sprayers. A study carried out in the 1990s showed that the actual rates of nitrogenous and potassium fertilizers in the Red River Delta and the Mekong Delta were higher

than the economically optimal rate. The actual rate of pesticide use was also higher than the economically optimal doses.

The annual imported volume of fertilizers was around 3.5 million tons, of which urea fertilizer was highest (1.8 million tons). Domestic production (capacity) satisfied only 4 per cent of urea fertilizer and 50 per cent of phosphate fertilizer demands. Urea is the most common nitrogenous fertilizer for rice, accounting for 65 per cent of total nitrogenous fertilizer consumption for all crops. Overall pesticide use increased from 20,300 tons in 1991 to 36,589 tons in 2001, of which it is estimated about 50 per cent was used for rice. The rate of pesticide use varied from 0.23-2.74 kg/ha.

An analysis of urea fertilizer consumption was conducted to determine the impact of trade liberalization on fertilizer imports and prices. The price elasticity of urea was relatively high (-0.768) indicating that if the price of urea fertilizer increased by 1 per cent its demand would decrease by 0.768 per cent. Yet, the real price (as the constant 1989 price) has declined significantly from VND 7,000 per kg in 1989 to VND 2,000 per kg in 2002, indicating a large change that was not totally transferred from the international prices. This can be explained by the initial existence of non-tariff barriers, especially the monopoly of state-owned fertilizer companies. For example, before 1994, about 90 per cent of fertilizers were imported by the Agricultural Material Corporation, while the figure for 1996 was 40 per cent. The monopoly implied high transaction costs, resulting in strong pressure on the domestic price of urea fertilizer. Between 1988 and 2002 the average domestic price of fertilizer in Viet Nam was 55.23 per cent higher than the world market price. With trade liberalization, the domestic prices converged towards international prices, especially after the Government removed non-tariff barriers and made the import market accessible to non-state-owned fertilizer companies.

Scenario analyses using the PEM indicated that further trade liberalization would cause the gap between the world (import) price and the domestic

price of urea fertilizer to narrow faster due to private participation in imports. The scale and dimension of trade liberalization would cause different simulation results. For Option 1 (the gap between the international and domestic price declines by 10 per cent), the domestic price would decrease by 11.19 per cent and demand for urea in Viet Nam would increase by 17,761 tons. If the price gap is reduced by 20 and 30 per cent (Options 2 and 3 respectively), demand will increase by 84,351 tons and 102,695 tons respectively. A control measure was also tested. With a 10 per cent cut in rice production, the demand for urea would be 783,198 tons, which is higher than the base scenario of 15,673 tons (assuming the urea market is similar to Option 3).

Biodiversity and rice genetic resources

Degradation of rice genetic resources was a concern indicated at the stakeholder workshop. Replacement of traditional rice varieties (TV) by modern varieties (MV) has been the major contribution to increased rice yield. A survey carried out in 2001 showed that the number of traditional varieties in the whole country is much lower than modern varieties. The area planted with TV rice accounted for just 3.6 to 21.4 per cent of the total rice growing area. Most irrigated rice lands are planted with MV rice, which requires application of high rates of chemical fertilizer and pesticides. Traditional varieties of rice are maintained in some parts of marginal rain-fed environments such as upland, coastal sandy and flood-prone areas, and require application of very low rates of fertilizer and almost no pesticides.

Viet Nam is one of the world's ten most biologically diverse countries – containing about 10 per cent of the world's species of flora and fauna, even though it covers less than 1 per cent of the earth's surface. Forests and wetlands are particularly rich in biodiversity. Between 1943 and 1993 forest cover in Viet Nam declined from 14.3 to 9.3 million hectares, an average loss of 100,000 ha/year. Expansion of rice lands has been one of the major causes. 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 yet to gain official recognition as a distinct land use or conservation management category. In 2000, the Viet Nam National Environmental Agency (NEA) identified 79 wetlands of national importance of which only 16 were included within decreed special use forests. Expansion of (irrigated) rice fields may contribute to a reduction of wetland areas.

7.7.4.2 Economic impacts

The reform process in Viet Nam over the 1990s has resulted in significant economic growth with an annual GDP increase of about 7 per cent. In the rice sector, the stable and high growth rate of rice production has helped Viet Nam meet domestic demand and generate surpluses for export. In the period 1989-2000, Viet Nam exported nearly 30 million tons of rice, gaining a turnover of more than US\$ 7 billion, equivalent to an average annual growth rate of about 13 per cent in terms of export volume and over 12 per cent in terms of export values. During recent years, Asia has been the main importer of Vietnamese rice, accounting for over 50 per cent of total rice exports; 30 per cent was exported to Middle East markets in 2000.

The above figures suggest that trade liberalization, together with the international integration policy, has had a positive impact on the national economy in general and the agricultural sector in particular. Additionally, trade liberalization creates competition in domestic production, affecting traders, exporters and producers. The ISG used a PEM to assess the impact of open trade on rice production. A base scenario was designed to simulate production, distribution and market factors for the year 2005 without further trade liberalization. The trade liberalization effects were chosen for comparison with the base scenarios, namely the reduction of tariff rates from 20 to 5 per cent to be implemented under the AFTA/CEPT, and the reduction of US rice import tariffs from 35 to 8.3 per cent to be implemented under the Viet Nam-USBTA. The effect of restricting rice supply by reducing land

area planted with rice (e.g. 10 per cent) was also tested. The PEM results indicated that trade liberalization has a positive impact on the rice sector. However, the extent of the impact depends largely on the scale and dimension of trade liberalization. Trade liberalization under AFTA brings considerably more economic benefit. The reduction in tariff from 20 to 5 per cent would result in a 4 per cent increase in the export price of rice. Thereby rice export volumes increase by 10 per cent. The effect of the Viet Nam-USBTA seems to be negligible in the rice sector because the supply restrictions increase. Regarding the measures on controlling supply, the 10 per cent cuts in the rice production area would increase the total value added by 1.6 per cent. This is due to the large share in the world rice market, where the supply restriction would increase the export price of Viet Nam's rice. This seems to be the highest level of reduction of rice production applied.

7.7.4.3 Social impacts

Under the policy reforms, changes in rice farming have had important social impacts. Farmers perceive changes in rice production and resulting social issues such as the impact of intensive rice farming. In the PRA exercises in the Mekong Delta farmers indicated that rice yields have increased steadily throughout the different farming periods starting 20-25 years ago. This increase in rice yield resulted from improved technical knowledge and greater experience of rice farmers, acquired through technical support programmes such as IPM, extension programmes, and improvements in infrastructure and paddy field establishment. The combination of these factors has impacted greatly on food supply, rice sales, rice inputs, family income and employment of the poor.

One of the most positive impacts of rice intensification has been in terms of meeting family rice needs and generating surpluses for sales. Most farmers are now wealthier from selling their rice. Some, however, have complained that the amount of rice sold now is less than five years ago, and they need to sell a lot of rice to cover the costs of

production inputs. This suggests that rice intensification may not be cost-efficient for the poor. However, there are opportunities to reduce input costs and earn more profit by applying IPM or ICM techniques, but this requires better knowledge. Most farmers agreed that switching to double or triple annual harvesting increased employment opportunities for the poor. On the other hand, increased mechanisation in rice farming (for land preparation, seeding and harvesting) and applying improved technologies (direct-seeding, well levelled fields, less supplementary transplanting and using effective herbicides) has negative effects on the livelihoods of the landless poor who depend on jobs as hired labourers. In the irrigated rice ecosystems of the Central Coast and Red River Delta, most interviewed households indicated their participation in the rice trade (92 to 100 per cent). The percentage of net rice seller households is quite high. However, it has decreased over the last three 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. This suggests that farmers have already started diversifying their production to increase their income.

Statistics showed a remarkable performance with respect to poverty reduction along with Viet Nam's economic growth rate of 7-8 per cent. The real total income of households increased by 27.6 per cent between 1993 and 1998, while income from agriculture increased by 60.6 per cent. In the same period, poverty decreased from 30 to 15.7 per cent or from 41.6 to 28.2 per cent depending on the method of analysis used. The decrease in total poverty in rural areas has been greater than in urban areas in absolute terms, but the proportional reduction is similar: from 32 to 16 per cent in urban areas and from 44 to 30 per cent in rural areas. There are, however, major regional disparities: the northern Uplands, the Mekong River Delta and the north central coast regions account for 70 per cent of the entire poor in the country. Here, agriculture is the dominant economic activity.

In exploring the links between trade liberalization and poverty, a framework was used to examine the

effect of trade-induced price changes on household income in their capacity as both producer and consumer. The lowering of tariff barriers is likely to reduce the price of imported goods in the domestic market, while at the same time export liberalization may lead to higher prices for exported goods. Rice is the most important single source of income for the majority of Vietnamese households. The increase in the real price of rice (by VND 26 per kg of paddy rice during the period 1993-1998) benefited mainly rural families as the rice producers. This price increase was not due solely to trade liberalization, but there seems to be a strong trade component. In contrast to the benefits to producers, price increases generate adverse effects on consumers. Rice accounts for a significant proportion of household expenditure, and even more so in poor households. Thus, the price of rice clearly has a major impact on poverty and requires close attention. A quantitative model called the Viet Nam Agricultural Spatial Equilibrium Model (VASEM) was used to simulate household data and rice marketing patterns. It showed that the elimination of internal rice trade restrictions increased the income of urban and non-poor households. The removal of the rice export quota had a greater effect on household income and poverty as a result of higher prices associated with eliminating the export quota: the real income of poor households (defined as the poorest 25 per cent) rises 1.7 per cent, while the real income of urban households (primarily net buyers) falls 2.6 per cent and 5.4 per cent (for the poor and non-poor respectively). As a result, the "food poverty" rate rises in urban areas (from 7.6 to 9.1 per cent), but falls in rural areas (from 29.4 to 28.6 per cent). Thus, equality between rural and urban populations is improved, while the poverty rate in the whole country falls slightly from 25.0 to 24.7 per cent. For specific analyses, two indicators were used to represent the poverty level – "food poverty" and "total poverty". The food poverty indicates a more critical situation than the total poverty. The total poverty line is the sum of the food poverty line and expenditure estimated for basic needs other than food.

7.7.4.4 Integrated impacts

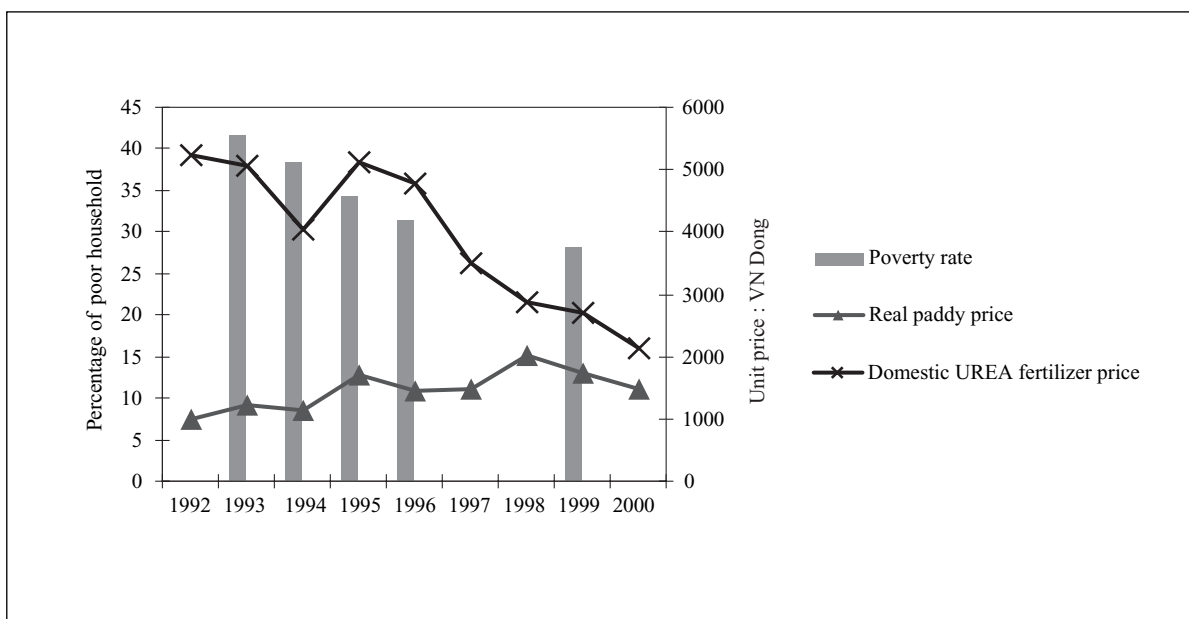
The reform process including trade liberalization in Viet Nam during the 1990s has resulted in significant changes in rice production and export. These have important positive impacts on the economy, food security and on poverty reduction, but mainly negative environmental impacts. Many of the effects of trade liberalization are interlinked. For example, the increase in real income of the poor (by 27.7 per cent from 1993-98) 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 fertilizer prices or the rice/fertilizer price ratio (see graphic below). The poor benefited from the increase in the price of rice because they were the rice producers. The food poverty rate declined from 20 to 13 per cent in 1993-99, and the total poverty rate from 42 to 28 per cent, while equity between rural and urban areas also improved as rice producers benefited most. These impacts and other opportunities provide the incentive to continue implementing policies to promote rice production and rice exports.

However, rice expansion and intensification have negative environmental impacts, suggesting that

the socio-economic improvements due to rice production are not sustainable. First of all, the increase in the price of rice and the decrease in the price of agro-chemicals resulted in higher total levels of agro-chemical use. This contributed to soil degradation, water pollution, loss of agrobiodiversity, and loss of aquatic habitat and freshwater fishery harvests. There were also negative impacts on human physical health due to misuse of fertilizers and pesticides, particularly by the poor and less-educated farmers. Secondly, expansion of rice cultivation will place at risk the remaining forests and wetlands that are particularly rich in biodiversity. Many local communities are largely dependent upon this biodiversity for their food and living environment. Thirdly, rice intensification has led to the replacement of traditional rice varieties with modern varieties. All of these environmental impacts will sooner or later incur economic costs in terms of 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 fertilizer, which supports rice production and export but also increases environmental damage. Moreover, it was demonstrated that the current

Trend of real prices of paddy rice, urea fertilizer and poverty rate during the 1990s



levels of fertilizer and pesticide use are not economically optimal, i.e. a lot of agro-chemicals are wasted, so a reduction in their use would make both economic and environmental sense. Therefore, measures to moderate the consumption level of agro-chemicals should be developed. Suggestions coming forward from this study are (i) taxing or banning the most harmful agro-chemicals (pesticides), and (ii) providing technical support and research to promote organic rice farming for “clean” rice production (in the framework of WTO green box subsidies). Initial studies indicate that clean rice production would reduce agro-chemical production costs, provide more scope for producing traditional rice varieties, have fewer negative health impacts, is more environmentally sustainable, and can potentially command higher prices. More knowledge and extension programmes, and more labour may be required and slightly lower rice yields may be expected.

7.7.5 Policy recommendations

The proposed policy response is based on the impacts that have been identified in the integrated assessment and takes into account the context of Viet Nam’s transition to a market-oriented economy. The major considerations include the stakeholders’ low level of awareness of the impacts, especially environmental ones. The policy-making processes involve multiple levels but these do not seem to be transparent. Together with further understanding of the policy processes, the responses should also take into account the perceptions of farmers and local communities of successful initiatives. Recommendations include:

- Building greater awareness of environmental and other impacts resulting from rice intensification and trade for rice stakeholders by including environmental education in public channels and extension systems. This should include providing equitable and appropriate access to extension and technical training.
- Sensitising policy makers to the environmental impacts by initiating an appropriate policy dialogue that will encourage integrating environ-

mental costs into the use of pesticides and chemical fertilizers in rice cultivation through bans or taxes. Current policies on banning the most harmful agro-chemicals, e.g. specified pesticides, are mainly based on compliancy with the standards developed by the World Health Organization (WHO).

- Enhancing policy dialogue through the ISG to reduce and stabilize the plans of the MARD for rice production and export, and improve the quality and price of rice for export.
- Promoting integrated and/or organic rice farming (green box) including IPM, by providing research and technical support to diversify farm production and develop non-farm rural small businesses.

Continuing with further trade liberalization in the agricultural sector with specific measures and policies on purchase, stocking, and exporting rice. The objectives should be (i) to further reduce/remove all non-tariff barriers, particularly in administrative procedures so that marketing and trading costs can be reduced and price competitiveness can be enhanced; and (ii) to stop protection of state-owned enterprises and establish credit guarantee facilities for all Vietnamese exporters. The Government needs to set appropriate levels of control but also facilitate exports in a transparent way, with equal opportunities for Viet Nam-based companies to access credit or new forms of insurance.

7.7.6 Main lessons learned

This assessment has drawn the attention of stakeholders in the rice sector to the environmental impacts of rice production and rice trade liberalization. Participants in the study were very helpful not only for the assessment team members but also for the policy makers and other stakeholders such as farmers. The study involved combining a variety of methods and study tools such as quantitative models, qualitative PRA and interview techniques. Each group or stakeholder may only be convinced to participate in the learning activities with certain facilitating tools or processes.

The general findings indicate that, in Viet Nam, the capacity for undertaking integrated impact assessment is low. Data availability and accessibility *ex post* is limited, making policy analysis difficult. Many agricultural researchers – particularly the assessment team who are knowledgeable in the qualitative analysis of rice cultivation, rice trade, and environment – were not familiar with quantitative assessment methods. Environmental impact valuation is relatively new in Viet Nam, since it has been using a centralized system for commodity pricing and exchange valuation.

An advantage provided by the assessment team, however, was that its members were familiar and experienced with participatory methods. Consequently, participatory tools and methods have been used for involving rice farmers and local stakeholders in the assessment, but the application of these tools and methods such as PRA requires trained researchers. This implies that wider awareness building needs to start with capacity building for the researchers and extension agents.

7.7.7 Suggestions for follow-up

7.7.7.1 Build awareness of the integrated assessment results

Build awareness of the environmental impacts of trade liberalization for researchers and stakeholders via various forms of communication and training workshops. The initial sensitisation of policy makers to the integrated impacts of rice intensification and trade liberalization could be made through the publication and dissemination of this study and related follow-up workshops. The dialogue should incorporate environmental considerations into the current MARD rice export programmes.

7.7.7.2 Proposed study on the promotion of integrated / organic rice farming

Promotion of integrated/organic rice farming is a recommended response based on the results of the quantitative models used for integrated assessment and also a response to farmers' perceptions. This would support "clean" rice production and exports,

and benefit the poor rice producers. At the same time it would mitigate the negative environmental impacts by reducing the level of agro-chemical consumption. Among the key hypothesized outcomes would be an expansion of organic rice farming, building on the practices of IPM and rice diversification by adopting "integrated rice crop management". The study would focus on farm-based activities, community and stakeholder participation, as well as education and capacity building on the integrated impacts of rice related policies. The proposal for a follow-up study on the promotion of organic rice farming would:

- Examine the current status of organic rice production and assess the requirements for promoting organic rice production in suitable areas in the major rice production regions. The study would be in collaboration with the MARD Programme for Zoning Development for High Quality Rice for Export, especially in terms of site identification for zoning and for initiating research.
- Identify rice growing techniques and appropriate rice-based farming systems for applying organic rice farming practices. This would be farm-based research with participatory and community-based research on farmer-managed trials. Biological, economic and environmental data would be collected and evaluated. The aim would be to strike the optimal balance between respecting environmental standards; reducing agro-chemical input costs, particularly for poor households; and achieving an optimal rate of return on investments made.
- Establish agreement among stakeholders on environmental standards with respect to water and soil quality, providing a legal basis to reduce the use of agro-chemical inputs. This would be very important to developing and providing a base for assessing the economic value of the negative environmental impacts.
- Expand the use of PRA tools and processes such as the strength, weakness, opportunity and threat (SWOT) analysis that was carried out to determine the major constraints and institutional problems in order to be able to promote "clean"

rice, i.e. to reduce the excessive use of agro-chemicals in agricultural extension.

- Develop farmer-to-farmer demonstration pilots with the formulation of community-based organizations for organic rice production and trade in target areas. This would involve training for extension staff, local stakeholders, farmers and capacity building.
- Generate information and knowledge to support environmental education, build awareness of the impacts of unsustainable rice farming and trade,

and build capacity of the extension systems. This includes detailed assessment of (i) organic rice production; (ii) crop management practices used in organic rice production, to protect the environment and increase farmers' income; (iii) farmer-to-farmer process of promoting organic farming with specific roles undertaken by different stakeholders from planning, organization, inputs, producing, processing, and marketing for agricultural commodity production; and (iv) evaluation of the integrated impacts of the expansion of organic rice production and trade practices.

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