WATER, TRADE AND AGRICULTURAL PRODUCTION
Report for the UN General Assembly in accordance with GA resolution 49/103

January 1997

Agricultural Economics Research Institute (LEI-DLO)
ABSTRACT

WATER, TRADE AND AGRICULTURAL PRODUCTION; REPORT FOR THE UN GENERAL ASSEMBLY IN ACCORDANCE WITH GA RESOLUTION 49/103
Bade, J., F.M. Brouwer and J.F.M. Helming
The Hague, Agricultural Economics Research Institute (LEI-DLO), 1997
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Two years ago the General Assembly of the United Nations (GA) urged the international community in resolution 49/103 to place food and agricultural development high on the development agenda and to mobilize resources at national, bilateral and multilateral levels in support of sustainable productive agriculture and food security in developing countries. The Assembly asks the relevant organizations and bodies of the United Nations system to strengthen their efforts to assist interested developing countries in the formulation and implementation of national water policies and strategies. The GA has asked the Secretary General to submit a report on the above, focussing in particular on the use of freshwater resources, as well as on the effects of the results of the Uruguay Round of multilateral trade negotiations on food production, including agro-industrial products and global food security in developing countries. The present report serves as a basis for this.

The GA recognizes that the availability of fresh water resources is a prerequisite for economic growth and sustainable development in developing countries. Therefore this report starts with a description of the problems of water quantity and quality at a world and regional level in relation to food security. The report elaborates upon the difficulties and promising new directions of water policies and strategies in developing countries.

The resolution also stresses the importance of the Uruguay Round as a basis for a process of trade reform in agriculture, for economic growth and for food security. The second part of the report describes the expected impacts of the Uruguay Round on developing countries through changes in trade, prices and income. Factors behind the changes are described and the implications for national and international agricultural policies are indicated.

Fresh water resources/Uruguay Round/ Food security/ Agricultural development/ Developing countries

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3
PREFACE

This report serves as a basis for a report requested by the General Assembly of the United Nations. It focuses on the use of fresh water resources, as well as on the effects of the results of the Uruguay Round of multilateral trade negotiations on food production, including agro-industrial products and global food security in developing countries.

The assignment was given to LEI-DLO staff members by the Trading Opportunities and Market Access Unit of the International Trade Division of the United Nations Conference on Trade and Development (UNCTAD).

The authors are drs J. Bade, ir. J.F.M. Helming, and dr. F.M. Brouwer. A contribution by the Land and Water Development Division of the Food and Agriculture Organization of the United Nations (FAO) has been incorporated in this report. Furthermore this report is largely based on existing publications, especially by FAO and UNCTAD.

We thank Mr Robert Brinkman, Mr Panos Konandreas, and Mr Jelle Bruinsma of FAO and Mr Harmon C. Thomas of UNCTAD, who all have provided assistance and useful information.

The Hague, January 1997

The director,

L.C. Zachariasse
SUMMARY

Water is a main determinant of life. Although at the national level water supplies seem comfortable this might not be the case at the regional level. Especially the continents of Africa and Asia are showing signs of a worsening in fresh water availability. Besides the problem of water quantity in some regions, the quality of water in general is decreasing in both developed and developing countries. Both water quantity and quality are affected through population growth. A decrease of the population growth would contribute to the water problem and the quantity and quality problem with depletable natural resources in general.

Another very important option to reduce water problems is to improve the overall efficiency of water use. Increase of water use efficiency might be realized among others through education and participation of local farmers in the design of irrigation systems and the use of suitable crops of high potential yield. At the macro-level it is recommended to continue the process of abolishing import duties and other artificial interventions in price setting. This might increase the allocation of resources according to the real comparative advantages of countries.

When annual internal renewable water resources are less than 1,000 m$^3$ per capita, water availability is considered a severe constraint on socio-economic development and environmental protection. More than 230 million people living in some 26 countries, 11 of them in Africa and nine in the near East, already fit into this category. Table 1.3 lists the countries where per capita internal renewable water availability will fall below 1,000 m$^3$ by the end of this decade. Countries with less than 2,000 m$^3$ per capita face a serious marginal water scarcity situation, with major problems occurring in drought years. By the end of the 1990s, water availability is expected to fall below 2,000 m$^3$ per capita in more than 40 countries. Especially the continents of Africa and Asia are showing signs of a worsening in fresh water availability, while water quality is also declining. In contrast, South America is well endowed.

The implementation of national water sector policy requires a comprehensive approach based on an agreed and well established methodology. In this context FAO, together with UNDP and the World Bank, and in collaboration with national governments, has developed a methodology and published guides and frameworks on approaches, processes and practices for water sector policy review at national level. The purpose of the guides is to stimulate countries to undertake national water sector reviews, to elucidate the wide range of water management measures available and their ramifications, including the relationship between the water sector and other parts of the economy, and to promote national policy and legislative reform, planning and institutional development in national water sectors. In this manner the guidelines support and
provide a specific methodology for the implementation of generally-accepted concepts for water policy, as provided for under Agenda 21 and the Dublin Statement (1992) and enunciated in the World Bank Policy Paper 'Water Resources Management', published in 1993.

Improvement of existing water management projects will be the challenge of irrigated agriculture in the future and FAO must be able to respond to the demands of its Member Nations in this major goal. The Water Resources, Development and Management Service of FAO has established a major programme called *water-use efficiency* aimed at responding to this need.

Water-related vector-borne diseases are most likely to be found in areas where irrigation has been introduced. Among them, malaria is by far the most important, both in terms of the number of people annually infected and whose quality of life and working capacity are reduced, and in terms of death. Worldwide, some 2,000 million people live in areas where they are at risk from malaria and the total number of cases is estimated at 100 million per year. Drug treatment has become difficult recently because the parasite has become resistant to certain drugs that have been used for a long time in many parts of the world. Interruption of disease transmission using chemicals for the control of the vector, mosquitoes, has become less effective because some mosquito vector species have become resistant to formerly effective insecticides and some insecticides have been banned for environmental reasons.

Food trade is vital to world food security. Without trade countries would have to rely exclusively on their own production. International trade influences food security in several ways. In the first place, trade allows food consumption to exceed food production in those countries where output is constrained. Resorting to imports generally allows food consumption needs to be met more cheaply than by relying on domestic production alone. While there can be specific reasons for some countries to aim at substantial food self-sufficiency, in general it makes better economic sense to follow a more flexible policy of food self-reliance, provided importers can rely on the world market as a dependable and efficient source of supply and exporters have a good market for their products. A particular concern for importing countries is whether imports will be available when needed and the possible risk of trade embargoes. To some extent the expansion of world cereal trade should allay fears about overall supply but importers continue to be concerned by the use of export restrictions. As regards the role of the world market as a source of earnings, the strong expansion in world trade has been accompanied by declining terms of trade for developing countries' products. In addition, their food import capacity has been frequently constrained by having to make large debt service repayments.

Trade liberalization as reflected in the Uruguay Round is not likely to affect significantly the global availability of food as reduced output in high cost countries will be generally replaced by increased output in other countries. In view of the likely change in the medium term in favour of food commodities' relative prices, countries should revise their agricultural policies and consider passing on some of the increase in world prices to their domestic sectors so as to stimulate food production. The effect of trade liberalization on the stability of world food prices is uncertain. Four factors are at play: the positive effect of
tariffication, the negative effect of declining global food stocks, the positive impact of the greater share of stocks in private hands and the uncertain effect of shifting the location of production. The impact of trade on household food security is part of a wider issue on the impact of economic growth and transformation on welfare and its distribution. Trade provides opportunities for specialization and growth, but the extent to which poor households can take advantage depends on their access to resources and jobs. This depends highly on the institutional environment and on the supportive role of the state.

Looking at trade balances regional differences turn out to be small. Africa sees its deficit decrease as an effect of the Uruguay Round, Latin America and Caribbean, and the Far East see their export surpluses grow, while the developed countries and the Near East see their deficits grow. In all commodities however some countries will gain and others will lose and every commodity has its own particularities. An important overall conclusion by the FAO is that the impact of the Uruguay Round is usually rather small compared with all other changes taking place.

International trade has a major bearing on access to food via its effect on incomes and employment. While more liberal trade policies over time contribute to economic growth, the main issue for food security is whether this economic growth reaches the poor. Some evidence shows that in most developing countries export industries were more labour intensive than import substituting industries and that employment tended to grow in outward-orientated economies. However, the linkages between trade, growth, employment and poverty are not clear-cut since each of these variables is influenced by other factors.

The main source of growth in agricultural exports of developing countries may not come from their traditional export commodities, but increasingly from non-traditional commodities, from processed products and from expansion into new markets. These gains from diversification can materialize in several ways. First geographically, by expanding into new import markets. Secondly horizontally, by increasing the number of commodities exported. Thirdly, by vertical expansion, increasing value added of exports. With respect to vertical integration a reduction of tariff escalation as a result of the Uruguay Round may be important. However, reductions could also have an adverse effect, increasing the relative difference in nominal tariffs between the output and the input commodity. The problem of tariff escalation is that importing countries often put a higher tariff on processed products than on raw materials. Obviously as an incentive to import raw materials rather than processed ones, thus depriving countries that export raw materials of the chance to increase value added on their primary products. The Uruguay Round, while reducing tariff wedges, may increase the share of primary products in agricultural exports.

One of the side-effects of the Uruguay Round will be the erosion of preferential trade margins. The loss of this, most of it to the poorest of the developing countries, has been estimated at US$ 0.8 billion. This loss calls for serious attention by preference giving countries.

There are important differences as regards changes in the trade balance of basic food commodities and in particular how the food import bill would be affected by the Uruguay Round in view of projected price increases. For the
developing countries as a whole their food import bill is projected to be nearly US$ 25 billion higher in the year 2000 than it was in 1988. This is an increase of about 4% annually. About US$ 3.6 billion (15%) of this increase would be due to the Uruguay Round. The food import bill of the low-income food-deficit countries is expected to increase by nearly US$ 10 billion of which 14%, or US$ 1.4 billion, is due to higher prices as an effect of the Uruguay Round.

Provided domestic policies are in place to spread around the gains and/or to compensate the losers, then trade liberalization can play an important role in improving food security even though there can be problems with adjustment to the new trade regime. The difficulties that countries may face during the reform process has been recognized and developing countries have been given special and differential treatment, mainly in the form of longer periods to make adjustments and lower reduction commitments. The Uruguay Round accords also recognize that during the process of reform the least developed and net food importing countries may experience negative effects in terms of the availability of adequate imported supplies of basic foodstuffs on reasonable terms and conditions. Accordingly, great importance is attached to making sure that the Uruguay Round Decision on Measures Concerning the Possible Negative Effects of the Reform Programme on Least-Developed and Net Food-Importing Developing Countries is implemented rapidly. It should be noted that the Uruguay Round may not make much difference to the volume of food aid for while the amount linked to surplus disposal may decline, the quantities linked to assistance under the above mentioned Decision could well increase.

The Uruguay Round has many implications for national and international agricultural policy. Especially developing countries have requested FAO for policy assistance. FAO has organized four regional expert consultations. The World Food Summit will also include these items. Reexamination of agricultural policies are required in the following areas: i) Higher food prices may call for changes in national food security and nutrition enhancement policies, including consumer price policies for food; ii) despite better incentives to producers, most developing countries will need to evolve targeted and decoupled (Green Box) forms of assistance; iii) tariffication, and thus elimination of non-tariff barriers, may lead to greater domestic price instability, which may lead to reconsideration of producer price policies and measures to prevent excessive instability; iv) some countries have to increase domestic food production and productivity to enhance food security in harmony with their comparative advantages; v) the increased transparency after elimination of non-tariff barriers may lead to increased intra-regional or sub-regional trade agreements; vi) export promotion policies to benefit from new market opportunities; vii) further promotion of diversification and primary processing, which requires avoidance of tariff escalation and targeted tariff reduction in areas of potential growth. More technical assistance will be required to achieve these policy targets.
INTRODUCTION

At its forty-ninth session, the General Assembly has urged the international community in resolution 49/103 to place food and agricultural development high on the development agenda and to mobilize resources at the national, bilateral and multilateral levels in support to sustainable productive agriculture and food security in developing countries. It recognizes that freshwater resources are an increasingly scarce commodity in a growing number of countries and that there is a need to increase food production in developing countries, in part through improved irrigation and water resource management. It also stresses the importance of the Uruguay Round as a basis for a process of reform of trade in agriculture, which will have an important impact on the development of food production, agro-industrial products, and international markets for agricultural and tropical products and on global food security. The Assembly asks the relevant organizations and bodies of the United Nations system to strengthen their efforts to assist interested developing countries in the formulation and implementation of national water policies and strategies. And to give special attention to revitalization of economic growth and sustainable development in developing countries inter alia through a more diversified food and agriculture sector.

The General Assembly has asked the Secretary General, in consultation with the relevant organs, organizations and bodies of the United Nations system, to submit a report on the above, focussing in particular on the use of freshwater resources, as well as on the effects of the results of the Uruguay Round of multilateral trade negotiations on food production, including agro-industrial products and global food security in developing countries. The present report serves as a basis for this. It is largely based on existing FAO and UNCTAD reports, which were freely quoted and summarized, as the final version of this report presented to the General Assembly will also be a UN report. A contribution by the FAO on the practical implementation of the resolution was partly incorporated in part 1 and added as an annex.
Part I  FRESH WATER RESOURCES AND AGRICULTURAL PRODUCTION
1. FRESH WATER RESOURCES AND AGRICULTURAL PRODUCTION

1.1 Introduction

Global water supplies are derived from two rather different sources, including surface water and groundwater. Surface water consists of the fresh water in rivers, lakes and reservoirs that collects and flows on the earth's surface. Groundwater, by contrast, collects in porous layers of underground rock known as aquifers. Though some groundwater is renewed by percolation of rain or melted snow, most was accumulated over geologic time and, because of its location, cannot be recharged once it is depleted (Tietenberg, 1992).

The available supply of fresh water (total runoff) on a global scale exceeds about 10 times demand. This looks comfortable, but this aggregated statistic masks the impact of growing demand and the rather unequal distribution of fresh water already resulting in severe excess demand situations in certain parts of the world. The Global Report estimates that by the year 2000, worldwide available water supplies will be only 3.5 times demand because of population growth.

Population growth increases the pressure on the quantity of water, but this is not the only problem. Ceteris paribus, population growth has a negative relationship with the quality of water. Much of the available water is polluted with chemicals, radioactive materials, salt or bacteria, especially on places with high population densities. Contamination of groundwater results from the migration of harmful substances from sites where high concentrations of chemicals can be found. These include industrial waste storage sites, landfills and farms. Many potential contaminants are removed by filtration and adsorption as the water moves slowly through the layers of rock and soil. Toxic organic chemicals are one major example of a pollutant which may not be filtered out during migration. Once these substances enter groundwater, very little, if any, further cleansing takes place. The most important non-point sources of surface water pollution are agricultural activity, urban storm-water runoff, silviculture and individual disposal systems. Contamination from agriculture includes eroded topsoil, pesticides and fertilizers. Urban storm-water runoff contains a number of pollutants, including, typically, high quantities of lead. Forestry, if not carefully done, may contribute to soil erosion and, by removing shade cover, could have a large impact on the temperature of normally shaded streams.
1.2 Availability and distribution of water and land

If global runoff were divided evenly across continents, it could provide each person with 7,690 m$^3$ a year of fresh water (1990 population). But of course, it is not distributed evenly. Some continents are rainier than others, and the variation within continents is even greater (table 1.1). Per capita water utilization ranges widely between continents. The continental averages range from 1,692 m$^3$ per year in North America to 244 m$^3$ per year in Africa.

Table 1.1 Annual water supply and withdrawal for continents and various countries (1990)

<table>
<thead>
<tr>
<th>Continents</th>
<th>Water supply</th>
<th>Water withdrawal</th>
<th>Per capita use/supply ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total (km$^3$)</td>
<td>per km$^2$ (m$^3$)</td>
<td>per capita (m$^3$)</td>
</tr>
<tr>
<td>WORLD</td>
<td>40,673</td>
<td>309,799</td>
<td>7,690</td>
</tr>
<tr>
<td>Africa</td>
<td>4,184</td>
<td>141,154</td>
<td>6,460</td>
</tr>
<tr>
<td>Kenya</td>
<td>15</td>
<td>26,330</td>
<td>590</td>
</tr>
<tr>
<td>Zaire</td>
<td>1,019</td>
<td>449,317</td>
<td>28,310</td>
</tr>
<tr>
<td>North America</td>
<td>6,945</td>
<td>324,882</td>
<td>16,260</td>
</tr>
<tr>
<td>Mexico</td>
<td>357</td>
<td>187,039</td>
<td>4,030</td>
</tr>
<tr>
<td>Canada</td>
<td>2,901</td>
<td>314,609</td>
<td>109,370</td>
</tr>
<tr>
<td>South America</td>
<td>10,377</td>
<td>591,982</td>
<td>34,960</td>
</tr>
<tr>
<td>Peru</td>
<td>40</td>
<td>31,250</td>
<td>1,790</td>
</tr>
<tr>
<td>Brazil</td>
<td>5,190</td>
<td>613,728</td>
<td>34,520</td>
</tr>
<tr>
<td>Asia</td>
<td>10,485</td>
<td>383,893</td>
<td>3,370</td>
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<tr>
<td>China</td>
<td>2,800</td>
<td>300,223</td>
<td>2,470</td>
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<tr>
<td>Indonesia</td>
<td>2,530</td>
<td>1,396,579</td>
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</tr>
<tr>
<td>Europe</td>
<td>2,321</td>
<td>490,746</td>
<td>4,650</td>
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<tr>
<td>Poland</td>
<td>49</td>
<td>160,946</td>
<td>1,290</td>
</tr>
<tr>
<td>Sweden</td>
<td>176</td>
<td>427,579</td>
<td>21,110</td>
</tr>
<tr>
<td>Oceania</td>
<td>2,011</td>
<td>238,639</td>
<td>75,960</td>
</tr>
<tr>
<td>Australia</td>
<td>343</td>
<td>45,025</td>
<td>20,480</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>801</td>
<td>1,768,759</td>
<td>199,700</td>
</tr>
</tbody>
</table>


Worldwide, almost 70% of water consumption is used agriculturally (table 1.2). Agriculture is constantly under pressure from other sectors which have a much higher potential and economic weight and usually end up reducing part of the share of agricultural water use. The pattern of water use can serve as an indicator of development: as wealth increases, the water withdrawal shifts from agriculture to industry and the domestic sector.

In many irrigation systems, water is lost at every stage between the source and the crop. Average losses in irrigation projects suggest that only about 45% of water diverted or extracted for irrigation actually reaches the crop.
Table 1.2 Uses of water for continents and countries (1990)

<table>
<thead>
<tr>
<th>Continents/countries</th>
<th>Domestic (%)</th>
<th>Industry/Power (%)</th>
<th>Agriculture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WORLD</td>
<td>8</td>
<td>23</td>
<td>69</td>
</tr>
<tr>
<td>Africa</td>
<td>7</td>
<td>5</td>
<td>88</td>
</tr>
<tr>
<td>Kenya</td>
<td>27</td>
<td>11</td>
<td>62</td>
</tr>
<tr>
<td>Zaïre</td>
<td>58</td>
<td>25</td>
<td>17</td>
</tr>
<tr>
<td>North America</td>
<td>9</td>
<td>42</td>
<td>49</td>
</tr>
<tr>
<td>Mexico</td>
<td>6</td>
<td>8</td>
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<tr>
<td>Canada</td>
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<td>80</td>
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<td>South America</td>
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<td>Indonesia</td>
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<td>Europe</td>
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<td>Oceania</td>
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<tr>
<td>Australia</td>
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<td>2</td>
<td>33</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>29</td>
<td>22</td>
<td>49</td>
</tr>
</tbody>
</table>


But losses vary widely, varying between 5 and 50%. Sources of losses are field application losses (25%), farm distribution losses (15%) and irrigation system losses (15%) (FAO, 1994).

Most of the water runs off or evaporates before it even reaches the plants. These actual figures characterize agriculture as a low-efficiency water user. In many countries, while scarcity is less of a problem at a national level, overuse of groundwater, contributing to waterlogging and salinity, has become a major problem in specific regions. Notable examples include northern China, western and southern India and parts of Mexico.

1.3 Water resource development and food security

World Food Summit

The FAO Conference, at its 28th Session in October 1995, called for the convening of a World Food Summit (WFS) at the level of Heads of State or Government, in Rome, in November 1996. The Summit subsequently received the unanimous endorsement of the United Nations General Assembly. The objective of the WFS is to renew the commitment of world leaders at the highest level to the eradication of hunger and malnutrition and the achievement of lasting food security for all.
The Summit is intended to provide a forum at the highest political level to address the need for global commitment and action to redress human society's most basic problem - food insecurity. It is expected to lead to the adoption of appropriate policies and strategies at international and national levels, as well as a plan of action for implementation by all parties concerned: governments, international institutions, and all sectors of civil society. Water management is one of the important issues to be discussed at the Summit. Among a number of technical background papers is one entitled 'Food Production: the Critical Role of Water'.

**Problem areas with respect to food security**

When annual internal renewable water resources are less than 1,000 m³ per capita, water availability is considered a severe constraint on socio-economic development and environmental protection. More than 230 million people living in some 26 countries, 11 of them in Africa and nine in the near East, already fall in this category. Table 1.3 lists the countries where per capita internal renewable water availability will fall below 1,000 m³ by the end of this decade. Countries with less than 2,000 m³ per capita face a serious marginal water scarcity situation, with major problems occurring in drought years. By the end of the 1990s, water availability is expected to fall below 2,000 m³ per capita in more than 40 countries. Especially the continents of Africa and Asia are showing signs of a worsening in fresh water availability, while water quality is also declining. In contrast, South America is well endowed.

**Table 1.3 Countries predicted to have scarce water resources in 2000**

<table>
<thead>
<tr>
<th>Country</th>
<th>Population in 2000 (mln)</th>
<th>Water availability</th>
<th>Water availability including river flows from other countries (m³ per capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>internal renewable water resources (m³ per capita)</td>
<td>water resources including river flows from other countries (m³ per capita)</td>
</tr>
<tr>
<td>Egypt</td>
<td>62.4</td>
<td>29</td>
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<tr>
<td>Somalia</td>
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<td>1,086</td>
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</tr>
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a) Countries with smaller populations also included in the water-scarce category: Libyan Arab Jamahiriya, United Arab Emirates, Jordan, Mauritania, Israel, Tunisia, Burundi, Botswana, Oman, Barbados, Cape Verde, Djibouti, Malta, Qatar and Singapore.

Irrigated agriculture, which is much more productive than rainfed agriculture, contributes nearly 40% of world food production on 17% of cultivated land. The intensive agronomic technology which has allowed steady increases in world food production, based on high-yielding varieties coupled with the application of fertilizers and effective means of pest control, is largely dependent on irrigation to secure and control soil moisture in the face of insufficient and unreliable rainfall. But irrigated agriculture is a highly water-intensive activity. It claims nearly 70% of world water abstraction - over 90% in agricultural economies in the arid and semi-arid tropics, but less than 40% in industrial economies in the humid temperate regions.

However, as food needs climb, it is becoming increasingly difficult to supply more water to farmers. Taking into account also industrial and municipal use, water losses and in-stream flow requirements, overall water requirements by 2025 appear to overcommit all accessible run-off by some 5%. The figures underlying this analysis (respectively contribution of irrigation and rainfed agriculture, amount of water required to produce human diet and in-stream flow requirements) may be subject to different interpretation. However, it is clear that human demands are on the way to collision with the ability of the hydrological cycle to supply water. Water is becoming globally scarce. This fundamental resource constraint will have an effect on the cost of food.

A worldwide overview of water supply and projected demand flags specific concern of the regions. Virtually all countries with mainly arid territory, such as in the Near East and North Africa, are already net food importers. Priority in water use in these countries will turn to securing adequate water for cities and a healthy economy in the industry and service sectors, with the aim of earning the income required for food imports. Because of the scarcity value of water, these regions will not be able to harbour water-intensive industries. The agriculture sector in water-scarce arid countries is bound to rely increasingly on wastewater freed by cities, and specialize in producing the crops yielding highest revenue and unsuitable for transportation. Food security in these countries will be closely tied to the solidity of the trading position anchored in a context of regional stability and collective security.

In Asia, the amount of freshwater currently available per person and per year (3,300 m$^3$) is quite close to the amount of water needed to produce the food requirements per person per year (2,000 m$^3$ for a balanced diet with some meat). As population and the diversity of the Asian diet increases and the scope for irrigation expansion and water development narrows, the intersectorial competition increases. Given that 60% of the world population live in Asia, this evolution has the potential of severely stressing global food markets. The economic strength of a number of countries in Asia is widely recognized, but it should not be overlooked that there remain large poverty pockets, in particular in South Asia.

Africa, with the exception of the central Congo-Zaïre basin, is the driest continent (besides Australia) and it suffers from the most unstable rainfall regime. Each year more people are at risk from the effects of inevitable droughts of greater or lesser severity. Moreover, Africa's water resources are relatively less developed than those of other regions. Agricultural productivity per capita
in sub-Saharan Africa has not kept pace with population increase and the region is now in a worse position nutritionally than it was 30 years ago: food production has achieved a growth of about 2.5% per year, while population has risen at the rate of 3% per year. Moreover, Africa's ability to earn from exports in order to buy food has not improved. In the past, additional food in Africa continued to come from increasing the area cultivated, but now good land is becoming scarce and the region will be forced to intensify production systems to increase yields. Water development in its various forms, from water harvesting through to modern piped irrigation, is destined to make a major contribution to transforming the efficiency and security of the African food supply.

As a continent Latin America is well endowed with water, although there are substantial inter-regional differences. Water problems in Latin America are mainly related to low water-use efficiency, resource management, environmental degradation and pollution control.

Increased production to satisfy the food demand of the future must essentially come from intensification, not from expansion of agriculture. Both rainfed and irrigated agriculture will have to intensify, but the intensification potential of irrigated agriculture is much higher. Some authors indicate that 80% of the additional food production will come from irrigated agriculture. Intensified demand for water will stimulate efforts aimed at developing new water and using existing supplies in a more efficient way. Increasing water supply is technically feasible but costly - the most attractive projects have already been executed. The next generation of storage reservoirs and water conveyance infrastructure is believed to cost several times more than the past generation of water development structures, if externalities are taken into account. Various proven methods for rainwater harvesting are available and bear promise in expanding supplies at low cost. Rehabilitation and protection of upper catchments, necessary for many reasons, also yield a more balanced hydrological regime and less sediments trapped in reservoirs.

Existing water supplies can be used more effectively by suppressing unproductive evaporation and preventing water pollution and salinization. A number of measures are available and expected to yield increased food production with unchanged, or even diminished, water available for agriculture. At the level of the river basin, integrated (conjunctive) water management, both structural and non-structural, can reduce water losses to evaporation, pollution and salinization. At the level of the irrigation scheme and the farm, irrigation efficiency, sometimes as low as 30%, can be substantially increased.

**Potential for irrigation**

The irrigation potential of a given country or region is extremely difficult to assess, given the conceptual and technical complexities involved. Available estimates often produce widely different results, but they all suggest that the potential for irrigation expansion is considerable. In 1990 a study of the World Bank/UNDP indicated that there is scope for an increase of over 110 million hectares (59%) in the irrigated area in the developing countries. The largest potential for increase is in Asia (69 million hectares, or 44%), followed by South
America (20 million hectares, or 217%, mainly in Brazil). The largest potential in relation to present levels is in Sub-Saharan Africa (from 3.4 million to 16.5 million hectares, or 470%, mainly in Angola). This increase in sub-Saharan Africa is a response to increased technical and economic opportunity and population pressure. Some countries in sub-Saharan Africa (such as Botswana, Burkina Faso, Kenya, Mali, Mauritania, Niger, Senegal and Somalia) already have population densities and food requirements exceeding the capacity of low-input rainfed farming. These countries also have very little land with growing periods exceeding 180 days. For these countries, irrigation is likely to be an indispensable part of the overall strategy for increasing food production.

The benefits of exploiting such irrigation potentials are considerable. According to the World/UNDP study, exploiting the developing countries 110 million hectares, total potential could theoretically produce an additional 300-400 million tons of grain—enough to provide the basic diet for 1,500 million to 2,000 million people. However, this would require investments estimated at US$500 - 1,000 thousand million (FAO, 1995). Besides high investments costs, a point of concern with irrigation projects is the experience of a gap between theoretical estimates and actual figures. However, there are arguments why returns to public (and private) irrigation investments might improve in the future. First, as mentioned above with respect to especially sub-Saharan Africa, population growth and increase in demand for food might increase the price of food. This might lead to an increase in the rate of return to irrigation projects. Second, sunk costs in irrigation already made. Incremental investment in modernization, completion, extension and rehabilitation will benefit from these sunk costs and yield high rates of return. Third, economic liberalization and macro-economic reform may favour the agricultural sector. In the past irrigation projects were completed when domestic terms of trade were stacked against agriculture with overvalued exchange rates and a variety of indirect taxes or subsidies to competing urban interests. As these practices changes in favour of agriculture, an improvement should be seen in rates of return to rural investment in general and to irrigation investment in particular. Fourth, advances in complementary investments. A precondition of these investments is an assured supply of soil moisture. Progress in engineering (such as drilling techniques, use of cheap and light plastic, and advances in management of construction) should lower capital costs of water development (FAO, 1995).

Requirements and prospectives of expanding sustainable irrigation

In arid and semi-arid countries, irrigation is often the only option for achieving major increases in food and fibre production. In sub-humid and many humid areas, irrigation is essential for the multiple cropping necessary to compensate for high population densities or has a valuable role to play in counteracting rainfall variability (FAO, 1990).

During the past four decades, development of irrigated agriculture provided a major part of the increase in production necessary to meet population demands. By the mid-1980s, 36% of the total crop production came from less than 15% of the arable land which was irrigated. On a global basis, the aver-
Age rate of expansion of irrigated land was about 1% per year in the early 1960s and reached a maximum of 2.3% per year from 1972 to 1975. The rate of expansion began to decrease in the mid 1970s and is now less than 1% per year (Figure 1.1 and 1.2).

The implementation of national water sector policy was a common cause of this decrease was the high cost of irrigation development. Construction costs have risen steadily and the world price for major cereals has fallen sharply; for example, the price for rice fell by about 40% in real terms between 1965 and 1985.

Currently the overall performance of many irrigation projects is much lower than was expected. Inadequate operation and maintenance and inefficient management of an increasingly scarce water resource contribute to many socio-economic and environmental problems. Of major concern is the rapid rise in groundwater leading to waterlogging, depressed crop yields and soil salinity. It is not unusual to find that 60% of the water diverted or pumped for irrigation is not made available for crop use. The estimated gross area of irrigated land globally is 270 million hectares. The gross irrigated area includes the land commandable and equipped to be irrigated and cropped, fallow and land temporarily not irrigated due to rehabilitation of irrigation systems and reclamation from waterlogging and salinity. About 20/30 million hectares are severely
affected by salinity and an additional 60-80 million hectares are affected to some extent. The principal techniques for controlling waterlogging and salinity are well-established and will be discussed section 1.6.

Sustained production on both irrigated and rainfed lands requires optimal use of the physical environment in each soil-crop-climate ecosystem. In rainfed areas of primary importance are water conservation measures such as fallow management including crop residue management, control of runoff and water harvesting. Integrated with these practices are selection of development of high-yielding, drought-tolerant varieties, efficient use of herbicides and fertilizers, crop rotation and optimal planting dates to maximize the probability of rainfall during critical periods of crop growth. The synergistic effects of such practices are complex when integrated through rainfed farming systems, yet are even more pronounced under irrigation. Under irrigated agriculture, additional effects may arise because of continuous monocropping. In rice production areas, for example, drainage may be required to remove toxic substances that accumulate in the soil after several consecutive crops of rice.
1.4 Water policies and strategies in developing countries

A growing need for effective and timely measures to address urgent water problems often directly or indirectly related to agricultural water uses, such as water scarcity and environmental degradation, has increased the demands for improved decision making, clear water policies and adequate legal and institutional frameworks at the national level. Many countries, however, while facing looming water problems, are not giving sufficient attention to or do not have the necessary capacity to take management measures and develop national water sector policies and the institutions to implement them.

The initiative and the ultimate responsibility for reviewing, formulating and implementing water policies rest with the national authorities. Individual countries faced with different climates, levels of water availability, economic structures, population pressures and cultural, political and administrative systems need to establish politically acceptable water policies to address country-specific priority issues. With a significant portion of the world’s water resources being shared between two or more countries, clear and harmonized national water policies also form an important base for inter-country dialogues on cooperation and development of transboundary waters.

The implementation of national water sector policy requires a comprehensive approach based on an agreed and well established methodology. In this context FAO, together with UNDP and the World Bank, and in collaboration with national governments, has developed a methodology and published guides and frameworks on approaches, processes and practices for water sector policy review at national level. The purpose of the guides is to stimulate countries to undertake national water sector reviews, to elucidate the wide range of water management measures available and their ramifications, including the relationship between the water sector and other parts of the economy, and to promote national policy and legislative reform, planning and institutional development in national water sectors. In this manner the guidelines support and provide a specific methodology for the implementation of generally-accepted concepts for water policy, as provided for under Agenda 21 and the Dublin Statement (1992) and enunciated in the World Bank Policy Paper ‘Water Resources Management’, published in 1993.

The water policy guides have been disseminated to national governments and water administrations and international agencies. As a result an increasing number of developing countries have initiated the process of review and reform of water sector policies, and support and technical assistance to national water sector policy reform has increasingly been adopted by donors as priority areas.

National water sector policy reviews, as part of a nation’s policy making, involve sensitive issues and political position. It is therefore important that the assistance is seen as a capacity-building process, that it is non-prescriptive, and that it leads to policies that can be developed and implemented based on political realities and dominantly national participation. It is therefore equally important that the policy measures are carefully selected to adapt to country-specific situations, including general government administration policy and
economic development and environmental policy, and that the process involves and secures the commitment of national decision-makers, including the legislative branches of Government. For the same reason it is in general not effective to introduce individual policy elements such as legislation or water pricing but to adopt a comprehensive approach with a balanced mix of policy measures in different fields including water management, macro- and sectorial policy and legal and institutional frameworks.

**Improvement of existing water management projects**

Improvement of existing water management projects will be the challenge of irrigated agriculture in the future and FAO must be able to respond to the demands of its Member Nations in this major goal. The Water Resources, Development, and Management Service of FAO has established a major programme called *water-use efficiency* aimed at responding to this need.

Irrigation efficiency is influenced by many factors (technical, social, economic, institutional and others), and no isolated approach is likely to succeed in solving the problems if they are not treated in an integrated manner. On the other hand, financial and human resources restrictions impose the need to concentrate actions in order to have a sizeable and durable impact. Hence the programme of water-use efficiency focuses in the following four areas where FAO has a comparative advantage arising from previous experience and accumulated expertise:

- improvement of on-farm water management;
- improvement of irrigation scheme management;
- assessment and dissemination of intermediate water development techniques;
- support to member nations.

In response to severe water shortages, Mexico for example introduced a series of reforms intended to cut per capita water use. Educating people about how to save water, setting high efficiency standards for domestic appliances and charging realistic water rates are the main mechanisms involved. These reforms were mirrored by federal legislation which establishes water as an economic commodity rather than a free good. The irrigation network was reorganized with users being encouraged to operate, maintain and finance the large irrigation districts.

At the macro-level governments find it increasingly hard to finance existing water policies. Therefore many developing countries are implementing fundamental changes in macroeconomic and sectoral policies. Typical adjustment programmes call for a greater reliance on markets, more open trade, fiscal austerity and a phasing out of producer and consumer subsidies (input and product markets). Budget-reducing measures imply increased competition between and within sectors for funding new water projects. The direct implications for water managers include fewer capital investments in new water projects, the elimination of irrigation subsidies, increased efforts to recover its cost and more emphasis on demand management to improve the efficiency of existing supplies.
1.5 Technical progress in water resource management

Modern irrigation designs, methods and techniques

In many irrigation systems, water is lost at every stage between the source and the crop. In large parts of the world the overall efficiency equals about 40%. This wastage can be reduced by improving the technology and the water management practices. Waste reduction is an indispensable tool for increased food production. Many existing irrigation systems were designed 50 to 80 years ago and are still using the same technology. New opportunities emerge from electronic applications. Modern communication and water control technology support a service-oriented mode of operation as opposed to supply-oriented mode. These technologies respond to farmers' demand for more flexible irrigation services, enabling increased crop diversification and market-oriented production. The distinctive feature of modern systems is the service concept. Water is provided as a service that should be as convenient and flexible as possible to users, who in turn cover the cost of the service desired. There are many ways of modernization. Four directions of irrigation systems improvement have the greatest potential for convenient services and environmentally and economically sustainable operation (FAO, 1995):

- structural improvements of main systems through the use of new equipment and material (low pressure pipes, geotextiles, etcetera);
- modern water control technology (local and central control of flow and water levels, decision support systems);
- integrated water-use systems (conjunctive use, artificial recharge);
- decentralized schemes with optimized distribution and application systems (low-lift pump schemes, small-scale irrigation).

What is generally needed is education and training of extension staff and farm managers to transfer experience and technology among scientists, technicians and farmers, monitoring and evaluation of irrigation project performance and groundwater and long-term strategies and planning for management of scarce water resources and refinement in short-term policies.

Small-scale water programmes

During recent decades, large irrigation projects have been given high priority while small-scale water programmes for agriculture, like water harvesting and small-scale irrigation, have received inadequate attention. Small-scale water programmes have considerable potential to meet agricultural and domestic water needs and to enhance land and water conservation. They can fulfill many local water needs within the context of sustainable agricultural development. The purpose of such programmes includes development of small-scale irrigation, water supply for humans and livestock, improved infiltration to groundwater, soil conservation, flood spreading and flood control.

In most parts of the world, women are the main producers in rainfed agriculture. The techniques mentioned above have particular implications for them. They may require women to take on roles traditionally reserved for men. They may also involve additional time, financial resources, technical and literacy
skills and organizational capacities. Women need to be involved in these activities and to have access to inputs, otherwise the technical solutions to the water problem may not prove viable.

**Water harvesting**

Because large capital investments are not necessary, water harvesting is an important element of small scale water programmes. Water harvesting can be used to make better use of the rainfall that does occur, especially in developing countries. This involves catching water over a large area without crops and spreading it over the land to be cropped. In very dry areas, such as the Negev desert, the catchment area can be very large: sometimes 250 ha of catchment are used to provide water for just 1 ha of crops. Variations on this theme have been used to increase the productivity of rainfed crops on every continent. Water harvesting techniques range from placing lines of stones along the contour lines on fields to hold back run-off, to much more sophisticated and expensive techniques. Water harvesting techniques have two advantages to the farmer: they increase agricultural productivity and reduce soil erosion, which is caused mainly by unchecked runoff. The potential for water harvesting is particularly great in Africa, where relatively little land is irrigated and where production depends primarily on rainfed agriculture. It has been estimated that in the semi-arid and dry subhumid areas of Africa water harvesting could increase production on 10 million hectares in the short term and on 50 million hectares in the long term.

**Modern, small-scale irrigation**

The advent of cheap, dependable motors and pumps and the increasing availability of fuel or electric power has revolutionized irrigation. Small pump schemes, individual or communal, have begun to play a very important role in augmenting food production. They are widely used as a means to supplement irregular canal water supply, particular in the river deltas of Asia but increasingly also in Africa. Pump schemes are easy to install and simple to operate. Experience has shown that pump schemes with a small number of farmers having small land holdings are more productive in terms of yield per hectare and more efficient in terms of water use than are large gravity schemes. Also, exposure to water-borne diseases (e.g., bilharzia) is reduced if water is distributed through pipes.

**Improving access to water resources; utilization of shallow aquifers**

The term 'shallow aquifer' refers to groundwater bodies in which water is accessible using indigenous methods of well construction and low cost techniques such as washbores, hand drilled wells and well points. Water for irrigation is abstracted through centrifugal pumps located at ground level or in a nearby pit, so that the pump is not more than 5 metres above the water level. The advantages of shallow aquifers for small-scale irrigation are numerous:

- easy access to the resource thanks to low capital costs, which facilitate private investment by individuals or small groups of farmers;
- no need to convey water over long distances;
full reliance on nature to renew, store and convey water with only limited intervention;
- widespread availability, even in semi-arid areas, mostly in the alluvial deposits of valleys but also in fractured rocks. Annual rain and floods contribute to the recharge of the aquifer and this recharge may often be increased artificially by creating small structures allowing water to infiltrate.

Information on the extent and yield of shallow aquifers is insufficient. A difficult problem is the management of shallow aquifers to avoid overdraft and equal access.

1.6 Mitigating environmental effects

Much agricultural land is deteriorating due to inappropriate soil and water management. Soil erosion, nutrient depletion, salinization and waterlogging all reduce productivity and jeopardize long-term sustainability. Fortunately, understanding of the causes of these negative effects has greatly increased and in almost all circumstances corrective measures are possible.

Water-related vector-borne diseases

Water-related vector-borne diseases are most likely to be found in areas where irrigation has been introduced. Among them, malaria is by far the most important, both in terms of the number of people annually infected and whose quality of life and working capacity are reduced, and in terms of death. Worldwide, some 2,000 million people live in areas where they are at risk from malaria and the total number of cases is estimated at 100 million per year. Drug treatment has become difficult recently because the parasite has become resistant to certain drugs that have been used for a long time in many parts of the world. Interruption of disease transmission using chemicals for the control of the vector, mosquitoes, has become less effective because some mosquito vector species have become resistant to formerly effective insecticides and some insecticides have been banned for environmental reasons.

The risk that bilharzia or malaria is introduced or has an increased impact is most likely in irrigation schemes where (FAO, 1995):
- soil drainage is poor;
- rice or sugar cane is cultivated;
- night storage reservoirs are constructed;
- borrow pits are left with stagnant water;
- canals are unlined and have unchecked vegetation growth;
- there is settlement of new immigrants who lack immunity or bring in new sources of infection.

Implementation of these measures of environmental management for vector control have been successful in a number of projects in Japan, China and Zimbabwe (FAO, 1995). In China, the introduction of intermittent irrigation in
rice cultivation, as opposed to continuous flooding reduced the larval mosquito population by 85%, decreased irrigation water demand by 50% and increased yield by 12%.

**Waterlogging and salinization**

The United Nations Environment Programme (UNEP) reported that the rate of loss of irrigated land from waterlogging and salinity is 1.5 million hectares per year. Millions of hectares of irrigated land suffer from this progressive conditions. Salinity-affected areas as a percentage of total irrigated area is estimated to be 10% in Mexico, 11% in India, 21% in Pakistan, 23% in China and 28% in the United States.

Salinity is caused by a combination of poor drainage and high evaporation rates which concentrate salts on irrigated land; it mainly occurs in arid and semi-arid regions. Even good-quality irrigation water contains some dissolved salt and can leave behind tonnes of salt per hectare each year. Unless this salt is washed down below the root level, soil salinity will result.

A related concern is the rapid rise in groundwater levels, leading to waterlogging and depressed crop yields. Waterlogging occurs when excessive water is used in systems with finite natural drainage capacities. Seepage occurs if: soils are very light; canals and watercourses are not lined or maintained; farmers near the head of a system withdraw or apply excessive amounts of water; fields are not levelled; and/or the delivery system cannot respond to rainfall by closing inflows. If seepage and horizontal recharge exceed evaporation and natural drainage, then groundwater levels rise, eventually causing waterlogging. If upward movement of water and evaporation exceed downward percolation and where the groundwater, soil or irrigation water contains some salt, the buildup of salt in the soil surface layers will eventually reach toxic levels.

1.7 Conclusion and recommendation

Population growth, migration and urbanization will continue to have a significant impact on all aspects of development. These changes will lead to improved infrastructure and marketing systems reaching out to underdeveloped rural areas. Enlarged and more reliable local food production, generated close to where it is consumed, is more than an insurance against the risk of rising prices. An increasingly efficient agriculture contributes to overall development. Ways must be found to overcome the evident opportunity costs and hardship generated by a growing gap between food needs and local production.

The world is currently undergoing an era of rapid change. Irrigation requires a fair macro-economic environment and there has been considerable progress in this regard. Water policy that led to past misallocation and wastage is reviewed and its implementation supported by an enabling environment, with adequate and properly enforced law. The importance of including the intended beneficiaries in the design and implementation of new projects is now recognized, as is the need for realistic, uncomplicated project designs. The
institutional capacity of governments, non-governmental organizations (NGOs) and the private sector to work together is rapidly improving. A wide array of water development technologies is now available but private and public investment funds are needed for their implementation. The major challenge, however, is building capacity at all levels to achieve the efficient, highly productive management of water needed to secure sustainable, sufficient and low-priced food for the projected population.

The importance of conservation, sustainable use and integrated management of water resources needs no emphasis in the light of increasing competition for a finite and limited supply of freshwater. The Dublin Statement (International Conference on Environment and Development) stressed the need for a holistic approach to effective management of freshwater resources including the protection of natural ecosystems. The central theme of Chapter 18 of Agenda 21, 'Protection of the Quality and Supply of Freshwater Resources', is the application of integrated approaches for conservation and sustainable use of freshwater. A number of agencies within the UN-system have accorded high priority, in their regular programme and in field projects, to integrated management of water resources including conservation and sustainable use.

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APPENDIX  Coordination of UN activities on water resources management

The overall objective of FAO's International Action Programme on Water and Sustainable Agricultural Development (IAP-WASAD) is to assist the Member Nations to adopt an integrated approach to water resources management in order to achieve the goals of food security, sustainable agriculture and rural development. The programme focuses on integrated rural water management, which is the management of water resources to meet the total water needs of the rural populations including agricultural production (irrigation, livestock production and aquaculture), agro-industries and drinking and sanitation in an integrated manner so as to improve water-use efficiency, conserve water resources and protect water quality.

National Action Programmes on Water and Sustainable Agricultural Development (NAP-WASAD) have been formulated in a number of countries, i.e., China, Egypt, Indonesia, Mexico, Tanzania, Syria and Zimbabwe and for Lake Chad. In the participating countries, NAPs have catalyzed the governments to review and revise national water policies, initiate action to prepare irrigation masterplans, implement pilot schemes on reuse of wastewater and undertake other similar follow-up actions.

One of the important activities within the UN system to promote integrated management of water resources was the World Bank's initiative to develop a comprehensive approach to water resources management. The core of the World Bank's initiative is the adoption of a comprehensive policy framework and the treatment of water as an economic good, combined with decentralized management and delivery structures, greater reliance on pricing and fuller participation by stakeholders. This has now been adopted by the Bank as an operational directive. This implies that the Bank will encourage and, when requested, selectively help countries develop and implement national policies, strategies and programmes for managing water resources in a comprehensive manner.

The World Bank has recently launched yet another initiative on integrated management of water resources in the sub-Saharan region. The key objective of the initiative is poverty reduction through sustainable management of water resources. Programme elements include household water security, food security and water, water quality and human health, environmental stewardship and regional cooperation.

The UN Department for Development Support and Management Services (DDSMS) is designated the lead agency within the UN system to assist Member Nations to implement the integrated water resources management component of Agenda 21. DDSMS is promoting the development of an interactive approach to policy formulation and resource planning, paying particular attention to the experiences gained in the various water-related projects throughout the world. This innovative approach is currently being tested through ongoing technical cooperation activities in many developing countries such as Bolivia, Central African Republic, India, Jordan, Morocco, Nepal, Niger, Peru, Senegal and Yemen. Through water sector assessments, diagnostic studies, and national and water basin programmes related to water resources planning and management, an integrated approach is applied to water use and equitable allocation of water among users.

WHO, in collaboration with UNEP, has promoted the protection of water quality in the context of human health and conservation of aquatic ecosystems. The development and application of drinking water quality guidelines, surveillance of drinking water quality and eradication of water-borne diseases have been given high priority.
Considerable progress has been made in the establishment of water quality monitoring programmes worldwide. International river basins such as the Danube, the Mekong, the Parana-Plata and the Nile are now covered by multilaterally-agreed monitoring networks.

The emphasis of FAO’s programmes relating to water conservation and water quality protection is strongly related to food production and food security. FAO has produced guidelines and provided assistance for pilot-scale projects on water harvesting and soil moisture conservation in order to conserve rainfall and increase the soil moisture availability for crops. In the area of water quality protection the Organization has promoted the adoption of agricultural practices which would minimize non-point source pollution. Safe use of treated municipal wastewater and saline drainage waters is promoted as a means to control water pollution and augment water supplies for agriculture.

The activities of IIMI, a CGIAR institution with the mandate to foster sustainable irrigated agriculture in developing countries are relevant in the context of efforts by international organizations outside the UN system to promote conservation and sustainable use of water for food production. IIMI has a strong programme on institution building which consists of strengthening national research capacity and human resources development for improved irrigation management.

The aim of ICID, the largest international and scientific NGO in irrigation and drainage, is to stimulate and promote irrigation and development worldwide in a sustainable manner. It has established national committees in more than 80 countries and, through its regular meetings and special seminars, has played a major role in the exchange of experiences and technical information on sustainable use and conservation of water in food production.

At the inter-agency level, there are a number of coordination mechanisms which address UN system activities related to freshwater resources, particularly integrated water resources management. Some important inter-agency mechanisms are presented below:

1. **The ACC-Subcommittee on Water Resources**
   It has overall responsibility for coordination of water resources activities of the UN system and, in particular, for follow-up of the Mar de la Plata Action Plan, the Dublin Water Conference, and acts as the Task Manager for Chapter 18 of Agenda 21. The ACC-SWR reports to the Inter-Agency Committee on Sustainable Development, which in turn reports to the ACC.

2. **The Global Water Partnership**
   The Partnership focuses on coordinated and integrated approaches to sustainable water resources management, consistent with the principles of the Dublin and Rio Conferences, in the development of catalytic activities.

3. **The UN Agency Informal Working Group on Water in the Special UN System Initiative for Africa**
   This body, co-chaired by the World Bank and UNEP, was established in April 1996. It coordinates activities outlined in the Water Cluster of the Special Initiative. These same activities form part of the implementation of Chapter 18 of Agenda 21 (but in a specific regional setting) and of the regular and field programmes of UN system organizations.
4. Panel of Experts on Environmental Management for Vector Control

The Panel is a joint activity of WHO, FAO, UNEP and UNCHS in the area of prevention and control of water-borne and associated diseases in agricultural water development activities.

UNDP has developed a sustainable agriculture networking and extension, called SANE for short. The primary goal of the SANE programme is to enhance capacity building and human resource development in the area of sustainable agriculture through agro-ecological training, participatory research, policy advocacy and information networking among non-governmental organizations and other national/international organizations in Africa, Asia and Latin America.

UNDP is also in the process of developing a food security strategy for handling food security issues in its programmes. Food security is an important area of work which cuts across all aspects of sustainable human development upon which UNDP places priority (poverty alleviation, sustainable livelihoods, gender issues and environment).

UNDP's Office to Combat Desertification and Drought (UNSO) has developed a Global programme to facilitate/transfer of knowledge, experiences, techniques and technologies on Sustainable water management in the drylands with focus on Africa in partnership with IDRC, Centre for Development Cooperation Services of the Free University of Amsterdam, Natural Heritage Institute (USA) and ENDA-Senegal.
Part 2 THE URUGUAY ROUND AGREEMENT ON AGRICULTURE AND WORLD FOOD PRODUCTION AND FOOD SECURITY
2. THE URUGUAY ROUND AGREEMENT ON AGRICULTURE AND WORLD FOOD PRODUCTION AND FOOD SECURITY

2.1 Introduction

After many years of negotiations the Uruguay Round Multilateral Trade Negotiations were concluded and the Final Act was signed at Marrakesh in April 1994. For the first time agriculture, comprising around 10% of world trade in merchandise in value terms, was included in the agreement.

The Uruguay Round Agreement fits in a trend of globalization of markets, driven by improved communication and information systems, improved transport, both cost and time-wise, and partly by policy reforms. Following the success of export-led growth in many East-Asian countries, many transition economies and developing countries have been adopting market-oriented trade policies. The forming of regional trade groupings has also added to this process. Government interventions, especially in agricultural markets have been and still are extensive. Liberalization could therefore have profound effects and cause major shifts in production patterns, prices and the structure of world trade.

This part of the paper will focus on the implications of the process of reform of trade in agriculture initiated by the Uruguay Round Agreement on Agriculture for the development of global food production, agro-industrial products and international markets for agricultural and tropical products, and for global food security. The most important question to be answered in this respect is whether the reforms will lead to a more food-secure or insecure world. This part will also examine how a more open agricultural trading system will stimulate food production and productivity in developing countries and identify how these countries could be assisted to transform their policies as well as be provided with technical assistance. The latter is done in the light of the decision on measures concerning negative effects of the reform programme on least developed and net food-importing developing countries.

After a very brief overview of the contents and implications of the agreement on agriculture (2.2), the likely effects on global production and trade of food and agricultural products (2.3), agro-industry and international markets for agricultural and tropical products (2.4), and on global food security (2.5) will be discussed. The effects of the agreement on income and food import bills of developing countries will be assessed (2.6) and needs of assistance will be identified (2.7).
2.2 The Agreement on Agriculture

The implementation of the Agreement on agriculture officially started in 1995. Figure 2.1 presents an overview of the agreement, making a clear distinction between developed and developing countries. Developed countries will complete all reduction commitments within six years, whereas developing countries have ten years. The least-developed countries are not required to make any reductions. Commodities included are all agricultural products, thus excluding fishery and forest products, except rubber, jute, sisal, abaca and coir, which fall under normal GATT tariff negotiations on goods. The agreements aims at liberalization of trade, by improving market access, reduction of domestic support and reduction of export subsidies. Though there are some complaints that the agreement does not go far enough, the implementation will be a major effort. Especially the abolishment of non-tariff barriers (tariffication), the reductions of tariffs, subsidies and support, and the fact that nearly all tariffs will be bound is an enormous achievement.

Developing countries have been given special and differential treatment. Purchases and sales from food security stocks is allowed at administered prices, provided that the subsidy to producers is included in the total Aggregate Measure of Support (AMS). Also untargeted subsidized food distribution, investment subsidies and input subsidies are excluded from the agreement. Developing countries are allowed ceiling bindings instead of tariffication. And most importantly, Least Developed Countries are not required to make any reductions.

As to the effects of the Agreement, aggregate domestic support will be reduced from US$ 198 billion to US$ 162 billion and export subsidies will be cut from US$ 21.3 billion to US$ 13.8 billion. The major part of these reductions (about 90%) will take place in developed countries. Simply because these countries have the highest levels of support. The regular monitoring of agricultural support by the OECD showed that support, measured as the percentage of Producer Subsidy Equivalent, increased from 30% in 1979-81 to 44% of the value of production in 1990-92.

Developing countries have quite a number of ways to take away the hardship where they have made commitments (Finger (1995) and Greenfield et al. (1996)). However, often the commitments they have made under Structural Adjustment Programmes are further-reaching than the Uruguay Round commitments. The Least-Developed countries do not have to make any reductions. However, the effect of the liberalization by other countries is something they cannot escape.

There is reason to believe that the major effects of the liberalization will be higher prices and an allocation shift in production. Also, a reduction in export subsidies will raise the prices paid by importers. Another effect of the agreement will be that surplus stocks will decrease as subsidies are reduced. This could limit the volume of food aid. In order to mitigate the effect to least developed and net food-importing developing countries, measures will be taken, such as additional food aid, technical assistance to raise agricultural productivity and short term assistance to finance commercial food imports.
<table>
<thead>
<tr>
<th>Policy</th>
<th>Developed countries</th>
<th>Developing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market access</strong></td>
<td>Prohibition of import restrictions other than tariffs; All tariffs bound; Special safeguard provisions against import surges or persistent import price decline (limited to ‘tariffed’ products and not applicable to imports under related tariff quota commitments); Tariffs resulting from conversion of non-tariff border measures under negotiating modalities plus pre-existing tariffs on all other agricultural products to be reduced; Implementation of current and minimum access opportunity commitments in respect of tariffed products</td>
<td>Average tariff reduction of 36% (minimum 15%) over 6 years</td>
</tr>
<tr>
<td><strong>Export subsidies</strong></td>
<td>Export subsidies subject to reduction are defined. Provisions for prevention of circumvention of commitments, including disciplines on the use of export credit and credit guarantees as well as food aid; Prohibition of the use of export subsidies on products not subject to reduction commitments</td>
<td>Average tariff reduction of 24% (minimum 10%) over 10 years; Where ceiling binding commitments are undertaken, reductions are not required except on ad hoc basis; Least developed countries are not required to undertake reductions</td>
</tr>
<tr>
<td><strong>Export prohibitions and restrictions</strong></td>
<td>Foodstuffs: requirement for advance notice and obligation to consult on request and provide information</td>
<td>Two-thirds of the reduction required for developing countries over ten years; certain marketing and transport subsidies allowed during implementation period</td>
</tr>
<tr>
<td><strong>Domestic support</strong></td>
<td>Two groups: i) permitted policies (green Box), such as general services to agriculture, food security stocks, and domestic food aid; ii) other policies included in the Aggregate Measure of Support (AMS) are subject to reduction commitments; Decoupled direct payments associated with production limiting programmes that are not in Green Box but excluded from AMS.</td>
<td>De Minimis provision allows exclusion from AMS if support is less than 5% of output value; Total AMS support to be reduced by 20% over 6 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Policies such as investment and input subsidies allowed under certain conditions; De Minimis provision allows exclusion from AMS if support is less than 10% of output value; Total AMS support to be reduced by 13.3% over 10 years</td>
</tr>
<tr>
<td><strong>Sanitary and phytosanitary measures</strong></td>
<td>Reaffirms the right to countries to set their own health and safety standards provided they are justifiable on scientific grounds and do not result in unjustified or unnecessary barriers to trade; International standards are encouraged</td>
<td></td>
</tr>
<tr>
<td><strong>Other aspects</strong></td>
<td>The Marrakesh Ministerial Decision on Measures Concerning the Possible Negative Effects of Reform Programme on Least-Developed and Net Food-Importing Developing Countries</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 2.1 Summary of the main provisions of the Uruguay Round Agreement on Agriculture Source: FAO (1996).*
2.3 Effect on global production and trade of food and agricultural products

It has been illustrated by a number of studies that attempts to quantify the impact of the Uruguay Round have yielded results that vary and may not always be compatible. The complexity of the reform package, the options for implementation and the uncertainty about the timing of the implementation makes it very difficult to assess the effects. Some studies have concentrated on the implementation and interpretation of the Agreement (Tangermann, 1995) and Hathaway and Ingco, 1995). The general view presented by these studies is that if countries want to escape the commitments there is ample room for them to do so. The largest impact of the Uruguay Round is expected to come from the reduction of export subsidies. But even here it is more likely that budget constraint are the real driving force behind the reduction rather than a commitment to liberalizing world trade.

Nevertheless, the various attempts have given some robust results that are worth mentioning and that can serve as a basis for policy adjustment. First, world prices for agricultural commodities, especially temperate zone products, will increase, albeit unclear how much. Secondly, the volume of trade will not rise significantly by the Uruguay Round. Thirdly, there will be shifts in production from subsidized production to competitive production, from which developing countries can benefit. Fourthly, the gains will initially be concentrated in those countries that have the capacity to respond and have a tradition of outward looking policies. Finally, when taking all effects into account, including those on imports, and loss of preferences, the net trade gains in the agricultural sector of some of the economically weaker developing countries are likely to be very small or even negative.

The impact of the Uruguay Round on selected agricultural commodities and for different regions has been analysed by the FAO, using the World Food Model (FAO (1995)). Table 2.1 presents an overview of the impact on prices, production and consumption in the year 2000. It presents the differences between the Uruguay Round simulation for the year 2000 and the baseline scenario for the year 2000. The outcome of this study is that the impact of the Uruguay Round on world agricultural production is negligible. Aggregate output for agricultural commodities is projected to grow at 1.6 % per annum from 1988 to 2000 in the baseline scenario and that growth rate remains the same under the Uruguay Round scenario. This result is not very surprising if one realizes that only a small part of production is traded. The overall growth of production is projected to decrease slightly. Decreases in growth rates are greatest for products with a lot of domestic support, such as rice, meat, other than bovine, dairy products, coffee, and cocoa. By contrast increases in growth rates are expected for tea and bananas. Also in absolute terms the changes in production in the year 2000 due to the Uruguay Round are generally small, exceeding 3 million tons only in the case of coarse grains.
Table 2.1  Impact of the Uruguay Round on prices (percentage), production and consumption (thousand tonnes) in the year 2000 as compared to the situation without the Uruguay Round

<table>
<thead>
<tr>
<th>Commodities</th>
<th>Prices</th>
<th>Global</th>
<th>Developing countries</th>
<th>Developed countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>production</td>
<td>consumption</td>
<td>production</td>
</tr>
<tr>
<td>Wheat</td>
<td>7</td>
<td>-1,538</td>
<td>1,781</td>
<td>5,143</td>
</tr>
<tr>
<td>Rice</td>
<td>7</td>
<td>-638</td>
<td>613</td>
<td>1,657</td>
</tr>
<tr>
<td>Coarse Grains</td>
<td>5</td>
<td>3,423</td>
<td>1,928</td>
<td>804</td>
</tr>
<tr>
<td>Fats and oils</td>
<td>4</td>
<td>1,067</td>
<td>1,038</td>
<td>1,010</td>
</tr>
<tr>
<td>Oilmeal</td>
<td>-</td>
<td>516</td>
<td>500</td>
<td>565</td>
</tr>
<tr>
<td>Bovine meat</td>
<td>8</td>
<td>164</td>
<td>167</td>
<td>249</td>
</tr>
<tr>
<td>Pig meat</td>
<td>10</td>
<td>-1,567</td>
<td>-1,484</td>
<td>-739</td>
</tr>
<tr>
<td>Ovine meat</td>
<td>10</td>
<td>-36</td>
<td>-36</td>
<td>-25</td>
</tr>
<tr>
<td>Poultry meat</td>
<td>8</td>
<td>-36</td>
<td>-37</td>
<td>-8</td>
</tr>
<tr>
<td>Milk</td>
<td>7</td>
<td>371</td>
<td>413</td>
<td>439</td>
</tr>
<tr>
<td>Butter</td>
<td>7</td>
<td>-73</td>
<td>11</td>
<td>-103</td>
</tr>
<tr>
<td>Coffee, cocoa, tea</td>
<td>-</td>
<td>155</td>
<td>186</td>
<td>155</td>
</tr>
<tr>
<td>Sugar</td>
<td>-1,081</td>
<td>1,058</td>
<td>629</td>
<td>739</td>
</tr>
<tr>
<td>Bananas</td>
<td>-1,092</td>
<td>-603</td>
<td>-1,034</td>
<td>-145</td>
</tr>
</tbody>
</table>

Source: FAO (World Food Model).

Consumption growth is also expected to slow down a little, especially in Least Developed and Food-Deficit Countries. Allowing for a population growth of on average 1.7%, global per capita consumption is expected to decrease for dairy products, grains, beef and coffee, while per capita consumption of vegetable oils, some meat, tea, bananas, cocoa, and rubber should rise.

Looking at commodities that account for 60% of the total value of world agricultural trade, the FAO study concludes that the slowdown in growth of trade in agricultural commodities will not be reversed by the Uruguay Round, despite the fact that the effect on growth in trade will be positive, especially for trade in rice, bovine meat, and fats and oils.

Developed country exports of wheat are expected to decrease and imports to increase. This should push up wheat prices by 6-7% in the year 2000 due to the Uruguay Round and encourage developing countries to produce more grains for their own requirements. The Uruguay Round is expected to have a significant influence on the rice market because of the reduction of subsidized rice exports by developed countries and the opening of previously closed markets for rice. The volume of global trade is expected to increase by 1.2 million tonnes and international rice prices to increase by 4-7% above the without-Agreement situation. Both imports and exports of coarse grains are expected to increase slightly in both developed and developing regions as a result of the Uruguay Round. Though the increase in the overall volume of trade is slight, coarse grain prices are expected to rise by between 4 and 7%. In oils, the Uruguay Round is expected to lead to increased import demand in
developing countries, particularly in the Far East and including China. This demand will be met largely by the low-cost producing countries of the Far East and Latin America. Oilmeal trade and prices are expected to be little affected. The Uruguay Round is projected to induce a minor rise in the volume of overall meat trade. It should stimulate an increase in imports by countries in the Far East, North America, Eastern Europe and the area of the former USSR as well as Japan, while improved market access should benefit mainly countries in Latin America, North America and Oceania. Partly because of the commitments to reduce subsidized exports, FAO projects a boost in international meat prices of the order of 8 to 10% although this is significantly less in the World Bank/OECD model (3 to 6%). Overall milk trade is not expected to change significantly as a result of the Agreement although there will be some redistribution of trade flows in terms of regional origin and destination. The reduced volume of subsidized exports permitted to several developed countries will be offset by increased exports from Oceania, while imports into developed countries could rise as a result of the minimum access provisions of the Agreement. An overall boost in milk prices of 7 to 10% is projected.

Of course liberalization does not necessarily boost the volume of world trade. Especially when protectionism is predominantly reduced by exporters of agricultural goods, the effect will mainly be on prices and trade shares. Higher prices will result in import reductions, whereas higher income growth will have a positive effect on trade.

Table 2.2 presents trade balances as projected by FAO with and without the Uruguay Round. The effects that can be attributed to the Uruguay Round are rather small. Developed countries can expect to continue to see both import and export growth rates decline as compared to the eighties, albeit slightly less. Growth rates of imports and exports of developing countries were on average 2.3 and 2.8% from 1978-88. For 1988-2000 they were both projected to be on average 1.0%, but the Uruguay Round will increase that to on average 1.7 and 1.6%, respectively. Particularly trade in temperate zone products will be negatively affected, though the developed countries will remain large net exporters of these products.

For developing countries the growth rates of imports and exports from 1977-87 were on average 5.5 and 4.6 respectively. They were projected for the 1988-2000 period to be on average 3.3 and 2.8 respectively, but taking the effects of the Uruguay Round into account gives projections of 3.9 and 3.4% respectively.

The import growth rate for developing countries is expected to decline for cereals, the oilseed sector, dairy, some meat and tropical fruit and to increase for bovine meat and bananas. Exports are expected to expand more rapidly, particularly for rice, coarse grains, dairy, tea, sugar, and bananas. The net surplus that developing countries had as a group is therefore likely to endure.

Looking at table 2.2, also regional differences turn out to be small. Africa sees its deficit decrease as an effect of the Uruguay Round, Latin America and Caribbean, and the Far East see their export surpluses grow, while the developed countries and the Near East see their deficits grow. In all commodities
however some countries will gain and others will lose and every commodity has its own particularities. An important overall conclusion by the FAO is that the impact of the Uruguay Round is usually rather small compared with all other changes taking place.

### Table 2.2 Trade balances of selected agricultural commodities, past and projected (US $ billion, f.o.b.)

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th>Baseline</th>
<th>Uruguay Round</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>imports</td>
<td>275.5</td>
<td>334.6</td>
<td>362.0</td>
</tr>
<tr>
<td>exports</td>
<td>280.4</td>
<td>340.4</td>
<td>366.2</td>
</tr>
<tr>
<td>Developed Countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>imports</td>
<td>208.7</td>
<td>236.4</td>
<td>256.3</td>
</tr>
<tr>
<td>exports</td>
<td>198.5</td>
<td>223.1</td>
<td>240.0</td>
</tr>
<tr>
<td>Developing Countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>imports</td>
<td>66.8</td>
<td>98.2</td>
<td>105.7</td>
</tr>
<tr>
<td>exports</td>
<td>81.8</td>
<td>114.3</td>
<td>122.6</td>
</tr>
<tr>
<td>Africa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>imports</td>
<td>8.4</td>
<td>13.9</td>
<td>14.9</td>
</tr>
<tr>
<td>exports</td>
<td>9.4</td>
<td>12.4</td>
<td>13.5</td>
</tr>
<tr>
<td>Latin America and Caribbean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>imports</td>
<td>10.5</td>
<td>15.9</td>
<td>16.8</td>
</tr>
<tr>
<td>exports</td>
<td>30.9</td>
<td>42.3</td>
<td>45.6</td>
</tr>
<tr>
<td>Near East</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>imports</td>
<td>17.8</td>
<td>25.5</td>
<td>27.1</td>
</tr>
<tr>
<td>exports</td>
<td>6.5</td>
<td>7.7</td>
<td>8.2</td>
</tr>
<tr>
<td>Far East</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>imports</td>
<td>30.1</td>
<td>42.9</td>
<td>46.9</td>
</tr>
<tr>
<td>exports</td>
<td>35.0</td>
<td>51.9</td>
<td>55.3</td>
</tr>
</tbody>
</table>


### 2.4 Effect on agro-industry and international markets for agricultural and tropical products

The main source of growth in agricultural exports of developing countries may not come from their traditional export commodities, but increasingly from non-traditional commodities, from processed products and from expansion into new markets. These gains from diversification can materialize in several ways. First geographically, by expanding into new import markets. Secondly, horizontally, by increasing the number of commodities exported. Thirdly, by vertical expansion, increasing value added of exports. With respect to vertical integration a reduction of tariff escalation as a result of the Uruguay Round may be important. However, reductions could also have an adverse effect, increasing the relative difference in nominal tariffs between the output and the input commodity.
Table 2.3  Shares of processed agricultural exports in total agricultural exports (percentage)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed</td>
<td>48.8</td>
<td>52.2</td>
<td>55.6</td>
<td>67.3</td>
<td>38.0</td>
</tr>
<tr>
<td>Developing</td>
<td>41.7</td>
<td>51.2</td>
<td>46.3</td>
<td>54.1</td>
<td>29.7</td>
</tr>
<tr>
<td>LDC</td>
<td>27.0</td>
<td>24.4</td>
<td>18.0</td>
<td>16.9</td>
<td>-37.2</td>
</tr>
</tbody>
</table>


Table 2.4  Shares of advanced processed agricultural exports in total agricultural exports (%)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed</td>
<td>18.6</td>
<td>20.9</td>
<td>22.4</td>
<td>67.3</td>
<td>74.7</td>
</tr>
<tr>
<td>Developing</td>
<td>8.4</td>
<td>9.8</td>
<td>9.8</td>
<td>16.6</td>
<td>97.2</td>
</tr>
<tr>
<td>LDC</td>
<td>5.1</td>
<td>5.9</td>
<td>4.6</td>
<td>5.0</td>
<td>-2.4</td>
</tr>
</tbody>
</table>


The problem of tariff escalation is that importing countries often put a higher tariff on processed products than on raw materials. Obviously as an incentive to import raw materials rather than processed ones, thus depriving countries that export raw materials of the chance to increase value added on their primary products. To illustrate this problem, table 2.3 and table 2.4 present data on shares of processed agricultural products in total agricultural exports. Table 2.3 also includes primary processing, whereas table 2.4 abstracts from that.

We see that the share of processed products in overall agricultural exports is relatively high for developed countries and low for LDC. More importantly the situation is deteriorating for LDCs in absolute terms, while the share increases more rapidly for developed than for developing countries, thus widening the gap. When abstracting from primary processing the differences between developed and developing countries increases, but the gap is closing, while LDCs have a low but constant share of processed products.

There have been studies to see whether the Uruguay Round reduces the effect of tariff escalation. Importing countries may rather reduce the tariffs for primary products and intermediary goods than those on final products, thus increasing tariff escalation at the final stage. Remember that under the Uruguay Round countries are only committed to an average reduction of tariffs. Lindland (1996) finds that in most cases the tariff wedge, i.e. the absolute difference in nominal tariffs between the output and the input commodity, will be reduced as a result of the Uruguay Round. This is not surprising given the minimum decrease of 15% per tariff line. However, for a number of commodity pairs high levels of tariff escalation will still remain or even increase. Besides, for a lot of commodity pairs (change in the) the size of the wedge does not determine the opportunities for vertical integration in exporting countries.
Often even reduced tariffs on processed products remain prohibitively high, whereas the reduced tariffs on raw materials stimulate exports. The overall result on shares of processed products in total exports will then be negative, even though the reductions must be valued as positive.

Lower value of trade preferentials

One of the side-effects of the Uruguay Round will be the erosion of preferential trade margins. The loss of this, most of it to the poorest of the developing countries, has been estimated at US$ 0.8 billion. This loss calls for serious attention by preference giving countries. The reduction in standard tariff rates combined with unchanged rates under the various tariff preference schemes, reduces the preference margin. The idea behind the schemes is that privileged exporting countries can either sell their products into the preference giving country at lower price, thus increasing its market share or at the going market price, thus getting a higher return. Typically however preferential access is given not only for a limited range of commodities, but also for limited quantities. Often the preferential rate is required to be able to compete with domestic producers in the preference giving country. FAO tried to assess the lower value of trade preferentials by looking at various schemes by the USA, covering Andean Countries and Israel, and the Caribbean Basin Initiative; the EU schemes for Andean Countries, and the Fourth Lomé Convention; and the EU and Japan schemes for Least Developed Countries. These three importers account for 80% of the total value under the GSP schemes of all OECD countries. Altogether 18% of the total value of OECD imports of all merchandise trade fall under the major preference schemes. For agricultural commodities, however, this percentage is less than five.

Table 2.5 Value of preferential margins by region (US$ million)

<table>
<thead>
<tr>
<th>Region</th>
<th>Value of preferential trade in 1992</th>
<th>Value of preferential margin in 1992</th>
<th>Value of preferential margin after the Uruguay Round</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>4,270</td>
<td>675</td>
<td>509</td>
</tr>
<tr>
<td>Far East</td>
<td>3,409</td>
<td>285</td>
<td>105</td>
</tr>
<tr>
<td>Near East</td>
<td>1,091</td>
<td>49</td>
<td>23</td>
</tr>
<tr>
<td>C. America &amp; Caribbean</td>
<td>1,997</td>
<td>303</td>
<td>245</td>
</tr>
<tr>
<td>S. America</td>
<td>4,266</td>
<td>432</td>
<td>246</td>
</tr>
<tr>
<td>Oceania</td>
<td>320</td>
<td>90</td>
<td>84</td>
</tr>
<tr>
<td>Europe</td>
<td>245</td>
<td>19</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>15,599</td>
<td>1,853</td>
<td>1,221</td>
</tr>
</tbody>
</table>


In 1992 the value of agricultural imports under preferential schemes into the USA, EU, and Japan was $15.6 billion, of which 63% by the EU, 27% by the USA and 10% by Japan. Expressed as a percentage of total agricultural imports,
this amounted to 9% for the EU, 6% for the USA, and 2% for Japan. The po-
tential value of preferences granted in 1992 was estimated at US$ 1,853 mi-
lion, or 12% of the total value of preferential trade. Of this 73% was given by
the EU, and about 14% each by the USA and Japan, indicating that the prefer-
ence margins given by the EU are relatively higher. Africa's share was the high-
est (36%) followed by South America (23%), Central America and the Carib-
bean (16%), the Far East (15%), Oceania (5%) and the Near East (3%).

The total reduction of potential benefits due to the Uruguay Round is
estimated at US$ 634 million. This is equivalent to 34% of pre-round benefits.
Table 2.5 indicates which regions are the biggest losers. As a percentage of
their pre-round benefits the Far East loses most (63%), followed by the Near
East (51%), South America (43%) and Africa (25%). These estimates do not look
at Uruguay Round effects on prices and trade volumes. Neither was growth
over the implementation period taken into account. The latter was estimated
to increase the loss by 10%, whereas the effect of the Uruguay Round on prices
and volumes would also certainly decrease the volume of preferential trade,
thus also increasing the losses.

2.5 Effect on global food security

Food security can be defined as a situation where all households have
both physical and economic access to adequate food for all members and are
not at risk of losing that access. Food security at a national level often implicitly
assumes that the domestic distribution of food supports food security. There
are two options to achieve food security at a national level: self-sufficiency and
self-reliance. Food self-sufficiency means meeting food needs from domestic
supplies. Self-reliance takes international trade into account. It implies the ca-
pacity to import from the world market as needed. Trade is thus an essential
part of food security based on self-reliance. First, as already mentioned, domes-
tic supplies can be supplemented by trade. Secondly, supply variability can be
reduced. Thirdly, economic growth is enhanced by trade and higher incomes
generally provide more security. Fourthly, trade permits global specialization
and more efficient use of natural resources. But food security based on trade
also incorporates risk. The risk of deteriorating terms of exchange on world
markets, the risk of uncertain supplies, price instability, and dependence.

Global food security is the sum of food security of individual nations
rather than there being enough food to feed the world population. Distribu-
tional aspects are often far more important then absolute quantities. Still it is
useful to see food security as the combination of three elements: i) food avail-
ability, ii) reliability of food supplies, and iii) access to food for all.

Under the Uruguay Round agreement government-subsidized production
in developing countries will be reduced and therefore the question about the
effect of global food availability on national food security is legitimate. As al-
ready mentioned in section 2.3, global food production is not expected to
change by the Uruguay Round, although there will be shifts in allocation. Some
importing developing countries benefited from the cheap food imports that
were the result of depressed market conditions. But for the majority of the developing countries this situation was not healthy. It caused dependence on imported foodstuffs as many farmers in developing countries could not compete with these artificially low prices. Especially not because many developing countries also kept domestic food prices low by taxing agricultural exports directly as well as indirectly by over-valued exchange rates (Krueger et al.). Therefore, the reduction of world market distortions could make some developing countries more dependent on their own food production and less on imports. It is important however that farmers are given the opportunity to respond to the new market opportunities. A change in agricultural policy is often warranted.

The risk with respect to stability of supplies actually becomes smaller as markets become more competitive. The price for this could however could be increased price instability. Many developing countries fear that reliance on the world market will not yield domestic price stability but that it will expose domestic markets to the sentiments of the world market. And price instability is likely to affect the food security of the poor. To access the effect of the Uruguay Round on price stability there are four influences to take into account. First, the reduction of tariffs will increase the absorption of production shocks, which is a stabilizing effect. Secondly, an uncertain effect stems from allocative shifts in production. Production shifts from high-level protection countries to low-level protection countries. It is unclear whether production in these latter countries will be more or less stable. Thirdly, there will be a reduction in the levels of stocks, mainly from major staple foods. This will have a de-stabilizing effect. Governments have reduced their stocks and with the reduction in price support programmes will continue to do so. As governments reduce their stocks, the private sector will not fully replace them. Particularly not because of the increased mobility of these stocks. In grains FAO has estimated that replacement will be well under 50% (FAO, 1990). Fourthly, stocks will become more responsive to price signals. The effect of this on price stability is unclear, because of speculative behaviour. Thus, there are four effects that influence market price instability: a positive effect from reduced subsidies and tariffication, an uncertain effect from shifts in production allocation, a negative effect from total stocks reduction, and an uncertain effect from changes in stock behaviour. This makes it difficult to estimate the sign of the overall effect.

To assess the relation between price instability and food security, we look at consumers, producers and governments. Evidently the poor urban population in developing countries, that consists of net food buyers will be quickly pushed into hunger as a result of price spikes. For all countries that rely on food imports, but particularly the poorest countries, an important aspect of the evaluation of trading regime changes for food security is their likely impact on world market instability. Even if price instability does not increase, the chance of price spikes occurring will probably be greater than in the past, as global stocks will be reduced. In section 2.6 we shall come back on this issue when discussing the Decision on Measures Concerning the Possible Negative Effects of the Reform Programme on Least Developed and Net Food-Importing Devel-
oping Countries. Producers and governments depend on commodity prices for their income. Instability in income can also lead to less food security although it is easier to mitigate these effects through income stabilization policies. A sudden collapse in the purchasing power of export commodities can also put a country's food security at risk. For this reason countries often maintain a higher level of food self-sufficiency than might otherwise be warranted, as insurance against unexpected fluctuations in import purchasing power. Maintaining foreign exchange reserves is a more efficient alternative, but hardly realistic in developing countries. A final risk is the risk of dependence and the risk of embargoes. Increased competition on the world market has greatly reduced this risk. In general political embargoes are easy to circumvent through transshipment. Nevertheless, internationally agreed trade embargoes may be effective. And even though they are not likely to include food, their threat will increase uncertainty about purchasing power and thus reliability of import supplies.

This brings us to the third element of food security: access. If food is available at a stable prices, what happens to access to food? Does the number of people that have access increase or decrease as a result of the Uruguay Round? In section 2.6 we will present an overview of several assessments of the effects on income of the Uruguay Round. But even if there is a positive effect on income and employment, the question is whether this reaches the poor. There is some evidence that employment tends to grow more rapidly in outward-oriented countries, but there are no clear-cut linkages between trade, growth, employment and poverty. The impact of trade on household food security is part of a wider issue on the impact of economic growth and transformation on welfare and its distribution. Trade provides opportunities for specialization and growth, but the extent to which poor households can take advantage depends on their access to resources and jobs. This depends highly on the institutional environment and on the supportive role of the state.

Fears are expressed that in areas where production for export increases, food consumption and the nutritional status of the poorest households will decline. Attention has to be given to the mechanisms through which export production influences local and national food availability, household access to food and intra-household distribution of food. For instance the nutrition of the rural poor who do not share in the benefits from export crops, but purchase food on the local market may suffer. Here however the principal problem could very well be deficiencies in rural marketing and transportation infrastructure, or policy decisions that prevent the movement of food from one area to the other. If export production is less labour intensive than food production, then the reduction in employment may have an adverse effect on food security of landless farm labourers. Similarly, if export crop income is controlled by male heads of households, and if men are less likely to spend income on food, then the food security of women and children in the household is at risk. This risk is of course smaller if the household produces food crops. Possible negative effects of this kind have to be avoided. Recent studies, among others by the International Food Policy Research Institute, suggest however that a move by smallholders from staple food to export production did not have a negative
impact on household food security. These studies also found that even though land was reallocated to new cash crops, staple food production per person did not decrease or even increased, due to access to better inputs. Employment, particularly of hired labour and income levels were higher and in no area was child nutrition adversely affected (Von Braun and Kennedy (1994)).

In general developing countries will benefit from the Uruguay Round. Provided domestic policies are in place to spread around the gains and compensate the losers, trade liberalization can contribute to improving food security. The difficulties that developing countries may face during the reform process have been recognized. Therefore developing countries have been given special and differential treatment, mainly in the form of longer periods to adjust. Where countries are confronted with negative effects in terms of the availability of adequate supplies of basic foodstuffs during the reform process, the Decision on Measures Concerning the Possible Negative Effects of the Reform Programme on Least Developed and Net Food-Importing Developing Countries has to provide a safety net.

2.6 The effect of the agreement on income of developing countries

International trade can accelerate national income growth and thereby enhance food security in two ways. First, by the fact that spending power increases, secondly by the fact that the budget share of food falls, thus reducing the insecurity. Liberalized trade contributes to growth in a number of ways. the most important ones are: benefits from comparative advantages, export demand multiplier effects, and benefits from increased transfers of capital and know-how. The range of estimated impacts on world income of the Uruguay Round is quite large. The WTO estimates these to be between US$ 1,000 billion and US$ 500 billion. The World Bank/OECD estimates US$ 213 billion.

The existing studies modelling the impact of the Uruguay Round only cover parts of the Final Act, typically those that are more amenable to quantification. These include the Agreement on Agriculture, market access reforms in manufactured and industrial products and the phasing out of the Arrangement Regarding International Trade in Textiles (MFA). We looked at two general equilibrium models; the MRT model (Harrison et al., 1995) the FMN model (Francois et al., 1995). The impact of the Uruguay Round (to be precise, of its three components referred to above, as incorporated in the models) on aggregate incomes ranges between 0.17% (about US$ 40 billion) of the 1992 base period GDP to 0.94% (about US$ 215 billion) in one model and between 0.41% (about US$ 94 billion) to 0.75% (US$ 172 billion) in the other model reviewed. Thus, despite the delicate nature of modelling such complex agreements, the difference in aggregate income effects estimated by these two general equilibrium models is not that far off, when one considers a global GDP in 1992 of some US$ 23,000 billion. Also, both models show a relatively marked impact of the Uruguay Round on developing regions, in particular, for East and South Asia. One area where the two models seem to disagree is on estimating income
effects for Africa. While in one model this region gains from the overall (mod­
elled) Uruguay Round package, the other model consistently shows negative
effects. However, all these effects are very small. In fact the size of the effect
can be compared with the effect of missing the leap-day in the year 2000.
Clearly, there is a need for further work in this area, but on a less aggregated
level and in particular in identifying the sources of loss or gain to specific coun­
tries and regions.

The estimated trade and income gains from the increase in market access
for goods are likely to underestimate the full impact of the Uruguay Round on
world trade and income. First, there are many possible dynamic effects men­
tioned in the economic literature that were not considered. Second, the esti­
mates implicitly assume that the status quo in commercial relations and busi­
ness confidence would have been maintained if the Uruguay Round had failed.
Many observers would argue that a failure of the Round would have meant a
distinct worsening of trade relations for a considerable period into the future
and a delay in world economic recovery. The avoidance of the associated losses
in trade and income would have to be included in a full accounting of the
gains from a successful Uruguay Round. Third, and in many ways most impor­
tant of all, the estimates ignore every result of the Round except the liberaliza­
tion of trade in goods. Because it simply was not feasible, models have not
attempted to include the beneficial impact of the strengthened rules, proce­
dures and institutions - including the market access commitments and rules for
services in the General Agreement on Trade in Services (GATS) - on the more
than US$ 4.5 trillion in current world trade in goods and services.

Irrespective of the size of the impact of the Uruguay Round, there are
also important distributional shifts both between and within countries with
significant implications for household incomes and therefore household food
security. On balance, UNCTAD estimates that the Uruguay Round will lead to
a small reduction in absolute poverty (1.4%), though there will be gains and
losses across regions as well as across groups within countries (UNCTAD
(1995b)).

There are important differences as regards changes in the trade balance
of basic food commodities and in particular how the food import bill would be
affected by the Uruguay Round in view of projected price increases. As shown
in table 2.6, these increases are expected to be substantial. For the developing
countries as a whole their food import bill is projected to be nearly US$ 25 bil­
ion higher in the year 2000 than it was in 1988. This is an increase of about 4%­
ly annually. About US$ 3.6 billion (15%) of this increase would be due to the Uru­
guay Round. The food import bill of the low-income food-deficit countries is
expected to increase by nearly US$ 10 billion of which 14%, or US$ 1.4 billion
is due to higher prices as an effect of the Uruguay Round.

The ability to pay for higher food import bills depends on the ability to
increase export earnings. As can be seen in table 2.2 the agricultural trade bal­
cance of developing countries is projected to improve by some US$ 1.9 billion
of which 0.8 is due to the Uruguay Round. So, there seems to be enough com­
pensation. However, this improvement in export earnings is not shared equally
between developing countries. Countries that have little capacity to respond
Table 2.6  Food bills of developing countries and low-income food-deficit countries (LIFDs), past and projected (US$ billion)

<table>
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<tr>
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<tr>
<td>World</td>
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<tr>
<td>All developing countries</td>
<td>137</td>
<td>40.0</td>
<td>64.7</td>
<td>24.7</td>
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<tr>
<td>LIFD countries</td>
<td>72</td>
<td>17.8</td>
<td>27.6</td>
<td>9.8</td>
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<tr>
<td>Africa</td>
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<td></td>
</tr>
<tr>
<td>All developing countries</td>
<td>52</td>
<td>6.0</td>
<td>10.5</td>
<td>4.5</td>
</tr>
<tr>
<td>LIFD countries</td>
<td>43</td>
<td>3.5</td>
<td>6.3</td>
<td>2.8</td>
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<tr>
<td>Latin America &amp; the Caribbean</td>
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<td></td>
</tr>
<tr>
<td>All developing countries</td>
<td>46</td>
<td>8.0</td>
<td>12.7</td>
<td>4.7</td>
</tr>
<tr>
<td>LIFD countries</td>
<td>10</td>
<td>1.6</td>
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<td>0.8</td>
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<td>Near East</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>All developing countries</td>
<td>19</td>
<td>11.5</td>
<td>16.8</td>
<td>5.3</td>
</tr>
<tr>
<td>LIFD countries</td>
<td>6</td>
<td>3.7</td>
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<td>1.0</td>
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<tr>
<td>Far East</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>All developing countries</td>
<td>20</td>
<td>14.5</td>
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</tr>
<tr>
<td>LIFD countries</td>
<td>13</td>
<td>9.0</td>
<td>14.2</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Notes: Food comprises cereals, oilseeds and products, meat, and dairy products. LIFDs are net cereal importing countries with a per capita income less than the cut-off point defined by the World Bank for IDA eligibility.

Source: Greenfield et al. (1996).

to increased opportunities perform less. Among the different regions Africa is most problematic, because per capita food availability is already low and the other sectors are not likely to compensate for the poor export prospects in agriculture. It must be added immediately that this concern would be there irrespective of the Uruguay Round. In fact the net effect of the Uruguay Round on the trade deficit is positive. But also in regions which are projected to perform better, there are countries, especially among the low-income food-deficit countries, which would face difficulties in paying for their food imports. Country-specific studies are required to assess these problems and decide on compensatory transfers or assistance.

2.7 Agricultural policy transformation

It is evident that improvements in developing countries' agricultural (and other goods' and services') output and export performance depend on many other policy-related factors, including improvements in: infrastructure (transport systems, energy networks, irrigation, etc.); education and training; dissemination of knowledge about appropriate (new) production technologies and product varieties; pest and disease control systems; quality management; reforms of the domestic regulatory system (including the agricultural price system, the distribution system, land reform); etc. Better market access abroad and
better trade and trade-related policies at home are clearly not a panacea for these requirements, but they can help to raise agricultural (and other sectors) productivity, income and employment and, at least indirectly, help to overcome the wider impediments for economic development and food security in developing countries, including by way of making these countries more attractive for, and increasing the efficiency of, foreign direct investment (including the transfer of capital, skills, technology and marketing channels), official aid and technical assistance.

Some developing countries have been concerned that the restrictions imposed on the policy instruments permitted to pursue agricultural policy objectives will make it more difficult for them to achieve their agricultural growth and food security objectives in the future. While direct subsidization of production will be increasingly limited, and the use of quantitative restraints on imports is prohibited, there are no restraints on the use of public investment measures for agricultural and rural development purposes. Investment and input subsidies, both frequently used measures in developing countries to promote increased production, continue to be permitted to developing countries under the Uruguay Round agreement.

In many developing countries, reforms undertaken within the framework of structural adjustment programmes (SAPs) go well beyond the adjustments countries are required to make under the Uruguay Round. Structural adjustment programmes usually require greater reductions in border protection than are required under the Uruguay Round. Input subsidies and consumer food subsidy programmes, permitted under the Uruguay Round, must often be cut back under SAPs. Structural adjustment programmes usually require currency devaluation and institutional reforms as well, areas not covered by the Uruguay Round.

The indirect effects on agricultural production incentives of industrial sector protection, exchange rate overvaluation, government procurement, and export taxation/quotations are often more important than the direct effects of sectoral policies, such as input subsidies. It has been demonstrated (Krueger et al.) that in many developing countries these indirect effects dominate the direct policy effects. The effects of Structural Adjustment Policies on the agricultural sector are therefore likely to be many times greater than the effect of the Uruguay Round. Generally, however, the Uruguay Round underpins the reforms undertaken by developing countries, and provides some assurance of increased market access in return for the risks they have taken or will take in opening up to trade.

The policy options for developing countries have to be seen in the framework of SAPs. Under the Uruguay Round agreement there are significant possibilities for consumption support policies and policies to reduce the impact of world market fluctuations. Domestic Food aid, e.g., is included under the Green Box measures and direct price support is still feasible under the de minimis provision. To reduce the effect of market instability, there are the special safeguard conditions, the 'sliding scale of tariffs' option, the allowed food security stocks, and the allowed export limitations. However, budgetary constraints are likely to limit these policy options.
While the Uruguay Round does not address this budgetary problem of many developing countries, it does contain a commitment not to aggravate it. This is the Decision on Measures Concerning the Possible Negative Effects of the Reform Programme on Least Developed and Net Food-Importing Developing Countries. The promise is that if food import prices rise because of the Uruguay Round, net food importing developing countries and the least developed countries could be eligible for increased food aid, financial support to maintain normal food imports, technical support to raise agricultural productivity, and eventually favourable treatment on agricultural export credits. Such aid could help these countries to mitigate the effect on consumer price increases, while allowing producer prices to rise.

The decision raises a great number of questions about its interpretation. It is not clear how food is defined, and which countries are eligible. Also the basis for compensation is not clear. It is also not clear how the effect of the Uruguay Round can be determined. Most importantly, however, is the question of the nature of the compensation.

Food aid is the most direct option. Theoretically the Uruguay Round should reduce the existence of surpluses in donor countries to which food aid has been closely linked. But Hathaway and Ingco (1995) argue that since the agreement puts specific limits on the use of export subsidies, food aid will remain as the only legitimate method of moving excess supplies into the world. Thus, if donor countries continue to use output expanding subsidies in the face of limits on export subsidies, the agreement may encourage rather than limit food aid.

A more structural solution means of support would be to increase agricultural productivity and strengthen infrastructure. If price increases are passed on to producers and supply can be made more elastic by technical support and improvement of infrastructure, then import needs will be reduced.

Financial support by means of a cheap loan, such as the IMF facility for cereals, or a grant raises a lot of considerations to ensure that the finance is used for food imports.

The Uruguay Round has many implications for national and international agricultural policy. Especially developing countries have approached FAO for policy assistance. FAO has organized four regional expert consultations. The World Food Summit will also include these items. Reexamination of agricultural policies is required in the following areas: i) Higher food prices may call for changes in national food security and nutrition enhancement policies, including consumer price policies for food; ii) despite better incentives to producers, most developing countries will need to evolve targeted and decoupled (Green Box) forms of assistance; iii) tariffication, and thus elimination of non-tariff barriers, may lead to greater domestic price instability, which may lead to reconsideration of producer price policies and measures to prevent excessive instability; iv) some countries have to increase domestic food production and productivity to enhance food security in harmony with their comparative advantages; v) the increased transparency after elimination of non-tariff barriers may lead to increased intra-regional or sub-regional trade agreements; vi) export promotion policies to benefit from new market opportunities; vii) further
promotion of diversification and primary processing, which requires avoidance of tariff escalation and targeted tariff reduction in areas of potential growth. In addition, technical assistance will often be required.

2.8 Conclusion and recommendations

Food trade is vital to world food security. Without trade, countries would have to rely exclusively on their own production. International trade influences food security in several ways. In the first place, trade allows food consumption to exceed food production in those countries where output is constrained. Resorting to imports generally allows food consumption needs to be met more cheaply than by relying on domestic production alone. While there can be specific reasons for some countries to aim at substantial food self-sufficiency, in general it makes better economic sense to follow a more flexible policy of food self-reliance, provided importers can rely on the world market as a dependable and efficient source of supply and exporters have a good market for their products. A particular concern for importing countries is whether imports will be available when needed and the possible risk of trade embargoes. To some extent the expansion of world cereal trade should allay fears about overall supply but importers continue to be concerned by the use of export restrictions. As regards the role of the world market as a source of earnings, the strong expansion in world trade has been accompanied by declining terms of trade for developing countries’ products. In addition, their food import capacity has been frequently constrained by having to make large debt service repayments.

Trade liberalization as reflected in the Uruguay Round is not likely to affect significantly the global availability of food as reduced output in high cost countries will be generally replaced by increased output in other countries. In view of the likely change in the medium term in favour of food commodities’ relative prices, countries should revise their agricultural policies and consider passing on some of the increase in world prices to their domestic sectors so as to stimulate food production. The effect of trade liberalization on the stability of world food prices is uncertain. Four factors are at play: the positive effect of tariffication, the negative effect of declining global food stocks, the positive impact of the greater share of stocks in private hands and the uncertain effect of shifting the location of production. The impact of trade on household food security is part of a wider issue on the impact of economic growth and transformation on welfare and its distribution. Trade provides opportunities for specialization and growth, but the extent to which poor households can take advantage depends on their access to resources and jobs. This depends highly on the institutional environment and on the supportive role of the state.

Looking at trade balances, regional differences turn out to be small. Africa sees its deficit decrease as an effect of the Uruguay Round, whereas Latin America and the Caribbean, and the Far East see their export surpluses grow, while the developed countries and the Near East see their deficits grow. In all commodities however some countries will gain and others will lose and every commodity has its own particularities. An important overall conclusion by the
FAO is that the impact of the Uruguay Round is usually rather small compared with all other changes taking place.

International trade has a major bearing on access to food via its effect on incomes and employment. While more liberal trade policies over time contribute to economic growth, the main issue for food security is whether this economic growth reaches the poor. Some evidence shows that in most developing countries export industries were more labour intensive than import substituting industries and that employment tended to grow in outward-orientated economies. However, the linkages between trade, growth, employment and poverty are not clear-cut since each of these variables is influenced by other factors.

The main source of growth in agricultural exports of developing countries may not come from their traditional export commodities, but increasingly from non-traditional commodities, from processed products and from expansion into new markets. These gains from diversification can materialize in several ways. First geographically, by expanding into new import markets. Secondly, horizontally, by increasing the number of commodities exported. Thirdly, by vertical expansion, increasing value added of exports. With respect to vertical integration a reduction of tariff escalation as a result of the Uruguay Round may be important. However, reductions could also have an adverse effect, increasing the relative difference in nominal tariffs between the output and the input commodity.

The problem of tariff escalation is that importing countries often put a higher tariff on processed products than on raw materials. Obviously as an incentive to import raw materials rather than processed ones, thus depriving countries that export raw materials of the chance to increase value added on their primary products. The Uruguay Round, while reducing tariff wedges, may increase the share of primary products in agricultural exports.

One of the side-effects of the Uruguay Round will be the erosion of preferential trade margins. The loss of this, most of it to the poorest of the developing countries, has been estimated at US$ 0.8 billion. This loss calls for serious attention by preference giving countries.

There are important differences as regards changes in the trade balance of basic food commodities and in particular how the food import bill would be affected by the Uruguay Round in view of projected price increases. For the developing countries as a whole their food import bill is projected to be nearly US$ 25 billion higher in the year 2000 than it was in 1988. This is an increase of about 4% annually. About US$ 3.6 billion (15%) of this increase would be due to the Uruguay Round. The food import bill of the low-income food-deficit countries is expected to increase by nearly US$ 10 billion of which 14%, or US$ 1.4 billion is due to higher prices as an effect of the Uruguay Round.

Provided domestic policies are in place to spread around the gains and/or to compensate the losers, then trade liberalization can play an important role in improving food security even though there can be problems with adjustment to the new trade regime. The difficulties that countries may face during the reform process has been recognized and developing countries have been given special and differential treatment, mainly in the form of longer periods to make adjustments and lower reduction commitments. The Uruguay Round
accords also recognize that during the process of reform the least developed and net food importing countries may experience negative effects in terms of the availability of adequate imported supplies of basic foodstuffs on reasonable terms and conditions. Accordingly, great importance is attached to making sure that the Uruguay Round Decision on Measures Concerning the Possible Negative Effects of the Reform Programme on Least-Developed and Net Food-Importing Developing Countries is implemented rapidly. It should be noted that the Uruguay Round may not make much difference to the volume of food aid, for, while the amount linked to surplus disposal may decline, the quantities linked to assistance under the abovementioned Decision could well increase.

The Uruguay Round has many implication for national and international agricultural policy. Especially developing countries have requested FAO for policy assistance. FAO has organized four regional expert consultations. The World Food Summit will also include these items. Reexamination of agricultural policies are required in the following areas: i) Higher food prices may call for changes in national food security and nutrition enhancement policies, including consumer price policies for food; ii) despite better incentives to producers, most developing countries will need to evolve targeted and decoupled (Green Box) forms of assistance; iii) tariffication, and thus elimination of non-tariff barriers, may lead to greater domestic price instability, which may lead to reconsideration of producer price policies and measures to prevent excessive instability; iv) some countries have to increase domestic food production and productivity to enhance food security in harmony with their comparative advantages; v) the increased transparency after elimination of non-tariff barriers may lead to increased intra-regional or sub-regional trade agreements; vi) export promotion policies to benefit from new market opportunities; vii) further promotion of diversification and primary processing, which requires avoidance of tariff escalation and targeted tariff reduction in areas of potential growth. Technical assistance will be required to reach these policy targets.

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