From:

Agricultural Diversification and International Competitiveness

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(STM 10-01) Report of the APO Study Meeting on Agricultural Diversification and International Competitiveness, Tokyo, 16–23 May 2001

Edited by Dr. Mubarik Ali, Agriculture Economist/Head of the Socioeconomic Unit and Economic and Nutrition Project, Asian Vegetable Research and Development Center, Republic of China

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AGRICULTURAL DIVERSIFICATION AND INTERNATIONAL COMPETITIVENESS

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Asian Productivity Organization
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FOREWORD

Diversification has been pursued in many countries as a way to improve the long-term viability of agriculture by enhancing the profitability and overall stability of the sector. The shift to other crops or economic activities, however, has not been an easy undertaking, particularly for small farmers. Government assistance in terms of more supportive policies and better infrastructure has, therefore, played a critical role in the promotion of diversification programs. With globalization further stimulating trade, developing countries in the region are being afforded greater opportunities for expanding the range of agricultural products that they can market abroad. However, expanded trade has also brought with it increased competition and hence the need for countries to focus diversification programs on agricultural activities where they have a competitive advantage.

Accordingly, in May 2001, the APO organized a Study Meeting on Agricultural Diversification and International Competitiveness in Japan to discuss the salient features and progress of agricultural diversification in Asia and the Pacific with the view to promoting it further as a key strategy for enhancing the international competitiveness of agriculture in the region. The study meeting concluded, among others, that diversification should be viewed as a first step in the process of achieving competitiveness. This will require the fostering of a favorable environment enabling farmers to determine the crops that could be efficiently produced for higher profit and achieve greater competitive advantage. In this regard, a number of requisites for creating such an environment were identified, such as: 1) investments in R&D to strengthen knowledge-based agriculture; 2) provision of adequate infrastructure and production and marketing facilities; 3) elimination of nontrade barriers; and 4) provision of relevant technology/knowledge, particularly productivity and management techniques/tools necessary for meeting international standards.

This volume is a compilation of the papers and proceedings of the study meeting. I hope that it will serve as a useful reference on the subject in APO member countries.

The APO is grateful to the Government of Japan for hosting the study meeting, and in particular to the Ministry of Agriculture, Forestry and Fisheries for providing financial and technical assistance, and to the Japan Association for International Collaboration of Agriculture and Forestry for implementing the program. Special thanks are due to Dr. Mubarik Ali for editing the present volume.

TAKASHI TAJIMA
Secretary-General

Tokyo
July 2004

Part I. STUDY MEETING HIGHLIGHTS

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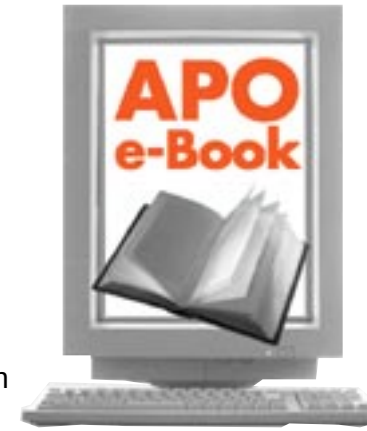

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STUDY MEETING HIGHLIGHTS

INTRODUCTION

The Study Meeting on Agricultural Diversification and International Competitiveness was held in Tokyo from 16 to 23 May 2001. This meeting was organized by the Asian Productivity Organization (APO) and hosted by the Government of Japan. The Association for International Cooperation of Agriculture and Forestry (AICAF) implemented the program in collaboration with the Ministry of Agriculture, Forestry and Fisheries (MAFF). Sixteen participants from 15 member countries and four resources speakers from the World Bank, U.S.A.; the National Centre for Agricultural Economics and Policy Research, India; the Food and Agriculture Policy Research Center, Japan; and the Asian Vegetable Research and Development Center, Republic of China, attended the study meeting.

The objectives of the study meeting were to:

1) discuss the salient features and progress of agricultural diversification in member countries; and
2) suggest ways of better promoting diversification as a strategy for developing the international competitiveness of agriculture.

The study meeting was consisted of the presentations and discussions of resource papers and country reports, as well as field visits to Yamagata and Miyagi prefectures. The topics covered in the resource papers were:

1) Globalization and International Competitiveness: Concepts and Policy Implications for Agriculture;
2) Diversification of Agriculture in More Competitive Environment;
3) Agricultural Diversification in Japan; and
4) Diversification with Vegetables to Improve Competitiveness in Asia.

The country reports, on the other hand, focused on recent changes in the agricultural production structure, policy/strategy on agricultural diversification; the degree to which agricultural diversification programs have enhanced the competitiveness of agriculture; and future prospects of agricultural diversification in the respective country.

At the end of the meeting, the participants were divided into two groups to consolidate the workshop outputs, and provide recommendations on how to promote diversity to enhance international competitiveness. The major recommendations of the groups include strengthening the physical infrastructure such as road, storage capacity of food and agricultural products, etc., promoting the agricultural business activities, providing information on the quality standards of different agricultural products in various countries, encouraging competition and the private sector, promoting dialogue to remove unnecessary protection in developing countries, and prioritization of research and development (R&D) activities keeping in view the potential benefits of different agricultural products and their environmental impact. The participants of this meeting, however, concluded that to improve competitiveness in the international market, the agricultural markets at home must be made competitive first.

HIGHLIGHTS OF RESOURCE PAPERS

Globalization and International Competitiveness: Concepts and Policy Implications for Agriculture

Economic policy-makers can benefit from having a clear concept of the problem they face and of quantifying the problem. This will help in the search for a solution as well as in monitoring any progress made to tackle the problem. Accordingly, the concepts of competitiveness in agriculture can be clarified and reviewed under a variety of ways that have been used by the economists.

The three concepts of *production growth, productivity* and *international competitiveness* are each very important in their own, related to each other, but also refer to substantially different issues. *Production growth* is a simple concept that refers to the volume of production between two periods of time. *Productivity* refers to the way various factors of production are combined to generate output growth. *International competitiveness* measures whether the commodity produced can compete with similar goods on the international market, given the costs incurred in the production process. If a product is competitive it can coexist with imports where domestic production is not sufficient to satisfy the domestic market, and can be exported. If it is not competitive, the commodity needs to be protected against imports if production is to take place at all and cannot be exported.

In a world with free trade and without government policies that assist particular sectors and influence exchange rates, there would be a level playing field in production and international trade across countries and across sectors. In such a world, countries would produce and export what they are good at and import the rest. However, public policy often interferes with free trade, with the objective to raise tax revenue, reduce the cost of living of certain segment of the population or to stimulate domestic production in particular sectors. In the process, the competitive position of products and sectors is affected. Several indicators have been used in the literature to assess this phenomenon. These indicators include *nominal protection, effective protection* and a new concept of *indirect protection*.

Export performance is another way of monitoring the change in competitiveness of a country. The interest in tracking export performance and finding a comparable index in this for a larger number of countries stems from the recognition that countries doing well on the export front will tend to have higher GDP and per capita growth than countries that perform poorly. With world trade growing faster than GDP in most countries, there is much to be gained from selling in a fast growing market as compared with selling in a slow growing market. But to do so, a country's exports need to be competitive.

In this regard, the *Trade Performance Index* (TPI) is relevant. The TPI measures by how much a country's share in world trade has changed over time, and can be used to identify factors affecting a country's changing share. The *National Export Trade Maps and Tables*, on the other hand, provide a succinct assessment of a country's export portfolio in terms of the dynamics of national supply and international demand. They focus on specific export products rather than broad sectors covered in the TPI.

Removing "export handicaps" should be the first line of action to improve competitiveness. This implies ensuring that the exchange rate is competitive, that export taxes are removed and that the tariff regime facing domestic producers has eliminated the "pro manufacturing bias".

Unit costs should be reduced so as to be able to compete with others on the world markets. Here there is a role for the State, but one that is much less than traditionally conceived. The State should intervene where there is a market failure, i.e., the private sector cannot do the job, largely because it cannot charge for the services rendered. In many countries there is a Trade Promotion Organization (TPO) that is supposed to assist diversification of exports. Their contribution, however, has often been minimal. To be able to greatly contribute many should change their modus operandi and provide more efficient services that the private sector can use.

None of a number of indicators that can be used to measure competitiveness of agricultural production provides the full and comprehensive picture. Data are often inadequate and the methodologies not fully consistent. Yet, used in combination they can shed light on the competitiveness of a sector, and assist in designing an action plan to enhance competitiveness and monitor the progress achieved. The competitiveness indicators also have the advantage of being transparent and objective. They can help focus national attention on the implications of certain policies for the growth of the agriculture sector.

Diversification of Agriculture in More Competitive Environment

Diversification is reckoned as an important strategy to overcome the challenges faced by many developing countries. Diversification of agriculture means developing a larger number crop- or enterprise-mix in favor of high-value and more remunerative enterprises. It may be of different forms as follows:

1) Supplementing farm incomes with non-farm incomes;
2) Increasing the number of crops grown and types of livestock reared; and
3) Use of resources in diverse farm enterprises.

There are four major objectives of diversification in agriculture, namely:

1) increase the income of smallholders;
2) generate additional employment;
3) stabilize farm income over the seasons and overtime; and
4) conserve natural resources.

Achieving these objectives simultaneously improve the domestic and international competitiveness.

The developing countries are facing the complex challenge of the new economic regime besides the usual problems of rising population, unemployment and poverty, declining investment in the agriculture sector and degradation of natural resources. Diversification of agriculture can help to overcome the following overriding problems in a more competitive environment:

1) Ensure food security;
2) Generate employment and alleviate poverty; and
3) Conserve natural resources.

With high economic and population growth, the dietary patterns in developing countries are rapidly changing. The food basket is diversifying in favor of livestock, fruits and vegetables. In response to these demands, the crop-mix is changing in favor of more commercial crops and from low- to high-elasticity commodities. Yet producing additional diversified food is a major challenge when resources are limited and degrading. To meet the challenge, the production strategy should be to encourage diversification of the production system without sacrificing the basic obligation of ensuring food security.

An example from India demonstrates that the agricultural economy has been diversifying from the crop sector towards its complimentary enterprises, such as livestock and fisheries. These enterprises are not competing for resources but generating additional employment and raising the purchasing power of poor people.

Conserving natural resources, in the face of commercialization, is the most daunting task. In the past, the experience has shown that higher agricultural growth partially came at the cost of overexploitation and degradation of natural resources. Declining water table and increasing soil salinity, waterlogging and soil erosion became acute problems in many fertile agricultural systems in developing countries. Most of these problems are because of the concentrated commercialization efforts on few crops, mainly cereals. Diversification of agriculture can play a key role in overcoming these problems. For example, there are evidences that diversification of cereal-based production system with legumes has improved soil sustainability.

To encourage the diversification of agriculture a multi-prone strategy needs to be designed. The principle of 5-Is is expected to meet the objectives in a competitive environment. These 5-Is are:

1) **I**ncentives;
2) **I**nnovations;
3) **I**nputs;
4) **I**nstitutions; and
5) **I**nfrastructure.

The first ‘I’ refers to the policy environment that is favorable to those commodities which augment income and generate employment without degrading resources. The second ‘I’ concerns technologies. Without economically viable, socially acceptable, and environment-friendly technologies for the crops to be used for diversification, the prospects of diversification would be bleak. The third ‘I’ refers to the availability of inputs required for cultivation and/or production of diversified crops or enterprises. Non-availability of inputs at appropriate time would hinder the prospects of diversification. The fourth ‘I’ involves the development of appropriate institutions for new crops or new enterprises. For example, a strong seed sector, credit and insurance institutions, etc. must exist. If the diversification of enterprises calls for collective

action, appropriate institutions are needed to support cooperatives. The fifth and last 'I' refers to the presence of required infrastructure. For example, marketing, processing and transportation facilities are important elements in case of vertical diversification. A well-knitted strategy encompassing the 5-Is would go a long way in enlarging the scope of agricultural diversification.

Agricultural Diversification in Japan

During 1960s to 1980s, Japanese agriculture had been diversified continuously both in value and quantity terms. Such diversification had been accompanied by the reduction in the production of some traditional crops and a rapid increase in the output of other farm commodities such as livestock products. This trend had been induced by the changes in dietary habits and supported by the increased imports of animal feeds. The share of rice, for instance, which occupied the largest portion (nearly 50 percent) of total dietary energy supply (DES) during the early 1960s has substantially declined while livestock products and oils and fats had registered a significant increase in their share in the diet.

Through the enforcement of various laws and programs and financial backstop, the Government of Japan has encouraged farmers to expand production and improve productivity of the livestock and horticulture industries. However, rationalizing the paddy farming, viewed from the point of budgetary appropriation, was considered as priority in the reorganization of agricultural production.

The productivity of Japanese agriculture is relatively high compared to that of other countries. For instance, it has been estimated that land and labor productivity in Japan is 20.1 and 0.5 times larger than that of the U.S.A. in 1998. Its competitive power in the world market, however, is low due to the high costs of production and distribution. Despite low competitiveness, Japanese farmers were able to apply sophisticated high cost production and marketing technologies to satisfy the demand of the domestic consumers for the high quality food.

Diversification with Vegetables to Improve Competitiveness in Asia

This paper considers diversity in production and consumption systems as an input in socioeconomic development rather than an output of the development, and quantifies its role in the socioeconomic development, therefore, in improving the competitiveness of an economy. The study also makes a first attempt to quantify the factors influencing diversity. It specifically highlights the role of vegetables in diversifying the production and consumption systems, because they have special advantages in terms of supply nutrients for the diet, enhancing farmers' income, and sustaining the resources engaged in production.

The diversity in consumption and production systems in this study was measured as an inverse of the Herfindal-index, or opposite to the concentration-index in industry. In consumption it was estimated in terms of food expenditure, while in production it was quantified in terms of total cropped area. The estimated diversity was related to the wage rate of the manual workers in consumption and to total factor productivity (TFP) in production. In an attempt to understand the factor influencing diversity, it was also related to different infrastructure, human capital, and institutional factors separately in production and consumption. The household consumption survey data collected by the Bureau of Statistics of Pakistan from throughout Pakistan during 1990-91 and 1992-93 were used to analyze the diversity in consumption. This data provide information on the monthly income of 1,655 rural manual workers, detail itemized consumption of their family, along with the socioeconomic characteristics of the worker. The production diversity was analyzed using a separately collected data on crop production, which contain district-level yearly area, production, and price for 33 crops and 17 input categories during the period 1971-94 for 16 districts in the Pakistan's Punjab. The senior author collected this data with the financial support from the World Bank.

Analysis of the household consumption survey data from Pakistan suggests that doubling the food diversity index will increase the wage of the manual workers by 67 percent, far more than the effect of doubling the expenditure on food while preserving its existing composition. Therefore, diversity in food is a better tool for development and poverty alleviation than increasing the expenditure on existing food without changing its structure. As vegetables and fruits are the main sources of food diversity, therefore, it is not surprising to note that improving their share in food enhances the productive capacity of manual workers. Doubling the share of vegetables and fruits in the diet will improve the earning capacity by 8.4 percent, about three times more than the effect of doubling the share of cereals. The impact of diversity on manual workers'

productivity comes through balanced diet, which improves muscle power and working hours, and reduces non-working days due to sickness, thus enhances their working efficiency.

On the other hand, analysis of the crop data from Pakistan's Punjab suggests that diversification in crop production can significantly improve TFP, a composite measure of productivity of all resources engaged in production, after controlling the other socioeconomic and institutional factors affecting TFP. More particularly, an increase in the concentration of cereal area can significantly reduce productivity, while an increase in the commercial crop, pulses, and vegetable area can improve productivity by breaking insect pest cycles and reducing soil mining in the cereal-based systems. A doubling of the diversity in crop production, which is not an ambitious plan looking at the concentration towards cereal-based cropping system in the country, will increase TFP by 56 percent in the Pakistan's Punjab through reduced production and marketing risks, enhanced sustainability, and improved resource use efficiency. This is more than the combined effect of the Green Revolution on TFP during 1965-94. In fact, diversity in production and consumption systems has a potential of generating a Second Generation Green Revolution.

Diversity is a phenomenon which is induced by the appropriate incentives for the nutrient-rich foods and crops along with development of physical infrastructure, human capital, institutional factors. The most important factor to encourage consumption diversity is the price incentives. For example, a 10-percent decrease in the relative prices of fruits and vegetable will increase their share in consumption by 0.84 percent. Similarly, a 10-percent increase in the prices received compared to the prices paid by farmers will improve diversity by 0.8 percent. A 10-percent increase in the prices of vegetables will increase their share in the cropping system by 1.7 percent. Therefore, technological innovation in production and marketing of vegetables which will increase farmers' profit, and reduce the prices for consumers will help reduce poverty and induce economic development process through enhanced diversity in both the production and consumption systems.

Improvement in physical and human infrastructure, rather than increase in income, is another important factor to induce diversity. For example, presence of refrigerator, an indication of improved physical infrastructure such as access to electricity and probably road, and education of the household significantly improve the diversity in consumption. Similarly, higher education, reduced distance from the road, and security in the ownership of land positively and significantly influence the shares of vegetables and commercial crops in the total cropped area. However, laxity of policy-makers for the minor crops and pulses geared these infrastructures towards concentrating the cereal production, and they went against to an overall production diversity in Pakistan's Punjab.

Therefore, overall production diversity has decreased overtime in Pakistan's Punjab as cereal concentration increased at the cost of pulses and minor crops. On average, diversity index in the Punjab decreased at the rate of 0.64 percent per annum. The highest decline was in the wheat-cotton region, and the lowest in the wheat-mungbean region. Despite the increase in the share of vegetables and fruits, however, the improvement was not enough to compensate the deterioration in the share of minor crops and pulses, thus the concentration of cereals increased in all but the wheat-mung bean region. This was due to emphasis of policy, research, extension, market structures, and credit programs to encourage cereal production, and neglect pulses, minor crops, and fruits and vegetables. For example, while modern wheat and rice varieties were continuously encouraged, no significant technological innovations took place in vegetables, minor crops, and pulses. Moreover, all credit and extension programs and price insurance were geared mainly towards cereals, and water supply was ensured for their cultivation.

Farm-level evidence from selected Asian countries, had also demonstrated the benefits of diversifying the production and consumption systems with vegetables to improve the farm sector competitiveness. It was shown that such diversification could play a catalyst role in overall socioeconomic development by improving nutritional status, generating incomes and jobs both in the farming and non-farming sectors, enhancing resource use efficiency, increasing productivity in other crops and boosting growth in TFP of the crop sector. The managerial capacity of farmers, a critical input in overall socioeconomic development, also improved as they learned to handle marketing and production requirements of management intensive vegetable crops.

Despite these advantages of diversification, biotic, abiotic, management and demand constraints have limited vegetable production and their per capita consumption has been fluctuating far below the minimum requirement to meet the recommended micronutrient levels in South and Southeast Asia. Vegetable

consumption is not only low but also highly seasonal and fluctuates from year to year without catching attention from policy-makers. Little has been done to overcome these constraints, as policy-makers in the past were obsessed with boosting and stabilizing cereal production. This situation has created the problems of sustaining productivity of agriculture resources at one hand, and micronutrient deficiency in the diet on the other.

Policies to encourage diversification need to go a step farther than the simple economic development policies. While economic development policies focus on physical and human infrastructure improvement alone, diversification policies need to combine these improvements with appropriate incentives for micronutrient-rich foods and crops, such as vegetables, fruits, and minor crops. These crops and foods may even look uneconomical to start with, but research and extension system and policy incentives geared towards these crops not only make them competitive by themselves, but will also produce substantial externalities in the form of improved earning capacity of human labor and productivity of the whole production system. In deciding R&D resources for these crops and food commodities, therefore, neglecting such enormous externalities would deprive societies from a very important source of economic growth.

HIGHLIGHTS OF COUNTRY REPORTS

Agriculture still plays an important role in the economies of Asia and the Pacific region although its contribution to GDP has rapidly declined in recent decades, especially in East and Southeast Asia. It continues to be a principal source of employment and foreign exchange earnings for the economies in the region. The sector has also become a major focus of many policy discussions in the last few years, particularly in light of the increasing globalization of the world economy. Globalization has raised a number of important concerns relating to, among others, sustainable development, food security and trade liberalization.

The agriculture sector of many of the participating countries has generally posted from medium to high growth during the past decade. Several of these countries have in fact achieved self-sufficiency in the basic staples such as rice and wheat, mainly due to the introduction of modern agricultural technology since the early 1960s. Some have also benefited from a more liberal trade environment in the last few years. The productivity of many crops, however, has remained relatively low and potential for further improvement abounds. These countries have also been able to diversify their agriculture to varying extent.

Agricultural diversification in many instances has occurred in the participating countries as part of the economic transformation or structural change that took place over the past decades. Such transformation replaced agriculture with the manufacturing and services sectors as the main engines of growth. With the economic growth, incomes have increased and the standard of living has improved. These in turn have contributed to significant changes in food consumption behavior as they began demanding balanced diet that contains essential micronutrients in addition to the required level of energy and protein. Such changes have been met largely through the diversification of products and markets. This type of demand-driven diversification has apparently occurred much more rapidly in East and Southeast Asia. In South Asia, where economic growth has been relatively slower, such diversification has taken place much more gradually. In these latter countries, food self-sufficiency has, in fact, been given the greatest priority so that concentration on cereal (particularly rice) production has been a more common phenomenon.

A policy-driven type of diversification, however, has also occurred in all the participating countries. For instance, in order to address concerns about nutritional deficiencies of the population, many of these countries have implemented special programs to promote the production and consumption of certain food items such as vegetables, tubers and pulses. Diversification has also been pursued to improve or stabilize the incomes of farmers by encouraging them to shift to the production of more profitable crops. In a few countries such as Japan, Korea, and Taiwan, diversification away from rice has been promoted to resolve the problem of its overproduction. Other policy objectives of diversification include:

1) substitution of imports with domestically produced goods in order to enhance food security and/or reduce the import bill; and
2) alleviation of environmental and resource sustainability problems such as soil degradation which has resulted from continuous cereal cropping.

From a different perspective agricultural diversification has also taken place at either or both the farm and regional/national levels. In the former case, a farmer has diversified his production activities in order to spread his risk and stabilize his income. In the latter case, a country has adopted some crop zoning system whereby specific commodities are promoted for particular regions based on each region's comparative advantage.

With the changing global trade environment in recent years, developing countries in the region have greater opportunities for exporting their products to the world markets and some of these countries have taken good advantage of such opportunities. The expanded potential for trade has brought with it an increased competition. To be able to increase exports, therefore, a country needs to continuously improve its international competitiveness. In this light, diversification has been viewed as a strategy for enhancing a country's capacity to market its products abroad by improving its competitiveness. The task has essentially entailed determining and promoting those commodities where the country has competitive advantage.

There are many constraints to diversification. The major ones are:

1) severe geographic and climatic conditions which have limited the scope of growing other than a particular crop or have resulted in very high production costs;
2) policy biases against agriculture that have made the sector generally less efficient/competitive vis-à-vis the other sectors and the rest of the world;
3) low adoption rate of new technologies;
4) poor marketing facilities and information system; and
5) inadequate rural infrastructure.

The future prospects of agricultural diversification in the developing countries of Asia and the Pacific will depend in part on their ability to develop only those products where they have competitive advantage. Such "product champions" may include in many cases high value products with niche markets such as fruits and vegetables and medicinal plants. The enhancement of the international competitiveness of these products will also increasingly depend on how well a country is able to exploit the advantages of a knowledge-based agriculture. Such kind of agriculture promotes value addition through agro-processing and the development of production and marketing systems that make use of information and other emerging technologies. To be sure, efforts to enhance international competitiveness will depend to a large extent on a number of specific measures such as:

1) formulating appropriate policies (e.g., adoption of a more competitive exchange rate, elimination of biases in the tariff/tax structure and doing away of export taxes);
2) redefining the role of the government vis-à-vis the private sector;
3) strengthening R&D and technology transfer;
4) improving marketing plans and strategies (e.g., through establishment of strategic alliances);
5) developing the needed human resources; and
6) investing in more rural infrastructure and support facilities.

FIELD STUDIES

For their field studies, the participants visited Yamagata and Miyagi prefectures. The specific places visited were:

1) JA Yamagata Okitama;
2) a flower growing farm;
3) JA Yamagata Okitama Beef Cattle Center;
4) a cherry producing farm; and
5) Zao Dairy Farm Center.

The highlights of these visits are presented below:

JA Yamagata Okitama

The Okitama region is situated in the southern part of Yamagata prefecture. It is comprised of three cities and five towns with a total population of some 250 thousand. The region's climate is typical of a valley with large temperature variances. Seasonal changes are marked with abundant snow during winter particularly in the surrounding mountains. Blessed with ample supply of quality water, Okitama is able to produce various agricultural products including fruits, vegetables and flowers in addition to its principal crop, rice. The region is also known for its livestock industry which produces the brand "Yonezawa Beef".

The region has about 14 thousand agricultural households cultivating some 27,500 ha. Rice account for 80 percent of the land while vegetable farmland, orchards and pastureland account for 9, 7 and 3 percent, respectively. Gross agricultural production amounted to some ¥49 billion in 1998.

The present agricultural cooperative, JA Yamagata Okitama, is the result of an earlier merger of the eight primary level cooperatives representing the three cities and five towns. Because of the declining agricultural output of Okitama, the cooperative has embarked last year on a plan to revitalize agricultural production in the region. Specifically, the Okitama Agricultural Promotion Plan, formulated with the involvement of the local governments and the local people, seeks to return the Okitama region to the level of output that it attained before the merger took place. To achieve this the JA is undertaking a number of initiatives that include increasing the size of farms and diversifying the local agriculture into non-rice commodities such as vegetables and fruits and livestock. For instance, the JA is promoting the Okitama Delaware brand of grapes and the Yonezawa brand of beef.

In the promotion of horticultural production, financial assistance to farmers is being provided in the form of subsidies. For example, in the construction of greenhouses, the prefectural government has contributed 30 percent and the JA has provided 10 percent of the total construction cost. The farmers meet the balance. In addition, to facilitate the shift to other crops, the JA also provides technical guidance on production, quality enhancement, etc. One of the bottlenecks in the production of horticultural products has been the high labor intensity of the operations, particularly, in the context of the shortage of labor in many rural areas in Japan.

Flower Farm

The flower farm, which is owned and managed by Mr. Seizaemon Suzuki, produces nine types of alstroemeria in three greenhouses having a total area of 3 thousand m^2. Mr. Suzuki used to work in the travel section of the JA Yamagata Okitama before he embarked on horticultural production in 1998. With additional technical guidance from the cooperative, he was able to set up his business together with his wife and his father. Assisting them in the farm are two part-time workers. He grows alstroemeria the whole year round, from where he earns a net income of ¥15 million.

The greenhouses, which had to be built with strong materials due to heavy snowfall during winter, cost some ¥20 million each including planting material. The amount is about three times that of ordinary greenhouses. To construct the greenhouses Mr. Suzuki received subsidies from the local government equivalent to 50 percent of the total cost. The JA provided the balance through a loan that Mr. Suzuki is amortizing over a 15-year period. The farm uses drip irrigation system having pipes imported from Israel.

The flowers are being marketed locally through the JA in Tokyo, Osaka and Fukuoka. For the future, Mr. Suzuki aims to continue to reduce his production costs to become more competitive, particularly, by improving fertilizer use efficiency and by cultivating high yielding varieties.

Beef Cattle Center

The Center, which is managed by the JA Yamagata Okitama, serves as a place for fattening *wagyu* or Japanese Black cattle. Farmers breed the animal and when the calves reach the age of 10 months, the JA purchases them and brings them to the rearing center. At the age of 30 months, when the cattle gain an average weight of 600 kg, they are sold at an average price of ¥700 thousand per head. At present, there are 120 head of cattle at the Center with two staff working full-time. The Center gets little profit from the sale of the animals. The fattening operations are maintained mainly to preserve and supply the local brand of Yonezawa Beef.

Cherry Farm

The farm which is owned and operated by Mr. Kyuichi Shikama produces five varieties of *sakurambo* (cherry) in two greenhouses having a total area of 4 ha. Mr. Shikama traditionally grows rice, Delaware grapes and cherry in open field. In 1990, he started producing cherry in greenhouses with financial assistance from the prefectural government and the JA Yamagata Okitama. Specifically, a subsidy of ¥5 million was provided for the construction of the greenhouses. The total investment amounted to ¥13 million including the cost of preparation and transplanting of the cherry trees. The balance was covered by a soft loan taken by Mr. Shikama from the JA. Due to the high price of early harvested cherry at that time, he was able to pay back the loan in three years.

Mr. Shikama produces about 200 kg of cherry per greenhouse of 2 ha. The JA target yield is 175-250 kg per 2 ha. The two greenhouses earn some ¥7 million per year. Mr. Shikama is assisted by his wife on the farm. In addition, he employs 100 workers during the harvest season. By shifting cherry production in greenhouses, which is a far higher paying operation compared to rice production, Mr. Shikama is expecting to entice his daughter to succeed him.

Zao Dairy Farm Center

The Center is presently located in Zao town in Miyagi prefecture. It was originally established in Atsugi city in Kanagawa prefecture as a foundation called the Dairy Farming Mechanization Center. In 1964, the Center was transferred to its present location and it assumed its present name later in 1980. As a foundation, the Center is a non-profit organization whose initial funds came from various national organizations of the Japanese agricultural cooperative system. It is under the guidance of the MAFF.

The basic function of the Center is to promote the dairy farming business in the country. However, in order to sustain its operations it engages in income-generating activities, mainly, the production of various types of natural cheese. The sale of these products accounts for about 85 percent of the total income of the Center.

The other businesses of the Center include production of raw milk (557 mt during 1999) and training. The raw milk is used to manufacture cheese and other dairy products. The training department conducts special training programs on manufacturing cheese for dairy farm helpers. It also operates a training camp for school children and other groups. The farm business department also undertakes R&D to improve dairy farm management.

As part of its promotion business, the Center has been receiving thousands of visitors annually. These visitors can enjoy visiting the facilities of the Center, and tasting its various products on sale. In 1998, the Center produced some 218 mt of cheese and 248 mt of other dairy products.

WORKSHOP OUTPUT

A workshop was conducted to provide the participants an opportunity to further discuss agricultural diversification and international competitiveness in the participating member countries. Specifically, two groups were formed to deliberate on the following point:

In the context of the changing global trade environment, how can agricultural diversification serve to enhance the international competitiveness of agriculture in Asia and the Pacific region?

The reports of the two groups were presented in a plenary session and these have been summarized as follows:

Report of Group I

Bangladesh, India, Islamic Republic of Iran, Mongolia, Nepal, Pakistan, Sri Lanka and Thailand

Chairman: Mr. Abdul Waheed Khan

* Food security should remain an area of prime importance for the developing nations. Accordingly, diversification should not be pursued at the cost of ensuring food security. In particular, increasing/ assuring access to food, especially to the poor, must continue to be a priority concern.
* International competitiveness may be enhanced through diversification. For diversification to succeed, however, a supportive policy and institutional environment (e.g., in the areas of research and market

information) is necessary. The following conditions/measures should be met/considered before deciding about diversification:

i) The available natural resources should be taken into account in determining the products a country should diversify.
ii) The products must be of high quality and produced at lower cost.
iii) Investments in R&D should be prioritized and focused on products with competitive advantage.
iv) Human resource development, particularly, in the application of relevant technologies and farm management appropriate for the new crops is vital to enhancing competitiveness.
v) Adequate infrastructure and production and marketing facilities should be provided.
vi) Timeliness in marketing and stable supply of the products is vital to developing the markets abroad.
vii) Linkages to the wholesalers in the world markets should be strengthened.
viii) Agro-processing for value addition with enabling environment, grading and packaging of the products are also important for effective marketing.
ix) International standards (e.g., SPS, ISO 9000, HACCP, etc.) should be promoted to ensure high quality and safety of products and for this, developed countries should provide technical assistance to developing countries as per commitment under the WTO.
x) Regulations that serve to hinder trade such as tariffs and non-tariff barriers should be minimized or eliminated altogether.
xi) Policies, especially those affecting trade, should be consistent.
xii) Profitability should be the essential factor in determining the products to be developed under the diversification program.
xiii) The role of the private sector should be strengthened.
xiv) The public sector should limit itself to a facilitating role.
xv) Joint private-public cooperation would facilitate diversification efforts.
xvi) Information dissemination needs to be improved, particularly, with regard to technologies and markets.
xvii) Technical assistance is important in facilitating the shift to other crops/economic activities.
xviii) Information technology can enhance competitiveness and accordingly training of traders in this area should be conducted (e.g., in establishing and facilitating e-commerce).
xix) Dumping and non-trade related issues should be adequately addressed through dialogue.
xx) Good governance should be promoted.
xxi) Law and order situation should be conducive to promoting investment in new/non-traditional products.
xxii) Educating the politicians/policy-makers on development priorities will facilitate the diversification efforts.
xxiii) Social and environmental issues should be duly considered in promoting diversification.

Report of Group II

Republic of China, Fiji, Indonesia, Republic of Korea, Malaysia, Philippines, Thailand and Vietnam
Chairman: Dr. Song-Soo Lim

Issue 1

Is diversification a prerequisite to competitiveness? Should countries diversify before they can be globally competitive? Or should countries just focus on the products in which they have comparative advantage?

Diversification, as a first step in the process, would encourage farmers to go into production of high value crops other than traditional ones. Under a competitive economy and a favorable economic environment, farmers in the process, will be able to determine the crops that can be efficiently produced, allow them to gain profit and achieve a competitive advantage.

Issue 2

Given that diversification is achieved, what can be done to promote international competitiveness?

1) Remove non-trade barriers:
   - Gather information and documents concerning international quality standards and disseminate this information to farmers in order to reconcile domestic standards with international standards.
   - Provide farmers with the knowledge and skills to comply with international standards through, for example, training programs and other means of technology transfer.
2) Research and development:
   - Invest in R&D so as to strengthen knowledge-based agriculture.
3) Patenting and branding of products:
   - Help farmers adopt modern production methods and implement strategic marketing plans.
   - Make efforts to take advantage of patents and secure consumers' recognition of product brands or product origin.
4) Improvement of infrastructure facilities:
   - Develop information systems to enable farmers to interact with markets to a great extent.
   - Improve infrastructure facilities to enhance production, marketing and trade.
5) Advocacy for the elimination/reduction of high tariff rates and other policies that discriminate against developing nations
   - Need to address high tariff and tariff escalation which have adverse effects on developing countries.
   - Continue to provide special and differential treatment (SDT) for developing countries.

Other Issues/Considerations

1) There are many opportunities for developing countries to develop niche markets for some products which can become internationally competitive.
2) International competitiveness starts from securing competitiveness in domestic markets where locally produced goods compete with imported products.

CONCLUSION

Agricultural diversification in Asia and the Pacific has basically occurred in two important ways:

1) as a response to the changing demand structure for agricultural products; and
2) as a result of policies designed to achieve certain specific objectives.

In this regard, it was observed that in a number of countries, particularly in South Asia, diversification has generally played a secondary role to the primary objective of securing food security.

In an international context, however, diversification has been pursued in all participating countries as part of their effort to expand export of agricultural products. In recent years especially, more and more developing countries have taken advantage of new trade opportunities generated through the trade liberalization initiatives of the WTO. Such initiatives, however, have brought about an environment not only of increased competition but also of reduced protection of their own products. Developing countries, therefore, have to exert greater efforts for improving their international competitiveness in agricultural products in order to expand their markets abroad. In this respect, diversification has been viewed as one strategy to increase competitiveness. The paper by Ali, Abedullah and Farooq in this book provides some evidence on how diversification can improve productivity of the cropping systems, and earning capacity of the human labor, thus induce socioeconomic development and competitiveness. However, this is an area where further research should be undertaken.

The study meeting provided the participants an opportunity to review the recent developments in the agricultural diversification efforts of their respective countries and to discuss specific measures on how diversification can serve to enhance the international competitiveness of their agriculture sector. The discussions raised a number of important issues which needed to be further addressed in greater depth in the future. It was hoped, though, that the study meeting had contributed to better understanding of the role and direction that diversification should take in promoting international competitiveness.

Part II. RESOURCE PAPERS (1)

by Dr. Luc De Wulf, Pramod K. Joshi

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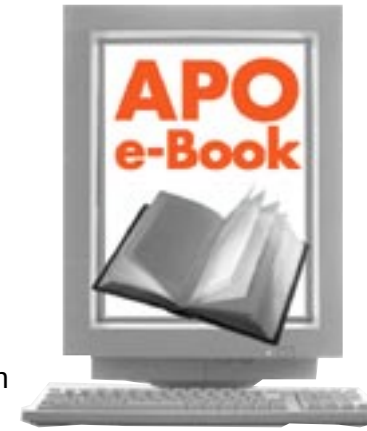

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1. GLOBALIZATION AND INTERNATIONAL COMPETITIVENESS: CONCEPTS AND POLICY IMPLICATIONS FOR AGRICULTURE

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AGRICULTURAL COMPETITIVENESS: CONCEPTS AND MEASUREMENTS

Economic policy-makers can benefit from having a clear concept of the issues they face and understanding the means of quantifying them. This will help in the search for a solution as well as monitoring any progress made to tackle the problem. This paper intends to clarify the concepts of competitiveness in agriculture and, without involving mathematical formulas and complicated symbols, reviews variety of ways that have been used by the economist to measure competitiveness with examples to indicate their importance.

Before explaining these methodologies, however, it is necessary to explain three concepts, which are basis of comparing competitiveness across sectors and countries. These are "Production Growth", "Productivity", and "Competitiveness". These concepts are very important in their own place and to some extent related to each other, but refer to substantially different issues.

Production Growth

It refers to the changes in the volume of production between two periods of time. For instance, rice production in Indonesia grew from 13.3 million mt in 1974-75 to 22.0 million mt in 1995-96. It is important to measure the achievement of the policy objectives of self-sufficiency and food security over the two periods, and may be helpful in measuring the potential for imports and exports. However, it says nothing about how efficient Indonesia is or was in rice production, or what are the reasons for the output growth.

Productivity

Productivity refers to the ways various factors of production are combined to generate output growth. For instance, the production of rice results from the application of labor and investment (land, infrastructure, and fertilizer), and how these factors are combined. A production function formalizes this relationship and assigns values to the contribution each of these factors makes to output growth. Studying this relationship provides insights on what policies should be focused on to foster growth in production. Research on rice production in Thailand, for instance, have clearly shown that in the 1960s and the 1970s the main factors contribute to the rapid growth in rice production was the application of more land and labor, and later introduction of high yielding varieties that required greater application of fertilizer. Investment in infrastructure and education were found to be useful, but not a major contributor. The policy conclusions from this relationship are that future growth in the sector should rely on factors other than land – given the environmental degradation caused and the exhaustion of available land. With slowing down returns from the introduction of new varieties, inputs such as fertilizer and irrigation, and additional labor, greater emphasis have to be given to better education (to have farmers using advance information available to increase productivity) and infrastructure. This then leads to implications for extension services, education, research and marketing strategies for inputs and outputs. Despite all these useful policy implications from productivity analysis this does not tell us whether Thai rice is cheaper than imported rice and can compete on the foreign market. For this we need another concept, and this is where competitiveness comes in.

Competitiveness

This measures whether, given the costs incurred in the production process, the commodity produced in a country can compete with the similar good in the international market. If a good is competitive it can coexist with imports where domestic production is not sufficient to satisfy the domestic market, and can be exported when it is in surplus supply. In case it is not competitive, the commodity needs to be protected against imports to let production take place at all in the country, and the commodity cannot be exported. The comparison with foreign prices and how cheaply goods can be brought into from foreign markets and from within the country is intrinsically intertwined with the notion of competitiveness. Hence, there is a need to go beyond production relations and to focus on international comparisons, on exports and imports. Also, exchange rates are relevant, as they are needed to compare domestic and foreign prices. In a pure case, a commodity is either competitive or not. This means, it is either locally produced, is made available to the domestic market and exported or not locally produced and imported. However, real life is somewhat more complicated than this pure case. Goods are not homogeneous within any given category, as there exist great variety in commodities broadly defined, transaction costs vary within a country and change over time and public policy interferes with the free flow of goods across countries.

The concepts defined below are intended to shed light on the issue of competitiveness of given goods in given countries, and will deal with public policies as they affect competitiveness in the agriculture sector.

COMPETITIVENESS AND PROTECTION

In a world of free trade and without government policies that assist particular sectors and influence exchange rates, there would be a level playing field in production across countries and across sectors. In such a world, countries would produce and export what they are good at and import the rest. Domestic production costs could exceed foreign production costs only to the cost margin of importing the commodity. Such cost is often high and prevents some commodities from being traded. For instance, many services (e.g., haircuts, medical services) cannot be traded, as the service provider must be physically present at the point of service delivery or transport cost for goods that must be consumed near to the place of production can be large (e.g., fresh vegetables). However, transaction costs are not a fixed item and in recent years have declined rapidly (telecommunications, multi-modal transport, etc.) bringing many new commodities into the sphere of international trade (e.g., seasonal vegetables, flowers, fresh fish, insurance claims service, billing).

As noted, public policy often interferes with free trade, with the objective to raise tax revenue, to reduce the cost of living of certain segments of the population or to stimulate domestic production in particular sectors. These objectives call for policy instruments such as raising export taxes, controlling the price of basic consumer goods, interfering with the marketing of agricultural products, controlling the price or subsidizing the fertilizer prices to lower production costs for the farmer, or subsidizing credit to particular sectors or levying import taxes on final products and intermediate commodities. In the process, the competitive position of products and sectors is affected intentionally. Several indicators have been used in the literature to assess this phenomenon. The coming sections of the paper shall successively discuss nominal protection, effective protection and a new concept of indirect protection, and illustrate these with examples from East Asia.

Nominal Protection

Nominal Protection Rate (NPR) is defined as the proportional difference between the domestic price and the comparable border prices evaluated at the official exchange rate. It measures the effect of price control, export taxes or quotas, and other such policies affecting the domestic (producer) prices of a tradable product. An import tariff of 10 percent is reflected in a positive NPR of 10 percent, while a 10-percent export tax is reflected in a negative NPR of 10 percent. A positive NPR suggests that domestic policies confer protection to producers of the commodity, while a negative figure indicates that policies penalize domestic producers of the commodity. A sector that operates under a positive NPR is sheltered from outside competition as it is permitting to produce at higher than competitive prices. This “extra“ can be reflected in higher returns to the factors of production (land, labor), or can cover inefficiencies in the production process. In any event, a sector that operates under positive protection has a hard time to export.

The NPR and its evolution overtime for Thailand, Philippines and Indonesia for different periods are presented in Table 1 (column 1). These indicators are sector averages and hide the variation around the average as incentives do at times differ substantially across products.

Table 1. Period Average Nominal Protection Rate, Indirect Protection Rate, and Total Protection Rate for the Philippines, Indonesia, and Thailand during 1961-95

Country and Period	Nominal Protection Rate	Indirect Protection Rate	Total Protection Rate
Philippines			
1961-70	-8.2	-20.9	-28.7
1971-80	-22.8	-23.8	-41.0
1981-90	-6.4	-24.5	-42.8
1991-95	18.0	-25.6	-19.8
Indonesia			
1961-70	-8.0	-27.5	-33.3
1971-80	-8.4	-15.7	-22.8
1981-90	14.0	-18.6	-7.2
1991-95	32.1	-24.6	3.5
Thailand			
1961-70	-29.4	-13.0	-38.6
1971-80	-29.0	-15.3	-39.9
1981-90	10.3	-15.6	-6.9
1991-95	22.0	-14.8	3.9

Source: Akiyama and Kajisa, 2000.

Let us take the example of the Philippines. In the 1960s the average negative NPR at 8.2 percent was relatively low, even though it was substantially positive for sugar, corn and chickens, suggesting that the price incentives provided to the agriculture sector were relatively weak during this period. It deteriorated during the 1970s to negative 22.8 percent. NPR for most commodities (including for major import-competing goods such as sugar, corn and rice) took an upward trend in the 1980s, in part because of the heavy regulation of agricultural markets, and it became positive 18 percent in the 1990s. Based on this indicator, distorted pricing policies instituted during the 1980s to mid-1990s have evidently been favorable to agricultural producers in a sense that they permitted the domestic producer to incur production costs that were higher than those prevailing on the international market. From being penalized during 1960s and 1970s, the Philippine agriculture sector was "favored" during 1980s until mid-1990s. It was protected from outside competition, but at the same time allowed it a cost structure that made exports very difficult. Similar trend in NPR was observed in Indonesia and Thailand.

Effective Protection

Another and better summary measure of the direct impact of trade and industrial policies is the Effective Rate of Protection (ERP) defined as the percentage excess of protected value-added over non-protected value-added of a particular economic activity. This measure takes into account the changes in the domestic prices of both inputs and outputs arising from tariffs, import control and the share of value-added in the output. With identical tariff on inputs and outputs, NPR equals ERP. When input tariffs are lower than output tariffs, ERP will exceeds NPR. Such rate differentiation (escalation of tariff rates according to the level of finishing) tends to be norm in import tariffs, so that ERP normally exceeds NPR, often by a large margin. Analogous to the NPR, a positive ERP implies that the sector enjoys protection by the system of tariffs and import controls, while a negative ERP indicates that the system penalizes (i.e., taxes) the activity of the sector.

Table 2 provides estimates of the ERP for the Philippines for five selective years for both the agriculture and the manufacturing sectors. The ERP for the agriculture sector is consistently positive over the time period under consideration and is increasing till 1995, to drop slightly thereafter. However, ERP for the manufacturing sector was higher than for the agriculture and increased at high rate until mid-1980s. This suggests relative neglect of the agriculture sector during this period. It is not surprising, therefore, that the

landed rich diverted some of their resources to manufacturing during the 1970s and 1980s. However, dramatic shift occurred in the relative ERP after mid-1980s at which time the ERP for the manufacturing sector dropped below that of the agriculture sector, suggesting a major shift in the incentive structure for the two sectors.

Table 2. Effective Rate of Protection by Major Sectors, Philippines, 1974-2000

(Unit: Percent)

Protection Type/Sector		1974	1985	1995	2000
ERP:	Agriculture	15	21	26	24
	Manufacturing	44	73	23	19
Relative protection:	Agriculture	100	100	100	100
	Manufacturing	125	143	98	96

Source: World Bank estimates, unpublished.

Indirect and Total Protection

There are other factors that permit a country to produce at higher costs than the rest of the world and that are not covered by either the NPR or the ERP. Hence these factors should be taken into account when making a final judgment of the level of protection of the agriculture or any other sector in the economy. These pertain to economy wide measures such as fiscal and exchange rate management and industrialization policies (including trade interventions – import tariffs, export taxes, quantitative restrictions – and domestic taxes and subsidies on non-agricultural products) which all affect the relative prices of agricultural commodities vis-à-vis non-agricultural commodities. Some of this was referred to above when discussing the ERP of the manufacturing sector. They should be fully accounted for in the final discussion and calculation of protection and competitiveness of a sector. Table 1 gives data for the indirect and total protection (NPR and indirect protection) for three East Asian countries. These data suggest that the indirect protection rate was substantially negative in all three countries for the time period considered, and in the Philippines it was still greater than the NPR granted to agriculture up to the latest date for which this analysis is available. Much of the indirect negative protection is the result of the overvaluation of the exchange rate. This overvaluation can best be measured by comparing the Real Effective Exchange Rate (REER) at any given period of time with the REER that prevailed at a time when the exchange rate was judged adequate to maintain long-term balance of payment equilibrium. Briefly the REER adjusts the nominal rate of exchange to account for the fact that inflation in a country may be higher or lower than the inflation rate in trade-partner countries, a development that is not necessarily reflected in the nominal exchange rate. For instance, if the inflation rate in Indonesia is 15 percent in a given year, while it is zero in its trading partners, a constant REER would imply that the nominal exchange rate (Rupiah versus the dollar say) would also depreciate by 15 percent. At an unchanged nominal rate of exchange, the REER will be shown an appreciation by 15 percent. Such an appreciation undermines the competitiveness of the Indonesian economy by about 15 percent. Table 3 provides the index of REER for selected countries suggesting that the REER can change quite rapidly within a short period of time, in response to a variety of factors. For instance, the Philippine peso appreciated in the mid-1990s as a reaction of private capital inflows thereby aggravating the effective protection of the economy as a whole. In sum, the concept of total protection that takes fully into account the relative valuation of the domestic currency does increase the measure of protection in case of overvaluation – the most frequent case – or decreases it in case of under valuation.

Table 3. Index of Real Effective Exchange Rate for Selected Asian Countries during 1993-2000

Country	1993	1995	1997	1999	July 2000
China	85.7	100	112.2	106.9	107.8
Malaysia	102.1	100	101.8	83.2	85.5
Philippines	92.9	100	108.8	96.4	91.3
Japan	90.3	100	78.8	-	85.6

Source: IMF, 2000.

COMPETITIVENESS AND EXPORT PERFORMANCE

Export performance is another way of monitoring the change in competitiveness of a country. The interest in tracking export performance and finding a comparable index for a larger number of countries stems from the recognition that countries do well on the export front tend to have higher GDP and per capita growth than those countries who do poorly on the export front. With world trade growing faster than GDP in most countries, there is much to be gained from selling in a fast growing market as compared with selling in a slow growing market.[*] But to do so a country's exports need to be competitive.

Trade Performance Index

The Trade Performance Index (TPI) measures by how much a country's share in world trade has changed over time. This index has been prepared by the International Trade Centre and the United Nation Development Program (ITC/UNDP) for 184 countries and for up to 14 major categories of commodities, using the internationally applied Standard of International Trade Centre (SITC) classification. The index was first published in 2000.

The TPI starts from the recognition that the export performance of any country and any commodity is the combined result of four factors:

1. ***Competitiveness Effect***

It measures the gains in market share due to increased competitiveness. It is calculated as the change in the exporting country's share in the destination market's imports, multiplied by the initial share of the partner's country's total imports.

2. ***Initial Geographic Specialization Effect***

This effect captures the benefits associated with the initial specialization of domestic exports on dynamic markets. It is calculated as the initial market share of the exporting country in partner countries, multiplied by the change in the share of partner countries in the world trade.

3. ***Initial Product Specialization Effect***

It captures the benefits associated with the initial sector specialization of domestic supply on products facing a dynamic demand. It is calculated as the change in the share of elementary markets in world trade, multiplied by the difference between the initial share of the exporting country in elementary markets in the world and the initial market share of the exporting country in destination markets.

4. ***Adaptation Effect***

This effect captures the ability of a country to adjust its supply of exports to the changes in world demand. It is obtained by calculating the changes in a given country's market share and the change in the share of elementary markets in world imports.

A country that captures a larger share of the market of its importer (benefits from the competitiveness effect), that itself grows fast (benefits from the initial specialization effect), and furthermore sells goods for which the demand grows rapidly (benefits from the initial product specialization) has positioned itself in a very competitive position. If its own productive capacities are such that it can adjust to the shifts in world trade, it is even better positioned. At the other extreme is the country that loses market share in its export markets that themselves are slow growing, and is specialized in products that have low demand elasticity and have expanded slowly. If the country is furthermore unable to shift its production towards commodities that are in growing demand in the world market, it further loses out. In reality, most countries have some gainers and losers and export to a variety of countries. Increasing the competitiveness of a country's exports, therefore, means to act on these various fronts so as to benefit from each of these effects.

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[*] In 1980-98, world GDP grew at 2.7 percent while world trade grew at 5.7 percent, for 1980-98 these rates were 2.4 and 6.6 percent, respectively. The most recent projections for 2000-02 predict these trends to continue (average GDP growth of 2.9 percent and average growth in world trade of 6.3 percent) (World Bank, *Global Development Finance*, Washington, D.C., 2000).

Table 4 provides the TPI for four countries and a few commodities, and shows what factors explain the change in market share of exports for each the countries included in the Table. Estimation are not made for finer categories of commodities, but this can easily be done for particular countries that are interested in viewing how their major exports have fared in recent years. Even though the ITC has not yet been approached for this purpose, there is little doubt that the Centre would respond favorably to performing such pointed analysis, as they have both the database and the statistical package to do the analysis.

Table 4. Trade Performance Index for Selected Countries in Asia, during 1994-98

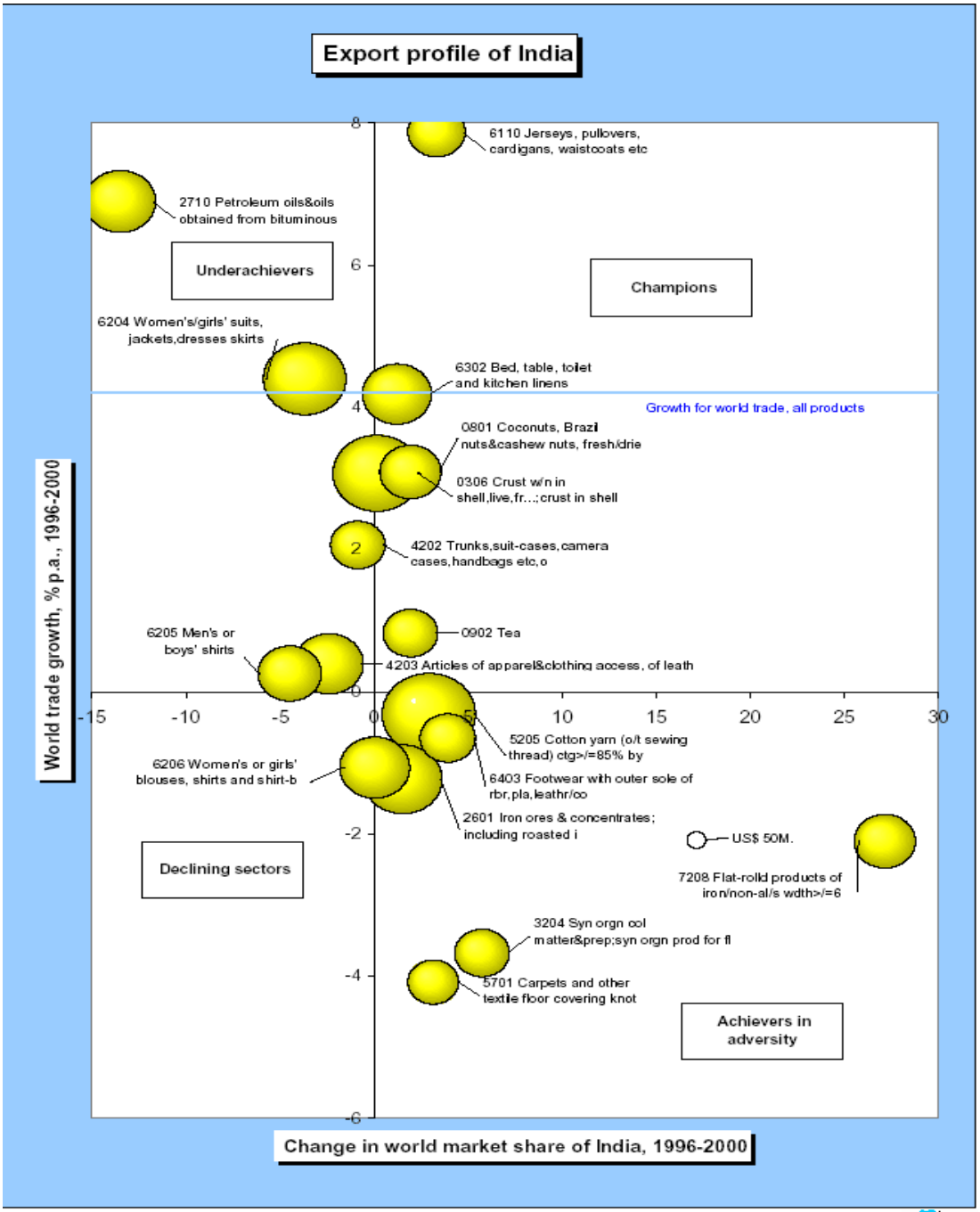
Product/Type of Effect	Indonesia	Thailand	Malaysia	Philippines
Fresh Foods				
Share in world markets (percent)	1.86	2.56	0.68	0.35
Percent change of world market share	-0.01	0.00	-0.05	-0.03
Competitiveness effect	0.01	0.01	-0.03	-0.01
Initial geographic specialization	-0.01	-0.01	-0.01	-0.02
Initial product specialization	-0.01	0.01	-0.02	0.01
Adaptation share in world market	0.01	-0.01	0.00	0.00
Processed Foods				
Share in world markets (percent)	0.94	3.03	2.71	0.54
Percent change of world market share	-0.02	0.02	0.02	0.00
Competitiveness effect	-0.01	0.02	0.00	0.00
Initial geographic specialization	0.0-0.01	0.01	0.01	0.00
Initial product specialization	0.01	0.02	0.01	-0.01
Adaptation share in world market	0.00	-0.03	-0.01	0.00
Leather				
Share in world markets (percent)	2.92	4.34	n.a.	0.86
Percent change of world market share	-0.08	-0.03	n.a.	0.06
Competitiveness effect	-0.08	-0.02	n.a.	0.06
Initial geographic specialization	0.00	-0.01	n.a.	0.00
Initial product specialization	0.01	0.01	n.a.	0.00
Adaptation share in world market	-0.01	-0.01	n.a.	0.00
Textiles				
Share in world markets (percent)	-1.60	1.34	0.74	0.19
Percent change of world market share	-0.03	0.01	0.03	0.09
Competitiveness effect	-0.01	0.06	0.06	0.10
Initial geographic specialization	-0.03	-0.01	-0.03	-0.02
Initial product specialization	-0.01	0.00	0.00	0.01
Adaptation share in world market	0.02	-0.04	0.00	-0.01

Source: ITC, http://www.intracen.org

National Export Trade Maps

These provide a succinct assessment of a country's export portfolio in terms of the dynamics of national supply and international demand. They focus on specific export products rather than broad sectors as the TPI does. National Export Trade Maps are presented as bubble charts, and are available for 20 leading export product groups of the country under review. The map for India is shown in Figure 1. It shows the export value of the product group under review (size of the bubbles), and it compares national export growth (horizontal axis) with the growth of international demand (vertical axis). In addition, the chart indicates the average nominal growth of total exports for the period 1996 to 2000 (vertical reference line) and the average nominal growth of world imports over the same period, which was 6 percent p.a. (horizontal reference line). Moreover, the diagonal line (i.e., the line of constant world market share) divides the chart into two parts:

exports of product groups of India to the right of this line have grown faster than world imports and thereby increased their share in the world market. Conversely, product groups to the left of the diagonal line have seen erosion of their world market share. The diagonal and the horizontal reference lines are of particular interest from a trade development perspective, since they divide the chart into four quadrants with different characteristics. For ease of reference, each quadrant has been given a name.



Note: the area of the circles correponds to the export value of the product group for India. See explanatory sheet for details.
Source: ITC calculations based on COMTRADE statistics.

Figure 1. Export Profile of India

1. ***Champions – Winners in Growth Markets*** (upper right, first quadrant)

These are the export products for which India has performed very well. They comprise in particularly of those products growing faster than world trade in general, and for which the country has been able to outperform world market growth and has increased its share in world imports. Exporters of these products have proven their international competitiveness over the mid-1990s. Trade promotion efforts for these products are less risky, as there are national success stories, which can serve as reference points. Promotional efforts should aim at broadening the supply capacity.

2. ***Underachievers – Losers in Growth Markets*** (upper left, second quadrant)

These products represent particular challenges for trade promotion efforts in the country. While international demand has been growing at above-average rates, the country has been falling behind. Its exports have either declined or grown less dynamically than world trade. As a result, the country under review has been losing international market share. In general, the bottleneck is not international demand, but rather on the supply side. For these products, it is essential to identify and remove the specific bottlenecks which impede a more dynamic expansion of exports.

3. ***Losers in Declining Markets*** (lower left, third quadrant)

The export prospects for these products tend to be bleak. World imports of the product concerned have increased at a below-average rate or actually declined, and the market share of the country under review has gone down. Trade promotion efforts for product groups in this category face an up-hill task. They need to adopt an integrated approach to take into account bottlenecks both on the supply and demand sides.

4. ***Achievers in Adversity – Winners in Declining Markets*** (lower right, fourth quadrant)

Products in this quadrant are characterized by growing shares of the country's exporters in world import markets which are declining or growing below average. From a trade promotion perspective, niche-marketing strategies are required to isolate the positive trade performance from the overall decline in these markets.

It should be noted that the criterion for distinguishing growing and declining products is the average nominal growth rate of total world imports from 1994 to 1998, which was at 6 percent annually. Products, whose world imports have grown below this rate – e.g., at 4 percent yearly – are classified as declining products, as their share in world trade is declining. The charts also provide an overview of the concentration of exports: the appearance of one or a few comparatively large circles show that exports are highly concentrated.

This classification of the export portfolios into four groups can be a useful preliminary analytical step. For concrete policy applications and product-specific trade promotion strategies and measures, the approach needs to be refined and additional product-specific information has to be taken into account.

National Export Performance Tables

The ITC presents tables with the data that are used in Figure 1. The tables do permit to have a close look on particular commodity groups that do not necessarily show on the chart (see Appendix and Figure 2 for the example of India).

ENHANCING COMPETITIVENESS

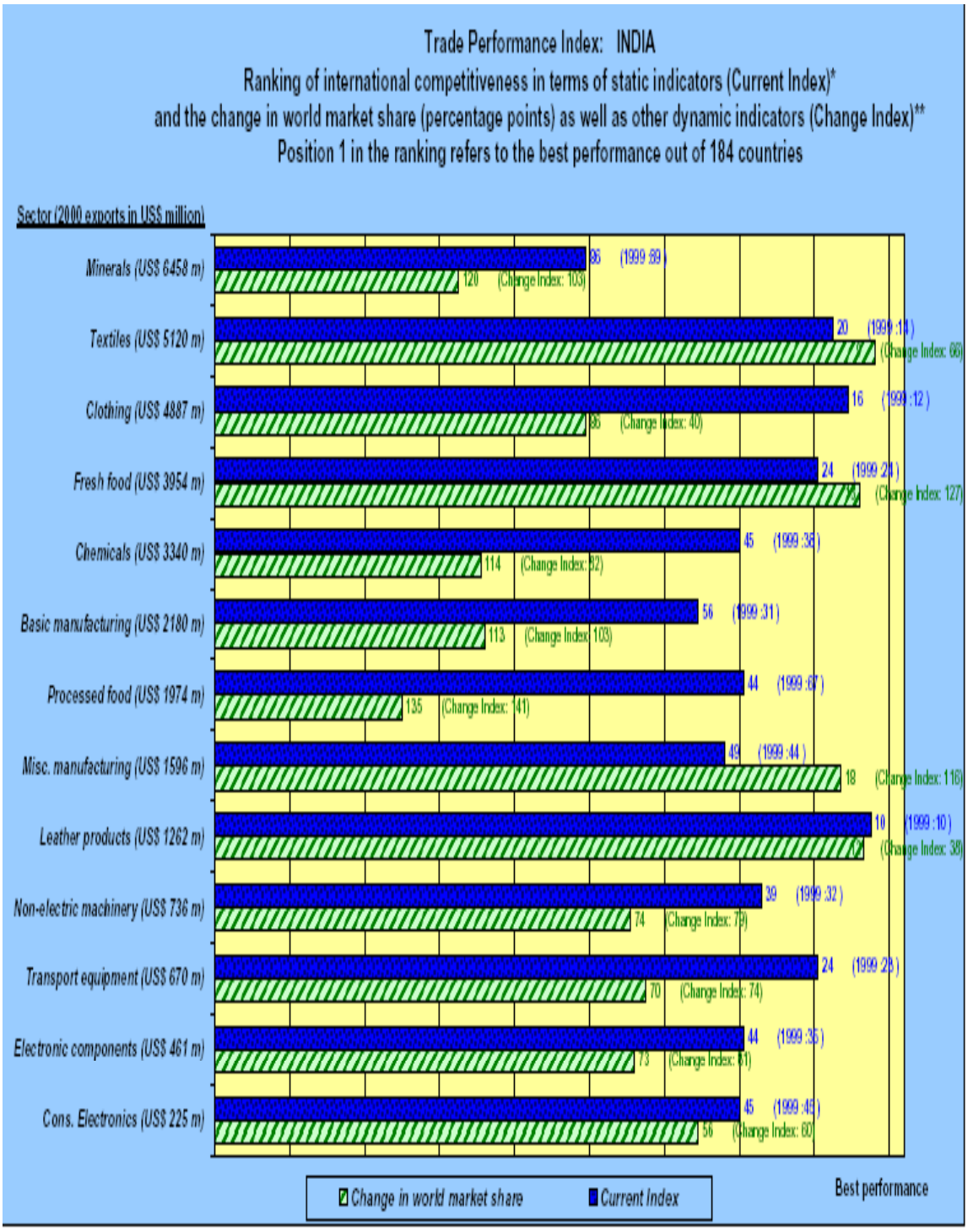
Removing the 'Handicaps'

As mentioned above, the agriculture sector operates under a set of public policies that affect its competitiveness. Some of these polices are designed to "assist" the agriculture sector, others affect the sector's competitiveness without being designed with this intention. The advantage of measuring competitiveness is both to help in understanding the policy environment of the agriculture sector and in identifying the policy action that should be taken to remove the handicaps to enabling the domestic production of a sector to compete on the international market.

Ensure a Competitive Exchange Rate

From the analysis of indirect protection it is clear that one of the most important handicaps to the competitiveness of agriculture rests on the extent of overvalued exchange rate that acts as a flat export tax. There are various reasons why countries adhere to overvalued exchange rates. A few of them are: to stop a

rapid inflow of foreign direct investment, to halt a boom in exports (often oil), to keep down the cost of living in urban areas where the consumer basket is heavily dependent on imported consumer goods, to protect the interests of the importing community, national pride, etc. All of them penalize the exporters. There are various techniques to monitor the REER, a mechanism to prevent the overvaluation from arising or to return to a competitive exchange rate.



* Net exports, per capita exports, share in world market, product diversification, market diversification.

** Change in: world market share, export/import coverage, product and market diversification, correlation with dynamics of international demand.

Figure 2. Trade Performance Index in India

Eliminate all Export Taxes

Most export taxes have now been eliminated, wherever they remain should be abolished. They were used to effortless raise fiscal revenue in a situation where raising other taxes was difficult or to exploit perceived monopoly power on the world market.

Eliminate the "Pro Manufacturing Bias" in the Tariff

Higher tariffs on manufacturing production ensures that the protection of the manufacturing sector is higher than that provided to the agriculture sector. A medium-term objective should be to move towards a flat rate tariff that taxes equally agricultural and manufacturing inputs and outputs. Over the long term the tariff should be abolished altogether and other fiscal revenue sources that do less harm to the allocation of resources in the country should be tapped.

Note the commitments of World Trade Organization (WTO) members to replace import quotas by tariffs. While a step in the right direction as it makes the protective effect of quotas explicit, it has often resulted, at least in the short term, higher tariffs than the tariff equivalent of the quotas that they replace. As such they worsen the competitiveness of the sector.

A strategic choice that often impact on the policy dialogue is to emphasize local agricultural production for which the country does not have a comparative advantage. Such a policy is argued for various reasons, including thrive for self-sufficiency, multi-functionality of agriculture, etc. However, this policy direction invariably tends to divert resources away from the production in which a country has comparative advantage towards those in which the country has no comparative advantage. As such it goes counter to enhancing the competitiveness of the sector and hampers the export potential of the country.

Reduce Unit Costs

Producing agricultural commodities and bringing them to the consumer – domestic and foreign – involves many steps. Each one adds to the cost of the final product and the final evaluation of the competitiveness of the sector will depend on the sum of these costs. Therefore, it goes without saying that any policy action that reduces these costs will add to the competitiveness of the sector. This goes from polices that lead to greater efficiency in the production (less and cheaper resources to produce a give output), improvement of marketing mechanisms, and development of infrastructure to bring the goods to market.

Define the Role of the State

Much of policy reform in the last few decades has centered on modifying the role of State. Fiscal reasons drove some of these reforms (e.g., reducing consumers' subsidies). Others were driven by the adherence to international trade agreements under the auspices of WTO. Still others stemmed from a new view of the role of State and from a view of the complementarities between the action of State and of the private sector. The discussion of policy actions to enhance competitiveness will benefit from a clear view of what a State should and should not do. This will then guide us to a clearer vision of what needs to be done by the various partners in the development process.

More and more countries adhere to the vision that it is the private sector that should be on the driver seat of economic development. This vision derives from the rather negative analysis of historical experiences with alternative approaches, where the State either dominated overall economic activity (centrally planned economies of the Soviet style) or where the State had assumed major responsibilities of activities and functions that could as well have been undertaken by alternative organizations (e.g., cooperative, private sector).

The modern view of the role of the State is that the State should intervene where there is a market failure. This view tells us that in situations where both the private sector and the State are equally competent to do the task, this should be left to the private sector. Only where the State can do better than the private sector should the State undertake the task. In the area of law and proper institutions – including effective judiciary and protecting property rights – it is obvious that the State has a role carved out for herself. In the sphere of production it has now become the widely accepted theory that the State should intervene if there are major "externalities". These externalities can be either positive or negative. Positive externalities are present when the economic agent that undertakes the activity cannot reap the full returns of his actions, as the product he creates becomes available for all and he cannot charge a price to cover his costs and make a profit. Negative externalities are present when the economic agent does not bear the full brunt of the costs

to society that his production entails; this will lead him to produce more than what is good for the society. Negative externalities of production demand that the State introduces measures that forces the agents to take into account the costs to society of the activity. Under circumstances of substantial positive externalities, fewer than optimum private parties will engage in this activity and the output level will be smaller than the optimum for the society (pollution is a good example). Society will be poorer if the State does not step in to ensure that this initiative is undertaken. Mostly this will be a combination of regulatory activity and of taxes.

In recent years and in many countries the State has pulled back the production and distribution of fertilizer and other agricultural inputs, the provision of credit through State agricultural banks, the marketing of agricultural output under clear price control mechanisms. Examples in the region abound. The discussion should be guided by the concern of what it is that the State should do to enhance agricultural competitiveness while leaving it to the private sector that the sector can handle better. It is clear that there is quite a full agenda. Here is a rundown from an economist's point of view.

1. ***Reduce Production Cost at the Farm Gate***

This is clearly a function that exceeds the scope of any private sector entrepreneur, as he cannot capture the externalities that involved. Here we find the traditional functions of the agricultural ministry with its research and development activities, extension services, provision of market and weather information. Cooperation with the private sector – producers associations, for instance – is essential and subcontracting to universities and research institutes, can play an important role.

The State should attempt to ensure that agricultural credit functions to the benefit of the producer. Past experiences with public banks have failed in doing so. A more promising venue has been to strengthen the banking sector in the country and in the rural areas, by providing them access to capital and ensuring a good regulatory environment. Subsidizing agricultural credit has often been recommended and attempted. However, it has mostly lead to unnecessary protection of the agriculture sector especially in the developed countries, the un-sustainability and ultimately the demise of agricultural credit institutions.

Subsidizing other agricultural inputs – such as fertilizer, fuel, and machines – has also been attempted. They tend to be costly, lead to waste and are financially unsustainable as they absorb large public resources that often are provided with delay or not at all. The private sector business environment should be such that these activities are undertaken efficiently.

The state of basic infrastructure in rural areas greatly influences the production costs. It is the role of the State to ensure that those entities that are responsible for rural water and electrification function efficiently. The government should regulate these entities and assist them to obtain the necessary operational and investment resources. Proper pricing of the services rendered needs to be addressed and demands for rural subsidies must be carefully considered in light of their fiscal sustainability and potentially distortion effects. Community participation in the design, delivery and maintenance of these infrastructure services has proven in many countries to contribute to their sustainability.

The State should also provide basic social services, such as education and health as this will ultimately reduce the labor cost in production and enhance the capacity of the rural population to absorb new production techniques and adjust to market signals.

2. ***Reduce Transaction Costs***

Costs of bringing inputs to the farm and taking the final products to market depend to a large extent on market intermediaries and infrastructure. The State can influence on these costs by implementing a program of private sector development and investment. Hence, there is a clear role of government action in many of these areas. Each country situation is different and a diligent review of these transaction costs can provide guidance to a custom-tailored reform program to reduce these costs. Only a few examples are given here. This list is not exhaustive, however, and can be enlarged depending upon the situation.

* Weak competition in the marketing chain.
* Poor transmission of price information to all participants so that producers get discouraged or do not produce along the most current market demands.
* Inadequate industrial development to transform agricultural inputs thereby reducing the market size for the agricultural production.
* Monopolistic transport policies that increase transportation costs; abuses of transport unions or restrictive licensing, government bureaucratic interference.

* Absence of institutions that would permit the participants to cover price risks, such as forward markets.
* Poor warehousing facilities leads to excessive produce deterioration.
* Poor road network and its management (physical and logistical infrastructure), particularly port facilities.
* Excessive and costly government intervention because of its regulatory measures or poor service delivery in customs. Experience has shown that these inefficiencies can add 10 percent or more to the cost of exports.
* Absence of clear standard certification mechanisms.

Facilitate Access to Market – The Trade Promotion Function

The test of external competitiveness is the success with which goods are sold to the foreign consumer. For many years, governments have assumed a responsibility of fostering foreign trade and have set up specialized organizations to promote this. The ITC, itself a specialized UN agency under UNCTAD and WTO, has made major efforts to assist governments to promote their exports. In addition to providing certain services such as advise on quality standards and packaging, the ITC has promoted the Foreign Trade Organizations (FTOs). Their objective was to identify measures and initiate policies to promote exports. The experience with the FTO has been diverse and rather negative. Many observers have proposed to abolish these organizations and seek out alternative ways of promoting exports – such as financing consultants in market research and production improvement.

A recent study of this subject proposes not to throw out the baby with the bath water, rather restructure the FTO work along the following lines:

* Ensure that a sound macro framework, including a competitive exchange rate, is in place.
* Make the FTO autonomous, so that it can operate outside of the bureaucratic framework.
* Support a demand-driven strategy and involve the private sector. Even bring them on the Board of the FTO.
* Ensure a balance of the FTO work between the onshore and the offshore work. Most FTOs have focused excessively on offshore work (foreign missions, exhibitions) and could get more effective by acting on the internal production cost.
* Ensure quality staffing. Exporting is largely a private sector activity and poorly qualified, civil servants – that are shifted from one service to the next and have little or no understanding of how the private sector functions – are not ideal for the task. Proper compensation is needed to attract the right people to stay on the job.
* Provide adequate funding. Operations of the FTO have floundered often by lack of funding. Foreign funds can be used to prime the pump, but not to ensure the sustainable operations. Fees for services rendered should be considered as part.

CONCLUSION

There are number of indicators that can be used to measure the competitiveness of agricultural production. None of these provide the full and comprehensive picture. Data are often inadequate and the methodologies not fully consistent. Therefore, some combination of these can be used to shed light on the competitiveness of any sector, and assist in designing an action plan to enhance the competitiveness, and monitor the progress achieved. Some of the policies are the responsibility of the authorities in charge of the agriculture sector and of the actors in the agriculture sector – public and private. Other policies pertain to macro policies such as fiscal, tariff and exchange rate policies intended to stimulate the manufacturing sector or provide cheap agricultural products to the national consumers. They are of the purview of other national authorities. Policies to enhance the competitiveness of the sector entail both those that remove "handicaps" and those that focus on reducing unit costs.

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Appendix

Trade Performance Index of India

Indicators		India	Fresh Food		Processed Food		Textiles		Chemicals	
			Value	Rank (168)*	Value	Rank (141)*	Value	Rank (109)*	Value	Rank (125)*
General profile	G1	Value of exports (US$ 000)	3,954,429		1,974,343		5,120,060		3,340,198	
	G2	Trend of exports (96-00) p.a.	1%	96	-3%	125	13%	43	3%	85
	G3	Share in national export (percent)	12		6		16		10	
	G4	Share in national import (percent)	3		6		1		16	
	G5	Average annual change in per capita exports	-1%	83	-6%	109	1%	50	0%	82
	G6	Relative unit value (world average = 1)	-		-		-		-	
	G7	Average annual change in relative unit value	-		-		-		-	
Position in 2000 for Current Index	P1	Value of net exports (US$ 000)	2,798,587	10	87,391	35	4,723,748	4	-2,006,790	107
	P2	Per capita exports (US$/inhabitant)	3.9	157	1.9	124	5.1	76	3.3	104
	P3	Share in world market	1.69%	17	0.88%	24	3.43%	10	0.55%	28
	P4a	Product diversification (N^0 of equivalent products)	14	24	3	98	16	40	26	35
	P4b	Product spread (concentration)		22		69		29		26
	P5a	Market diversification) (N^0 of equivalent markets)	12	17	17	10	18	6	25	3
	P5b	Market spread (concentration)		6		9		5		1
Change 1996-2000 for Change Index	C1	Relative change of world market share (percent per annum)	5.02		-1.78		2.04%		-0.65	
		Sources Competitiveness effect	2.58%	60	0.81%	86	2.73%	29	4.02%	33
		Initial geographic specialization	1.26%	45	-0.38%	83	0.86%	38	-0.21%	43
		Initial product specialization	3.28%	57	-0.15%	71	-0.15%	51	-0.03%	47
		Adaptation	-2.10%	117	-2.06%	85	-1.41%	68	-4.44%	106
	C2	Trend of import coverage by exports	-2%	97	-25%	136	-5%	79	1%	67
	C3	Matching with dynamics of world demand		58		92		104		67
	C4a	Change in product diversification (N^0 of equivalent products)		121		129		21		98
	C4b	Change in product spread (concentration)		118		126		22		98
	C5a	Change in market diversification) (N^0 of equivalent markets)		141		122		55		44
	C5b	Change in market spread (concentration)		135		120		54		38
Indicators included in chart	A	Absolute change of world market share (percent points per annum)	0.0229%	13	0.0609%	135	0.0269%	9	-0.0189%	114
	P	Current index		24		44		20		45
	C	Change index		127		141		66		82

... To be continued

Appendix (Continuation)

Indicators		India	Leather Products		Basic Manufacturing		Non-electric Machinery	
			Value	Rank (86)*	Value	Rank (130)*	Value	Rank (94)*
General profile	G1	Value of exports (US$ 000)	1,261,976		2,180,133		735,691	
	G2	Trend of exports (96-99) p.a.	1%	60	23%	29	1%	70
	G3	Share in national export (percent)	4		7		2	
	G4	Share in national import (percent)	0		8		10	
	G5	Average annual change in per capita exports	1%	40	-1%	94	-3%	82
	G6	Relative unit value (world average = 1)	-		-		-	
	G7	Average annual change in relative unit value	-		-		-	
Position in 2000 for Current Index	P1	Value of net exports (US$ 000)	1,146,527	9	-509,370	105	-2,494,288	78
	P2	Per capita exports (US$/inhabitant)	1.2	71	2.2	107	0.7	88
	P3	Share in world market	1.94%	15	0.50%	35	0.13%	41
	P4a	Product diversification (N^0 of equivalent products)	9	5	33	27	44	16
	P4b	Product spread (concentration)		11		24		16
	P5a	Market diversification) (N^0 of equivalent markets)	9	14	8	44	15	8
	P5b	Market spread (concentration)		6		20		11
Change 1996-2000 for Change Index	C1	Relative change of world market share (percent per annum)	1.32		2.35		1.62	
		Sources (p.a.) Competitiveness effect	3.98%	30	4.81%	34	4.66%	29
		Initial geographic specialization	0.24%	48	-1.30%	80	-0.27%	46
		Initial product specialization	-0.70%	45	5.50%	42	2.62%	21
		Adaptation	-2.21%	67	-2.66%	94	-5.40%	81
	C2	Trend of import coverage by exports	-2%	45	-5%	55	5%	44
	C3	Matching with dynamics of world demand		28		81		53
	C4a	Change in product diversification (N^0 of equivalent products)		43		109		78
	C4b	Change in product spread (concentration)		39		109		76
	C5a	Change in market diversification) (N^0 of equivalent markets)		35		122		73
	C5b	Change in market spread (concentration)		32		121		69
Indicators included in chart	A	Absolute change of world market share (percent points per annum)	0.0173%	12	-0.0155%	113	-0.0078%	74
	P	Current index		10		56		39
	C	Change index		38		103		79

... To be continued

Appendix (Continuation)

Indicators		India	Cons. Electronics		Electronic Components		Transport Equipment	
			Value	Rank (68)*	Value	Rank (92)*	Value	Rank (85)*
General profile	G1	Value of exports (US$ 000)	235,232		461,211		670,465	
	G2	Trend of exports (96-00) p.a.	-6%	66	4%	73	-4%	82
	G3	Share in national export (percent)	1		1		2	
	G4	Share in national import (percent)	4		4		2	
	G5	Average annual change in per capita exports	-10%	67	-2%	84	-6%	67
	G6	Relative unit value (world average = 1)	-		-		-	
	G7	Average annual change in relative unit value	-		-		-	
Position in 2000 for Current Index	P1	Value of net exports (US$ 000)	-1,170,620	45	-821,517	70	113,546	19
	P2	Per capita exports (US$/inhabitant)	0.2	68	0.5	86	0.7	79
	P3	Share in world market	0.04%	41	0.08%	43	0.10%	40
	P4a	Product diversification (N^0 of equivalent products)	6	26	21	19	7	19
	P4b	Product spread (concentration)		26		17		15
	P5a	Market diversification) (N^0 of equivalent markets)	7	33	15	4	22	1
	P5b	Market spread (concentration)		28		7		1
Change 1996-2000 for Change Index	C1	Relative change of world market share (percent per annum)	-14.29		-6.81		-6.85	
		Sources (p.a.) Competitiveness effect	-10.95%	65	1.41%	41	-3.21%	71
		Initial geographic specialization	-0.47%	34	-2.53%	57	1.39%	15
		Initial product specialization	-0.70%	38	0.77%	29	-2.46%	74
		Adaptation	-2.17%	45	-6.47%	88	-2.57%	58
	C2	Trend of import coverage by exports	-29%	68	-8%	81	12%	29
	C3	Matching with dynamics of world demand		44		70		60
	C4a	Change in product diversification (N^0 of equivalent products)		11		64		50
	C4b	Change in product spread (concentration)		11		63		50
	C5a	Change in market diversification) (N^0 of equivalent markets)		27		16		41
	C5b	Change in market spread (concentration)		26		17		38
Indicators included in chart	A	Absolute change of world market share (percent points per annum)	-0.0155%	56	-0.0117%	73	-0.0159%	70
	P	Current index		45		44		24
	C	Change index		60		81		74

... To be continued

Appendix (Continuation)

Indicators		India	Clothing		Misc. Manufacturing		Minerals	
			Value	Rank (114)*	Value	Rank (119)*	Value	Rank (145)*
General profile	G1	Value of exports (US$ 000)	4,886,657		1,595,502		6,458,397	
	G2	Trend of exports (96-00) p.a.	5%	81	5%	83	7%	61
	G3	Share in national export (percent)	15		5		20	
	G4	Share in national import (percent)	0		4		38	
	G5	Average annual change in per capita exports	3%	59	5%	51	5%	69
	G6	Relative unit value (world average = 1)	-		-		-	
	G7	Average annual change in relative unit value	-		-		-	
Position in 2000 for Current Index	P1	Value of net exports (US$ 000)	4,881,640	5	107,728	16	-6,208,229	137
	P2	Per capita exports (US$/inhabitant)	4.8	94	1.6	98	6.4	121
	P3	Share in world market	2.61%	11	0.39%	30	0.98%	28
	P4a	Product diversification (N^0 of equivalent products)	14	47	4	101	1	114
	P4b	Product spread (concentration)		41		59		58
	P5a	Market diversification) (N^0 of equivalent markets)	8	9	6	60	5	54
	P5b	Market spread (concentration)		5		29		23
Change 1996-2000 for Change Index	C1	Relative change of world market share (percent per annum)	-0.15		2.83		-0.32	
		Sources (p.a.) Competitiveness effect	1.47%	48	3.75%	36	1.80%	56
		Initial geographic specialization	1.64%	52	1.14%	32	2.67%	63
		Initial product specialization	-1.84%	103	0.05%	56	-3.02%	89
		Adaptation	-1.42%	77	-2.11%	89	-1.77%	78
	C2	Trend of import coverage by exports	8%	30	-3%	87	-1%	90
	C3	Matching with dynamics of world demand		92		107		69
	C4a	Change in product diversification (N^0 of equivalent products)		21		95		107
	C4b	Change in product spread (concentration)		21		93		106
	C5a	Change in market diversification) (N^0 of equivalent markets)		37		86		105
	C5b	Change in market spread (concentration)		38		85		100
Indicators included in chart	A	Absolute change of world market share (percent points per annum)	-0.0096%	86	0.0057%	18	-0.0083%	120
	P	Current index		16		49		86
	C	Change index		40		116		103

Source: ITC calculations based on COMTRADE of UNSD.

2. DIVERSIFICATION OF AGRICULTURE IN MORE COMPETITIVE ENVIRONMENT

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BACKGROUND

During 1990s, two major events compelled many developing countries to review their agricultural programs and policies. These included:

1) mounting supplies of surplus grains due to success in the adoption and performance of new cereal production technologies; and
2) economic reforms as a result of the World Trade Organization (WTO), which has made trade more open and competitive.

Both these forces led to sharp decline in the prices of food grains. Such trends are posing threats to their business among the farming community in almost every country. To manage surplus food grain and save farming community from the emerging challenges of WTO, the current agricultural policies are being reviewed, and economic reforms in the agriculture sector are being launched.

Diversification was reckoned an important strategy to overcome the emerging challenges to the agriculture sector. It has become an integral part of the structural adjustments and transformation program of the agriculture sector in almost every country of Asia to derive potential benefits of globalization. The economies are diversifying both horizontally where new high value commodities are incorporated in the existing production system, and vertically in which secondary and tertiary sectors are becoming more important in terms of their contribution in national income and employment (Taylor 1994; and Vyas 1996). The horizontal diversification is taking place within the agriculture sector, in which crops are substituted with sub-sectors like animal husbandry, forestry, and fisheries. These are now perceived to be occupying more significance compared to crop production. Even within the crop sub-sector, the more remunerative cereals are now replacing the low profitable cereals. On the other hand, the vertical diversification in agriculture broadens the income base of farmers, and new agriculture and non-agriculture sectors, such as food processing, textile industry, services sector, etc. are becoming increasingly important sources of income of the rural communities.

This paper concentrates on five important issues related to agricultural diversification. These are:

1) concept and objectives of diversification;
2) forces behind diversification;
3) importance of diversification;
4) conditions for diversification of agriculture; and
5) challenges of agriculture diversification.

Some successful examples of diversification with pulses are also presented, and the last section concludes the paper.

CONCEPT AND OBJECTIVES OF DIVERSIFICATION

In the agriculture sector, diversification is considered a shift from one crop to another crop, or from one enterprise to another enterprise (Vyas, 1996). Diversification of agriculture may also come as an additional complementary enterprise to the main enterprise. Based on these concepts Vyas (1996) proposed three situations of diversification:

1) Shift from less profitable crops or enterprise to more profitable crop or enterprise within agriculture (horizontal diversification);
2) Shift from farm to non-farm activities (vertical diversification); and
3) Use of resources in diverse activities (due to both horizontal and vertical diversification).

Some, however, takes the macro approach of diversification where it extends well beyond the farm level encouragement of farmers to grow non-staple crops. According to this approach, diversification is not merely an agronomic question of what additional crops can be grown, neither it is merely an economic question of how to make them profitable. It relates to providing wider opportunities to farmers, both on the farm as well as non-farm, to use their resources including family labor and management skill with increasing efficiency. The issue is, therefore, tightly knitted with the broader agricultural development strategies, especially the interplay between short-run policies designed to meet immediate government objectives for the sector and the longer-run relationship of agriculture to the rest of the economy during the process of structural change (World Bank, 1990). This type of agricultural diversification includes diversification in production, marketing, and processing activities among different sub-sectors, and can contribute significantly to both growth and equity.

In a subsistence agricultural system, diversification is considered as a strategy to minimize farm risk, which arises as a result of fluctuations in output prices, weather uncertainties, and insect-pest incidences, among others. In an era of commercial and market-led agriculture, however, diversification is a growth strategy which replaces the subsistence enterprises with the high value ones. In the process, it reduces risk in agricultural production. Broadly there are four major objectives of diversification in agriculture:

1) Increase income of small farm holders;
2) Encourage full employment of available resources;
3) Stabilize farm income across seasons; and
4) Conserve the natural resources

(Vyas, 1996).

In a competitive environment, when the food grain prices slide down, the urban consumers and the landless poor gain but it may result in net income loss to food grain producers, especially those located in unfavorable environments (David and Otsuka, 1993). The livelihood of the poor in these environments critically depends on incomes from diverse sources including the production of commercial crops. In the course of development, diversification of agricultural resources to production of commercial crops and livestock products with high-income elasticities becomes necessary to increase incomes in agriculture as well as to earn foreign exchange. Agricultural diversification can also be designed to alleviate poverty and protect the environment (Hayami and Otsuka, 1994). For a proper policy design, however, it is important to understand the nature of agricultural diversification required in less-developed countries today.

FORCES BEHIND DIVERSIFICATION

The domestic and international economic environment is rapidly changing since the early 1990s. Diversification of the production and consumption system is one of the responses to these changes. In the dynamic and more competitive environment, several forces are behind diversification. Important of those are:

1) implementation of regulations and commitments of the WTO;
2) concern for food security;

3) degradation of natural resources; and
4) rising concern for poverty.

Most developing countries are member of WTO. Therefore, all of them have to remove quantitative restrictions and reduce tariff rates. Simultaneously, international markets are opening up for agricultural commodities in the wake of implementation of WTO agreement. Thus implementation of WTO agreement is creating a force for diversification.

Another force for diversification is the fast economic growth in developing countries, which leads to rising incomes and demand for high value crops, and declining demand and prices for cereals. This results in new consumption pattern, which are expected to change the employment opportunities and affect natural resources. The growth and diversification of the agriculture sector would solely depend on how swiftly a country responds to the changing national and international economic environments. To take full benefit of new economic regime and to thrive for equity, there is a need for appropriate planning for those regions and groups expected to be adversely affected by this development process.

The sustainability of the continuous cereal-based cropping systems, a dominant system in Asia, is now in question in light of the reduced soil fertility and build-up of insect-pest complex in these systems. Growing evidence points to slowed productivity growth and increasing degradation of the resource base of these systems (Ali and Byerlee, 2002). Resource degradation of the cereal-based systems along with declining prices of cereals are forcing farmers to shift their resources to more profitable crops.

Although, the Green Revolution technologies helped to improve food supply and per capita food availability, initial expectation from these technologies to eradicate poverty did not materialize. The increased sensitivity for poverty and its eradication, especially at the international level, forces donors to increasingly shift their investment for those crops and enterprises which generates higher income and engage more poor people in productive jobs. This implies investment away from cereal crops, brings diversity in the production system and induces diversity in consumption as well.

IMPORTANCE OF DIVERSIFICATION

Diversification of agriculture can meet several challenges. In this section we have focused on three dimensions:

Food Security

The competitive environment is changing the enterprise-mix in favor of more commercial crops. For example, during the decade of 1988-98, the growth rates in production of sugarcane, edible oil, horticulture and livestock increased in majority of the developing countries (Table 1) – a clear indication of intensification and diversification of agriculture in favor of these crops.

On demand side, with increase in population and income, the demand for food is rapidly increasing and diversifying. The projection on food demand reveals that South Asia will exhibit a more diversified food basket with shifting per capita consumption from low-income elastic commodities such as cereals towards high-income elastic commodities such as milk, fruits, vegetables, meat, eggs, fish, and pulses. This will generate high growth in demand for the latter products (Table 2). More specifically, the demand for vegetables, fruits, and milk will increase at much higher rate than other food item. Moreover, this increase will be much higher among the group having high-income growth compared to those with low-income group.

The impact of structural shift in dietary pattern through diversification is expected to show a marginal improvement in nutrition, especially energy (Table 3). The predictions are that the calorie levels would be sufficiently met in every South Asian country, therefore there will be decline in the demand for cereals. In South Asia as a whole, the share of horticultural crops in total energy will improve from 5.2 percent in 1995 to 7.8 percent in 2030, from 7.5 to 12.3 percent for livestock and fisheries products, while there will be marginal improvement for “other” food items during this period. The same pattern is expected to follow in each South Asian country. These changes will bring improvement in food security in terms of enhanced availability of micronutrients, such as iron and vitamin A. Despite these diversification led structural changes in demand and their impact on food security, however, food grains will continue to dominate and maintain their share of 61-82 percent in total energy even in 2030.

Table 1. Annual Compound Growth Rates of Area, Production and Yield of Various Food Commodities in South Asia 1988-98

(Unit: Percent)

Item	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka	South Asia	World
Staple Food Crops								
Rice:								
Area	-0.3	1.9	0.2	0.7	1.3	-0.2	0.3	0.3
Production	1.1	2.0	1.6	1.2	3.8	0.5	1.4	1.5
Yield	1.4	0.1	1.4	0.5	2.6	0.7	1.2	1.2
Wheat:								
Area	2.9	1.2	1.1	1.0	1.0	-	0.7	0.1
Production	5.5	1.6	3.6	3.3	3.0	-	3.2	1.1
Yield	2.6	0.4	2.4	2.3	2.0	-	2.5	1.0
Maize:								
Area	-4.9	0.6	0.5	1.3	0.3	-0.8	0.9	0.8
Production	-4.3	1.7	1.5	2.3	0.8	-1.1	3.5	3.3
Yield	0.6	1.1	1.0	1.0	0.5	-0.4	2.5	2.5
Other cereals:								
Area	0.0	1.0	-0.4	1.2	0.9	-0.3	0.1	-0.1
Production	1.3	1.7	1.8	1.9	3.1	0.5	2.1	1.4
Yield	1.3	0.7	2.2	0.7	2.2	0.8	1.9	1.5
Pulses:								
Area	-0.8	0.2	0.6	0.4	0.2	-3.2	0.9	0.2
Production	0.0	0.3	1.1	3.1	2.2	-6.0	1.3	0.1
Yield	0.9	0.1	0.6	2.7	2.1	-2.9	0.4	-0.1
Roots and Tubers								
Area	0.6	0.0	3.5	2.8	3.8	-4.8	0.2	0.9
Production	1.6	1.3	4.4	4.5	6.3	-5.6	1.7	1.4
Yield	1.1	1.3	0.9	1.6	2.5	-0.8	1.5	0.5
Other Crops								
Sugarcane:								
Area	-0.2	0.2	2.2	5.5	2.0	-0.1	2.5	1.8
Production	0.3	0.7	3.3	7.7	4.0	5.7	3.5	2.3
Yield	0.5	0.5	1.1	2.1	1.9	5.7	1.0	0.5
Edible oil crops production (oil equivalent)								
Edible oil	1.3	-0.1	3.7	1.4	1.5	2.1	4.6	3.9
Horticultural Crops								
Vegetables	2.1	2.0	1.9	4.8	5.2	0.1	5.6	3.6
Fruits	0.8	0.4	5.0	0.2	4.6	1.2	5.9	2.7
Livestock Products								
Milk	4.2	0.3	4.0	2.3	5.2	3.6	4.2	0.2
Meat	4.6	1.2	2.9	2.4	6.5	7.4	6.2	2.4
Hen eggs	8.0	3.0	4.7	4.0	4.0	1.0	9.2	3.9
Fish	2.7	0.0	5.5	9.6	3.4	3.3	2.3	1.0

Table 2. Annual Per Capita Food Consumption in South Asia in 2000 and Projection for 2030

(Unit: kg)

Food	Low-income Growth[a]			High-income Growth[b]		
	2000	2030	Changes	2000	2030	Changes
Cereals	158.2	154.0	-4.2	156.8	150.3	-6.5
Pulses	11.1	11.7	0.6	11.4	12.5	1.1
Roots and tubers	19.9	21.5	1.6	20.5	23.6	3.1
Edible oil	7.6	8.3	0.7	7.8	8.8	1.0
Sugar	22.4	23.2	0.8	22.7	24.1	1.4
Vegetables	62.2	79.2	17.0	67.9	101.1	33.2
Fruits	38.5	49.7	11.2	41.8	62.6	20.8
Milk	65.4	83.2	17.8	70.1	100.8	30.7
Meat	6.2	8.8	2.6	6.8	11.4	4.6
Eggs	1.6	2.2	0.6	1.8	2.9	1.1
Fish	5.3	7.1	1.8	5.8	9.4	3.6

Source: Paroda and Kumar, 2000.

Notes: [a] Low-income growth: 3.5 percent in per capita GDP growth; and [b] high-income growth: 5.5 percent in per capita GDP growth.

Table 3. Source of Energy by Major Food Groups and Country in South Asia during 1995 and 2030

(Unit: Percent of the total energy consumed)

Food Group	Year	Per Capita GDP Growth	Bangladesh	India	Nepal	Pakistan	Sri Lanka	South Asia
Food grain	1995	3.5	85.9	68.6	81.9	61.0	75.8	69.8
	2030*	3.5	83.2	64.0	77.6	55.5	71.4	65.0
	2030	5.5	81.2	60.6	74.3	51.7	68.1	61.7
Horticultural product	1995	3.5	2.4	5.8	5.9	3.4	6.3	5.2
	2030	3.5	3.0	7.6	7.2	4.4	7.9	6.7
	2030	5.5	3.4	8.9	8.3	5.1	9.1	7.8
Livestock and fisheries products	1995	3.5	3.0	7.3	6.5	13.0	5.7	7.5
	2030	3.5	4.4	9.8	9.1	16.8	8.2	10.3
	2030	5.5	5.5	11.7	11.1	19.7	10.2	12.3
Other food items	1995	3.5	8.7	18.2	5.7	22.7	12.2	17.5
	2030	3.5	9.4	18.6	6.1	23.3	12.5	18.0
	2030	5.5	9.8	18.8	6.8	23.5	12.5	18.3
Daily per capita energy (kcal)								
	1995	3.5	2,048	2,188	2,107	2,347	2,107	2,188
	2030	3.5	2,048	2,294	2,172	2,455	2,086	2,289
	2030	5.5	2,059	2,389	2,235	2,554	2,151	2,375

Source: Paroda and Kumar, 2000.

Note: * Projections for 2030 were done for two different growth rates (i.e., 3.5 and 5.5 percent).

Employment Generation and Poverty Alleviation

Asia is the home of more than half of the world's poor. The poor people need employment to raise their income and thus purchasing power. Agricultural diversification in favor of high value commodities is expected to raise income, generate employment and alleviate poverty.

In the Indian context, agricultural diversification is taking place from crop sub-sector to livestock and fisheries sub-sectors. It is observed that share of crop sub-sector in gross value of output has come down to about 68 percent in 1997-98 from 82 percent in 1970-71. In contrast, the value of output from livestock rose from 16 to 21 percent in the corresponding period. In the livestock sector, milk and eggs started contributing more in the 1990s than in the 1980s and 1970s. Share of fisheries sub-sector in gross value of output rose

from 1.5 to 10.7 percent in this period (Table 4). Within the crop sector, non-food grains are gradually occupying higher share in area allocation. Oilseeds, fruits and vegetables have started gaining their share in cropped area.

Table 4. Value of Output from Agriculture, Livestock and Fisheries in India

(Unit: Percent)

Particular	1970-71	1980-81	1990-91	1997-98
Crops	82.27	80.20	77.18	68.27
Livestock	16.19	18.22	20.92	21.03
Fisheries	1.53	1.58	1.90	10.70

In order to maximize the labor absorbing capacity of the rural sector, it is critically important to add extra farm production activities to traditional cereal production by means of developing more intensive crop rotations and crop-livestock combination. Agricultural diversification can act a powerful force in this direction and can counteract the population pressure which otherwise results in growing poverty and inequality in many less-developed economies. In this context, the trends in agricultural diversification in India are welcoming.

There are several micro level evidences, which demonstrate that diversification of agriculture in favor of commercial crops augments income, generates more employment opportunities, and alleviates rural poverty. The diversification as a result of competitive environment is a sequel of economic reform. The empirical evidences reveal that economic reforms have generated more employment opportunities. For example, Dev (2000) had shown that the employment growth during 1983-88 was slow which improved during 1987-94 because of the economic reforms during the later period. Similarly, incidence of poverty in agriculture sector among rural households also declined marginally from 37 percent in 1987-88 to 36 percent in 1993-94 (Bhalla, 2000). Recent estimates from the Planning Commission (2001) showed that these positive trends have further strengthened, and population below poverty line has come down to 26 percent in 2000. These trends in poverty alleviation can be related to agricultural diversification as well. Such kind of diversification must be encouraged and sustained through continuous monitoring policies and institutions responsible for the change.

Sustainability of Natural Resources

The general observation is that in the future, environmentally sound growth in productivity may be more difficult to achieve than in the past. During the past few decades, agriculture in developing countries made a remarkable success. This enabled food production to keep pace with the growing population. However, this increase has been achieved partly at the cost of stress on natural resources and the environment. As we look into the future, the need to continue increasing food production, while at the same time minimizing environmental damages, conserving the resource base, and reducing poverty, hunger and malnutrition pose an enormous challenge.

Past experience from the rice-wheat cropping system (RWCS) in the Indo-Gangetic plain (IGP) of India provides a classical example in this regard. The production of rice and wheat grew at a rapid rate in the plain, which transformed the food deficit in India into a surplus one. However, estimates of total factor productivity (TFP) of rice and wheat indicate sustainability problems in the IGP as growth rates in TFP first decelerated, and then turned strongly negative in almost all cases (Table 5). Similar sustainability problems are observed in the rice-wheat system of Pakistan's Punjab (Ali and Byerlee, 2002). Many regions in the IGP were actually sustainable prior to the Green Revolution in 1970s (Joshi, *et al*., 2000a). The sustainability problem seems to be related to overexploitation of resources like groundwater and soil nutrients, as groundwater level in many regions has gone down, and the sign of nutrient deficiency is common.

The IGP region is now being advocated for diversification in favor of legumes, which enhances soil nutrients and consumes less water. Prior to the Green Revolution, legumes used to be the integral elements of the cereal-based cropping system, because of their importance as a source of protein and ability to fix atmospheric nitrogen (N) and thus improving soil fertility. Lack of input responsive legume varieties, and availability of cheap alternative sources of soil nutrients in the form of inorganic fertilizers leads the

relegation of legumes out of the cereal system to marginal lands (Ali, *et al*., 1997). It is expected that the emerging problems in the IGP would induce diversification of the dominant rice-wheat system in the region, particularly towards legumes, oilseeds and vegetables (see a later section for the empirical evidence on this).

Table 5. Growth Rates in Total Factor Productivity of Rice and Wheat in Different Regions of Indo-Gangetic Plain in India

(Unit: Percent per year)

Agro-eco-region	Rice			Wheat		
	1966-76	1977-86	1987-96	1966-76	1977-86	1987-96
Trans-Gangetic Plain Region						
Foothills of Shivalik	8.22	0.93	2.03	5.12	0.30	0.28
Plains	9.00	2.79	0.82	2.41	-3.23	-3.77
Arid	13.26	5.44	3.27	3.52	0.29	-0.57
Upper Gangetic Plain Region						
Northwestern plain	1.12	-1.97	-8.62	1.43	-0.51	-8.26
Southwestern plain	0.72	-0.47	6.33	1.59	-1.03	-8.72
Central plain	1.04	-1.05	-3.31	3.23	-0.63	-8.90
Middle Gangetic Plain Region						
Eastern plain	2.07	3.15	0.26	6.65	-1.55	-9.99
Vindyan	1.52	-1.48	3.79	3.34	-0.88	-18.79
South Bihar plain	1.84	-6.06	-5.73	2.55	-2.11	-1.06
Northeastern plain	1.12	0.87	-1.84	1.37	0.22	-8.85
North Bihar plain	4.43	-2.66	-4.60	4.10	-2.96	-1.65
Northeast plain	5.81	-7.06	0.30	0.68	-3.57	-5.22
Lower Gangetic Plain Region						
Barind plain	0.35	1.99	-0.74	29.46	-6.06	-12.49
Central alluvial plain	0.88	2.20	0.12	19.87	-2.26	-10.46
Rorh plain	-1.27	0.32	-0.52	15.32	-0.26	-9.16
Alluvial coastal saline plain	-0.58	0.76	-1.15	26.25	-1.99	-12.93

Source: Kumar, *et al*., 2000; and Joshi, *et al*., 2000b.

CONDITIONS FOR AGRICULTURE DIVERSIFICATION

Diversification to new crops and livestock products is not likely to be successful unless it is based on major technological advancements in both farm production and processing/marketing operations. In the past the important role of agricultural diversification has been emphasized repeatedly, especially in the periods of relatively abundant supply of food-cereals, e.g., in the initial Green Revolution bandwagon period in the late 1960s to the early 1970s. Hayami and Otsuka (1994) observed that policy efforts toward agricultural diversification usually waned soon after the periodic euphoria of staple food affluent was over. Significant progress in agricultural diversification cannot be expected unless it is supported by technological innovations to make new crop rotation and crop-livestock combinations profitable in normal product- and factor-market conditions.

The technological innovations must be further supported by major institutional innovations. Adequate support not only for technological innovations but also for major institutional reorganizations in production, processing and marketing systems are often required. For example, if agriculture is diversifying from cereals in favor of fruits and vegetables, there is a need for good market for quick disposal or good network of processing. Failing that, the diversification would be limited. Frequently overlooked in the diversification debate is the importance of efficient marketing systems and the associated processing and storage functions that must be carried out to provide an outlet for farmers to sell agricultural commodities other than rice. Developing marketing systems for non-rice crops is a significantly different task from that of developing markets for dominant cereal grain, whether rice or wheat.

Basic condition for significant diversification of agricultural production resources from staple food crops to high value commercial commodities is a sustained increase in the supply of staple food crops outpacing the growth in demand for them. Therefore, technological innovations in traditional cereal crops and sustained growth in yields per unit area of staple crops is vital for the success of agricultural development in general and agricultural diversification in particular. Otherwise significant diversion of limited land resources from traditional food-cereals to new commodities will result in reduction in the supply of food-cereals and an increase in their prices relative to the new crops, making production of the later less profitable and diversification of resources to them less attractive. Therefore, in addition to the traditional requirements, new policies will become indispensable for facilitating increases in the productivity of lands in order to prevent this self-defeating process. One such requirement has been met by the Green Revolution.

It may be mentioned that the recent enthusiasm for agricultural diversification in Asia has stemmed mainly from the successful modern varieties diffusion in cereals that has achieved self-sufficiency in staples in many countries in this region and, as a result, the need has arisen to divert land and labor resources to non-cereals activities in order to prevent cereal prices and income from declining sharply.

There is also need for encouraging vertical diversification – adding more value added in the entire commodity system, from input supply to processing and distribution. The vertical diversification offers added demand for agricultural commodities, especially for premium qualities and varieties (World Bank, 1990). This benefit induces farmers to diversify away from traditional practices, as well as consumers to choose from a more diversified array of products.

CHALLENGES OF AGRICULTURAL DIVRSIFICATION

Different countries have different potential to implement the WTO regulation, thus diversify their production and consumption systems. The concern for food security remains a sensitive issue. Related to this is agricultural and food subsidies and would require more attention in the new economic regime. Considering the social objectives of various forms of subsidies in agriculture and their political sensitivity, reforms in input sector in terms of withdrawal of these subsidies are going to be the real challenge for the policy-makers. The extent of diversification in different countries will depend upon how efficiently the WTO issues are implemented and free markets are allowed to work both in the input and output markets.

As noted before, cereal grains will continue to be a dominant source of energy in most Asian countries, especially in South Asia. Therefore, in the competitive environment, no country can afford to dilute efforts in sustaining production growth of food grain crops. This growth must come through raising productivity levels because the scope for area expansion is now limited in the event of diversification towards high value crops and more competition of land for non-agricultural uses. The targeted yield levels to meet the food security challenges were computed and given in Table 6. The available estimates reveal that the yield levels of all food grain crops need to be stepped up substantially, failing that would create food security threats and jeopardize the diversification drive in developing countries.

Having said that, producing balanced food is also the major challenge in the fast changing economic paradigm especially when resources are limited and degrading. Concentration of efforts on cereals and demand shift to other food may create an imbalance in the supplies of the cereals and the non-cereals commodities. For example, the concentrated efforts on the diffusion of modern cereal production technologies enabled Indonesia to move from being the largest importer in the world to self-sufficiency in rice within the decade ending in the mid-1980s, while the self-sufficiency ratio of soybean (a major source of protein foods) declined from 100 to almost 50 percent, partly because of rising demand for high-protein foods and partly because of significant diversion of land from soybean to rice (Hayami and Otsuka, 1994). Similar imbalance in demand and supply can be observed in pulses and oilseed in Pakistan and Bangladesh, and pulses in India. As a result, either the consumption of these commodities has reduced, or the import bill on account of these commodities has surged. The reduced consumption of especially pulses has serious implication for the balanced diet, especially for the poor income group. Therefore, keeping a balance between cereals and non-cereals in the policy arena is an important challenge of diversification programs.

Lastly, building infrastructure and institution for diversification is an expensive and daunting task. Appropriate fiscal incentives for alternative crops and enterprises, based on their competitive advantage, will be required to build on favorable environment for diversification.

Table 6. Targeted Yield Levels to Meet the Domestic Demand for Food Grains

(Unit: mt/ha)

Crop	Year	Bangladesh	India	Nepal	Pakistan	Sri Lanka	South Asia
Rice	1994-96	1.74	1.92	1.46	1.70	1.96	1.87
	2029-30	3.18	2.70	3.48	2.82	3.23	2.82
Wheat	1994-96	1.88	2.45	1.49	2.00	-	2.31
	2029-30	6.25	3.30	2.67	4.69	-	3.72
Maize	1994-96	-	1.52	1.67	1.46	1.04	1.53
	2029-30	-	2.21	3.10	2.81	2.85	2.36
Cereals	1994-96	1.74	1.74	1.49	1.79	1.91	1.74
	2029-30	3.41	2.40	3.10	3.95	4.59	2.67
Pulses	1994-96	0.75	0.60	0.61	0.50	0.77	0.60
	2029-30	1.55	0.99	1.44	1.32	3.13	0.99

Source: Paroda and Kumar, 2000.

SUCCESSFUL EXAMPLES

In the following discussion, two case studies have been illustrated to demonstrate the beneficial effects of diversification with legumes in the rice-wheat system.

Case Study 1

Farmers in the Terai region of Nepal were interviewed through the Rapid Rural Appraisal approach to understand their perception on residual effect of legumes on subsequent cereal crops. Farmers' response revealed that legumes grown previous to a rice crop, in comparison to wheat or fallow land, contributed to enhanced yields of rice ranging 10-40 percent (Table 7).

Table 7. Farmers' Perceptions on Residual Effects of Legumes on the Yield of Subsequent Crops in the Terai Region of Nepal, 1995 (all subsequent crop is rice)

District	Legume	Yield Increase (percent)*	District	Legume	Yield Increase (percent)*
Morange	Khesari	20	Rauthaut	Lentil	20
	Lentil	10-15	Rupandeyhi	Lentil	15
Sunsari	Lentil	15-20	Kapilvastu	Lentil	25
	Black gram	15-20	Banke	Lentil	20-25
Sirah	Chickpea	25		Chickpea	35
Dhanusha	Lentil	40	Bardia	Chickpea	25
Mohatari	Lentil	10-15			

Source: Joshi, 1998.

Note: * Estimation is qualitative and based on farmers' perceptions; increase in yield of rice after legume compared to that after fallow or wheat.

Case Study 2

To understand the role of legumes in the sustainability of the RWCS, the growth in TFP in the IGP region was decomposed by running a TFP regression model on legume area along with a trend variable. Inclusion of trend variable was to capture the aggregate effect of research stock, expenditure on extension, infrastructure and literacy on TFP. The estimated TFP decomposition equation for the RWCS in the IGP region is given below:

$$TFP = 3.7125 + 0.1382\ Ln\ ARLEG + 0.0445T - 0.0011T^2$$
$$(3.98)^{**} \qquad (5.68)^{**} \quad (2.81)^{**}$$

Adjusted $R^2 = 0.60$

where *Ln* = natural logarithm; *TFP* = index of total factor productivity in the *RWCS*; *ARLEG* = index of legume area; *T* = trend variable (starting from 1973); and T^2 = square term of trend variable. The figures in parentheses are the student t-statistics, and ** suggests that the coefficient is significant at 1 percent probability level.

The effect of legume on TFP of RWCS was positive and highly significant which suggest the positive role of legumes in sustaining the productivity of the RWCS in IGP. Therefore, improving the productivity of legumes may actually encourage the sustainability of rice and wheat crops in the IGP region.

There is a high trade-off, when diversification with legumes replaces rice or wheat in the RWCS of IGP. It was observed that rice and wheat remained the most profitable crops. However, continuous cultivation of these crops threatens the sustainability of the existing production system and natural resource base. On the other hand, legumes are less profitable in the short term but they help to conserve natural resources in the long run (Table 8). This suggests that it will be difficult for legumes, except berseem, to compete with rice or wheat in the short term in the IGP region. However, technological breakthrough in legumes can enable them to be incorporated in the rice-wheat system without replacing any of the cereal crops. The focus of technological innovation in legumes should be to enhance productivity to increase their profitability, reduce crop duration to decrease competition between cereal and legumes, develop resistance to reduce risk, and reduce their production cost.

Table 8. Trade-off (percentage change) in Replacing Rice or Wheat with Legumes in Karnal District, Haryana, India, 1996-97[a]

Indicators	Pigeon Pea	Chickpea	Lentil	Berseem[b]
Profit	-49	-19	-41	+2
Food grain	-76	-64	-76	-
Fixed resources	-57	-49	-61	-43
Groundwater	+95	+85	+83	-125
Soil nutrients	+65	+73	+75	+56

Source: Joshi, *et al*., 2000c.

Notes: [a] In the RWCS, rice was substituted by pigeon pea and wheat by chickpea, lentil and berseem; and [b] berseem is a fodder legume.

SUMMARY AND CONCLUSION

Diversification is reckoned as an important strategy to overcome the challenges faced by many developing countries. Diversification of agriculture is developing a larger crop-mix or enterprise-mix in favor of high-value and more remunerative enterprises.

There are four major objectives of diversification in agriculture:

1) Increase the income of smallholders;
2) Encourage fuller employment of available resources;
3) Stabilize farm income over the seasons; and
4) Conserve natural resources.

The developing countries are facing the most complex challenge of the new economic regime besides the usual problems of rising population, unemployment and poverty. The new challenges include declining investment in the agriculture sector and degradation of natural resources. Diversification of agriculture can help to overcome these overriding problems in more competitive environment as a strategy to ensure food security, generate employment and alleviate poverty, and conserve natural resources.

In the scenario of higher economic growth and population pressure, the production environment and dietary patterns in most developing countries are rapidly changing. To meet the demand in the competitive environment, the crop-mix is changing in favor of more commercial crops and low-elasticity commodities to high-elasticity commodities. However, producing balanced food is the major challenge in the fast changing paradigm shift when resources are limited and degrading. To meet the challenge, the production strategy

should be more diversified towards commercial crops without sacrificing the basic objective of ensuring food security.

Agricultural diversification generates higher income, creates more employment opportunities and alleviates poverty. As an example, Indian agricultural economy diversified from the crop sector towards the livestock and fisheries sectors and generated additional employment and raising purchasing power of poor people.

Conserving natural resources has been one of the most daunting task in the race of commercialization. When maximization of profit became the sole objective in the past, the experiences showed that higher agricultural growth came at the cost of overexploitation and degradation of natural resources. Declining water table, soil salinity, waterlogging, and soil erosion became acute problems in many fertile agricultural systems in developing countries. Diversification of agriculture can play a key role in overcoming these problems. Role of legumes was highlighted in improving soil fertility and conserving water resources.

To encourage diversification of agriculture a multi-prone strategy needs to be designed. The principle of 5-Is is expected to meet the objectives in a competitive environment. These 5-Is include:

(i) **I**ncentives;
(ii) **I**nnovations;
(iii) **I**nputs;
(iv) **I**nstitutions; and
(v) **I**nfrastructure.

The first 'I' refers to the favorable policy environment in favor of those commodities, which augment income and generate employment. The second 'I' refers to the technologies. Without economically viable and socially acceptable technologies in favor of those crops, which have potential for diversification, the prospects of diversification would be bleak. Besides, the supply of improved technologies for food grains should be balanced with the technological innovation in commercial and high value crops. Failing that the efforts of diversification towards commercial crops would wane soon after, i.e., either there is a deficit in food grains or there is no profitable option available for diversification. The third 'I' refers to the availability of inputs required for cultivation and/or production of diversified crops or enterprises. Non-availability of inputs would hinder the prospects of diversification. The fourth 'I' refers to the development of appropriate institutions for new crops or new enterprises. For example, strong seed sector, presence of credit and insurance institutions, etc. must exist. If the diversification of enterprises calls for collective actions, appropriate institutions are needed to support these actions. The last 'I' refers to the presence of required infrastructure. For example, marketing, processing, transportation, are important elements in case of vertical diversification. A well-knitted strategy encompassing the 5-Is would go a long way in enlarging the scope of agricultural diversification.

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Part II. RESOURCE PAPERS (2)

by Mitsugi Kamiya, Mubarik Ali, Abedullah, and Umar Farooq

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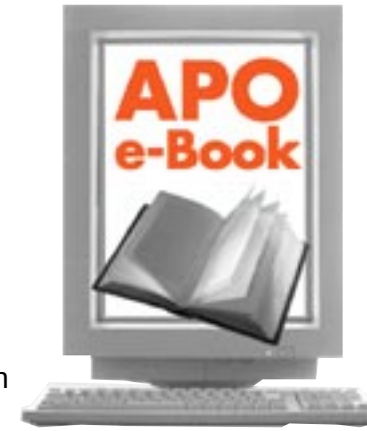

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3. AGRICULTURAL DIVERSIFICATION IN JAPAN

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INTRODUCTION

A monsoon climate, a paddy farming, a high man-land ratio, and so on, are the phrases used to featuring the agriculture not just of Japan but the whole Southeast Asia region. Roughly the agriculture in these countries has followed the same course of labor-intensive development. A paddy farming, favored by high temperature and humidity in summer, enabled these countries to feed their dense population. Technological improvement and economic development improved the productivity of farming, particularly of paddy, and the nature of paddy cultivation changed from a subsistence to a commercial crop. In addition, the changes in food demand have forced the agricultural production to be diversified to meet the varied demands for food, and subsistence farming was converted into market-oriented production.

In some Southeast Asian countries, which experienced a good economic performance for a fairly long period ended in the mid-1990s, the animal dietary energy supply (DES) per capita per day has shown an increasing trend. Although the diet of most Southeast Asian countries is dominated by rice, Taiwan, Malaysia and Thailand have recently joined Japan to show a negative income elasticity for. The increase in the consumption of livestock products in these countries, however, has been supported by expanded imports of animal feeds in the same manner, but not so much, as in Japan. Despite these changes, however, the share of cereals and root crops in total harvested area under food crops (excluding the area of fruits and nut trees, berries, industrial crops other than fiber crops and tobacco, and feed crops) has been more than 50 percent (FAO, 1981 and 1995 issues). In this regard, these Southeast Asian countries and Japan have something in common.

Diversification of agricultural production, which happens in line with increased commercialization, means that production and distribution react more strongly to changes in market prices. Indeed, in some Southeast Asian countries, such as Malaysia and Thailand, farmers are trying to change their crops and adjust production and marketing methods taking into consideration the fluctuations in market prices, changes in production costs, and expanding potential in the export market for their products. Farmers in Japan, with encouragement of the government, had also banded their effort to expand the livestock and horticultural production.

The farmers in some Asian countries have succeeded to export their products to Japan markets, taking advantage of relatively low production costs in these countries. In spite of higher yield per unit of land in Japanese agriculture compared with those in the Asian developing nations, the varied demands for foods in Japan was met not by the domestic production but by the increasing supply of foreign farm products. Instead of reorganizing the domestic agricultural production, the selective expansion of food imports supported by the appreciated Japanese yen after the mid-1980s has contributed to drastic transfiguration of the food consumption pattern.

The high cost of production and distribution, due to high-priced labor and land, is a crucial problem to develop the competitive power of Japanese agriculture. At the same time, however, we should notice the development of sophisticated production and marketing in the farming sector to respond to the high-grade food demand. Anyhow, policy-makers are now facing the challenge of establishing the desirable and stable farms to be able to cope with the demand for foods.

BASIC INDUCEMENT FOR DIVERSIFICATION

Immediately after World War II, Japan found most of her production facilities destroyed and her economy in distress suffering from rising inflation and acute food shortage. Economic reconstruction was urgently required and the institutional innovations were also deemed necessary to bring a democratic atmosphere to all societies in order to increase productivity (Kamiya, 1996).

The annual consumption of rice per person in 1946 was 82.7 kg (or 1,400 kcal) compared to 162.9 kg (or 2,128 kcal) in 1934-38. The war left a big gap in energy uptake and energy requirements. To fill this gap as well as to meet the added requirement of increasing population, the need to boost rice supplies was obvious. Therefore, initially major attention was devoted to agricultural recovery, particularly to increase rice production.

In coping with such a situation, the food aids, extended by the U.S. mainly in wheat, helped the Japanese people to relieve from hunger. It also gave an opportunity to the Japanese people to change their dietary habits. On the other hand, the government gave high priority to increase rice production. Special public supports for this purpose include "Food Control Law" which helped to stabilize rice prices, financial supports to investments in farming facilities like irrigation and machinery which helped to facilitate farmers' efforts of increasing productivity of their farming, and reconstruction of fertilizer industry (under the priority production scheme of key industries) which helped to boost fertilizer supply. With these supports, the farmers succeeded in increasing the yield of rice at an annual growth rate of 1.4 percent during the 20 years period from 1946-50 to 1966-70, as against 0.3 percent in the period from 1936-40 to 1946-50. Needless to say, the efforts that went into agricultural research helped to boost productivity, and the land reform carried immediately after the World War II encouraged farmers to put forth their efforts in producing more foods. Such an increasing trend in rice yield has been maintained up to now although at a declining rate.

Such improvement in productivity of rice farming, together with the changes in dietary habits, yielded overproduction of rice in around 1966 and after, and consequently forced the government in 1970 and afterwards to take measures to restrict rice production. The per capita per annum rice consumption registered at 117.2 kg in 1962, the largest after the end of World War II, and then it turned to decline continuously. However, the calorie consumption of Japanese people continued to advance from about 2,300 kcal in the beginning of 1960s to 2,600 kcal in the latter half of 1980s, and then afterwards it saturated. However, the composition of energy supplies has considerably changed in the past 40 years or so. Rice, which occupied the largest portion of nearly 50 percent in total DES and was the king of food items in around 1960, has reduced its importance by half. On the other hand, livestock products and oils and fats, a considerable portion of which is supplied from abroad, have improved markedly in their importance (Table 1).

Table 1. Changes in the Supply of Total Dietary Energy, 1960-99

(Unit: Composition = percent)

Food Item	1960	1970	1980	1990	1999
Cereals:	62.8	49.8	43.4	38.6	37.1
Rice	48.3	36.7	30.1	25.9	24.2
Wheat	10.9	12.3	12.7	12.1	12.4
Roots and starch	6.2	4.5	5.9	7.7	8.1
Pulses	4.5	4.6	3.8	4.0	4.0
Vegetables	3.7	3.1	3.1	3.2	3.1
Fruits	1.3	2.1	2.1	2.3	2.5
Livestock products:	3.9	9.0	12.1	13.8	15.4
Meats	1.2	3.2	5.4	5.8	6.5
Eggs	1.2	2.5	2.5	2.5	2.7
Milk and milk products	1.5	3.3	4.2	5.5	6.2
Fish and shellfish	3.8	4.0	5.2	5.4	4.9
Sugar	6.9	11.2	9.5	8.7	8.1
Oils and fats	4.6	9.0	12.5	13.6	14.5
Others	2.3	2.7	2.4	2.6	2.3
DES (kcal per capita per day)	2,291	2,529	2,562	2,639	2,619

Source: Ministry of Agriculture, Forestry and Fisheries (MAFF), various issues during 1960-2000.

The decrease in DES from rice consumption since 1963 had been roughly balanced by an increase in the ingestion of livestock products and oils and fats. In the last several decades, thus, we experienced the improvement in nutritional intake and the conspicuous changes in our eating habits, which might have little parallel in the world. For any Asian economy, however, it can generally be concluded that, in the process of economic development, the plant source of DES reaches a peak at a certain level of income and then it decreases as the income reaches to higher level, and the DES from animal sources proportionally increases. In addition to the changes in food consumption patterns, the eating habits shifted from home-prepared food to eating out and processed foods, which was accompanied by the greater participation of women in public affairs. Such a growing dependence on the food service industries has undoubtedly caused higher costs of food distribution. The severe competition among enterprises in the food service industry is forcing them to reduce production and distribution costs of food. Their efforts are mainly directed to reduce material costs by using imported foodstuff in place of domestic one. This may cause reduction in the domestic production of some crops like vegetables.

FACTORS FOR AGRICULTURAL PRODUCTION DIVERSIFICATION

Changes in dietary habits in Japan had been accelerated through economic growth, social development, and increase in the foreign exchange earnings during 1960-90. The diversification in agricultural production occurred to cope with the changes in dietary habits. As a result, the share of traditional crops decreased and those of livestock products rapidly increased. The development centers of some crops like vegetables of the Western type were also established to meet the requirement of mass consumption of these in urban areas. The expansion of the large-scale supermarkets retailers brought a structural change in the marketing and distribution of farm products and other foods. Further, the volume of food imports, including final products and intermediate goods, expanded at an annual growth rate of 7.2 percent in the above-mentioned period, as against the annual gain of merely 0.9 percent in the volume of domestic agricultural production as a whole.

In the transformation of agricultural production pattern in Japan, the imported feeds played a very important role. Originally, livestock raising was dependent upon wild grass and remnants in farms as feeds, because of the limited pastureland. The expansion of the livestock sector in the 1960s and after, however, could not but increasingly rely on the imported feeds. During 1965-85, the output of beef cattle and dairy farming expanded at annual rates of 7.1 and 4.2 percent, respectively, supported by 6.2 percent per annum increase in the imported feeds.

In 1998, the shares of rice, horticultural crops, and livestock products in the value of all agricultural outputs was almost equal at 25.6, 35.3 and 24.4 percent, respectively, compared with the corresponding shares of 47.4, 15.1 and 15.2 percent in 1960. As for land use, the share of paddy in total planted areas under crops maintained at around 40 percent during 1960-98, while the shares of horticultural and feed crops have gained fairly during the 1980s and 1990s (Table 2).

Although the shares of horticultural and feed crops in total planted areas have expanded fairly, this does not imply an absolute increase in acreage of these crops. For instance, the planted areas under vegetables and fruit trees in 1960, 1980 and 1998 were 1.07, 1.17 and 0.94 million ha, respectively, and the acreage under feed and forage for the above-mentioned year were 0.51, 1.03, and 0.97 million ha, respectively (Table 3). The decrease in total planted areas in the last nearly 40 years, which resulted mainly from the reduction in areas under paddy, has clearly contributed to relative expansion of acreage under fruit, vegetable, and feed and forage crops. Although it is impossible to disregard the effects of improved productivity in the output of crops, the trend in absolute acreage of each crop has also been reflected in the change of their output. The increment of production in livestock farming has been influenced by the increase in imports of feeds, as mentioned before, not so much by the expansion of acreage under feed and forage crops.

The change in relative prices of rice, horticultural crops and livestock products has also affected the transfiguration of agricultural production in terms of value. For example, the producer prices of rice, vegetables, fruits and livestock products have gone up by 3.5, 6.5, 4.2 and 2.2 times, respectively during the last nearly 40 years (1960-98). Therefore, it may be concluded that the diversification of agricultural production in value was realized by the quantitative expansion of livestock production supported by the increased imports of feeds, on one hand, and the relative gain in producers' prices of horticultural products,

on the other. Further, the agricultural diversification process in Japan can be partly explained by the declining share of traditional farm produces in total agricultural production, such as cocoon, wheat and barley, minor grains and pulses, from more than 10 percent in 1960 to less than 2 percent in 1998.

Table 2. Contribution of Various Farm Products in Area and Output

(Unit: Percent)

Farm Produce	Output			Planted Areas		
	1960	1980	1998	1960	1980	1998
Crops:	80.5	67.9	74.7	91.8	79.8	77.3
Rice	47.4	30.1	25.6	40.7	45.9	39.0
Wheat and barley	5.5	1.5	1.0	18.7	5.6	6.0
Root crops	3.0	2.0	2.7	4.0	1.1	1.0
Pulses	2.5	0.9	0.7	9.7	5.0	4.7
Vegetables[a]	9.1	18.5	26.3	10.0	13.3	13.9
Fruits and nuts	6.0	6.7	9.0	3.1	7.1	6.4
Others[b]	7.0	8.2	9.4	5.6	1.8	6.3
Sericulture[c]	3.0	1.5	0.0	2.0	2.1	0.2
Livestock:[d]	15.2	29.9	24.4	6.2	18.1	22.5
Meat	7.1	17.7	13.4	-	-	-
Raw milk	2.5	6.6	7.1	-	-	-
Eggs	5.6	5.6	3.9	-	-	-
Others	1.3	0.7	0.9	0.0	0.0	0.0
Total	1,915[e]	10,262[e]	9,944[e]	8,129[f]	5,706[f]	4,616[f]

Source: MAFF, various issues during 1960-99a and 1960-99b.

Notes: [a] Including maize and pulses harvested as green crops; [b] including flowering plants and industrial crops; [c] output of cocoon and areas under mulberry; [d] output of livestock products and area under feed and forage crops; [e] ¥ billion (US$1.00 = ¥130.9 during 1998); and [f] 000 ha.

Table 3. Trend in Output and Planted Areas of Selected Crops

Crops	1960	1980	1998	Percent Change	
				1960-80	1980-98
Production index (1995 = 100):					
Rice	116.4	90.0	83.3	-23	-7
Wheat and barley	548.3	167.0	111.3	-70	-33
Vegetables	72.3	109.1	94.0	51	-14
Fruits	58.4	125.1	94.7	114	-24
Livestock products	23.3	90.7	97.8	289	8
Planted area (000 ha):					
Rice	3,308	2,377	1,801	-28	-24
Wheat and barley	1,502	320	276	-79	-14
Vegetables	812	761	640	-6	-16
Fruits	254	408	295	61	-28
Feed and forage crops*	506	1,033	969	104	-6

Source: MAFF, various issues during 1960-99a and 1960-99c.

Notes: * Including unripe crops harvested for feed.

By the way, the relative increase in producer prices of horticultural products has been caused by the fact that the consumers have shown preferences to food items of higher grade, as time has gone on. The producers then also selected the crops of higher quality and of higher value-added to catch the changes in consumers' preference, as shown in Table 4.

Table 4. Trend in the Consumption and Production of High-grade Fresh Vegetables and Fruits

	Vegetables			Fruits		
	1975	1985	1996	1975	1985	1996
Consumption (000 mt):						
Total (A)	257.7	231.2	200.3	193.2	135.1	104.6
Quality goods* (B)	51.0	54.0	47.5	19.9	22.6	18.9
Percent (B/A)	18.5	23.4	23.7	10.3	16.7	18.1
Planted area (000 ha):						
Total (C)	703.8	709.9	616.4	460.9	441.2	351.2
Quality goods (D)	132.9	153.3	140.3	120.3	118.5	97.3
Percent (D/C)	18.9	21.6	22.8	24.5	26.9	27.7

Sources: Statistics Bureau/Management and Coordination Agency, 2000; and MAFF, various issues during 1975-97.

Notes: * Commodities, which are sold at price of 1.5 times more higher than the average price of vegetables and fruits as a whole in the retail market, are classified into quality goods.

PUBLIC SUPPORT TO AGRICULTURAL DIVERSIFICATION

Changes in food consumption pattern and other socioeconomic factors mentioned above induced the farmers to diversify agricultural production in Japan during the last forty years. The government has also encouraged farmers to alter the pattern of production to cope with changes in demands for farm products. The "Agricultural Basic Law", which emphasized 'selective expansion of agricultural production (or diversification of production)' as one of the main pivots for modernizing the Japanese agriculture along with 'improvement of agrarian structure' and 'stabilization of prices of farm products', were enacted in 1961. The stream of agricultural policies, developed so far on the basis of the "Food Control Law (1942)" and the "Agricultural Land Law (1952)", were rectified by the enforcement of "Agricultural Basic Law". In other words, the objectives of agricultural policies were changed from protecting agriculture to modernizing and improving its efficiency.

The 'selective production', which meant reorganization of production pattern to cope with changes in the demand for farm products, was expected to produce highly efficient agriculture and to foster viable farming units. Accordingly, since the 1960s, various measures were taken to promote production of vegetables, fruits and livestock products under newly enacted laws, such as "Poultry Production Promotion Law (1960)", "Fruit-growing Industry Promotion Special Measures Act (1961)", "Law Concerning the Stabilization of Livestock Products Price (1961)", "Agricultural Modernization Fund Law (1961)", "Temporary Law for Compensation Price for Producers of Milk for Manufacturing Use (1965)", "Law for Stabilization of Production and Shipment of Vegetables (1966)", "Wholesale Market Law (1971)", "The Amendment to Law Concerning Promotion of Dairy and Beef Cattle Production (1983)", and so on (Yamamoto, 1988).

For instance, with a purpose of stabilizing prices of some designated vegetables, a project for 'fostering major producing areas' was started in 1963, and a project for 'compensation of price-gap' was also initiated by the Stabilization Fund Association for production of 'designated vegetables' under the "Law for Stabilization of Production and Shipment of Vegetables". This Law aims at efficient connection between major producing and consuming areas and at price stabilization in distribution of vegetables (Toda, 1989). Under the Law of "Promotion of Dairy and Beef Cattle Production", in conformity with the 'Principle of Modernizing Production', various comprehensive measures for expansion of livestock raising facilities, improvement of livestock raising techniques, promotion of self-supplied feed production and environmental protection were taken.

In order to meet with the changed demand for farm products and to respond to consumers' preference for commodities of higher quality, and also to improve the productivity of farming in the horticulture and livestock sub-sectors, new technologies, such as improved seeds, farming methods and facilities were introduced. Especially in horticulture sub-sector, development of new varieties and techniques of glass culture, together with progress in transportation and storage facilities, have contributed to the year-round

supply of commodities. The well-organized public financial systems have also played an important role in modernizing farming in these sub-sectors.

It is true now that the rice stands side by side with livestock and horticultural products, but it is also true that the rationalizing the paddy farming has so far been considered a priority in reorganization of agricultural production. Therefore, the paddy farming sub-sector has occupied so far the very important place in the budgetary appropriation for both price and non-price measures adopted, although its position has gradually been weakened (Table 5).

Table 5. Budgetary Appropriation for Paddy, Horticulture and Livestock Sub-sectors

Commodity	Amount (¥ billion)				Percent			
	1960	1980	1990	1999	1960	1980	1990	1999
Selective expansion:	3.2	459	262	195	2.3	14.8	10.4	6.6
Livestock production	1.9	84	56	106	(59.3)	(18.3)	(21.5)	(54.7)
Horticultural production	0.6	30	22	23	(19.3)	(6.5)	(8.3)	(11.6)
Rationalizing paddy farming	0.7	344	183	65	(21.0)	(74.9)	(70.0)	(33.3)
Price stabilization:	31.2	773	311	367	22.4	24.9	12.4	12.5
Rice, wheat and barley	29.0	652	232	243	(92.9)	(84.3)	(74.5)	(66.3)
Livestock products	-	49	29	88	-	(6.4)	(9.3)	(24.0)
Vegetables and fruits	-	16	9	5	-	(2.0)	(2.8)	(1.5)
Research and development	6.4	89	89	117	4.6	2.9	3.5	4.0
Structural improvement	4.7	272	364	432	3.4	8.8	14.5	14.7
Total for agriculture, forestry and fisheries	139	3,108	2,518	2,939	100.0	100.0	100.0	100.0

Source: Minister's Secretariat, MAFF.
Notes: Figures in parenthesis indicate the share of each sub-sector in respective items.

COMPETITIVE POSITION IN WORLD MARKET

Establishment of Highly Efficient Agriculture

Diversification of agricultural production happens in line with increased commercialization, because the commercialized agricultural production can react more strongly to changes in market prices than the subsistence agriculture. In commercialized farming, farm operators decide their pattern of production and farming methods to obtain more earnings in due consideration of changes in market prices and production costs. In other words, development of agricultural diversification requests the farmers to establish more efficient farm management under the conditions of market and location.

In the process of agricultural diversification, some appropriate farm products are produced to accommodate the growing demand for them, and the improvement of farming techniques, including improved varieties and farming methods, is pursued to increase the efficiency of farming. The public sector plays an important role in research and extends financial assistance to farmers in introducing improved techniques and facilities. Highly efficient farming is realized through reforming production systems accompanied by improved techniques, and also through enlarging farming units. Especially for specialized production of certain produce, enlarged farming units may enjoy the benefit of economies of scale. And in some cases, combined farming of different kinds, such as crop and livestock, is deemed effective for complementary utilization of the given resources. Such a complementary use of resources among the farming units of different types in a region may also be operative for improvement of efficiency and for sustainable development of regional agriculture.

Highly efficient agriculture will be realized not only by enlarging scale of farming unit and reforming the production systems, but also through effective linkage between farming sector and other industries through marketing and distribution of products and various services such as information, credit, etc. In addition, the establishment of modern and efficient agriculture can be secured by fostering the highly motivated and well-qualified farmers to undertake farming business. The diversification of agriculture may provide a good chance for such qualified persons, as it provides high profit of their managerial capacity by using high technology in farming business.

Competitive Power of Japanese Agriculture

As mentioned before, the transfiguration of Japanese agriculture has been accompanied by a decline in the production of traditional crops, mainly paddy, and by an increase in the outputs of livestock and horticulture sub-sectors. In the process of agricultural diversification, the share of large-size farms in total number of farming units has increased (Table 6). The labor and land productivity in farming increased at 10.8 and 2.0 percent per annum, respectively, during 1960-90. During the 1990s, the increasing trend in labor productivity slowed down significantly, while land productivity showed a negative trend, mainly because of the declining trend in overall agricultural production (Table 7). All these led Japan to excel over other countries in the improvement of agricultural productivity in the past some thirty years. Using data on agricultural value-added provided by the World Bank, it was estimated that the land and labor productivity in Japan were respectively 20.1 and 0.5 times as large as those in the U.S.A. in 1998, compared with the corresponding figures of 11.9 and 0.1 times in 1965. Compared with those figures in Malaysia with relatively higher agricultural productivity among the Asian countries, Japan was 16.6 and 5.3 times higher in 1998, and 5.3 and 1.4 times higher in 1965.

Table 6. Distribution of Number of Farms by Size (excluding Hokkaido)

(Unit: Percent)

Year	Total (000 farms)	<1.0 ha	1.0-2.0 ha	2.0-3.0 ha	3.0-5.0 ha	>5.0 ha
1960	5,823	71.8	24.1	3.5	— 0.6 —	
1970	5,236	69.4	24.5	4.7	— 1.4 —	
1980	4,542	71.0	21.6	5.3	1.8	0.3
1990*	2,884	60.8	27.1	7.7	3.5	0.9
2000*	2,274	59.7	26.0	8.0	4.4	1.9

Source: MAFF, 1985, 1992, 1995, and 2000.
Notes: * Self-supporting farms are excluded.

Table 7. Indices of Agricultural Production, Labor Force and Land Area (1995 = 100)

Year	Agricultural Production	Agricultural Labor Force	Arable Land Area	Labor Productivity	Land Productivity
1960	75.5	365.7	120.5	20.6	62.7
1970	94.9	248.0	115.0	38.3	82.5
1980	99.0	154.7	108.4	64.0	91.3
1990	104.8	119.9	104.1	87.4	100.7
1998	92.5	94.2	97.4	98.2	95.0
Percent change per annum					
1960-90	1.10	-3.65	-0.49	10.78	2.02
1990-98	-1.55	-2.97	-0.83	1.54	-0.71

Sources: MAFF, various issues during 1960-99a and 1960-99c; and Statistics Bureau/Management and Coordination Agency, various issues during 1960-98.

In spite of these facts, it may be true that the competitive power of Japanese agriculture in world market has not been raised, due to high production and distribution costs. According to the survey conducted by the MAFF, the gap in retail prices of foods between Tokyo and major cities in the highly industrialized nations has been generally widened in the 1990s (Table 8). The higher prices of foods in retail markets in Japan have been caused by the rapid increase in incomes during the 1960s through 1980s on the one hand, and by very high costs of production and distribution on the other. The 1999 World Development Indicators of the World Bank suggest that per capita GNP in Japan registered an average annual growth rate of 3.6 percent during 1965-97, compared with 2.2, 1.9 and 1.5 percent in France, the U.K. and the U.S.A., respectively. Table 9 explains the main causes for higher costs of production and distribution compared with those in the U.S.A. It is nothing new to say that, despite some consolidation in the past, the cultivated area per farm is very small in Japan compared with other developed countries. However, high prices of land, wage

level, and so on, are a bit of surprise to foreigners and even I am swayed by the apprehensions about Japanese agriculture in the future.

Table 8. Gap in Consumer Prices of Foods between Tokyo and Major Cities in the Highly Industrialized Nations (Tokyo = 100)

Year	New York	London	Paris
1990	82	88	84
1992	72	75	70
1994	70	65	78
1996	80	79	86
1998	73	78	77

Source: MAFF, 2001a.

Notes: Weighted average of prices for foods in common to each city by using the weight of each item of the Consumers Price Index in Tokyo.

Table 9. Major Factors Affecting the Prices of Farm Products in Comparison with Those in the U.S.A.

Factor	Japan (A)	U.S.A. (B)	Percent (A/B)
Size of cultivated area per farm for 1998 (ha)	1.6	176.1	0.91
Price of farm land for 1995 (¥10,000/acre)	1,697	15.0	11,313.3
Price of fertilizer (ammonium sulfate) for 1999 (¥/20 kg)	545	429	127.0
Wage rate in manufacturing for 1996 (¥/hour)	2,208	1,390	158.8
Electricity charges for 1997 (¥/kwh)	17.7	5.3	334.0
Price of gasoline for 1997 (¥/liter)	104.4	39.4	265.0

Source: MAFF, 2001b.

SUCCESSFUL EXAMPLES

However, I am also able to put my hopes in the future of Japanese agriculture. This is because of development in some parts of livestock and horticultural farming. For instance, rearing sizes per farming unit of dairy cows, beef cattle and pigs in Japan have come up to or even surpassed those in the U.S.A. and EU countries. The size of pig farming in Japan is comparable with other countries or regions, whereas the country has still much smaller size of beef cattle farming. As for dairy farming, its size is comparable with that in EU, although it is smaller than that of the U.S.A. Japan exceeds EU, ranking next to the U.S.A., in milk production per head (Table 10). Drinking milk cannot be an internationally traded commodity in principle, although its products such as skimmed milk powder, butter and other processed products produce in Japan can compete in the international markets provided that the present level of tariff rate is valid.

However, supposing the tariff rate lowers in the future, it is required even for the dairy sub-sector to raise labor productivity more through improvement in managing technologies for rearing and also by developing high quality commodities demanded in markets. It would not be easy for Japan, however, to fill the international gap in size of beef cattle farming, because this gap reflects the differences in infrastructure for feedstuff production as well as in rearing system. At present the operators of livestock farms are bending their efforts to expand feed production, improve the rearing techniques, and tackle the environmental problems caused by the increased livestock wastes. The government encourages them to do so by enforcing laws and action programs concerned, such as "The Law Concerning the Appropriate Treatment and Promotion of Utilization of Livestock Manure" and 'A Promotion Plan for Increasing the Production of Feed Crops'.

Another example where Japanese agriculture can be internationally competitive is the capital-intensive horticulture sector. The facility-use type culture for forcing and retarding culture, which aims at higher prices in the markets, has gained importance in the horticultural production (Table 11). Commodities of these types are also suited to consumers' preference for high quality.

Table 10. Comparison of Livestock Farming Size among Selected Countries

Region/Year	Dairy Farming			Beef Cattle Farming		Pig Farming	
	Total Number of Cows (000 head)	Head per Farm (number)	Quantity of Milking per Head (kg)	Total Number of Cattle (000 head)	Head per Farm (number)	Total Number of Pigs (000 head)	Head per Farm (number)
Japan							
1992	1,282	23.2	6,721	2,898	13.8	10,966	366.8
1995	1,213	27.8	6,980	2,965	17.5	10,250	545.2
1999	1,172	33.1	7,183[a]	2,842	22.8	9,879	790.3
U.S.A.							
1992	9,688	n.a.	7,062	107,200	n.a.	56,150	n.a.
1995	9,466	67.6	7,441	113,000	94.9	58,283	346.9
1999	9,156	82.5	8,061	107,700	98.3	60,191	527.7
EU (15 countries)							
1992[b]	21,857	n.a.	5,040	82,808	39.6	106,823	70.2
1995	22,279	22.1	5,351	86,523	44.7	116,795	91.5
1999	21,121	23.6[c]	5,610	83,925	48.5[c]	125,287	103.7[c]

Sources: Agriculture and Livestock Industries Corporation, 1998 and 1999; and Association of Agriculture and Forestry Statistics, 2000.
Note: [a] 1998; [b] 12 countries; and [c] 1997.

Table 11. Planted Areas under the Facility-use Type Horticultural Crops

(Unit: 000 ha)

		1985	1990	1995	1999
Vegetables:	Total planted area (A)	63.90	62.46	56.81	63.32
	Planted area with facility* (B)	4.14	4.67	5.10	5.25
	Glasshouse (percent of B)	1.8	1.9	2.0	2.3
	Percent (B/A)	6.5	7.5	9.0	8.3
Flowering plants:	Total planted area (A)	1.47	1.87	2.09	2.08
	Planted area with facility* (B)	0.49	0.64	0.96	1.11
	Glasshouse (percent of B)	1.1	1.3	1.7	1.8
	Percent (B/A)	33.3	34.2	45.9	53.4
Fruits:	Total planted area (A)	43.04	34.63	31.49	29.07
	Planted area with facility* (B)	0.76	0.93	0.67	0.69
	Glasshouse (percent of B)	0.2	0.2	0.2	0.1
	Percent (B/A)	1.8	2.7	2.1	2.4

Source: Agricultural Production Bureau/MAFF, various issues 1985-2000.
Notes: * Facilities include glasshouses and vinyl plastic houses.

In Japan, the farming techniques have shown a tendency of increasing sophistication, and farm products of higher quality by using such sophisticated technologies have gradually expanded. It may be a fair chance for exporting these products to meet the demand in international markets, like *Wagyu*-beef and some kinds of fruits of high-grade. While, the imports of low-priced products, suited to mass consumption and processing, may continue to increase.

SUMMARY AND CONCLUSION

Japanese agriculture had apparently diversified during the 1960s through the 1980s, being induced by the changes in dietary habits and supported by the increased imports of feedstuffs. However, the present status of food consumption pattern has not necessarily been realized by the diversification of domestic production, but by the selective expansion of food imports. The diversification of agricultural production in value has been generally realized by the quantitative expansion of livestock production, supported by the increased imports of feeds, and the relative gain in producer prices of horticultural products.

The government has encouraged farmers to expand production and improve productivity of the livestock and horticulture sub-sectors, through the enforcement of various laws and programs and financial backstop. However, rationalizing the paddy farming, viewed from the point of budgetary appropriation, was considered as priority in the reorganization of agricultural production.

The land and labor productivity of agriculture in Japan is relatively high compared with those in other countries. Nevertheless, the competitiveness of Japanese agriculture is low in the world market, because of high costs of production and distribution. Farmers, however, can continue to manage the farming business by introducing sophisticated technologies, and targeting the Japanese people preference for high quality as they can afford relatively high priced goods. On the other hand, imports of low-priced foods and food materials, suited to mass consumption and processing, will continue to increase. The whole process will further bring diversification along with international competitiveness in the Japanese agriculture.

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4. DIVERSIFICATION WITH VEGETABLES TO IMPROVE COMPETITIVENESS IN ASIA

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INTRODUCTION

The Green Revolution of the 1970s and 1980s in Asia has focused on cereals, and neglected other food crops, such as vegetables and legumes, which traditionally are an integral part of the cereal-based system. The other crops lead to substitution of diversified crop rotation with vegetables and legumes to a continuous cereal-cereal (in some cases cereal-cash crop) rotation. The sustainability of the continuous cereal-based cropping systems now, however, is in question in light of the reduced soil fertility and build-up of insect-pest complex in these systems (Byerlee 1992; Huang and Rozelle 1995; Pagiola 1995; and Pingali and Heisey, 2001). Growing evidence points to slowed productivity growth and increasing degradation of the resource base of these systems (Ali and Byerlee, 2002).

With the Green Revolution strategies, most developing countries became self-sufficient in cereal production. Per capita cereal consumption, at least on an average in Asia, has reached the recommended level. Domestic and international demand pressures on cereals have reduced dramatically culminating low prices of cereals and eroded income of farmers (Rosegrant and Pingali, 1994). Therefore, initial expectation on the role of Green Revolution in poverty alleviation did not materialize.

On the demand side, while increase in cereal production enabled mitigating energy deficiency in many developing countries, micronutrient deficiency has surfaced more prominently with the neglect of micronutrient-rich foods (Walker and Ryan, 1990; Bouis and Novenario-Reese, 1991; Kurz and Johnson-Welch, 1994; and Calloway, 1995). The most important micronutrient deficiency is iron and its anemia affecting about 3.5 billion people in the developing world (United Nations Administrative Committee on Coordination [UNACC]/Subcommittee on Nutrition in collaboration with International Food Policy Research Institute [SCN/IFPRI], 2000). Some 250 million preschool children are suffering from at least a mild vitamin A deficiency (UNACC/SCN/IFPRI, 2000), 0.7 million new cases are added to this every year (UNACC/SCN, 1987), and an estimated 250-500 thousand vitamin A deficient children become blind every year (WHO, 2002).

Fast economic growth, urbanization, and greater awareness of the advantages of diversifying the cereal-based diet all have created strong demand for high value agricultural products. On the production side, declining cereal prices and shortage of water due to deteriorating irrigation infrastructure, reduced profitability of irrigation investment (Rosegrant and Pingali, 1994), and/or competing water demand for domestic use are driving farmers to replace cereals, especially rice, with water-use efficient crops like vegetables. Sustainability problems in the cereal-cereal systems are also forcing farmers to look for alternatives to the cereal crops.

Despite recognized advantages of diversification in generating additional income and employment, reducing risk, and sustaining agricultural resources (Delgado and Siamwalla, 1997), its role in overall economic development is rarely quantified. Generally diversification is considered as a function of commercialization and development, rather than as one of the key factors in the development process. Literatures hypothesize that increased diversity in consumption is instigated through enhanced income, which in turn become a driving force for production diversity (Goletti, 1999). This paper looks other way around, and hypothesizes that diversification of the production and consumption systems with vegetables is in fact one of the key inputs in the socioeconomic development (Figure 1).[1] Vegetables in the production system induce agricultural businesses in the rural economy, and generate employment and incomes. Growers learn to manage multiple-cropping systems, and deliver quality output in time by experiencing contractual arrangements and sophisticated marketing systems. The managerial skills needed for successful vegetable production are the very skills required in running any commercial business, and are the catalyst for the socioeconomic development to take off. On the other hand, fruits and vegetable contribute in balancing the diet by enhancing the supply of essential micronutrients leading to improved health, learning capability, and working capacity of working class. All these factors enhance their working efficiency, critical in improving competitiveness of overall economy. The focus of the paper is mainly Asia, largely because the lack of access to the relevant data from other regions. However, conclusions drawn may be equally applicable for other regions.

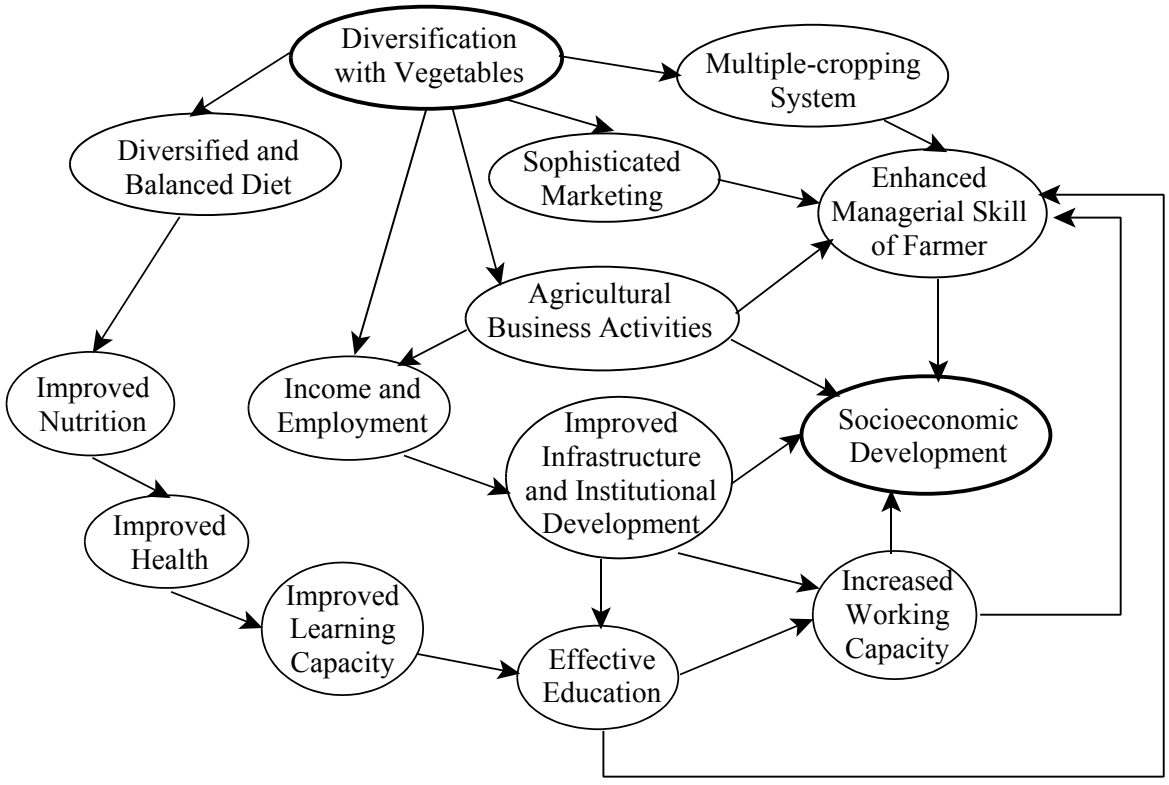

Figure 1. Vegetable Production and Socioeconomic Development

This paper is divided into nine sections. Section II aimed at explaining why vegetables are preferred to diversify the diet. Section III quantifies the effect of food diversification on the earning capacity of the manual workers, and factors affecting the food diversity in Pakistan. Section IV estimates the effect of crop diversity in agricultural production on the sector's productivity and explores the factors contributing in

[1] This study is focused on the diversification with vegetables, but perhaps the same reasoning follows for the diversification with other high value crops.

production diversity in the context of Pakistan's Punjab. In Sections III and IV, particular emphasis is placed on looking into the effect of and factor responsible for the diversification with vegetables. Section V explains the mechanism through which macro-level development effects of diversification occurs by providing farm-level evidences from selected Asian countries on the role of diversification with vegetable in improving income, employment, resource use efficiency, and productivity of other crops. After investigating the role of diversification with vegetables on various development parameters, the current status and potentials and constraints on using vegetables for such diversification, and solutions to overcome those constraints, are discussed in Sections VI and VII. Section VIII provides selective examples of successful incorporation of vegetables in the existing production and consumption systems. The last Section concludes the paper, and suggests policy recommendation to enhance diversity both in production and consumption.

FOOD DIVERSITY AND VEGETABLES

Diversification of the Diet with Vegetables

Vegetables are the major source of food diversity in every culture. For example, a total number of 139, 96, 133, 74, 531, and 144 food items were found consumed in a 24-hour consumption surveys in Vietnam, Lao PDR, Cambodia Philippines, Taiwan, and Bangladesh, respectively, and majority of them were vegetables (Table 1).

Table 1. Total Number of Food Items Found Consumed in a 24-hour Survey in Selected Asian Countries

Food Group	Vietnam	Lao PDR	Cambodia	Philippines	Taiwan	Bangladesh
Cereals	14	4	11	7	60	9
Vegetables	47	48	54	27	121	54
Fruits	20	17	23	9	48	18
Meat	9	6	12	6	44	8
Seafood	28	11	20	17	108	22
Egg and milk	4	2	2	4	38	4
Others*	17	8	11	4	112	29
Total	139	96	133	74	531	144

Source: Unpublished survey data of the Socioeconomic Unit, AVRDC.
Note: * "Others" includes sugar, drinks, salt, oils, etc.

Why Vegetables?

After a certain income level, when cereal consumption is sufficient to meet the daily energy requirements, vegetables are first picked to increase food diversity (Ali and Tsou, 1997). Why do consumers prefer vegetables to diversify their diet, especially in the earlier stage of development? Rather than a fad, it is out of the necessity to overcome deficiency in micronutrient and trace elements. Moreover, they provide a wide range of taste, improve the palatability of food, and enhance the consumption of overall food. They are relatively easy to cook, or can be consumed even as raw in salad form.

1. ***Dense Source of Micronutrients***

Vegetables are rich source of essential micronutrients, especially vitamins, iron and calcium, and have high fiber content (Table 2).

2. ***Relative Nutrient Cost***

Vegetables are not only rich, but also the most economical sources of many individual micronutrients. To prove this, we compared the relative nutrient cost (US$/unit of nutrient) of individual nutrients from different food groups. This was estimated as total food expenditure of the consumers on all commodities containing the nutrient under consideration divided by the total amount of nutrient supplied from the consumption of all those commodities in the group (Ali and Tsou, 2000). The relative nutrient costs of nine nutrients important for health, estimated from the household consumption survey data collected by the

Table 2. Nutrient Density per 100 g of Edible Portion of Selected Vegetables and Other Food Items

Food Group/ Commodity	Energy (kcal)	Protein (g)	Fiber (g)	Vitamin A (RE)	Vitamin B_1 (mg)	Vitamin B_2 (mg)	Vitamin C (mg)	Niacin (mg)	Calcium (mg)	Iron (mg)
Vegetables										
Carrot	33	1.0	0.8	8,782	0.03	0.04	4	0.70	26	0.4
Radish	29	0.7	0.5	0	0.01	0.02	16	0.36	24	0.2
Onion	39	1.0	0.5	0	0.03	0.01	5	0.38	24	0.3
Garlic	33	2.6	1.2	276	0.04	0.06	37	0.64	75	2.0
Pak choi	12	1.0	0.4	225	0.02	0.04	38	0.48	101	1.3
Common cabbage	22	1.1	0.5	5	0.02	0.02	31	0.29	49	0.3
Mustard	18	0.8	0.5	64	0.01	0.05	33	0.48	94	1.3
Kale	26	2.4	0.8	718	0.00	0.01	-	0.18	238	1.9
Kangkong	24	1.4	0.8	378	0.01	0.10	14	0.70	78	1.5
Amaranth	15	1.8	0.5	180	0.03	0.06	13	0.34	131	4.1
Spinach	20	1.9	0.7	581	0.05	0.07	8	0.46	70	1.9
Sweet pepper	21	0.7	0.8	31	0.03	0.03	80	0.68	9	0.3
Chili	58	2.1	4.3	352	0.16	0.14	134	2.00	15	7.0
Tomato	25	0.9	0.6	83	0.02	0.02	21	0.59	10	0.3
Vegetable soybean	125	14.0	2.4	18	0.34	0.09	16	1.00	38	2.5
Fruits										
Mango	54	0.6	0.6	258	0.03	0.04	19	0.60	6	0.2
Apple	49	0.3	0.6	94	0.01	0.01	2	0.22	5	0.1
Banana	357	1.3	0.4	0.7	0.01	0.04	17	0.30	5	0.3
Cereals										
Wheat	362	13.9	2.2	0	0.42	0.09	10	5.78	9	4.0
Corn	65	2.2	0.5	1	0.04	0.05	4	0.83	1	0.4
Rice	353	7.0	0.2	0	0.10	0.03	-	0.70	6	0.2
Meat										
Beef	331	14.8	-	32	0.05	0.13	0	2.83	5	2.3
Mutton	198	18.8	-	14	0.09	0.27	-	3.10	8	0.6
Chicken	160	15.7	-	17	0.03	0.10	18	4.00	3	0.8
Seafood										
Fish	127	10.8	-	37	0.06	0.09	0.5	2.54	34	0.6

Source: Food Industry Research and Development Institute (FIRDIP)/Pintung University of Science and Technology (PUST), 1998.

Socioeconomic Unit of the AVRDC,[2] are reported for Vietnam and Bangladesh in Table 3. The nutrient costs of vitamins, iron, and calcium are lowest when they come from vegetables.

3. ***Economic Nutritive Efficiency of Vegetables***

Vegetables may be an economically efficient source of one nutrient but inefficient for others. What is the overall economic efficiency of a commodity or group of commodities in supplying all nutrients important for health? This depends upon the dollar value of all nutrients present in the commodity (henceforth termed as "relative nutrient value") compared to its price. The relative nutritive value (US$/ 100 g) of a commodity is the sum of the products of the relative nutrient costs (US$/unit of nutrient) of various nutrients and their density (nutrient/100 g) in the commodity, normalized by the number of nutrients considered in the analysis. The economic nutritive efficiency was estimated as relative nutrient value (US$/ 100 g) divided by the market price of the commodity (US$/100 g). The nutritive efficiency greater than one suggests the nutritive value of the commodity is higher than its cost, and vice versa if the efficiency is less than one (Ali and Tsou, 2000).[3]

The nutrient efficiency of vegetables, estimated from the household consumption survey data collected by the Socioeconomic Unit of AVRDC in various Asian countries, is always greater than one implying that the value of nutrition consumers obtain from vegetables is higher than the price they pay for them. These results implies that reallocation of food budget from other food items having nutritive efficiency less than one to vegetables would improve the dollar value of nutrition of the whole diet without added cost. However, relative ranking of the efficiency varies across countries. It was highest in Vietnam and Bangladesh, second after cereal in the Philippines and Cambodia, and third after cereals and eggs and milk in Taiwan (Table 4).

FACTORS IN FOOD DIVERSITY AND RELATIONSHIP WITH WORKERS' PRODUCTIVITY

In understanding the factors responsible for food diversity, usually researchers treat diversity as an outcome of the economic development. For example, the difference in vegetable food diversification in the Philippines and Taiwan diet (Figure 2) is mainly attributed to the difference in income levels across the two countries. In a given culture, the positive effect of home-garden and negative effect of a working-woman[4] on food diversity consumed at home have also been studied (Ali, *et al*., 2000).

The intention of this study, however, is to treat diversity as an input in socioeconomic development. For this purpose, we related the monthly income of manual workers, an indication of their productivity and working capacity, with the diversity in their food along with other socioeconomic and regional factors associated with such earning capacity. As the consumption survey data collected by the Socioeconomic Unit of AVRDC does not provide enough information on the earning capacity and other related variables, therefore, we used the household consumption survey data collected by the Federal Bureau of Statistics (FBS) of Pakistan. The FBS collected these data in two consecutive surveys conducted through out Pakistan during 1990-91 and 1991-92.

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[2] The production and consumption surveys were simultaneously conducted in 3-5 provinces/districts of Cambodia, Lao PDR, Vietnam, and Bangladesh during 1998-2000. The consumption surveys were also conducted in the Philippines (Central Luzon) and Taiwan (throughout the country). In all these surveys, the names and quantities of all food items consumed in the three meals within preceding 24 hours at the time of survey, along with their prices, number of people participated in each meal, and source of food were recorded on per meal and family basis using a recall method. Except in Taiwan (where no distinction was made), both vegetable and non-vegetable farmers were included in the sample for comparison purpose. About one hundred vegetable and non-vegetables farmers were randomly interviewed from the main vegetable growing villages of each 3-5 provinces/districts.

[3] The analysis of nutritive efficiency can also be performed at the food group level, or for the whole diet if the relative nutritive value and prices are estimated at these levels.

[4] However, incidence of outside eating increases when the head lady in the house is a working woman, which may increase the overall diversity in the diet.

Table 3. Relative Nutrient Cost by Food Source in Vietnam and Bangladesh

(Unit: US$/1,000 unit)

Nutrient/Country	Calories (kcal)	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Vitamin C (mg)	Vitamin B_1 (mg)	Vitamin B_2 (mg)	Niacin (mg)
Vietnam									
Cereals	0.11	4.75	1.09	43	1.58	2.41	321	943	21
Vegetable	0.81	8.70	0.28	13	0.01	0.56	231	149	30
Fruit	0.85	53.03	2.73	25	0.07	2.38	1,106	1,353	154
Meat	0.64	9.05	19.32	77	0.35	-	571	960	46
Seafood	1.19	6.36	0.47	124	2.21	152.29	2,419	992	60
Milk and egg	0.36	10.22	1.49	48	0.08	80.21	895	419	958
Bangladesh									
Cereals	0.09	4.51	2.57	36	0.52	1.52	376	500	15
Vegetable	0.23	3.52	0.39	10	0.02	0.70	209	172	24
Fruit	0.53	37.96	1.69	41	0.03	2.07	1,117	476	88
Meat	0.62	3.12	3.46	16	0.58	-	2,680	551	28
Seafood	1.18	8.73	0.67	100	3.82	7.87	5,994	2,122	81
Milk and egg	0.73	12.33	0.59	109	0.10	24.46	1,056	283	614

Source: Unpublished survey data of the Socioeconomic Unit, AVRDC.

Table 4. Nutritive Efficiency of Major Food Groups in Selected Countries of Asia

Food Group	Vietnam	Cambodia	Philippines	Taiwan	Bangladesh
Cereal	1.25	2.2	1.64	2.21	1.1
Meat	0.52	0.3	0.72	0.96	0.7
Seafood	0.64	0.7	0.39	0.65	0.5
Vegetable and pulses	2.38	1.4	1.42	1.18	2.2
Fruit	0.54	1.1	0.45	0.54	0.5
Egg and milk	0.66	0.8	1.02	1.88	0.6
Others	1.58	1.6	0.53	0.79	1.5
Whole diet	1.02	1.03	1.01	1.03	1.0

Source: Unpublished survey data of the Socioeconomic Unit, AVRDC.

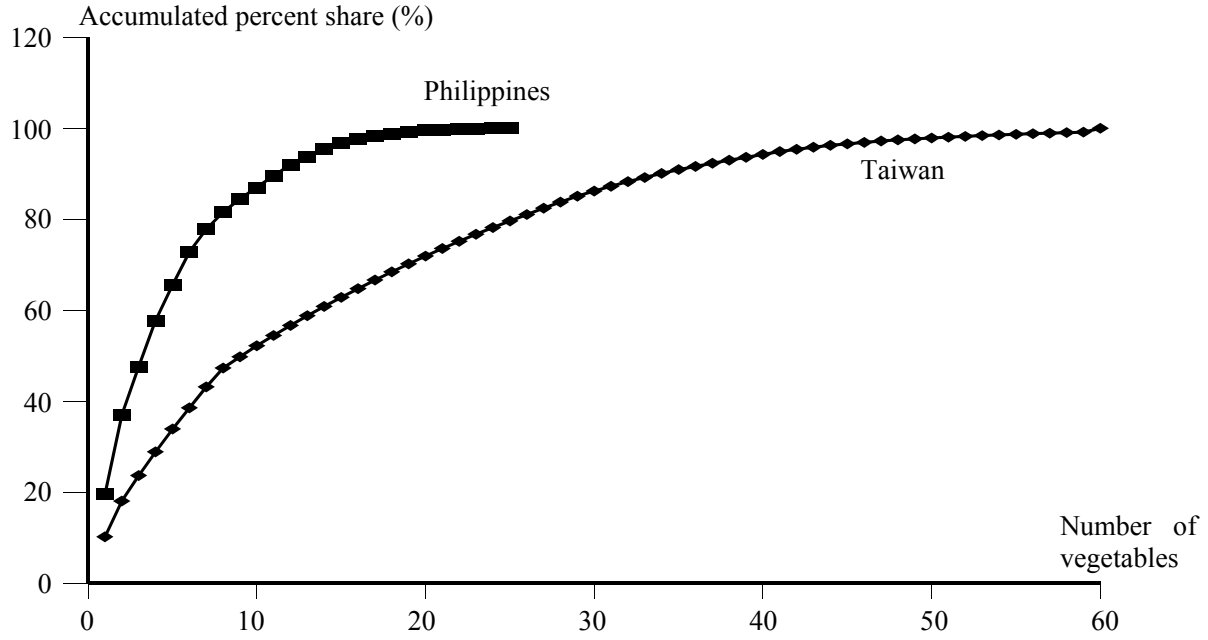

Figure 2. Diversity in Vegetable Consumption in Taiwan and the Philippines

Source: Unpublished data from the Socioeconomic Unit, AVRDC.

These surveys, spread over randomly selected 20,000 households from 57 administrative units (districts) across the country, provide detail information on the monthly consumption of individual food items along with income sources of the family, and other socioeconomic characteristics of the household and household head. From the total sample, we selected the rural households having single earning member engaged in certain type of manual work. The monthly income of the earning member was related with the diversity index of food, total per capita expenditure on food, and other socioeconomic characteristics of the bread-earner and the family as:[5]

$$\ln W = \beta_0 + \varepsilon_1 DTF + \beta_1 EXF + \beta_2 EDU + \beta_3 SEX + \beta_4 AGE + \sum_{f=5}^{6} \beta_f PRF_f + y_1 DYR + \sum_{d=1}^{56} d_d DIS_d \quad (1)$$

where W is the wage rate of manual workers in the logarithmic (ln) form, EXF is household food expenditures, EDU is the education of manual workers, SEX and AGE respectively indicates the sex and age of the workers, DYR is dummy for the survey year, PRF_f are series of dummy variables on different professions, DIS_d are regional variables on districts, and DTF measures diversity in the diet, estimated opposite to the concentration measure of *Herfindal-Index* in industry (Hanson and Simons 1995) as:

$$DTF_h = 1/(Herfindahl - index)_h = 1/\left[\sum_{j=1}^{n}\left(EXF_{jh} / EXF_h\right)^2\right] \quad (2)$$

where EXF_{jh} is the expenditure on the jth food item, and EXF_h is the total expenditure on all foods, and n is the total numbers of food items consumed by the hth household.

To understand the factors affecting food diversity, we consider it an endogenous variable depending upon various socioeconomic and regional factors as follows:

[5] Following Deolalikar (1988) and Croppenstedt and Muller (2000), we specified the log-linear function for the wage rate.

$$DTF = \chi_0 + \chi_1 INC + \chi_2 EDU + \chi_3 REF + \sum_{o=1}^{3} \chi_0 SES_0 + y_1 DYR + \sum_{d=1}^{56} d_d DIS_d \qquad (3)$$

where *INC* is the total monthly income from all sources (such as assets, livestock, including wage earning, etc.), *REF* is a dummy variable showing possession of refrigerator in the house, *SES* stands for season, while *EDU, DYR,* and *DIS* are as defined before. The working definition of each variable is given in Table 5. The equations (1) and (3) were estimated using the Two-Stage Least Square (2SLS) method.

The results suggest that more diversified food in fact does increase earning capacity of the manual workers significantly after controlling the effect of socioeconomic and regional variables (Table 5). The estimated elasticity of wage rate with respect to food diversity at the sample mean level is 0.67. This implies that a 10-percent increase in food diversity is expected to increase workers income by 6.7 percent.

It should be noted that increasing the food expenditure would also enhance the capacity of the workers. The elasticity of wage with respect to per capita food expenditure at the sample mean is 0.06, which is far below than the improvement due to increase in food diversity. This suggests that food diversity can play a far bigger role in poverty alleviation than merely increasing food expenditure by preserving the existing food composition.[6]

The equation (3) models the variables hypothesized to be contributing in food diversity. Unlike common notion, income is not very important variables in inducing food diversification. Instead, human and physical infrastructure, such as education, and presence of refrigerator in the house, are the most important variables. The education variable captures the effect of better understanding of the household head about the food needs of the family, while the refrigerator variable is a composite measure of the developed surroundings, such as presence of electricity, better housing condition, connection with the market, etc. These infrastructures play their role in development through, among other routes, whetting diversification in the diet.

Food diversity varies across professions. The labor related to professional work (i.e., two groups included in the equation) eat more diversified food than other farm labor (excluded group). Food diversity varies across season as well, for example, it is highest during July-September (Table 5).

Total diversity in food was disaggregated into two components: i) relative share of different food groups; and ii) diversity within each food group. To isolate the effect of each component on wage rate, we respecified equation (1) as follows:

$$\ln W = \beta_0 + \sum_{i=1}^{7} \varepsilon_j FDS_j + \sum_{j=1}^{6} \phi_j DTF_j + \beta_1 EXF + \beta_2 EDU +$$
$$\beta_3 SEX + \beta_4 AGE + \sum_{f=5}^{6} \beta_f PRF_f + y_1 DYR + \sum_{d=1}^{57} d_d DIS_d \qquad (4)$$

where FDS_j is the share of the jth food group in total food expenditure (or budget share), and DTF_j is the diversity index estimated as in equation (2) but only within the jth food group. All other variables are as defined before. The food was divided into eight groups (wheat, other cereals, pulses, meats, milk and its products, fats, fruits and vegetables, and miscellaneous). The shares and diversity within food group for respectively seven and six groups were included in the equation.[7]

We also looked into the effect of changing the budget share on the earning capacity of manual workers. For this purpose, the equation in (3) was respecified as:

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[6] Consistent to many other studies reviewed in Lockheed, *et al* (1980) and Ali and Byerlee (1991), education of the rural workers is an important factor in enhancing their earning capacity. The negative factors affecting the earning capacity of the workers are their sex (females are earning less because of the discrimination against women in the job market) and age, however, the coefficient for age is insignificant.

[7] Only seven shares could be included in the equation to avoid singularity, and six diversity variables were included because there is no within group diversity for wheat. We also tried fruits and vegetables as separate groups, but because of their strong substitution in consumption, therefore multi-collinearity, we decided to merge them into one group.

Table 5. Effect of Food Diversity on Earning Capacity, and Factors Affecting Food Diversity in Pakistan[a]

Variable Description (unit)	Variable Name	Mean Value	Wage Equation[b]		DTF Equation[b]		Wage Elasticity[c]
			Estimated Coefficient	Standard Error	Estimated Coefficient	Standard Error	
Total food diversity index (see equation 2)	*DTF*	8.84	0.0762[d]	0.0409	-	-	0.6732
Monthly per capita food expenditure (Pakistan Rupee [PKR])	*EXF*	249.53	0.0003[e]	0.0001	-	-	0.0629
Education of the worker (years)	*EDU*	1.16	0.0276[e]	0.0053	0.0751[e]	0.0251	0.0386
Ownership of refrigerator (1 = own; 0 = otherwise)	*REF*	0.01	-	-	1.5219[e]	0.5513	0.1159
Sex of the worker (1 = female; 0 = male)	*SEX*	0.03	-0.2403[e]	0.0738	-	-	-0.2403
Age of the worker (years)	*AGE*	37.72	0.0013	0.0011	-	-	0.0478
Per capita monthly income from all sources (PKR)	*INC*	390.0	-	-	0.0001	0.0001	0.0042
Profession (1 = brick layer/carpenter and building labor; 0 = otherwise)	PRF_1	0.43	0.0389	0.0327	0.5720[e]	0.1450	0.0824
Profession (1 = fisherman/cobbler/blacksmith/plumber/welder, etc. except farm labor; 0 = otherwise)	PRF_2	0.14	0.1155[c]	0.0441	0.7123[c]	0.2039	0.1697
Season (1 = July-September; 0 = otherwise)	SES_1	0.23	-	-	0.3104[d]	0.1835	0.0236
Season (1 = October-December; 0 = otherwise)	SES_2	0.27	-	-	-0.1358	0.1777	-0.0103
Season (1 = January-March; 0 = otherwise)	SES_3	0.26	-	-	0.2692	0.1795	0.0205
F-value			11.4[e]		9.46[e]		
Adjusted R^2			0.29		0.25		
Number of observation = 1,655							

Notes: [a] The estimated coefficients for district dummy variables are not reported in the Table, as these variables were included just to control the regional differences and have little relevance in the discussion. We also omitted the values of the intercept and year dummy from the Table; [b] **endogenous variables**: *W* (monthly wage earnings in rupees of the manual work) in the log form; *DTF*, and **instrument variables**: *EXF, EDU, REF, SEX, AGE, INC*, PRF_1, PRF_2, SES_1-SES_3, DIS_1-DIS_{36}, *DYR*; [c] the elasticity of wage with respect to a variable ($\delta \ln W/\delta \ln V$ or $\delta W/W/\delta V/V$) appeared only in wage equation can be estimated by multiplying its coefficient of the variable in the wage equation (which gives $\delta W/W/\delta V$) with the mean value of the variable. The elasticity of wage with respect to a variable appeared in only DTF equation can be estimated by multiplying its coefficient in the DTF equation with the coefficient of the DTF in the wage equation and the mean value of the variable. The elasticity of the variables appeared on both wage and DTF equations will be the sum of both the above elasticities; [d] imply that the coefficient is significant at 10 percent; and [e] imply that the coefficient is significant at 1 percent.

$$FDS_i = \lambda_0 + \lambda_{1i} EDU + \lambda_{2i} INC + \lambda_{3i} REF + \sum_{f=4}^{9} \lambda_{fi} PRC_f + \sum_{o=10}^{11} \lambda_{fi} PRF_f + \sum_{o=12}^{14} \lambda_{oi} SES_o + \sum_{d=1}^{57} d_{di} DIS_d + \gamma_{1i} DYR \quad (5)$$

where PRC_f is the weighted average price of the ith food group and all other variables are as defined before. The system in (4) and (5) was estimated using the 2SLS.

The result suggests that *ceteris paribus*, increasing the budget share of all food groups, except milk products, positively affects wage rate. All the coefficients for diversity within food group, however, are insignificant, except milk products. Although, the coefficient for the share of milk products is negative but it is insignificant; on the other hand the coefficient for diversity within milk product group is positive and significant (Wage Equation in Table 6).

The elasticities of wage earning with respect to food share was highest for fruits and vegetables, and lowest for milk and other cereals (Table 6). The reallocation of food budget from the group with low elasticities to the group with high elasticities can improve wage earnings. For example, a 10-percent increase in the share of fruits and vegetables in the diet (equivalent to 9.5 percent decrease in the share of wheat) will increase the wage rate by about 7.5 percent in Pakistan.[8]

Relative price of food is one of the main determinant factors of crop share (fruits and vegetables equation in Table 6). The elasticity of wage earning with respect to the prices of fruits and vegetables is -0.086.[9] This implies that a 10-percent decrease in the relative prices of fruits and vegetable, say through technological innovation, will increase their share in consumption by 0.86 percent.[10]

Among other factors, again variables related to human and physical infrastructure significantly enhance the share of fruits and vegetables in the diet. For example, a 10-percent increase in schooling of workers, on average, will directly increase their earning capacity by 0.4 percent and also affect their capacity by increasing the shares of fruits and vegetables by 0.08 percent, thus total effect of education on earning is 0.5 percent. Similarly, the presence of refrigerator in the house improves the share of fruits and vegetables in the diet by 1.1 percent, which through wage equation increases workers' earning by 0.01 percent. It looks that the effect of refrigerator on earning capacity is much more through enhancing overall food diversity (equation 5), rather than here through influencing the shares of food groups. After controlling the effect of prices, there is no effect of seasonality on fruit and vegetable share.

DIVERSITY IN CROP PRODUCTION AND VEGETABLES

The diversity in production is more complicated than consumption diversity. Apart from the human, institutional, and physical infrastructure, production technologies and qualities of resource engaged in production are added dimensions in production diversity. This section first estimates the trends in crop production diversity, then measures the effect of the diversity on the productivity of the cropping system after controlling the effect of other socioeconomic and institutional factors determining such productivity in Pakistan's Punjab. The effect of diversification with vegetables on productivity is particularly highlighted. For this purpose, a comprehensive data collected by the senior author through the cooperation of World Bank were used. The data contain district-level yearly area, production, and price for 33 crops and 17 input categories during the period 1971-94 for 16 districts in the Pakistan's Punjab.

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[8] Other variables affecting wage earning have similar sign here, with slightly higher magnitude, compared to those reported earlier in Table 5. The elasticity of wage with respect to food expenditure increased more than four times, but still remained far below the elasticity with respect to overall food diversity reported in Table 5.

[9] We estimated the budget equations for six food groups, but only results for only fruit and vegetable equation are reported here as the focus of this paper is on vegetables. Similar negative relationship was observed between the prices of other food groups and their consumption shares. The elasticity reported here includes only the own-price effect.

[10] This does not include the effect of increase of overall food budget due to the increase in income by such innovation.

Table 6. Effect of Food Group Share and Diversity within Group on Labor Productivity, and Factors Affecting the Share of Vegetables[a]

Variable Description and Unit		Variable Names	Wage Equation[b]		Fruits and Vegetables[b]		Wage Elasticity[c]
			Coefficient	Standard Error	Coefficient	Standard Error	
Share in Food Expenditure (percent):	Wheat	FDS_1	0.023[d]	0.013	-	-	0.433
	Other cereals	FDS_2	0.014	0.020	-	-	0.099
	Pulses	FDS_3	0.057[d]	0.026	-	-	0.229
	Milk products	FDS_5	-0.006	0.015	-	-	-0.102
	Fats	FDS_6	0.048[e]	0.013	-	-	0.533
	Meats	FDS_4	0.041[e]	0.011	-	-	0.294
	Fruits and vegetables	FDS_7	0.084[e]	0.026	-	-	1.160
Diversity Index: Other cereals (equation 2)		DTF_2	-0.043	0.048	-	-	-0.076
Pulses (equation 2)		DTF_3	0.013	0.034	-	-	0.030
Meats (equation 2)		DTF_4	-0.006	0.056	-	-	-0.007
Milk products (equation 2)		DTF_5	0.268[d]	0.116	-	-	0.293
Fats (equation 2)		DTF_6	-0.001	0.079	-	-	-0.001
Fruits and vegetables (equation 5)		DTF_7	-0.058	0.028	-	-	-0.363
Monthly per capita food expenditure (PKR)		EXF	0.001[e]	0.0003	-	-	0.261
Age of the worker (years)		AGE	0.002	0.002	-	-	0.075
Sex of the worker (1 = female; 0 = otherwise)		SEX	-0.345[e]	0.117	-	-	-0.345
Education of the worker (schooling year)		EDU	0.038[e]	0.008	0.037	0.048	0.048
Per capita monthly household income from all sources (PKR)		INC	-	-	2.6	0.1	0.9
Ownership of refrigerator (1 = if own, 0 = otherwise)		REF	-	-	1.477	1.055	0.001
Price (PKR/kg)[f]:	Wheat	PC_1	-	-	0.164[d]	0.074	0.053
	Other cereals	PC_2	-	-	0.014	0.041	0.007
	Pulses	PC_3	-	-	-0.045[d]	0.019	-0.052
	Milk products	PC_5	-	-	-0.009	0.017	-0.005
	Fats	PC_6	-	-	-0.101[e]	0.011	-0.241
	Meats	PC_4	-	-	-0.050	0.011	-0.117
	Fruits and vegetables	PC_7	-	-	-0.049[d]	0.049	-0.036
Profession (1 = brick-layer and carpenter, 0 = otherwise)		PRF_1	-0.018	0.054	0.289	0.280	0.007
Profession (1 = fisherman/cobbler/blacksmith/plumber/ welder, etc. except farm labor, 0 = otherwise)		PRF_2	0.053	0.070	0.519	0.392	0.097

... To be continued

Table 6. Continuation

Variable Description and Unit	Variable Names	Wage Equation[b]		Fruits and Vegetables[b]		Wage Elasticity[c]
		Coefficient	Standard Error	Coefficient	Standard Error	
Dummy for season (1 =July-September, 0 = otherwise)	SES_1	-	-	0.002	0.352	0.000
Dummy for season (1 = October-December, 0 = otherwise)	SES_2	-	-	-0.019	0.340	-0.002
Dummy for season (1 = January-March, 0 = otherwise)	SES_3	-	-	-0.124	0.346	-0.010
Year dummy (1 = 1992-93, 0 = otherwise)	DYR	0.068	0.050	0.155	0.320	0.081
F-values		4.85[e]		10.90[e]		
Adjusted R^2		0.15		0.30		

Notes: [a] We omitted the values of the intercept, district dummies, and year dummy from the Table; [b] **endogenous** variables: *W* (monthly wage earning in rupees), FDS_1-FDS_6 and **instrument** variables: *ESF, AGE, EDU, SEX, INC, REF,* PRF_1-PRF_6, PC_1-PC_7, DTF_1-DTF_6, SES_1-SES_3; [c] the same formulation as explained in footnote 3 of Table 5 was used here to estimate these elasticities, except the coefficient of DTF was replaced with the coefficients of fruit and vegetable equation; [d] and [e] imply that the coefficient is significant at 10 and 1 percent, respectively; and [f] the weighted average prices of commodities at the group level were used here. These were estimated as $\text{Exp}[\sum_i s_i \ln(p_i)]$ where p_i is the price of the ith commodity in the group, and s_i is the share of the ith commodity in the group food cost (i.e., $p_i*q_i/\sum_i p_i*q_i$, q_i is the quantity of the ith commodity).

Trends in Crop Diversity

Parallel to food diversity, the diversity in crop production (*DTP*) in a district *d* during year *t*, was estimated as follows:

$$DTP_{dt} = 1/\left(H-index\right)_{dt} = 1/\left[\sum_{j=1}^{m}\left[A_j / A\right]^2\right] \qquad (6)$$

where A_j is area under the *j*th crop and A is the total area under all crops, and m is the total number of crops in a district *d* at time *t*.

The trends in crop diversity were estimated by cropping region as well as for the whole Punjab. The four cropping regions defined on the basis of dominant *kharif* crop in a district are: wheat-mixed, wheat-cotton, wheat-rice, and wheat-mung bean (Ali and Byerlee, 2000). The results show that crop diversity based on area under different crops has declined during 1971-94. The average rate of decline was 0.64 percent per annum (Table 7). The declining trend was pervasive in all regions, but lowest in the wheat-mix and wheat-mung bean regions. These trends seem to reject the hypothesis of Timmer (1997) that regional diversity improves overtime.[11]

Table 7. Trends in Crop Diversity by Cropping Region and Major Crop Group* in Pakistan's Punjab, 1971-94

(Unit: Percent per annum)

Cropping Region	Growth in Diversity	Change in the Share in Total Area					
		Cereals	Commercial Crops	Minor Crops	Vegetables	Fruits	Pulses
Wheat-rice	-0.9	2.6	-7.6	-5.5	3.2	0.7	-4.7
Wheat-cotton	-1.0	-0.3	4.4	-5.2	1.7	8.1	-8.9
Wheat-mix	-0.3	0.5	-0.7	-3.7	2.3	7.3	-4.2
Wheat-mung bean	-0.4	-0.7	-1.2	1.2	-2.4	0.8	3.7
Punjab	-0.6	0.4	-0.5	-3.5	1.4	5.1	-4.2

Note: * The crop group specification is as follows: Cereals include wheat, rice, and corn; Commercial crops include cotton, sugarcane, tobacco, and potato; Minor crops include *juwar, bajra*, barley, rapeseed and mustard, guar seed, and non-traditional oils; Vegetables include onion, garlic, chili, and all other vegetables; Fruits include citrus, mango, banana, guava, dates, and other fruits; Pulses include *garm*, mung bean, mash, *masoor*, peas, and other pulses.

Looking at the trends of individual crop group shares in total crop area suggest that concentration of cereals has increased, while pulses and minor crops were gradually thrown out of the cropping system during the period. The rate of increase in the concentration (opposite to diversity) of cereal crop in the Punjab was 0.4 percent, while the rate of decrease in the share of pulses and minor crop area was 4.2 and 3.5 percent per annum, respectively. Even commercial crops were thrown out from most of the cropping systems, except wheat-cotton where cotton experienced a strong positive growth. The only sign of relief for crop diversity in Punjab was the increasing shares of vegetable and fruits at an average rate of 1.4 and 5.1 percent per annum, respectively (Table 7).

Productivity Effect of Crop Diversity and Its' Determinant Factors

At present, no empirical study to our knowledge is available which quantifies the effect of crop production diversity on productivity, perhaps because of the extensive data requirements for this purpose. A comprehensive district-level data on crop production in the Pakistan's Punjab provides an opportunity to establish such relationship through the following model:

[11] The hypothesis of increased regional diversity, however, may be true in the vertical sense in which off-farm activities are added to the crop production system, although this was not looked into in this paper.

$$\ln TFP_{dt} = \alpha_0 + \beta \ln DTP + \mu \ln CIP + \delta_1 \ln EDU + \delta_2 \ln ROD + \gamma_1 \ln ELC + \gamma_2 \ln SOP + \gamma_3 \ln SOM + \gamma_4 SST + \sum_{r=1}^{4} \eta_r RGT_r + \sum_{d=1}^{15} d_d DIS_d \quad (7)$$

$$\ln DTP = \alpha_0 + \phi_1 TTA + \phi_1 MWV + \phi_2 IRA + \nu_1 \ln EDU + \nu_2 \ln ROD + \nu_3 \ln FAS + \nu_4 \ln AOD + \psi_1 \ln ELC + \psi_2 \ln SOP + \psi_3 \ln SOM + \psi_4 SST + \sum_{r=1}^{4} \eta_r RGT_r + \sum_{d=1}^{15} d_d DIS_d \quad (8)$$

where TFP_{dt} is the chain-linked Tornqvist-Theil index of total factor productivity (*TFP*) in a district *d* and year *t*.[12] This is composite measure of productivity of the crop sector, and includes value of all crop outputs and inputs used during a one year time. The variation in *TFP* was related to: (i) crop diversity (*DTP*); (ii) technological innovation proxy by cropping intensity unit; (iii) human resources such as literacy ratio of farmers (*EDU*), infrastructure such as distance from road (*ROD*); and (iv) soil and water quality such as electro-conductivity (a measure of salts content in water) (*ELC*), available soil phosphorous (*SOP*) and soil organic matter (*SOM*), and soluble salts in soils (*SST*). To capture the effect of other unknown factors affecting *TFP*, variables on regional trends (RGT_r) and district dummies (DIS_d) were also included.

In an attempt to understand factors affecting crop diversity, the latter was treated as an endogenous variable determined by policy environment, technologies, human resources, infrastructure, and institutions. The policy environment or terms of trade for agriculture (*TTA*) was proxy by the weighted average index of prices received by farmers divided by prices paid by farmers. In a circumstance when right hand side variables in one equation becomes endogenous variables in another, instrument variables need to be identified to identify each equation uniquely. Therefore, while in equation (7) *CIP* was used to capture the effect of technological change, variables on percentage of wheat area under modern variety (*MWV*) and percentage of irrigated area (*IRA*) were included in equation (8) for this purpose. We also included institutional factors, such as average farm size of the district (*FAS*) and percentage of area owned (*AOD*), as determinant of diversity. Other variables in equation (8) on human resources, infrastructure, regional and district dummies were the same as in equation (7). All variables in both the equations were transformed into an index with 1971 as base 100, and each continuous variable was converted into logarithm (ln) form. The system of equations was estimated simultaneously using the iterative 2SLS method, and the results are reported in Table 8.

The estimation suggests that a 1-percent increase in crop diversity in a year will enhance the sectors' productivity by 0.56 percent at the given level of resources (*TFP* Equation in Table 8).[13] This is because the diversity helps breaking the insect-pest cycles, reducing soil micronutrient-mining, and utilizing spare farm and non-farm resources. Above all, enhanced managerial capacity gained from incorporating vegetables in the cropping system improves system's performance as a whole. Therefore, production diversity enhances the competitiveness of the agriculture sector, and has the potential to generate a Second Generation Green Revolution.

Better terms of trade positively affect diversity. A 10-percentage increase in the prices received compared to the prices paid by farmers will increase crop production diversity by 0.8 percent. This implies that indirect taxing agriculture, a norms in most developing countries, had negative consequences on production diversity, thus indirectly on crop productivity.

Both technological variables (modern variety and irrigated area) negatively affect crop diversity in Pakistan's Punjab (*DTP* equation in Table 8). This suggests biases towards specialization in technological change. For example, most of the increase in water availability from the public canals in the Punjab was during winter (*rabi*) season when more than 80 percent of total cultivated area is under wheat. Relatively easy access to credit and other inputs for, assured crop prices, and whole extension system geared towards major crops also enhanced concentration of these crops in total cropped area. Under such policy biases against diversification, it is natural that educated farmers focused on major crops, therefore, diversity and literacy ratio were found to be negatively correlated. More will be discussed on these biases when we discuss the determinants of the shares of individual crop group.

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[12] See Ali and Byerlee (2000) for details of the estimation procedure and relevant literature on *TFP*.

[13] The effects of technological change, infrastructure, and resource quality on *TFP* were consistent and significant. For more details on roles of these factors in productivity, see Ali and Byerlee (2002).

Table 8. Relationship between TFP and Diversification, and Factors Affecting the Crop Diversity[a]

Description of Variable[b]	Variable Name	*TFP* Equation[c]		*DTP* Equation[c]		Total *TFP* Elasticity[d]
		Coefficient	Standard Error	Coefficient	Standard Error	
Diversity index (see equation 6)	*DTP*	0.558[f]	0.2712	-	-	0.558
Terms of trade for agriculture (index of prices received/index of prices paid)[e]	*TTA*	-	-	0.082[f]	0.027	0.046
Technological change:						
Index of percent of cropped area to cultivated area	*CPI*	0.389[f]	0.093	-	-	0.389
Index of irrigated areas as percent of cultivated area	*IRA*	-	-	-0.075[g]	0.022	0.042
Index of percent of modern wheat variety area	*MWV*	-	-	-0.038[f]	0.013	0.021
Infrastructure, human capital, and farm structure						
Index of percent farmers who are literate	*EDU*	0.422[f]	0.162	-0.217[f]	0.047	0.301
Index of inverse of distance from road	*ROD*	0.310[f]	0.082	0.083[f]	0.026	0.264
Index of percent area owned	*AOD*	-	-	0.372[f]	0.114	0.208
Index of average farm size	*FAS*	-	-	-0.139[g]	0.101	0.078
Water and soil quality:						
Index of electro-conductivity	*ELC*	-0.011[g]	0.008	-	-	-0.011
Index of phosphorous in soils	*SOP*	0.077[f]	0.028	-	-	0.077
Index of organic matters in soil	*SOM*	0.077[f]	0.037	-	-	0.077
Index of soluble salt in soils	*SST*	-0.013[g]	0.008	-	-	-0.013
Regional trend:						
Trend value if the region is wehat-mixed, otherwise = 0	RGT_1	-0.009	0.007	0.008[g]	0.003	-0.005
Trend value if the region is wheat-cotton, otherwise = 0	RGT_1	0.003	0.007	-0.004	0.004	0.001
Trend value if the region is wehat-rice region, otherwise = 0	RGT_1	-0.016[f]	0.006	0.002	0.003	-0.015
Trend value if the region is wehat-mung bean, otherwise = 0	RGT_1	-0.009	0.007	0.007	0.004	-0.005
F-value		30.2		69.3		
Adjusted R^2		0.682		0.817		
Number of observation: 367						

Notes: [a] The estimated coefficients for district dummy variables are not reported in the Table, as these variables are just to control the regional differences and have little relevance in the discussion. Similarly, intercept is also not reported; [b] all continuous variables were converted into index with 1970 = 100 as base, and in logarithmic form; [c] **endogenous** variables: *TFP* (total factor productivity index), *DVT*, and **instrument** variables: *TTA, CPI, IRA, MWV, EDU, ROD, ELC, SOP, SOM, SST, AOD, FS*; [d] to estimate these elasticities same formulation as explained in footenote 3 of Table 5 can be used here, except that in this case mean value of the respective variable is not involved, as coefficient in both *TFP* and vegetable equations are in logarithm form; [e] the weighted average prices of all inputs and outputs were used here. The weighted average prices of outputs were estimated as $\text{Exp}[\sum_j s_j \ln(p_j)]$ where p_j is the price of the $_j$th crop, and s_j is the share of the $_j$th crop in the total revenue from all crops (i.e., $p_j*q_j/\sum_j P_j*q_j$, q_j is the output of the $_j$th crop). Similarly, the weighted average prices for all inputs (material, machinery, labor, land) were estimated; and [f] and [g] imply that the coefficient is significant at 10 and 5 percent, respectively.

Development of infrastructure, such as reducing the distance of a village from road, helps to mitigate such biases against diversity as reduced distance of village and crop diversity are positively related. Therefore, reducing the distance from roag help to improve TFP by improving the crop diversity. Reducing the distance from also directly influence TFP. The total elasticity of road infrastructure on TFP is 0.264.

Interestingly, crop diversity is higher in those districts having large farms compared to those with smaller size (*DTP* equation in Table 8), perhaps because of the institutional biases towards those districts in providing inputs, information, and marketing infrastructure necessary for diversity. As farm size in the Punjab has decreased over time (Ali and Byerlee, 2000), this has reduced crop diversity.

Crop production is more diversified on owned than tenanted farms (*DTP* equation in Table 8), because of reduced incentive for crop diversity for tenants who are mainly sharecroppers. As percentage of rented land has decreased from 44 percent in the 1960s to 30 percent in the 1990s (Ali and Byerlee, 2000), this helped to improve crop diversity in the Punjab. After controlling the effects of technological and institutional changes, trend in crop diversity was significantly negative only in wheat-rice.

Diversification with Vegetables and Total Factor Productivity

To quantify the productivity effect of diversification through vegetables, the diversity variable in equations (7)-(8) was replaced with the share of different crop groups (CRS_j) in total area as follows:

$$\ln TFP_{it} = \alpha_0 + \sum_{j=1}^{6} \beta \ln CRS_j + \mu \ln CIP + \delta_1 \ln EDU + \delta_2 \ln ROD + \gamma_1 \ln ELC + \gamma_2 \ln SOP + \gamma_3 \ln SOM + \gamma_4 SST + \sum_{r=1}^{4} \eta_r RGT_r + \sum_{d=1}^{15} d_d DIS_d \qquad (9)$$

To understand factors affecting the share of these crop groups, equation (8) was specified for each crop share (as independent variable) keeping all other independent variables but replacing *TTA* variable with normalized relative prices (*NCP*) of all groups (in logarithm form) in each equation as:

$$\ln CRS_i = \alpha_0 + \sum_{j=1}^{m} \varphi_j \ln NCP + \varphi_1 \ln MWV + \varphi_2 IRA + \nu_1 \ln EDU + \nu_2 \ln ROD + \nu_3 \ln FAS + \nu_4 \ln AOD + \psi_1 \ln ELC + \psi_2 \ln SOP + \psi_3 \ln SOM + \psi_4 \ln SST + \sum_{r=1}^{4} \eta_r RGT_r + \sum_{d=1}^{15} d_d DIS_d \qquad (10)$$

Again the system of equations in (9) and (10) was estimated simultaneously using the 2SLS method. Although, we estimated the system of all share equations, we report the results of vegetable equation only because that is the focus of the paper.

Increasing the proportion of vegetable area to total area improves overall productivity of the cropping system, after controlling the effect of prices, technology, soil and water quality, and infrastructure variables (*TFP* equation in Table 9). For example, a 10-percent increase in the proportion of vegetable area (i.e., from 1 percent of the current share to 1.1 percent) can enhance productivity of the overall agriculture system by 0.8 percent.[14] Similar positive effect of the increase in the share of commercial crops, fruits, and pulses in cropped area was also observed. A corollary to these results is that a 10-percent increase in the concentration of cereal and minor crop area decreased productivity by about 6 and 3 percent, respectively (*TFP* equation in Table 9).[15]

As noticed before, the share of vegetables in total cropped area has increased at the rate of 1.4 percent per annum during 1971-94, thus contributed to enhance *TFP* in the province. On average, the Pakistan's Punjab gained productivity growth by 0.12 percent per annum due to this improvement in crop structure. On the other hand, the crop sector in the province lost productivity growth by about 0.24 percent per annum due to the increase in the share of cereal area at the rate of 0.4 percent per annum during this period.

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[14] The estimated coefficient in this case directly gave elasticity of the variable as both dependent and independent variables are in logarithmic form.

[15] As before in the overall *TFP* and diversity relationship (Table 8), the effect of education, distance from road, and technology variable remained significant here as well.

Table 9. Productivity and Diversification with Crop Groups, and Factors Affecting the Vegetable Share[a]

Variable Description[b]	Description	*TFP* Equation[c]		Vegetable Equation[c]		Total *TFP* Elasticity[d]
		Co-efficient	Standard Error	Co-efficient	Standard Error	
Index of Share of Crops in Total Cropped Area						
Cereals	CRS_1	-0.5901[e]	0.1985	-	-	-0.5901
Commercial crops	CRS_2	0.3680[e]	0.1174	-	-	0.3680
Minor crops	CRS_3	-0.2935[g]	0.1951	-	-	-0.2935
Vegetables	CRS_4	0.0835[f]	0.0386	-	-	0.0835
Fruits	CRS_5	0.1379[f]	0.0718	-	-	0.1379
Pulses	CRS_6	0.2942[f]	0.1235	-	-	0.2942
Index of Normalized Relative One-year Lag Prices (output/input)[h]						
Cereals	NCP_1	-	-	0.0415[f]	0.0208	-0.1089
Commercial crops	NCP_2	-	-	0.0530	0.1350	0.0527
Minor crops	NCP_3	-	-	-0.1028	0.0806	0.0150
Vegetables	NCP_4	-	-	0.1701[f]	0.1063	0.0218
Fruits	NCP_5	-	-	-0.1868[g]	0.1008	0.0084
Pulses	NCP_6	-	-	-0.0078	0.0965	0.0531
Technological Change						
Index of cropped as percent of cultivated area	*CPI*	0.2623[g]	0.1479	-	-	0.2623
Index of irrigated as percent of cultivated area	*IRA*	-	-	-0.0875	0.1611	-0.0554
Infrastructure and Human Capita						
Index of percent farmers who are literate	*EDU*	0.3535[g]	0.2836	1.0855[e]	0.3380	0.1603
Index of inverse of distance from road	*ROD*	0.1947[g]	0.1297	0.9410[e]	0.2000	0.2810
Index of percent area owned	*AOD*	-	-	-0.3116	0.8234	0.9923
Index of average farm size of the district	*FAS*	-	-	-0.1063	0.7369	-0.1423
Soil and Water Quality						
Index of electro-conductivity	*ELC*	-0.0824[g]	0.0512	-	-	-0.0824
Index of phosphorous in soils	*SOP*	0.0077[g]	0.0050	-	-	0.0077
Index of organic matters in soil	*SOM*	0.0143[g]	0.0055	-	-	0.0143
Index of soluble salt in soils	*SST*	-0.0586[f]	0.0304	-	-	-0.0586
Regional Trend						
Trend if region is wheat-mixed, otherwise=0	RGT_1	-0.0064	0.0115	-0.0668[f]	0.0246	-0.0439
Trend if region is wheat-cotton, otherwise=0	RGT_2	0.0030	0.0125	-0.0723[f]	0.0256	-0.0403
Trend if region is wheat-rice, otherwise=0	RGT_3	-0.0133	0.0116	-0.0422[g]	0.0238	-0.0473
Trend if region is wheat-mung bean, otherwise=0	RGT_4	-0.0097	0.0116	-0.0998[f]	0.0242	-0.0348
F-value		14.8[e]		45.4[e]		
Adjusted R^2		0.55		0.78		
Number of observation = 367						

Notes: [a] We estimated all the share equations as part of the system, but for our interest we report the results for the vegetable share equation only; [b] all continuous variables are in the index form with 1971 = 100 as base, and these were converted into log form; [c] **endogenous** variables: TFP, CRS_1-CRS_6 and **instrument** variables: CPI, IRA, MWV, EDU; ROD, ELC; SOP, SOM, SST, AOD, FAS, NCP_1-NCP_6; [d] to estimate these elasticities same formulation as explained in footnote 3 of Table 5 can be used here, except that in this case mean value of the respective variable is not involved, as coefficient in both TFP and vegetable equations are in logarithm form; [e], [f] and [g] imply that the coefficient is significant at 1, 10 and 15 percent, respectively; and [h] the weighted average prices of all inputs and each output group were used here. The weighted average price of each crop group was estimated as $\text{Exp}[\sum_j s_j \ln(p_j)]$ where p_j is the price of the $_j$th crop, and s_j is the share of the $_j$th crop in the group revenue (i.e., $p_j*q_j/\sum_j p_j*q_j$, q_j is the total output of the $_j$th crop). Similarly, the weighted average prices for all inputs (material, machinery, labor, land) were estimated.

The major factors affecting the share of vegetable area in total area are their relative prices, infrastructure such as distance from road and human capital (vegetable equation in Table 9). A 10-percent increase in the relative farm prices of vegetable, say through reducing their production and marketing costs, will increase vegetable share by 1.7 percent. Apart from increasing farmers' income directly, this will increase *TFP* indirectly by about 0.14 percent. Therefore, research on production and marketing aspects of vegetables can be an important tool to enhance diversity. Interestingly, fruits are competitive with vegetables in the sense that increasing fruit prices negatively affects vegetable share, while cereals are complementary.

An increase in irrigated area insignificantly affects the share of vegetables. Therefore, lack of irrigation is not a major constraint on crop diversification with vegetables in the irrigated Punjab where more than 80 percent area is linked to canal or under groundwater supply systems.

A higher literacy significantly induces higher share of vegetable area. This is in contrast to the earlier results showing the negative effect of education on overall diversity (Table 8). Actually, the human infrastructures are positively related with the share of commercial crops as well. The negative relationship between overall diversity and technology and human capital variables was mainly because of the negative relationship of these variables with pulses and minor crop shares (the results of commercial crops, pulses and minor crop equation are not shown here). Due to laxity of policy-makers for pulses and minor crops, the yields of these crops remained stagnant. Thus education went against these crops, tend to benefit cereals, commercial crops and vegetables, but hampered overall diversity.

Reducing the distance of a village from road improve both TFP and the share of vegetables in total area. The direct elasticity of TFP with respect to road is 0.19, and indirect effect through vegetable share is 0.09, giving the total effect of road at about 0.28. This implies that reducing a 10-percent distance of a village to road will increase overall productivity by 2.8 percent.

Ownership of land provides incentives to increase the share of vegetables in total crop area, while higher farm size decrease it (vegetable equation in Table 9).

VEGETABLES AND ECONOMIC COMPETITIVENESS: FARM-LEVEL EVIDENCE

So far we analyzed the development impact of diversification at the aggregated level without understanding the mechanism by which such impacts are generated. This section provides an understanding of such mechanism by analyzing the farm-level impact of vegetable cultivation on employment, income, nutrition, and other development related parameters. For this purpose, production survey data collected by AVRDC were used.[1]

Enhanced Employment

Vegetable cultivation needs many times more labor compared to other field crops, such as cereals (Table 10). It is estimated that, on an average, each hectare of rice converted to vegetable in one season generates one year-round job.

Not only vegetables use more labor, higher proportion of it is hired. Family labor becomes engaged in critical decision-making regarding production and marketing. To compensate this, labor is hired for routine vegetable production activities, such as input application, weeding and harvesting. Moreover, timeliness of operation is very critical in vegetable production. To handle the urgency, say harvesting the ripened output within few hours, labor has to be hired if family labor is not sufficient. For example, on an average, 25 percent of the total labor used on vegetables in Taiwan is hired, while in cereal the proportion is only 6 percent. Such difference is sharper in commercial than in subsistence vegetable production. Moreover, vegetables engage more labor of vulnerable population groups, like women. For example in Taiwan 61 percent of the labor used on vegetables is women while the proportion is 48 percent in vegetables. Braun, *et al*. (1989) also arrived at similar conclusion in their study in Guatemala.

[1] The operation of these surveys is explained in footnote 2. The production surveys include farmers' characterization, input quantities and costs of all inputs, and yield and return from all crops grown during the year completed just before the survey.

Table 10. Input Use and Cash Cost in Vegetables and Cereals in Selected Countries of Asia

Input/Crop		Vietnam	Lao PDR	Cambodia	Bangladesh
Labor (day/ha)	Vegetables	278	223	437	338
	Cereals	92	100	79	133
Fertilizer (kg/ha)	Vegetables	534	92	148	276
	Cereals	388	75	46	113
Manure (mt/ha)	Vegetables	7.6	1.3	1.7	5.0
	Cereals	2.1	0.3	0.3	1.4
Pesticide (number of spray)	Vegetables	7.6	1.5	6.2	6.5
	Cereals	3.2	0.1	0.6	1.3
Irrigation (number)	Vegetables	31	39	50	3
	Cereals	6	2	4	2
Cash cost (US$/ha)	Vegetables	658	117	406	428
	Cereals	233	53	78	143

Source: Estimated from the unpublished survey data of the Socioeconomic Unit, AVRDC.

Agriculture Business Activities and Multiplier Effect

Vegetable cultivation requires more purchased inputs, such as fertilizer, pesticide, labor, and irrigations. These obligate more liquidity in hand (Table 10). This ultimately translates into higher demands for agricultural business activities, i.e., more loans, and fertilizer and pesticide sales shops are needed.

On the other hand, most vegetable output (except from home garden) is produced for market in contrast to cereal production in developing countries which is mainly intended for home consumption. The expansion in vegetable production creates substantial demand for marketing activities. As vegetables have shorter shelf life compared to cereal crops, they need sophisticated marketing infrastructure, such as better roads, storage, etc. Once such infrastructure is established, the efficiency of the whole marketing system is improved.

The commercial nature of vegetable production creates higher multiplier effect of a given increase in production compared to the same increase in cereals. Through a hypothetical example,[2] the same worth of initial increase in income in both sectors was shown to create a multiplier effect of three in vegetables and less than two in cereals.

Economic Efficiency

Low productivity of the agriculture sector in developing countries can be traced back to its low economic efficiency. So economic efficiency in production is as an important criterion to judge economic viability of different technologies, as well as to compare the role of different crops in uplifting productivity of the sector. Economic efficiency can be defined in terms of individual, i.e., input-use efficiency or partial productivity. The partial productivity of a variable input is measured as:

$$PP \text{ (partial productivity)} = \text{(gross revenue} - \text{variable cost)/quantity of the input} \quad (11)$$

In estimating the partial productivity, cost of only that input is considered as variable, while costs of all other inputs are fixed.

The estimated partial productivity of labor, fertilizer, and water are significantly higher in vegetable than in rice cultivation (Table 11). This implies that shifting resources from rice to vegetable cultivation will improve overall economic efficiency of the resources engaged in crop production. That is why net returns on per unit of land and benefit-cost ratios for vegetables are far higher than in cereals.

Output Efficiency

Output efficiency can be measured in terms of unit output cost or benefit-cost ratio. Here output efficiency of rice production was compared between vegetable and non-vegetable farmers. Although rice yield was not different, total cost of producing similar yields was significantly lower on vegetable farms than

[2] This example assumes 90 percent of the vegetable and 30 percent of the cereal output sold in market. Similarly, 40 percent inputs in vegetables compared to 50 percent in cereals were assumed to be purchased.

on non-vegetable farms. This increased the benefit-cost ratio and reduced unit cost of rice production on vegetable farms compared to such on non-vegetable farms (Table 12).

Table 11. Resource Use Efficiency in Vegetables versus Rice Cultivation in Selected Countries of Asia

Crop/Input		Vietnam	Lao PDR	Cambodia	Bangladesh
Labor (US$/labor day)	Vegetables	7.7	5.9	3.8	4.4
	Cereals	4.1	1.6	2.0	1.4
Irrigation (percent return	Vegetables	21	11	8	65
on water cost)	Cereals	15	42	21	40
Fertilizer (US$/kg of nutrient)	Vegetables	8	27	17	10
	Cereals	3	16	7	4
Land (US$/ha)	Vegetables	1,151	696	452	553
	Cereals	120	80	48	30
Benefit-cost ratio (percent)	Vegetables	106	170	96	81
	Cereals	43	54	53	13

Source: Estimated from the unpublished survey data of the Socioeconomic Unit, AVRDC.

Table 12. Economics of Cereal Production on Vegetable verses Non-vegetable Farms in Selected Asian Countries

Type of Farm/Parameter		Vietnam	Lao PDR	Cambodia	Bangladesh
Yield (mt/ha)	Vegetable farm	4.8	2.5	2.2	2.1
	Non-vegetable farm	4.6	2.6	2.3	2.1
Total cost (US$/ha)	Vegetables farm	430 (56)	247 (24)	184 (42)	196
	Non-vegetable farm	448 (60)	302 (29)	209 (37)	244
Net return (US$/ha)	Vegetables farm	137	84	52	86
	Non-vegetable farm	87	64	24	39
Benefit-cost ratio	Vegetables farm	49	54	55	44
(US$/US$100)	Non-vegetable farm	31	54	40	16
Unit output cost (US$/mt)	Vegetables farm	102	107	96	93
	Non-vegetable farm	106	119	96	116

Source: Estimated from the unpublished survey data of the Socioeconomic Unit, AVRDC.
Note: The figures in parenthesis are percentage share of cash costs in the total cost.

It can be argued that higher output efficiency of vegetable farmers may be due to the difference in farm size (small farmers are mostly more efficient [Ali, 1995], and vegetable farmers have smaller size), difference in education, or input use. The production function analysis on the combined data for the three Indo-China countries suggests that rice production was 20 percent higher on vegetable compared to non-vegetable farms after controlling the effect of input use in production, and the difference in education, farm size and irrigation status of the two groups.[3]

Thus once vegetable cultivation starts, it improves output efficiency in other crops. This is achieved through improvement in managerial capacity of vegetable farmers, as they learn production processes and understand agriculture markets. They must experience these, as profitability in vegetables is highly sensitive to climatic, biological, and economic environments. Once farmers learn these, they apply them to other crops.

[3] The production function (*PF*) included quantities of seed, fertilizer, farm manure, labor, irrigation status (irrigated field = 1, and otherwise = 0), and farm type (vegetable farmer = 1, and otherwise = 0) as independent variables. To control the selectivity bias of vegetable farmers, a second equation was specified where farm type was made dependent on the level of education, farm size, and irrigation status. The *PF* equation was specified in the trans-log, and the second equation was in log linear form. Both equations were estimated simultaneously using the 2SLS method.

Income

Shifting from cereal to vegetable cultivation improves resource use efficiency. It also improves output efficiency of other agriculture production. All these translate to higher overall farm incomes (Table 13). Despite having less physical assets, especially land, vegetable farmers earn higher income from crop production compared to non-vegetable farmers. When this was added with the off-farm incomes, the earning difference amplified.

Table 13. Farm Income on Vegetable versus Non-vegetable Farms in Selected Countries of Asia

(Unit: US$/family/year)

Type of Farm/Income Source		Vietnam	Lao PDR	Cambodia
Vegetable Farm	Income from cereals	67	318	88
	Income from vegetables	1,193	87	54
	Income from other crops	3	6	9
	Off-farm income	1,595	n.a.	55
	Sub-total	2,858	411	206
Non-vegetable Farm	Income from cereals	209	154	156
	Income from vegetables	n.a.	n.a.	n.a.
	Income from other crops	7	52	3
	Off-farm income	482	n.a.	20
	Sub-total	698	206	179

Source: Estimated from the unpublished survey data of the Socioeconomic Unit, AVRDC.

Although incorporating vegetables in the cropping system generates high income, but the probabilities of losing money are also high. This is portrayed by the higher cumulative density function of income for vegetables as compared to rice at the low income levels (Figure 3). Therefore, diversification with vegetables is a risky venture.

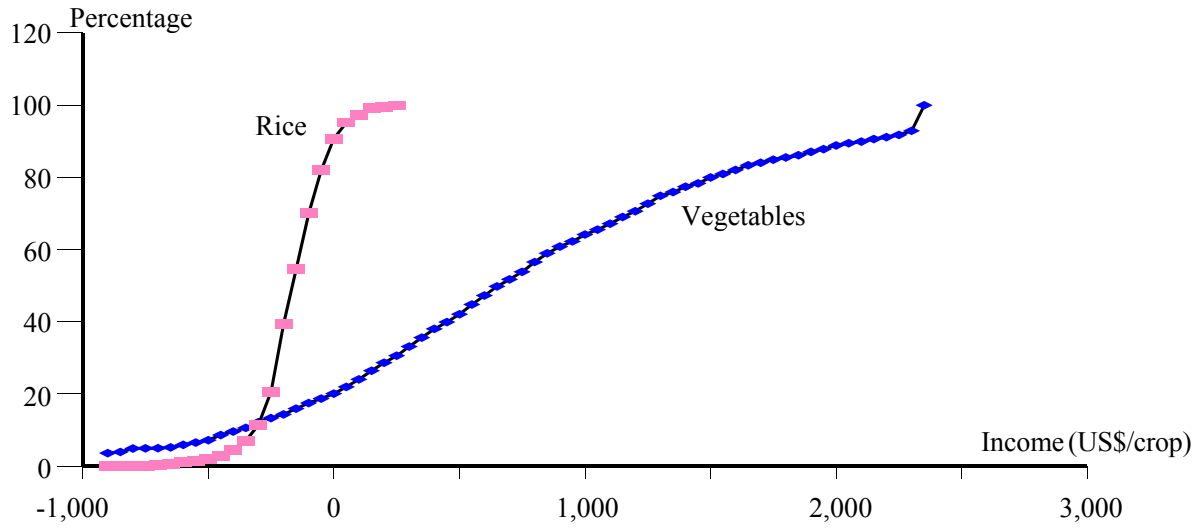

Figure 3. Cumulative Density Function for the Income from Vegetables and Rice in the Indo-China Countries

CURRENT STATUS OF VEGETABLES IN ASIA

This section discusses the role of vegetables in the current production and consumption systems to understand the potential of their expansion in enhancing the competitiveness of the agriculture sector in different Asian countries.

Production

1. ***Per Capita Availability***

Despite the advantages of diversifying food and production system with vegetables, per capita vegetable availability in many developing countries is far below the recommended level in terms of required micronutrients (Figure 4). Similar conclusions were arrived when average vegetable consumption was taken from the household consumption surveys data of different countries (Ali, 2000). Moreover, per capita vegetable availability in most developing region of Asia remained almost stagnant during the 1980s and early 1990s, a time when cereal production was on the rise. The rise in real vegetable prices during this period in Asia raises serious concerns about the future increase in vegetable consumption. Increase in real vegetable prices, however, did not induce supplies enough to make significant improvements in per capita consumption due to serious constraints on vegetable production (Ali and Abedullah, 2002).

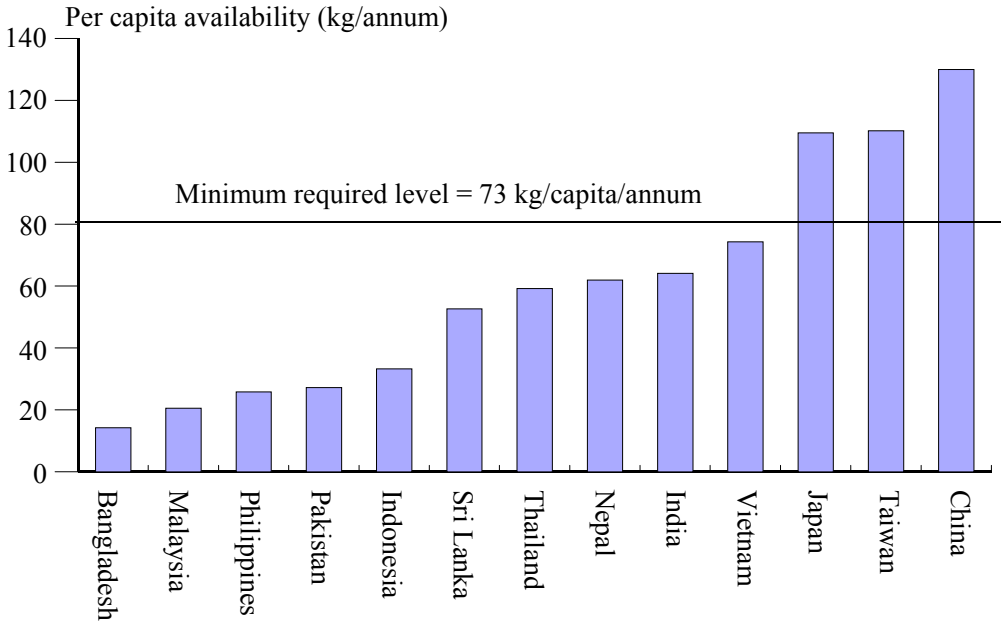

Figure 4. Vegetable Availability in Selected Asian Countries during 2000

Source: Ali, *et al*., 2002.

2. ***Seasonality***

The average annual supply figures actually mask the more serious problem in vegetable availability. Due to strong seasonality in vegetable supply, the deficiency is more acute during some times of the year. For example, in Taipei city which is one of the most developed markets of Asia, average monthly availability index decreased 20 percent in September (end of summer) compared to that in January (end of winter). More serious implication of seasonality in terms of reducing vegetable supplies was observed in less developed markets of Asia, like in Dhaka. This caused 25 percent increase in vegetable prices in September in Taiwan, and 50 percent increase in October in Bangladesh, compared to that in January in both countries (Ali, 2000). Thus, seasonality makes the micronutrient deficiency problem more acute in the off season for vegetable supply than the average consumption figures depict. For example, vitamin A adequacy ratio (availability compared to the minimum recommended level) in Ilocos Norte, Philippines in March 1998 was 88 percent, which reduced to 66 percent in June in the same year (AVRDC, 1999).

3. ***Annual Fluctuation***

Wider annual fluctuations were observed in vegetable production than in cereal production (Ali, 2000), mainly because of lack of government support to stabilize vegetable production and consumption that usually exist in cereals. This not only suggests that vegetables are more risky to grow, but also leads to considerable variation in the consumption of vegetables and consequently in micronutrient availability between the same

seasons in different years. For example, Bouis and Novenario-Reese (1991) found that vitamin A and vitamin C adequacy ratios in the Philippines dropped from 1.95 and 1.46, respectively, in the first round of a household survey carried out in August 1984, to 0.71 and 0.53 in the fourth round carried out exactly one year later.

Consumption and Nutrient Availability

Household consumption surveys conducted by the Socioeconomic Unit of AVRDC in selected Asian countries suggested that micronutrient deficiency, except that of calcium, and vegetable consumption were closely related. For example, vegetable consumption in the Philippines, Cambodia, and Bangladesh was less than minimum required level, and consequently the availability of vitamin A, and vitamin B_1 and B_2 in these countries were deficient (availability was either close or less than the lower range of recommended levels). Bangladesh and Cambodia foods were also deficient in niacin (availability was less than the lower recommended range). It appeared that iron availability in these countries, except Cambodia, was close to the recommended level; but actually most iron in their food comes from rice which has very low bio-availability. Vegetable consumption was slightly higher than the minimum required level in Vietnam, therefore, vitamin A supply was sufficient, although vitamin B_1, vitamin B_2, niacin, and iron could be considered as deficient (availability was close to or less than the lower recommended range). These deficiencies in micronutrients are affecting the human capacity to work and learn. In Taiwan vegetable consumption was sufficient, therefore, all other micronutrients except calcium were above the recommended level (Table 14).

Table 14. Daily Vegetable and Nutrient Consumption in Selected Asian Countries

Item (unit)	Recommended Level*	Vietnam	Cambodia	Philippines	Taiwan	Bangladesh
Vegetables (g)	200	239	170	106	460	126
Energy (kcal)	1,800-2,400	1,919	1,914	2,187	1,929	2,006
Protein (g)	45-63	69	68	39	81	67
Calcium (mg)	800-1,200	514	455	533	594	330
Iron (mg)	10-15	12	9	12	16	13
Vitamin A (IU)	4,200-5,000	4,812	2,818	3,530	9,907	2,620
Vitamin C (mg)	50-70	81	53	75	239	62
Vitamin B_1 (mg)	1.0-1.5	1.0	0.8	1.2	1.5	0.5
Vitamin B_2 (mg)	1.2-1.8	0.7	0.5	1.2	1.2	0.7
Niacin (mg)	13-20	13	12	28	17	12

Source: Unpublished survey data of the Socioeconomic Unit, AVRDC.

Note: * Recommended levels of nutrients were taken from Food and Nutrition Board (1989). These levels are average for males and females above the age of 10 years.

Estimates of nutrient availability suggest that all countries consume very similar levels of food energy, and average energy consumption is higher than the lower recommended range (Table 14). Wherever seasonal consumption data were available (only in the Philippines and Taiwan), seasonality in micronutrient availability was also related with seasonality in vegetable consumption.

Despite low consumption, vegetables are major sources of vitamins A, C, and B_2. They also provide a significant portion of iron, calcium, and vitamin B_1 (Table 15). This implies that whatever small amounts of these micronutrients are available, majority of them comes from vegetables and enhancing vegetable supply is the natural solution to tackle their deficiency and improve human capacity to work and learn.

POTENTIALS, CONSTRAINTS, POSSIBILITIES AND LIMITATIONS ON EXPANSION

Potentials

The previous section concludes that despite nutritional, economic, and productivity advantages of vegetables, their share in the existing production and consumption systems is still low. Their supplies are seasonal and uncertain. However, the role of vegetables can be enhanced only if consumers would like to

consume more when they are available at affordable prices. Review of vegetable demand literature suggests that vegetables are responsive to incomes and prices. The demand elasticity of price ranges -0.2 to -0.8, with an average of -0.6. Average income elasticity is around 0.40 with wide variations across species and regions (Ali, 2000). These elasticities imply that people consume more vegetables when they become economically affordable.

Table 15. Contribution of Vegetables in Supplying Nutrients in Selected Countries of Asia

(Unit: Percent)

Nutrient	Vietnam	Cambodia	Philippines	Taiwan	Bangladesh
Calories	2.5	1.9	5.1	5.6	5.5
Protein	6.5	4.0	8.4	10.7	9.8
Calcium	25.9	16.9	36.6	36.9	29.4
Iron	24.3	20.1	27.6	35.1	23.7
Vitamin A	80.6	58.7	60.5	75.0	78.1
Vitamin C	81.2	73.4	82.1	47.4	63.4
Vitamin B_1	16.8	14.8	15.1	17.7	21.5
Vitamin B_2	34.9	20.4	18.6	31.7	22.4
Niacin	9.4	6.2	7.2	16.2	9.4

Source: Unpublished survey data of the Socioeconomic Unit, AVRDC.

In addition to fast economic growth, urbanization, and greater awareness of the advantages of diversifying the cereal-based diet all have created strong demand for diversifying the cereal-cereal production system. On the other hand, declining cereal prices and shortage of water, due to deteriorating irrigation infrastructure, reduced profitability of irrigation investment (Rosegrant and Pingali, 1994), and/or competing water demand for domestic use are driving farmers to replace cereals, especially rice, with more efficient water-utilizing crops like vegetables. Similarly, sustainability problems in the cereal-cereal systems are also forcing farmers to look for alternatives to the cereal crops.

How far can vegetables diversify the existing cereal-cereal system? Wide variation in the proportion of vegetable to cereal area suggests both limits and potential for diversification. Vegetable area can be as high as one-third of the total cereal area in Taiwan and the Republic of Korea and one-fourth in Japan, but as low as 2-6 percent in most South and Southeast Asian countries (Ali, 2000). Variation is mainly due to economic conditions like input-output prices, especially labor wage, rental rates of machines, price of inorganic fertilizer and output prices, access to markets and information regarding input output prices, risk-covering policies, and physical factors such as climate, irrigation, erosion, drainage, soil, and topography.

Constraints

Despite its potential, incorporation of vegetable in the existing production and consumption systems is restricted by the supply- and demand-side constraints. The supply-side constraints can be divided into two groups: production and marketing (Ali and Tsou, 1997).

1. ***Production Constraints***

Production constraints can be biotic, abiotic, management, or institutional. Abiotic stresses, like high temperature (particularly, high night temperature in tomato) (Peet and Willits, 1993) and flooding (Midmore and Poudel, 1996), and biotic stresses especially during summer result high yield losses, create high production risk, and hamper vegetable cultivation.

The farmers' desire to avoid risk along with lack of pest control information and technical skills leads to excessive use of chemicals, resulting in higher production, health and environmental costs to both farmers and consumers. Thus, vegetable production is restricted only to those farms who can afford these costs and bear production and marketing risks. Institutional constraints such as insufficient and untimely input supplies including credit and seed, poor coverage and quality of extension, and labor shortages during critical times especially when cereal and vegetable cultivation overlaps may be significant production constraints in some countries.

Fine soils with little aeration and poor drainage sometimes impede diversification of rice-based systems. For example, in Batac, Philippines, about 90 percent of the coarse soils are under vegetables, and about 75 percent of the fine soils are under rice cultivation (Mirjam, 1997).

Vegetable cultivation is sensitive to excess and shortage of water supplies. Therefore, they are mostly grown on the irrigated part of the farm. Lack of irrigation and drainage facilities on the farm, irregular water supply from public canals, or capital required to build irrigation structure usually impedes vegetable cultivation.

2. ***Marketing Constraints***

Constraints associated with marketing include poor shelf life of vegetables, combined with inadequate market capacity and storage facilities, poor packaging and grading, wide seasonal and annual fluctuations in vegetable prices, lack of information among producers on price developments and on consumer preferences for different attributes of vegetables, and poorly developed transportation facilities.

3. ***Demand Constraints***

Availability of vegetables at affordable prices compared to incomes, lack of information on the importance of micronutrients, and the role of vegetables in supplying micronutrients, seasonal availability, and localized social taboos against some vegetables are major constraints on the demand side.

Solutions and Possibilities

As price elasticity of vegetables is generally higher than income elasticity, reducing prices through technological innovations has greater impact on consumption than such through economic development. Moreover, increased income can only generate additional demand. Unless such demand is fulfilled through additional supplies, it simply results in higher prices.

It should be noted that income elasticities of demand is expected to concentrate during the off-season, as vegetables are relatively abundant during the peak supply period. This, combined with the fact that most Asian cities are located in the lowland tropics, creates a high demand for off-season production technologies.

Technologies to overcome environmental stresses in vegetable cultivation are available, and depending upon vegetable prices and physical factors that affect costs, the harsh environments can be ameliorated. For example, vegetable farmers on the periphery of Bangkok build and regularly maintain ditch and dike systems called *sorjan* to manage flooding in vegetable fields (Sritunya, 1975). Similar systems are used to grow year-round vegetables in China (Plucknett, *et al*., 1980) and in Indonesia (Pingali, 1992). Technologies such as hydroponics are also available for the tropics (AVRDC, 1995). Planting chili on raised (40 cm vs. 20 cm) and narrow (1.0 m vs. 1.5 m) beds can improve plant survival and total fruit yield in the rainy season (AVRDC, 1992). Grafting of tomato on eggplant rootstocks improves its survival in flooding and enhances yield many fold during the hot-wet season; combining raised beds, fruit set hormones, and simple plastic rain shelters can increase tomato yield up to three folds (AVRDC, 1993).

Poor internal drainage (i.e., heavy soils) may not be a major obstacle to overall expansion of vegetable cultivation as these can be remedied with relatively ease, especially under the situation of good external drainage. For example, in upcountry Banderawaela, Sri Lanka, where external drainage is good due to slopes, vegetable farmers use 10-20 mt of manure to every crop, and change the topsoil every 3-4 years. A similar situation exists in the Cameron Highlands of Malaysia.

Cheap mechanical power, made available through contractual arrangements of machines, partly alleviates the labor shortage constraint and improves farmers' ability to bring large area under vegetables. Certain other operations, such as weeding and insect monitoring, can be replaced by chemical use. Determinate vegetable varieties, which can be harvested once or few times, can also partly alleviate this constraint.

Most Asian countries have highland areas where environmental conditions are favorable for vegetable cultivation when it is very hot and humid in the lowlands. For example, summer vegetable supply for Bangkok mainly comes from Chiang Mai, for Manila from Baguio, and for Kuala Lumpur from the Cameron Highlands. Maintaining good trade and transportation links with these areas within a country can reduce seasonality in vegetable supply.

Limitations

Although technological solutions are available to overcome vegetable production constraints, these solutions are expensive to install, operate, and maintain, and require high management skills. Thus these are

economically viable only in a limited economic environment when vegetable supplies are extremely limited and prices are quite high.

Market access of upland vegetable producers, who have favorable environment for vegetable cultivation especially when it is hot-wet in the lowland, is sometime difficult and costly. Despite recent improvements in the supply from these areas, such sites can meet only a small proportion of the potential vegetable demand during the hot-wet season, and seasonality in vegetables remains a big issue.

The managerial skill required in vegetable cultivation is the most binding constraint to diversify the cereal-based systems with vegetables. Vegetables are management intensive crops, and are responsive to the timeliness of management operations. Adjusting production decisions with marketing potential is the major skill required, which is usually lacking among the uneducated and un-informed farmers of developing countries.

As discussed earlier, vegetable production is input, consequently it entails higher operating costs than cereals. To manage this constraint informal arrangements, such as obligatory sale of output to commission agents who finance inputs, are quite common in Asia. The cost of finance is expected to decline as financial institutions develop in the near future. High capital requirements when combined with high risk, however, will continue to be a major constraint in vegetable cultivation.

In the dry season of the irrigated lowlands, it is relatively easy to switch to vegetable crops. However, sometime entire irrigation structures (water flow rate at the head, irrigation canals, channels and drainage, field slope, etc.) need to be rehabilitated to make rice fields suitable for vegetable cultivation. This requires additional investment, which is economical only if consumers can afford to pay higher prices for vegetables.

SUCCESSFUL EXAMPLES OF VEGETABLE EXPANSION

There have been some marginal improvements in diversifying Asian cereal-based systems as the proportion of vegetable area to cereal area increased from 3.6 percent in 1980 to 7.6 percent in 2000. The increase is more prominent in East Asia, mainly because of the expansion of vegetable area and reduction of cereal area in China, Taiwan, and the Rep. of Korea. Small improvement in the share of vegetable area over cereal area occurred in South Asia, while the proportion remained almost stagnant in Southeast Asia (Ali, 2000).

However, there has been significant improvement in vegetable production value. In Southeast Asia alone, it has increased from US$8.1 billion in 1991 to US$10.8 billion in 2000. The value of vegetable production as a proportion of the value of cereal production increased form 24.4 to 31.9 in the corresponding period (Ali, *et al*., 2002). This is because of the increase in the relative prices of vegetables to cereals, as well as increase in vegetable production in the region. Although updated price data are available only for Southeast Asia, we believe that similar trends happened in other Asian countries. A few country-specific examples are discussed in the following paragraphs.

Bangladesh

From 1990 to 1999, per capita availability of farm produced vegetables (excluding home-garden supplies) in Bangladesh increased by 18 percent from 34 to 40 g. During this period, new vegetable production technologies were introduced through a collaborative vegetable development project. In addition farm housewives were given vegetable awareness training. Farmers adapting new vegetable production technologies produced 38 percent higher vegetable yields on average compared to farmers who did not adopt. The economic efficiency in input use, especially of land, labor, and water employed for vegetable cultivation improved by 65, 40, and 12 percent, respectively. Overall farm income of vegetable farmers increased by about 10 percent, and generated about US$8.8 million to producers (in terms of high income from vegetable production) and consumers (because of greater vegetable availability at lower prices). Vegetable consumption and micronutrient availability on adopter farm families were also significantly higher than at non-vegetable and non-adopter vegetable farm families (Ali and Hau, 2001).

The AVRDC, in collaboration with an NGO, Hellen Keller, promoted a specially designed home-garden (16 m^2) to provide nutrient-rich vegetables over most of the year to Bangladesh families. Per capita vegetable consumption significantly increased among the home-garden adopter families compared to non-adopter families. Increased consumption of micronutrient-rich foods, especially provitamin A, reduced

likelihood of vitamin A deficiencies of vitamin A. Consequently, it lowered the incidence of blindness and improved the weight and height of children (AVRDC, 1994).

Pakistan

The adoption of high-yielding, short-duration, and yellow mosaic virus-resistant mung bean varieties in cereal-based system in Pakistan lead to 55 percent yield increases, four-fold income enhancement, and 25 percent reduction in unit cost. Wheat productivity in the wheat-mung bean rotation increased by 19 percent compared to wheat-wheat or wheat in rotation with other crops. Mung bean production in the country increased from 32,000 mt in 1981 to 80,000 mt in 1999. The expansion of mung bean cultivation in the fallow-wheat rotation expanded the sustainability advantage of the leguminous crop on a larger wheat area. Therefore, increase in wheat productivity in the country was highest in the mung bean growing areas. This technological innovation generated about US$20 millions, distributed almost equally between producers and consumers (Ali, *et al*., 1997).

Thailand

Asparagus cultivation in Thailand started in 1985 with training of farmers by AVRDC, and distribution of seed by a private company in Taiwan. Within a few years, 3000 ha rice area was converted to asparagus. This generated about US$20 million annual income to producers, created 19,500 additional jobs, and prompted now agricultural business activities in the area (AVRDC, 1998).

Taiwan

Introduction of modern vegetable technologies along with government policy support for off-season vegetable production has proven to be a sustainable way to increase vegetable production and reduce seasonality. In Taiwan for example, introduction of heat-tolerant tomato varieties and stress-tolerant production technologies from AVRDC has reduced seasonality in prices, especially during the summer months of August-November (Figure 5).

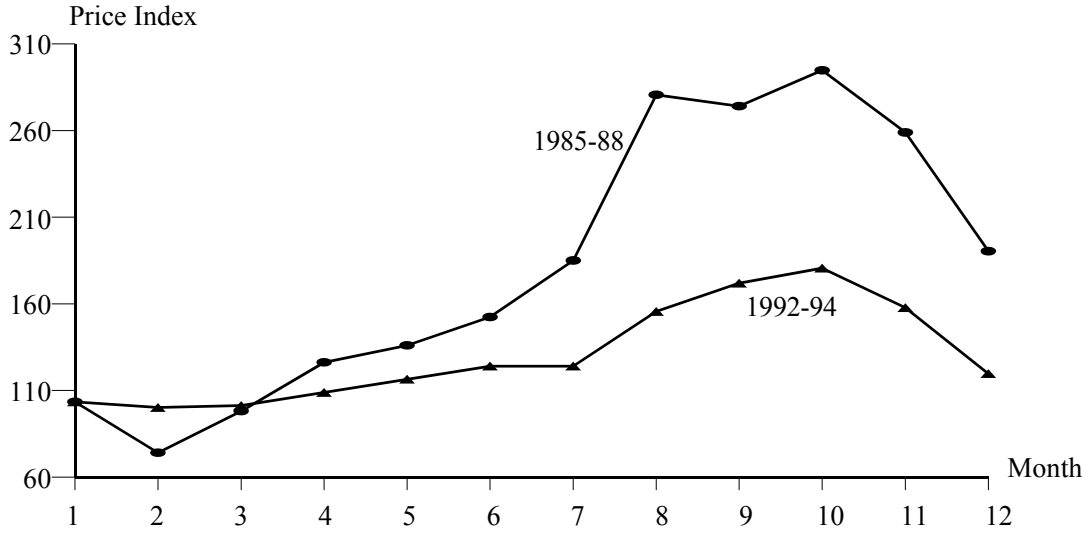

Figure 5. Improvement in Seasonal Tomato Prices in Taiwan

SUMMARY AND CONCLUSION

Albeit well recognized advantages of diversification in terms of improved income, enhanced sustainability and reduced risk, it is never considered as a development tool. It is usually treated as a function of income and commercialization. In this approach, emphasis is placed on income generating strategies, which in turn can bring diversification. This paper reverse the notion on diversification, and provides empirical evidence to show that it as a tool of economic and social development. The emphasis of the study

is on the diversification with vegetables, as they have a special advantage in term of high nutritive efficiency for supplying many individual micronutrients as well as overall nutrients of the diet.

The analysis in this paper asserts that diversifying food can improve the earning capacity of manual workers. The evidence from Pakistan suggests that doubling the food diversity index will increase the wage of the manual workers by 67 percent, far more than the effect of doubling the expenditure on food while preserving its existing composition. Therefore, diversity in food is a better tool for development and poverty alleviation than increasing the existing food without changing its structure. As vegetables and fruits are the main sources of food diversity, therefore, it is not surprising to note that improving their share in food enhances the productive capacity of manual workers. An increase of 10 percent in the share of vegetables and fruits in the diet will improve the earning capacity by 7.5 percent.

The impact of diversity on manual workers' productivity comes through balanced diet, which improves muscle power and working hours, and reduces non-working days due to sickness, thus enhances their working efficiency. Although this analysis is focused on manual workers, as it is relatively easier to isolate the impact of food and food diversity on the working efficiency of the class who works relatively in simpler environment, but one can easily speculate at least similar impact on other working classes. In fact the impact of food diversity on the efficiency of intellectual labor classes may even be higher as it not only improves the muscle power of workers, but also enhances their learning capacity and cognitive skills required in their works. However, more analysis will be required to quantify the effect of food diversification on intellectual workers.

On the other hand, diversity in production also improves productivity through reduced production and marketing risks, enhanced sustainability, and improved resource use efficiency of the cropping system. Looking at the diversity level of other developed countries, such as Taiwan and Korea, 100 percent increase in production diversity may not be an ambitious plan for Pakistan agriculture.[19] This will enhance productivity by 56 percent, more than the effect of the Green Revolution during 1965-94 (Ali and Byerlee, 2002). Actually, crop diversity has a potential of generating a Second Generation Green Revolution.

More particularly, increase in the share of vegetables in the cropping system will enhance its productivity. It is estimated that a 10-percent increase in the share of vegetable area in total crop area will increase the productivity of the cropping system by 0.83 percent. This is in addition to the effect of such changes directly on the income of the farmers.

Surprisingly, food diversity is less affected by incomes as speculated by earlier studies, but more by improved human and physical infrastructures. Therefore, food diversity is not a phenomenon that people will not automatically initiate to achieve the productivity gains. It needs investment on physical and human infrastructure, such as better access to markets, improved food-preserving capacity of the households, and strong basic educational institutions at the village level. Decreasing vegetable prices through technological innovation is another way to encourage diversity with vegetables.

Similar role of infrastructure was observed in enhancing the diversity in production system. Although, human capital contributed in increasing the share of vegetables and commercial crops in cropped area, but education negative influenced the share of pulses and minor crops because of the laxity of policy planners for these crops which made them uncompetitive in the cropping system. Therefore, development in human infrastructure alone may impede production diversity unless such development is combined with appropriate policy incentives for fruits, vegetables, and minor crops. Again another important way to encourage production diversity is to increase the profit through technological innovations in the arts of producing and marketing of these crops. Improving physical infrastructure, such as reducing distance of a village from road, is an important source of diversification and productivity.

These results on the positive role of diversity in economic development were substantiated from the micro-level farm survey data from the Indo-China countries. The farm-level analysis suggests that incorporating vegetables in the cropping system generates incomes and employment, and improves resource-use efficiency. The farm survey data provide strong evidence of enhances productivity of other crops as well by incorporating vegetables in the production system.

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[19] For example, the share of vegetables in cropped area is 20 percent in Taiwan (Council of Agriculture, 2000), compare to only 1.0 percent in Pakistan (Government of Pakistan, 2000).

Despite these advantages of diversification with vegetables, however, policy-makers in Asia were preoccupied with the development and stabilization of the cereal-based systems. Most institutional setups and policy incentives were directed to increase and stabilize cereal production. This helped to partly overcome energy deficiency in food, while availability of vegetable remained far below the minimum required level in most developing countries of Asia. In addition, vegetable production remained highly seasonal, and annual production unstable. This caused serious imbalance in the diet reflected in micronutrient deficiency, and cereal dominated production system became vulnerable to insect, diseases, and soil mining.

Policies to encourage diversification need to go a step farther than the simple economic development policies. While economic development policies focus on physical and human infrastructure improvement alone, diversification policies need to combine these improvements with appropriate incentives for micronutrient-rich foods and crops, such as vegetables, fruits, and minor crops, and remove the policy biases against these crops. These crops and foods may even look uneconomical to start with, but research and extension system and policy incentives geared towards these crops not only make them competitive by themselves, but will also produce substantial spillover effect in the form of improved earning capacity of human labor and productivity of the whole production system. In deciding research and development resources for these crops and food commodities, therefore, neglecting such enormous spillover effect would deprive societies from a very important source of economic growth.

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Part III. SELECTED COUNTRY REPORTS
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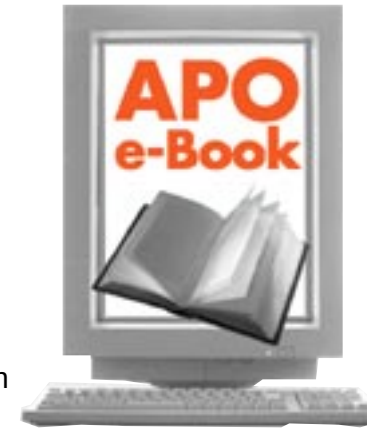

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1. BANGLADESH

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INTRODUCTION

Bangladesh is endowed with resources suited for the production of a wide range of enterprises therefore, has a great potential and opportunities for producing a diverse range of crops. Crop diversification is now recommended for maintaining agricultural growth, especially for cereal-cereal rotations suffering from sustainability problems. There are also increasing concerns about the possible adverse effect on crop yields resulting from the depletion of micronutrients and organic matter in soil. Further, it is also apprehended that productivity gains through simple expansion of area under high-yielding varieties (HYVs) might have reached its limits, as over 90 percent of *boro* (dry season of winter) and nearly 54 percent of *aman* (wet season) rice is already under these varieties. Therefore, crop diversification may be the means of sustaining agricultural growth and productivity, and boosting farmers' income in Bangladesh.

For Bangladesh agriculture crop diversification is sought in intensive rice cultivation via both increased cropping intensity and improved rice yield, thus sparing land for other crops after ensuring food grains security. Stable rice production will also stabilize rice prices as well as farmers' income from rice crop. Moreover, diversified sources of income from crop sector will also save the farmers from various production risks. Real prospects of crop diversification would, however, depend on the domestic competitiveness of non-cereal crops and the cost-effectiveness and quality assurances of the products of these crops in the international market.

CROP PRODUCTION PERFORMANCE AND DIVERSIFICATION

To counter the population pressure on land in Bangladesh, cropping intensity has considerably increased since the independence in 1971 (Table 1). This increase in intensity was facilitated by the adoption of short duration cereal varieties and improvement in the availability of irrigation water from underground sources. However, higher intensity did not imply higher crop diversity, rather it was an indication of concentration of few cereal crops to counter their low yield and meet the food need of the population from limited land.

Table 1. Land Utilization Statistics, Cropping Intensity and Population Growth

Items	1972	1980	1990	1999	Growth Rate[a] 1980-99 (percent)
Single cropped area (000 ha)	5,088	3,955	3,634	2,019	-3.17
Area sown more than once (000 ha)	3,156	4,492	4,716	5,970	1.16
Cultivated area (000 ha)	8,244	8,447	8,350	7,989	-0.64
Gross sown area (000 ha)	11,400	12,939	14,064	13,959	0.28
Cropping intensity (percent)[b]	138	153	168	175	0.92
Population (million)	70.64	88.22	109.47	126.95	1.78

Source: Bangladesh Bureau of Statistics (BBS), 1993; and BBS, various issues (1989, 1993, 1997, 1998, and 2000).

Notes: [a] Growth rates were defined using linear logarithmic trend using the whole data series during 1980-99; and [b] cropping intensity is defined as gross sown area divided by cultivated area.

At the time of independence of Bangladesh, yields per ha of all the crops including horticultural ones were very low (Table 2). For the food security reasons, priority was given to the development of food grain crops. Therefore, until the mid-1980s, the main thrust of development planning of Bangladesh had centered on attaining the self-sufficiency in basic food and almost all programs and investments were directed towards increasing the production of cereal crops, particularly rice and wheat (Mahmud, 1995). As a result, Bangladesh has been quite successful in achieving higher production of rice and wheat.

Irrigation and high yielding new rice varieties have expanded the rice-wheat growing belts by transforming cereals-pulses, cereals-oilseeds, cereals-tubers and other crop rotations into rice-wheat system. Because of emphasis on cereal crops since independence, area and production of key nutritional food crops such as pulses, cheena and kaon and other cereals experienced a decline (Table 2). On the consumption side, as pulses have been the main source of protein, the decline in their per capita availability has caused protein deficiency especially among the poor who cannot afford other expensive sources of protein. To meet the increasing demand of the growing population, the government had to import these products by spending hard-earned foreign exchange.

In the Third Five-Years Plan (1985-90), the emphasis was given to the promotion of nutrition-based agriculture. A feasibility study was carried out in 1985, which recommended to undertake a Crop Diversification Program (CDP) for increasing production and consumption of tubers (mainly potato), pulses and oilseed crops. Accordingly, the CDP was undertaken as a special development project to improve the dietary diversity through increased production of these crops. In 1993, maize, wheat, jute, sugarcane, vegetables and fruits were included in the CDP (Ministry of Agriculture, 1993). The program brought modest success by curbing expansion in rice area in favor of other crops. However, rice production has increased mainly due to improvement in yield per ha as area under modern varieties gradually increased. Although area under sugar crops was increased over past two decades, however, the production could not rise mainly because of decline in yield per ha. The same can be observed in case of fruits and vegetables (Table 2).

The area under wheat rose from an average of 132 thousand ha in the 1970s to 882 thousand ha in 1999 while wheat production increased from about 0.1 to 1.9 million mt during the same period. During 1980-99, the growth in the expansion in area, production and yield of wheat was recorded as 2.2, 2.4 and 0.2 percent, respectively. The areas under oilseed crops fluctuating around 300 thousand ha during the 1970s and early 1980s, increased to 574 thousand ha during 1990, but later declined to 512 thousand ha during 1999. Growths in the expansion of oilseeds area, production and yield were recorded at 2.6, 2.9 and 0.4 percent, respectively during 1980-99 (Table 2). The yield improvement during 1990s was mainly attributed to the interventions from CDP.

Khesari (grass pea), lentil and gram are major pulses grown in Bangladesh. Despite the push from CDP, the area under pulses has experienced a continuous decline. However, total production of pulses regularly increased, thanks to the commendable improvements in yield per ha, especially of lentil and mung bean (Table 2).

In case of horticultural crops, both area and production of vegetables continuously increased during 1973-99 whereas yield per ha has been on the declining trend. This may be because of shifting of the farmers from more voluminous and less value crops to less voluminous but high valued crops. During 1980-99, growth in the area, production and yield of vegetables were recorded at 2.8, 2.1 and -0.7 percent, respectively. Similar trends can be observed in case of fruits.

For tuber crops, although their area continuously declined during 1970s till early 1990s, but started increasing afterwards. The upward rise in area and production of tubers during 1990s is mainly because of changing crop production emphasis initiated through CDP. On the other hand, production increased during 1970s till mid-1980s and later on declined till 1990 and started reviving again. During the past two decades, the area, production and yield of potatoes was found growing at 0.6, 0.7 and 0.1 percent, respectively.

The area and production of fiber crops also declined continuously while it slowly improved between 1980 and 1999. In case of drugs and narcotics, their area gradually declined, however, the production increased due to improvement in yield per ha. Although the area and production of spices and condiments fluctuated between 1973 and 1990, however, they gradually increased during 1990s (Table 2).

Table 2. Overtime Change in Area, Production and Yield of Various Crops in Bangladesh

Crops/Crop Groups	Area (000 ha)				Growth Rate (percent)	Production (000 mt)				Growth Rate (percent)	Yield (mt/ha)				Growth Rate (percent)
	1973	1980	1990	1999	1980-99	1973	1980	1990	1999	1980-99	1973	1980	1990	1999	1980-99
Wheat	80	476	592	882	2.23	99	823	890	1,908	2.40	1.24	1.73	1.50	2.16	0.17
Rice[a]	9,832	10,159	10,479	10,116	-0.19	11,727	12,740	17,856	19,905	2.09	1.19	1.25	1.70	1.97	2.28
Cheena and kaon	81	45	19	16	-5.19	85	41	15	10	-6.11	1.05	0.91	0.79	0.63	-0.92
Other cereals[b]	309	167	71	60	-5.37	49	38	48	40	-0.78	0.16	0.23	0.68	0.67	4.59
Total cereals	10,757	10,935	11,184	11,086	-0.13	11,979	13,656	18,826	21,872	2.09	1.11	1.25	1.68	1.97	2.22
Pulses[c]	983	860	738	570	-1.41	225	217	512	436	4.00	0.23	0.25	0.69	0.76	5.42
Oilseeds[d]	317	311	574	512	2.56	232	249	438	449	2.92	0.73	0.80	0.76	0.88	0.36
Spices and condiments[e]	168	155	148	251	0.46	328	302	325	395	1.10	1.95	1.95	2.20	1.57	0.64
Sugar crops[f]	149	160	199	189	0.86	6,503	7,031	7,711	7,276	0.29	43.64	43.94	38.75	38.50	-0.57
Fiber crops[g]	760	788	569	516	-1.81	6,479	5,893	4,760	4,566	-0.59	8.53	7.48	8.37	8.85	1.22
Drugs & narcotics[h]	133	148	141	131	-0.68	140	155	165	191	0.73	1.05	1.05	1.17	1.46	1.41
Fruits[i]	135	145	167	187	1.29	1,407	1,364	1,449	1,428	0.12	10.42	9.41	8.68	7.64	-1.16
Vegetables[j]	107	126	170	231	2.81	889	919	1,046	1,335	2.14	8.31	7.29	6.15	5.78	-0.67
Tuber crops[k]	212	187	169	286	0.64	1,450	1,708	1,577	2,145	0.69	6.84	9.13	9.33	7.50	0.05
Other non-food crop[l]	6	6	8	8	0.70	166	73	50	52	-1.44	27.67	12.17	6.25	6.50	-2.13

Source: BBS, 1993; and BBS, various years (1989, 1993, 1997, 1998, and 2000).

[a] Includes *Aus, Aman* and *Boro* rice; [b] crops other than wheat, rice, barley, sorghum, millet, maize, cheena and kaon; [c] gram, pigeon pea, lentil, peas, mung bean, mash bean, black gram, grass pea, gari kali and other pulses; [d] sesamum, rapeseed and mustard, groundnut, linseed, castor seed, coconut and other oilseeds; [e] chilies, onion, garlic, turmeric, ginger, coriander and other spices; [f] sugarcane, date palm, palmyra palm; [g] jute, meshta, cotton, sun hemp and other fiber crops (for fiber crops, the production and yield are in 000 bales and 000 bales per ha, respectively); [h] tea, tobacco, beetle nuts, beetle leaves and other drugs and narcotics; [i] banana, mango, pineapple, jack fruit, papaya, melons, litchi, guava, jujube, orange, grape fruit, limes/lemons, other citrus fruits and other fruits; [j] pumpkin, eggplant, patal, okra, water gourd, sponge gourd, ash gourd, bitter gourd, snake gourd, cucumber, arum, cow pea, spinach, Indian spinach, amaranth, cabbage, cauliflower, tomato, radish, beans and other *Rabi* and *Kharif* vegetables; [k] potato and sweet potato; and [l] fodder and mulberry.

In summary, the changes in crop production priority initiated during mid 1980s through the Third Five-Year Plan and CDP have brought major shifts in the growth in area under various crop types. However, remarkable improvements in yield per ha were noticed for pulses and to some extent in total cereals during 1980-99. The growth in yield of wheat and oilseeds remained almost stagnant, whereas for fruits and vegetables, it actually declined. Thus, it can be concluded that CDP has been partially successful.

COMPETITIVENESS OF PRODUCING THE CDP CROPS

International Market Prices of the CDP Crops

Despite increase in production, considerable quantities of pulses, oilseeds and edible oils are imported every year and imports of these commodities have increased in the recent years. Although, the main purpose of imports is to supplement local production to meet domestic consumption, but it also exposes local production to compete with world market producers. The world market prices of agricultural commodities, particularly of oilseeds, are declining in the recent years which are likely to negatively influence on expansion of the area under these crops.

Comparative Advantage

Comparative advantage or profitability of the CDP crops is an important parameter for promotion of diversification. Comparative advantage of different crops assessed in a recent study (Shahabuddin, 1999) in terms of net economic profitability and domestic resource cost (DRC) ratio (or financial return) confirmed earlier World Bank observation (World Bank, 1995) that, except for a few import competing crops (such as sugarcane, oilseeds, chili, and onion), Bangladesh has a comparative advantage in the production of most agricultural crops. The longer-term comparative advantage assessed in terms of expected technological innovation (resulting in higher yields) and changes in world market conditions (particularly after 2005) demonstrate substantial improvements in both financial and economic profitability for most crops (other than HYVs *boro*). Modern varieties of potato display strong comparative advantage even under existing farming practices, which will improve further with technological innovations. For edible oil crops, economic returns were found to be positive but those were below the financial returns. While pulses as non-irrigated crops, unlike oilseeds, are quite competitive in terms of both financial and economic profitability, but profits are lower than in HYVs of *boro* rice. Economic analysis of maize cultivation using improved varieties found financial profitability in the order of current returns to *boro* rice, but economic and financial returns are substantially more attractive in hybrid maize (Ateng, 1995).

The profitability estimates show that vegetables are highly competitive in terms of both financial and economic returns. All vegetables (except radish) have highly favorable financial returns when compared with rice, even those of HYVs. One would, therefore, expect these products to be better represented in the production pattern currently prevalent in the country. But, this is not so, may be because of greater perishability and higher variation in the prices of vegetables. The financial return of vegetable products for export appears to be fabulously high as compared to that of most other crops. However, their exports are constrained by lack of experience in exporting these crops as well as marketing problems like poor product quality, non-acceptable packaging, high transport costs and lack of market access.

Tea is a major export crop in Bangladesh. The estimates of financial return indicate that there is strong comparative advantage of tea production for export. The profitability for tea production is also observed to be quite strong, and it has increased over the last ten years.

CONSTRAINTS TO THE PROMOTION OF CDP CROPS

Each CDP crops experiences a different set of problems. However, some of the common constraints for promotion of crop diversification can be summarized as under (Ministry of Agriculture, 2000):

Non-availability of Suitable Land

Because of competing claim for land particularly by HYV *boro* and farmers' preferences for cereal crops for food security reasons, potential for expansion of area under CDP crops is limited. Therefore, the

CDP crops are mostly confined to marginal and relatively less fertile lands resulting low yield and production.

Non-availability of Water and Technologies

It is stated that all the CDP crops, except pulses, require irrigation during the *boro* season. But the subsistence farmers can hardly afford to irrigate crops other than rice. Besides, the absence of an appropriate technological package and water management system for the production of crops other than rice is considered to be major agronomic constraint to diversification of crops and cropping systems.

Low Adoption Rate of New Varieties

Although a considerable number of improved varieties with high-yielding potentials for several crops including potato, pulses, oilseeds and maize are available, diffusion of these varieties and other technologies has not yet been widely spread. Non-availability of seeds, inadequate extension, absence of adequate post-harvest technology, lack of improved marketing, storage and processing facilities, etc. are considered to be the major constraints on the wider adoption of these varieties.

Imports as Disincentives to Diversification

Considerable quantities of pulses, oilseeds and edible oils are imported every year. Import exposes local production to compete with world market producers. Currently, the harvest prices (of lentils, mustard, etc.) are higher than the world market price and the world market prices for oilseeds are declining in the recent years. The international competitiveness of these crops will reduce even further if miller costs and profits of the wholesalers are also added in the harvest prices.

Existing Marketing System as Detrimental to Diversification

It has been observed that prices of most crops (including pulses, potatoes, oilseeds) drop to the lowest levels during the time of harvest. Farmers requiring cash are compelled to sell at least 40-50 percent of their output at any price prevailing at harvest. This reduces their incentive to diversify their system with these crops. Moreover, primitive market infrastructure substantially increases the post-harvest losses, and further reduces the farmers' benefit and therefore incentive for crop diversification.

SUMMARY AND RECOMMENDATIONS

Intensive and well-organized efforts are required to improve comparative advantage and profitability of the CDP crops. Comparative advantage can be improved through reducing production cost by raising yields or reducing input cost. This can be achieved through the introduction of scientific innovation in the art of production, marketing, and processing of these crops. Such innovation should focus on the development of new varieties, introduction of advance agronomic management practices, improvement in the marketing system and search for new processing techniques. Researchers should prioritize their agenda in the light of crop management problems faced by the farmers, such as developing verities to reduce duration of the crops to better fit the CDP crops in existing rotations, mitigate the pest pressure on crops, and develop attribute in the CDP crops which are best suited to the market and consumers preferences. For instance, the export of potatoes has been recently started to Singapore, Malaysia and Sri Lanka. In order to expand this export, the new varieties of potatoes should meet the preferences of foreign consumers, along with solving farmers' constraints.

Exploiting the current yield gap between actual and potential yields is a redeeming feature for Bangladesh agriculture, especially for the CDP crops. The gap can be narrow down by demonstrating improved management practice for improved varieties and increasing the production and supply of quality seeds. To augment the production of certified seed, linkages among research, extension and private sector have to be strengthened (Ministry of Agriculture, 1998).

Most of the crops identified for promotion under CDP program requires increased supply of irrigation water. In order to overcome water shortages at farm level, appropriate water management techniques (e.g., lining of water channels), and drought tolerant rice varieties should be developed and introduced. In addition, intermediate irrigation technologies, such as hand tubewells and treadle pumps which are advantageous for

small and marginal farmers and for growing crops like potatoes, spices and vegetables, are also suggested to be promoted by extending appropriate incentives to the farmers and relevant industries.

The linkage – 'Millers and Growers Model' promoted by the CDP particularly for pulses and oilseed crops – may be further improved and implemented on a large scale. This will substantially reduce the existing marketing constraints and ensure reasonable prices of these crops to the farmers. Cooperative marketing and contract marketing initiated by the CDP may be further developed and promoted. Further development of agro-processing and marketing networks should also be pursued as effective means of enhancing competitiveness. The processing and milling efficiency of these crops need to be improved for value addition at the domestic market as well as to compete in the international markets.

The support price policy backed by an efficient procurement system should be adopted for CDF crops in order to save the farmers from sudden fall in prices during post-harvest periods. Credit facilities may be extended through involving banks having business interests in the CDP crops. Credit will help the farmers to meet part of the production costs and cash requirements particularly during the time of harvest when prices are low. Facilities of *Shogorip* (credit cum-storage) may be extended particularly to the small and marginal farmers.

The low comparative advantage of traditional oilseed crops in international market calls for substantial changes in the production and marketing status of these crops. Improved varieties, better seed, adequate agronomic practices, advanced marketing channels and finally modern processing technologies will have to be brought in place in order to change this scenario. Besides, efforts will have to be directed towards identification and introduction of economically viable non-traditional oil crops. A number of crops such as sunflower, rapeseed, soybean, maize, etc. have been mentioned in different studies. In recent years, production of soybean received additional attention due to the increase in its demand as poultry feed. However, the quantity of soybean produced in the country is still very small for an economically viable solvent extraction plant. Sunflower has been promoted by the CDP project and has gained a certain degree of popularity among farmers in some areas, though area and production are very small.

Demand of maize both for human consumption and feeds has been increasing. There is need to strengthen research activities for development of hybrid maize having higher yield potentials with disease-resistance and stress-tolerance characteristics (Karim, 1992). Appropriate strategies and actions are also needed to promote the diversified use of this amazing cereal crop. Market for sweet corn and baby corn is also developing gradually (Razzaque, 2000). Therefore, the prospects for maize are very good, specially recognizing the fact that it can be used for multiple purposes, e.g., oil, starch, vegetable, derivate, etc. Its use as feed is expanding as poultry industry is fast developing.

For increasing production of pulses, new pulse crops are to be identified and their suitability as well as economic feasibility needs to be studied in addition to increasing the production and yield of existing crops. Strategic alliances and cooperation with the international and foreign pulse research institutes of dry as well as humid regions should be strengthened.

Production of aromatic or specialty rice may be considered for promotion as a CDP crop, particularly for export purpose, because the prices of aromatic rice are higher both in the local and international markets. Bangladesh produces several varieties of aromatic rice varying from small (e.g., *chinigura, kalijira*, etc.) to long slender (*kataribhog, dadkhani*) types, and has been exporting aromatic rice since 1993-94. These varieties fetch the highest price in the international market. An analysis of net economic returns found that the specialty rice could be produced in Bangladesh competitively for export purpose (International Food Policy Research Institute [IFPRI], 1998).

The analysis carried out by different studies suggests that despite low domestic prices of vegetables compared with international prices, their export is insignificant. This requires some positive action to be pursued, especially in the arena of foreign trade policies.

Development of agro-processing industries and marketing networks provide effective means for reducing variability in prices. Development of rural infrastructure including roads and inland water transport, rural electrification, and communication facilities is an essential prerequisite for integrating localized rural markets with each other and with urban markets. In fact, market integration can induce a virtuous circle where argo-processing industries will have new opportunities to expand, which in turn will promote the diversification in agriculture. This will also help reduce cost of production and promote export-led growth in agriculture.

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2. REPUBLIC OF CHINA

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INTRODUCTION

Taiwan is a mountainous subtropical island located in Far East Asia. The country has one of the world's highest population densities with a population of more than 22 million and a total area of only 36,000 km^2. The agriculture of the country is on the path of modernization and fast development since the 1950s, and was quickly transformed into an intensive commercial farming. In the very beginning of its development, the planners not only attempted to provide sufficient food for domestic consumption and enough employment opportunities for the densely populated rural communities, but also tried to earn foreign exchange to build up the base for industrialization and speed up economic growth. In view of the fact that the agriculture sector grew up quite rapidly in early stages and then staged or slowed down, the competitiveness of agricultural products also first improved then rapidly declined in recent years. The government has taken some measures to adjust production structure and enhance competitiveness of the sector without any significant effect.

This paper aims at reviewing Taiwan's past experiences in agricultural structural adjustments for diversification, looking into the past trends in diversification, evaluating the effects of policy actions in this direction, and finally throwing some light on the efforts of the government to cope with the new challenges of trade liberalization and globalization.

STRUCTURAL CHANGES IN AGRICULTURE

Agricultural modernization in Taiwan has been significant, evident from the improvements in infrastructure, productivity, and rural living conditions. Although, average farm size remained at only slightly over one ha, Taiwan has developed from an agriculture-based economy to a newly industrialized one over the past five decades. Along with changes in the structure of the economy, the share of industry in the GDP has increased from 19.7 percent in 1952 to 32.4 percent in 2000, while the share of agriculture in the GDP fell rapidly from 32.2 percent in 1952 to 2.1 percent in 2000 (Table 1). Therefore, the role of agriculture has been shifting from purely a food supplier to the balance among productivity, livelihood, and ecology.

Table 1. Gross Domestic Product by Sector

(Unit: Percent)

Year	Agriculture	Industries	Services	Year	Agriculture	Industries	Services
1952	32.2	19.7	48.1	1980	7.7	45.7	46.6
1955	29.1	23.2	47.7	1985	5.8	46.3	47.9
1960	28.5	26.9	44.6	1990	4.2	41.2	54.6
1965	23.6	30.2	46.2	1995	3.5	36.4	60.1
1970	15.5	36.8	47.7	1999	2.6	33.2	64.3
1975	12.7	39.9	47.4	2000	2.1	32.4	65.6

Source: Council for Economic Planning and Development (CEPD), 2001.

Land Use

At present, about 851 thousand ha or about 24 percent of the total area of the island is used for agricultural production. Rice and dryland crops account for 40 and 60 percent of the total cultivated land,

respectively during 2000. Before 1960s, limited available farmland was intensively utilized due to abundant rural labor. However, since the 1970s, the intensity began to decline because of the decreasing availability of the rural labor. The multiple-cropping indices, as an indication of intensity, reached a peak of 190 in 1964 and plummeted to 106 in 2000 (Table 2). Increasingly more farmlands are now set aside without cultivation.

Table 2. Multiple-cropping Index

Year	Planted Area (000 ha)	Cultivated Land Area (000 ha)	Multiple-cropping Index	Year	Planted Area (000 ha)	Cultivated Land Area (000 ha)	Multiple-cropping Index
1952	1,521	876	173.6	1980	1,400	907	154.4
1955	1,508	873	172.7	1985	1,257	888	141.6
1960	1,600	869	184.1	1990	1,155	890	129.8
1964	1,673	889	190.0	1995	1,036	873	118.7
1970	1,656	905	183.0	1999	931	855	108.8
1975	1,659	917	180.9	2000	904	851	106.2

Source: Council of Agriculture (COA), 2001.

From 1985 to 1999, urbanization and other factors have made paddy field decreased by 47,080 ha and dryland increased by 17,491 ha. An average of 5,626 ha or 0.6 percent of total farmland is converted to non-agricultural uses every year (Mao, 1998).

According to the 1995 census, the average farm size was 1.1 ha and only 28 percent of the farm households had landholding more than 1.0 ha. The tiny scale of these farms once was a major bottleneck to the promotion of productivity in Taiwan's agriculture. However, fast development of the agriculture-business service industry in the country helped to overcome this constraint in recent years.

Labor and Other Inputs

The number of farm households in 2000 was about 787 thousand nearly the same as that in 1985. The agricultural employment has decreased from l.3 to 0.7 million person during the same period. One positive development, however, is that full-time farm families increased from 11.45 percent in 1985 to 17.95 percent in 2000.

Agricultural machines have been used to replace farm labor in production activities since 1970s. In addition to farm mechanization, inorganic fertilizers and chemicals were also employed as substitutes for labor input (Chen, 1997). The consumption of inorganic fertilizer per ha increased from 1,069 kg in 1970 to a peak of 1,582 kg in 1995. The per ha consumption of chemicals was 30 kg in 1975 and increased to 42 kg in 1995. Today, we can hardly imagine any agricultural practice without fertilizer and chemicals.

Agricultural fixed capital formation, in absolute terms, had an increasing trend (except 2000), but its percentage contribution in total fixed capital formation in the country has steadily decreased from 6.7 percent in 1970 to only 0.7 percent in 2000 (Table 3).

Table 3. Agricultural Fixed Capital Formation in Taiwan

Year	Agricultural Fixed Capital Formation (NT$ million)	Percentage of Total Fixed Capital Formation	Year	Agricultural Fixed Capital Formation (NT$ million)	Percentage of Total Fixed Capital Formation
1970	3,308	6.7	1997	26,494	1.4
1980	13,732	3.0	1998	22,515	1.1
1990	24,072	2.5	1999	26,355	1.2
1995	24,041	1.4	2000	15,906	0.7
1996	27,402	1.6			

Source: COA, 2001.

Agricultural Production

The total value of agricultural production in 2000 was about NT$364 billion (US$11.02 billion). The growth rate in the GDP and production index of agriculture have slowed down significantly in recent years (Table 4). The average annual growth rate in GDP from 1990 to 1999 was only 3.3 compared to 7.7 percent during 1975 to 1985.

Table 4. Indicators of the Changes in Agricultural Production (base year: 1996 = 100)

Year	Agricultural Production Index	Change in Agricultural Production (percent)	Agricultural GDP (NT$ million)	Real Economic Growth in Agriculture* (percent)
1970	52.0	-	35,076	4.8
1980	76.4	3.92	114,556	-2.0
1990	94.5	2.15	180,110	2.3
1995	99.8	1.10	244,265	2.9
1996	100.0	0.20	245,184	-0.3
1997	98.7	-1.30	212,100	-1.5
1998	93.3	-5.40	220,605	-6.6
1999	94.4	1.10	237,531	2.7
2000	96.4	2.00	201,810	1.2

Source: COA, 2001.
Note: * Compared to previous year, deflated by aggregate price index.

Of the total value of agricultural products, crops, livestock, fisheries and forestry accounted for 45.4, 29.6, 24.9 and 0.1 percent, respectively in 2000. In relative terms, the share of crops and forestry products has been declining, while that of fishery and livestock productions is increasing over the years (Table 5).

Table 5. Composition of the Agricultural Production

(Unit: Percent)

Period	Crop	Livestock	Fishery	Forestry	Total
1952	68.6	15.8	9.1	6.5	100.0
1953-56	67.1	18.6	9.0	5.3	100.0
1960	64.0	20.9	9.6	5.5	100.0
1965-68	62.8	21.9	9.6	5.7	100.0
1970	57.2	24.1	13.5	5.2	100.0
1973-76	54.2	26.4	15.2	4.2	100.0
1980	47.1	29.0	21.6	2.3	100.0
1985-88	43.3	28.8	26.8	1.1	100.0
1990	44.1	27.0	28.4	0.5	100.0
1995	41.0	34.3	24.5	0.2	100.0
1999	43.6	33.2	23.1	0.2	100.0
2000	45.4	29.6	24.9	0.1	100.0

Source: COA, 2001.

Farm Incomes

By definition, farm income includes earnings from both agricultural and non-agricultural sources. Before 1970, farm income came mainly from agriculture. After 1971, the rapid development of industrial and commercial sectors led to a significant increase in off-farm employment opportunities. Thus, the share of non-agricultural income began to increase. However, the share of agriculture over total farm income has stabilized at 38 percent during the past 10 years.

Agricultural Trade

Agricultural exports and imports of Taiwan have been growing steadily since the end of World War II. In the 1950s, agricultural products dominated the total exports, with a share of over 90 percent. However,

despite increased in absolute terms, the share of agriculture in total exports and imports steadily declined over the period after 1960 (Table 6).

Table 6. Agricultural Trade of Taiwan

Year	Agricultural Exports (US$ million)	Agricultural Imports (US$ million)	Agriculture Share in Total Exports (percent)	Agriculture Share in Total Imports (percent)
1952	114.2	66.5	95.5	32.1
1955	124.4	65.5	92.8	34.5
1960	121.0	75.8	71.0	30.1
1965	260.1	154.2	57.8	27.7
1970	310.2	376.5	21.7	24.6
1975	908.8	1,224.2	17.1	20.9
1980	1,876.5	3,090.0	9.5	15.7
1985	2,107.9	3,380.5	6.9	16.9
1990	3,661.4	6,088.3	5.5	11.1
1995	5,638.8	9,763.9	5.1	9.4
1998	3,154.8	7,794.4	2.9	7.4
1999	3,101.6	7,629.6	2.6	6.9
2000	3,280.2	7,591.6	2.2	5.4

Source: COA, 2001.

Taiwan's major agricultural exports were sugar and rice, which accounted for 81.4 percent of total agricultural exports in 1952. During the 1970s, however, the major exported products turned out to be sugar, canned asparagus, canned mushrooms, and bananas, which accounted for 45.8 percent of the total agricultural exports. By 1990, aquatic products, pork, preserved vegetables and poultry feathers became the major agricultural exports (Liu, 1997). The development of newly introduced products has been due largely to the successful adaptation of technologies by well-educated and highly motivated farmers.

Total agricultural imports also have increased significantly after 1952, rising from US$66.5 million in 1952 to US$7,591.6 million in 2000. The rate of increase in agricultural imports is obviously greater than that of exports. Imports became an important source of food diversity. The remarkable increase in the imports is mainly resulted from two sources:

1) Rapid increase in the imports of dairy products and beef in response to the improved living standard in Taiwan; and
2) Rapid increase in the imports of corn, soybean, and fishmeal due to the expansion of the livestock and aqua cultural industries.

AGRICULTURAL DIVERSIFICATION POLICY

With rapid changes in both the outer and inner environments, the government undertook lot of programs to enhance agricultural diversification for the purpose of improving competitiveness of the sector and escalate farmers' welfare. These programs are as follows:

Crop Diversification Program: I (1984-89) and II (1990-97)

As per capita income has increased rapidly since the mid-1970s, the pattern of food consumption changed significantly. Per capita rice consumption sharply declined, causing a serious problem of its overproduction. In 1984, agricultural policy turned to grant a subsidy to those farmers who converted their rice fields to the production of non-rice crops (Lei, 1991). If a farmer would switch from rice cultivation to the cultivation of corn, sorghum or soybean, he could be subsidized by an equivalence of 1 mt of paddy rice per ha. In addition, the government purchased corn, sorghum, and soybean at the guaranteed prices. If farmers shifted from rice production to the production of other crops (excluding corn, sorghum, and soybean) or green manure, the subsidy increased to 1.5 mt of paddy rice per ha. Thus, many farmers became interested in participating in this program and rice production steadily decreased overtime.

This program was extended again and again, and standards of subsidy were changed several times. At last, this program was incorporated to "the Utilization and Adjustment Plan for Paddy Fields and Dry Lands" in 1997.

Taiwan's rice policy has been criticized for its contradictory provisions. Farmers are encouraged to shift from the production of rice to other crops, but the guaranteed rice price gives farmers an incentive to produce even more rice. This is due to the conception among politicians that abolition of the guaranteed price might lead to social instability. Therefore, policy-makers are reluctant to abolish the policy, but it puts heavy financial burden on the government as well as reduces the effectiveness of other policies to reduce rice production (Chen and Han, 2002).*

Program of Improving the Structure of Agricultural Production and Enhancing Farm Income (1985-90)

In 1985, a six-year program of improving the structure of agricultural production and enhancing farm income was launched. This program emphasized on:

1) adjusting the crop production;
2) improving agricultural marketing; and
3) strengthening agricultural research and extension.

Public spending on the agriculture sector grows as the economy expands. The questions are how to employ public funds and resources in the most effective way, so that new technology can be developed, and the efficiency of agricultural production and marketing improved. These have been the major challenges facing to the agricultural economists since 1985 (Chen and Han, 2002).

Integrated Agricultural Adjustment Program (1991-97)

In 1991, another six-year program was carried out in succession in order to continue promoting agricultural development and maintaining progress and prosperity in rural areas. The Integrated Agricultural Adjustment Program (IAAP) of 1991-97 consisted of only policy guidelines indicating future policy directions. However, the proposals such as pensions for retiring farmers, crop insurance, and direct income payments to farmers involve a great deal of public expenditure. Therefore, these three proposals were not implemented during the period. In the meantime, Taiwan's agricultural development emphasized to:

1) strengthen the agricultural production and marketing system;
2) improve quality rather than quantity;
3) establish a timetable to liberalize imports and reduce tariff rates; and
4) develop plans for conservation of natural resources and preservation of the ecosystem.

In order to prevent further deterioration of the rural environment, the program limited the production of hog and aquaculture industries for domestic production only until the pollution and land subsidence were brought under control (Chen and Han, 2002).

Cross-Century Agricultural Development Program (1997-2001)

The "Cross-Century Agricultural Development Program" (CCADP) implemented in July 1997 replaced the IAAP. The CCADP hoped to achieve the following objectives.

1) Develop a modernized agricultural industry.
2) Construct prosperous farms and fishing villages.
3) Improve farmers and fishermen welfare.

* Recently, a direct payment scheme to farmers' income and land use is widely discussed, and it is receiving increasing attention among agricultural economists and policy-makers.

The program set the target of 0.5 percent increase in average annual growth rate of agricultural GDP, and embarked on increasing total production, income of farming household, and productivity of agricultural labor.

The program includes following plans:

1) Utilization of paddy fields and uplands for adjusting rice production.
2) Structural adjustments of industries to increase competitiveness of the production of fruit, fishery, poultry, pig, milk and beef.
3) Guidance to farmers for key crops with comparative advantages.

The main strategies focus on "technology, information, and brand" to built national brand of agricultural product with high quality. The other strategies include:

1) improving production and marketing efficiency;
2) developing agricultural technologies;
3) accelerating automation; and
4) utilizing information technology in the agricultural industry.

In order to lay down the foundation of agricultural development, Taiwan has amended the Agricultural Development Statute (ADS) in January 2000 to regulate the new farmland policy. Based on the guiding principle of comprehensive planning of national land, the agricultural land resources are released. The objective is to relax the restriction on the trade of farmland for increasing efficiency of farmland utilization (Chen and Han, 2002).

CHANGES IN THE AGRICULTURAL STRUCTURE

Crop Production

To examine the striking changes that have occurred in the composition of crop production, we classified crops into rice, other common crops, special crops, fruits, vegetables, and others as shown. Rice has been the most important crop in Taiwan for generations. The average yield per ha was 4.4 mt in 1999. Total rice production has grown from 1.9 million mt in 1960 to 2.7 million mt in 1976, and then declined to about 1.6 million mt in 1999. Therefore, the share of rice production in total value of crop production declined from 58.7 percent in 1952 to 21.6 percent in 1999 (Table 7). The area for rice cultivation that was 429 thousand ha in 1991, has dropped to 353 thousand ha in 1999, and the quantity of brown rice reduced from 1.8 to 1.6 million mt in the corresponding period.

The shares of vegetables and fruits in total crop production have significantly increased over the period. Vegetable production has reached at a total value of NT$40 billion in 1999 but fall to NT$38.6 billion in 2000. It accounted for more than 23.4 percent of the value of crop production. Per capita availability of vegetables increased from 38 kg in 1945 to 57 kg in 1965, 135 kg in 1995 and 147 kg in 2000. It is one of the highest in the world. There are many varieties of vegetables in Taiwan. Some of them were originally developed for export, such as mushrooms, asparagus, processed tomatoes. However, in recent years, the export competitiveness of such vegetables has diminished, thus, many varieties have been directed to domestic market only.

Fruits have the production value of NT$57.8 billion, or 35 percent of total crop products in 2000. The important fruits include mango, litchi, longan, banana, pineapple, oranges and so on. Fruit farming occupied more than 26 percent of the estimated total cultivated land. In recent years, less export and more import of fruits have led to a large-scale changes in the structure of fruit production, which has become more diversified.

Taiwan's economic development has produced higher standards of living, which in turn generated demand for diversified products. Taking flowers as an example, the production value has reached NT$9.6 billion in 1995, or 3.41 percent of total farm products. Flower cultivation has increased from 2,400 ha in 1984 to over 10,848 ha in 1999. It is estimated that the floral sector can maintain an annual growth rate of more than 10 percent over the next 10 years.

Table 7. The Composition of Crop Production Value

Year	Value of Crop Production (NT$ million)	Percentage Contribution					
		Rice	Other Common Crops	Special Crops	Fruits	Vegetables	Others
1952	4,996	58.7	13.3	19.7	3.5	4.8	-
1955	7,720	56.4	14.3	21.0	3.3	5.0	-
1960	16,496	57.0	15.8	17.4	4.2	5.6	-
1965	24,225	48.9	13.5	18.2	11.3	6.4	1.7
1970	30,405	45.0	12.9	14.3	11.8	14.3	1.7
1975	70,906	48.6	8.8	20.0	8.3	13.1	1.2
1980	100,667	41.8	8.9	11.5	14.5	20.9	2.4
1985	126,809	32.6	8.8	12.3	23.0	20.9	2.4
1990	138,389	27.4	8.9	10.4	29.8	19.4	4.1
1995	168,518	23.6	8.4	9.1	32.3	20.1	6.5
1999	170,602	21.6	5.3	7.6	35.4	23.4	6.8
2000	165,214	21.0	5.8	7.9	35.0	23.3	7.0

Source: COA, 2001.

Livestock Production

Pork has the highest production value among any other single agricultural product in Taiwan. In 1996, the total value of pork production was NT$89 billion, comprising 27.5 percent of the total value of farm products. High density of large-scale hog farms in the countryside has resulted in many kinds of pollution problems. However, pork production in recent years has been seriously affected by the sudden outbreak of foot-and-mouth disease in March 1997. The total number of farm animals dropped from 10.7 million heads in 1995 to 7.97 million heads by the end of 1997. Fortunately, there are some other important livestock products, such as fresh milk, chicken and eggs all have shown increasing production trends (Table 8). It is obviously a response to the rapidly increasing demand of these products.

Table 8. Quantity and Value of Livestock Production

	Year	Hogs	Milk	Chicken	Chicken's Eggs
Production (000 mt)	1994	1,203.6	289.6	480.0	5,200.8
	1995	1,233.0	317.8	504.7	5,718.6
	1996	1,269.4	315.9	545.3	6,288.8
	1997	1,029.8	330.5	612.5	7,104.4
	1998	891.8	338.4	609.3	7,157.7
	1999	822.3	338.0	603.1	7,274.5
	2000	920.6	358.0	608.7	7,270.0
Value (NT$ million)	1994	75,279.4	5,588.8	22,853.9	8,160.0
	1995	88,986.6	6,133.7	24,360.6	8,829.5
	1996	88,607.5	6,097.4	30,514.6	10,596.6
	1997	44,701.7	6,741.6	33,088.6	10,037.1
	1998	48,858.5	7,214.0	34,934.7	12,926.8
	1999	61,401.6	7,223.5	35,057.0	12,708.5
	2000	52,033.6	7,621.4	26,471.5	10,396.1

Source: COA, 2001.

Inputs

As shown above, the agricultural labor forces and land resources were transferred to non-agriculture sectors. The agricultural employment declined from 0.86 millions in 1990 to 0.74 millions in 2000. However, the number of full-time farm families increased from 0.11 millions in 1990 to 0.13 millions in 2000. The

proportion of full-time farm families also increased from 13.19 percent in 1990 to 17.95 percent in 2000 (Table 9).

Table 9. Farm Families by Full-time and Part-time

Year	Full-time Farm Families[a]		Part-time Farm Families[b]				Total
	Number	Percentage of Total	Mainly Agricultural Job (number)	Mainly Part-time Job (number)	Sub-total	Percentage of Total	
1990	113,382	13.19	148,691	597,699	746,390	86.81	859,772
1991	117,988	14.31	191,838	514,430	706,268	85.69	824,256
1992	107,396	13.46	194,071	496,278	690,349	86.54	797,745
1993	129,609	15.76	195,719	497,067	692,786	84.24	822,395
1994	141,144	17.47	196,001	470,646	666,647	82.53	807,791
1995	103,011	13.00	102,640	586,469	689,109	87.00	792,120
1996	109,426	14.04	189,903	480,098	670,001	85.96	779,427
1997	112,915	14.47	180,268	487,063	667,331	85.53	780,246
1998	121,088	15.48	181,249	479,799	661,048	84.52	782,136
1999	122,788	15.59	176,587	488,032	664,619	84.41	787,407
2000P	129,439	17.95	64,459	527,178	591,637	82.05	721,076

Source: COA, 2000.

Note: [a] Full-time farm family refers to the family in which no member is engaged in non-farm work and all income originates from the work on farms; and [b] part-time farm family refers to the family of which one or more members are engaged as part-time or full-time in non-farm work.

The percentage of farm managers aged above 45 years old is increasing and has reached to over 85 percent in 2000. These results reflect increasing manpower shortage and aging problem in rural communities. However, a healthy sign is that the number of highly educated farmers is increasing, and their proportion has increased from 10.5 percent in 1990 to 18.3 percent in 1999 (Table 10). Increases in full-time and highly educated farmers are helpful in improving agricultural competitiveness, and the government should make further efforts in this direction in the future.

Table 10. Farm Managers by Ages and Level of Education

Year	Ages (number)					Level of Education			
	<45 years	Percent of Total	>45 years	Percent of Total	Total	Above High School	Percent of Total	Under High School	Percent of Total
1990	243,775	28.4	615,997	71.6	859,772	90,504	10.5	769,268	89.5
1991	200,735	24.4	623,521	75.6	824,256	75,513	9.2	748,743	90.8
1992	186,557	23.4	611,188	76.6	797,745	81,051	10.2	716,694	89.8
1993	188,222	22.9	634,173	77.1	822,395	90,042	10.9	732,353	89.1
1994	159,697	19.8	648,094	80.2	807,791	92,144	11.4	715,647	88.6
1995	159,375	20.1	632,745	79.9	792,120	90,153	11.4	701,967	88.6
1996	142,761	18.3	636,666	81.7	779,427	100,820	12.9	678,607	87.1
1997	148,775	19.1	631,471	80.9	780,246	104,154	13.3	676,092	86.7
1998	123,909	15.8	658,227	84.2	782,136	111,317	14.2	670,819	85.8
1999	132,070	16.8	655,337	83.2	787,407	143,992	16.2	743,415	83.8
2000P	105,394	14.6	615,592	85.4	720,986	108,103	15.0	612,973	85.0

Source: COA, 2001.

The average farm size is around 1.1 ha in recent years. It is mostly due to the limitation of land endowment and the restrictive land regulations. Therefore, unless cooperative efforts are strengthened and small-scale technologies are promoted, individual farm or agricultural industry in Taiwan is doomed to be less competitive.

The expenditure of agricultural research and extension, both in absolute term as well as the share of GDP allocated for research, had slowly increased in recent years (Table 11) through structural adjustment programs.

Table 11. Research and Development Expenditure for Agricultural Science

Year	Research and Development Expenditure for Agriculture (NT$ million)	Percentage of Agricultural GDP
1987	4,607	2.7
1988	5,759	3.2
1989	5,618	2.9
1990	7,104	3.9
1991	6,076	3.3
1992	9,047	4.7
1993	10,201	4.7
1994	10,437	4.6
1995	10,635	4.3
1996	9,906	4.0

Source: CEPD, 2001.

Labor Productivity

The annual growth rates in agricultural labor productivity remained positive although the rate has declined in the late 1990s (Table 12). It is believed that the adjustment measures contributed positively to the productivity growth. However, the rate of growth in labor productivity was generally lower, and growth in labor cost per unit of output was higher in agriculture than in industry.

Changes in Other Features of Diversification

* ***Goodly Rice*** – The "goodly rice" is planted on 68 thousand ha that accounts for 19 percent of the total planted area to rice.
* ***Organic Product*** – The production of organic vegetables and fruits is about 248 thousand mt. This accounts for 5.5 percent of domestic production of vegetables and fruits.
* ***Green Manure Crops*** – The green manure crops are planted on 150 thousand ha that account for more than 15 percent of total planted area of agriculture. The consumption of chemical fertilizer per ha decreased from a peak of 1,582 kg in 1995 to 1,380 kg in 1999.
* ***Marketing Structure*** – About 58 percent of the agricultural commodity were traded through the wholesale channel. Of these, about 57 percent are auctioned by computer.
* ***Area of Ecology Reservation*** – The area of ecology reservation accounts for 12.6 percent of total area of Taiwan.

FACTORS BEHIND DIVERSIFICATION

Taiwan's agriculture has remarkable capacity to restructure and adjust in response to the challenges of changing economic environment. For example, the production of hogs increased rapidly until 1997 in response to the prosperous export market. The planted areas of sugarcane and tobacco decreased due to lack of international competitiveness. Later rice and sugarcane areas were shifted to fruits that offered greater value-added and export potential.

These quick adjustments were not without pains, however. For example, fruit growers have suffered from overproduction. At the same time, Taiwan has encountered growing pressure from trading partners to open her domestic market. Imports of foreign product have flooded the domestic markets, while foreign competition is squeezing local farm products out of export markets. As a result, many orchards are being forced to scale down their operation, and are diversifying into tourism orchards. Similar history can be traced with the expansion and downfall of sugar, mushroom, and asparagus production. However, farmers in Taiwan are resilient to these shocks. Every time, to offset production losses, they make some adjustments to cope with the impact.

Table 12. Labor Productivity and Unit Labor Costs (1996 = 100)

Year	All Industry				Agriculture			
	Labor Productivity (output per hour)		Unit Labor Costs		Labor Productivity (output per hour)		Unit Labor Costs	
	Index	Annual Rate of Change (percent)	Index	Annual Rate of Change (percent)	Index	Annual Rate of Change (percent)	Index	Annual Rate of Change (percent)
1989	68.67	8.21	82.88	6.00	77.49	4.11	71.32	6.64
1990	72.52	5.61	90.89	9.66	78.89	1.81	79.25	11.12
1991	76.35	5.28	95.73	5.33	79.50	0.77	88.60	11.80
1992	80.62	5.59	98.64	3.04	80.89	1.75	93.84	5.91
1993	85.37	5.89	101.58	2.98	90.95	12.44	95.95	2.25
1994	89.36	4.67	102.57	0.97	91.81	0.93	105.37	9.82
1995	94.54	5.80	101.98	-0.58	95.94	4.51	99.90	-5.19
1996	100.00	5.78	100.00	-1.94	100.00	4.23	100.00	0.10
1997	106.46	6.46	97.72	-2.28	104.63	4.63	100.07	0.07
1998	111.52	4.75	97.01	-0.73	102.88	-1.67	101.24	1.17
1999	116.66	4.61	93.44	-3.68	109.89	6.81	81.70	-19.30

Source: COA, 2000.

It is obvious that in the future, land-based framing in Taiwan is limited due to fixed land endowment. Production value for forestry products has proportionately decreased to address the conservation and security concerns. Production value for fishery products has stagnated or even decreased due to lack of water resources for breeding and restrictions of international regulations on deep-sea fishing. For livestock, on the other hand, the production of hogs maintained at a high level. Although the price of hog plummeted in March 1997 as a consequence of the outbreak of foot-and-mouth disease. However, it started rising since August 1998, and then reached to a high level again in 1999, thanks to the structural adjustment measures such as encouraging farmers to leave the livestock industry forever. The production volume of chicken meat and cow milk also increased. The negative real economic growth rates of agriculture during 1996 to 1998 have turned positive again in 1999. In terms of volume of production, the agricultural structural adjustment policy and policy of encouraging higher value-added activities had little effect. However, production composition is changing to adapt to economic liberalization and consumer behavior. But the competitiveness of agricultural product didn't enhanced significantly. Therefore, there is a need to put more efforts, as the speed of regulation is still inadequate in meeting the new demands of international trade, environmental standards, and farmers' welfare.

MEASUREMENT OF INTERNATIONAL COMPETITIVENESS

Methodology

To assess the competitiveness of Taiwan's farm products on world market, we evaluate the comparative advantages of those products. Various measures can be used to estimate the comparative advantage of producing a product in a country. These measures include net social profitability (NSP), the effective rate of protection (ERP), and domestic resource costs (DRCs) (Akrasanee and Wattananukit, 1976; and Person, Akrasanee, and Nelson 1976). Of these measures, the DRC is more widely applied. The DRC measures the social cost of earning or saving a marginal unit of foreign exchange, and may be expressed as value-added at domestic prices in local currency divided by value-added at world price in foreign currency. By definition, if DRC coefficient for a product is less than one then cost of producing the product at home is less than the cost of its import and it is economically efficient to produce that product domestically. Chen and Han (2002) had calculated the DRCs and others measures of eight important agricultural products of Taiwan. The selected products were:

* rice, Taiwan's main food crop, in the production of which Taiwan has attempted to achieve self-sufficiency.
* corn and grain soybean those account for the bulk of Taiwan's agricultural imports.
* bananas and sugar, Taiwan's traditional farm exports.
* citrus and cut flowers, whose importance as economic crops has increased markedly in recent years.
* hogs, Taiwan's most important animal product. Ten million new piglets were produced each year, 40 percent of which were exported to Japan before 1996.

Results

For these products, Chen's results on DRC are presented in the following:

1. ***Rice***

It was more efficient to grow Ponlai rice, the most popular variety of rice among Taiwan's farmers, than to import rice from abroad only during 1970, 1974 and 1978 (Table 13). More specifically, the DRC coefficient for rice was at its lowest level in 1974, reflecting a worldwide energy and food crisis that pushed the world market price of rice up to US$373/mt. Since the world price of rice had dropped after the food crisis, it was less efficient to grow rice than to import from abroad.

2. ***Corn and Soybean***

Taiwan's farmers have enjoyed a comparative advantage in the production of corn and soybean only few years during the study period of 1970-96 (Table 13). However, the comparative disadvantage in these two crops has worsened during the latter years of the study. Nevertheless, farmers still have reaped profits because there was a guaranteed price provided by the government and an NT$40/mt tariff imposed on

imported grain of these crops. Now when the former supported action has been terminated for soybean since 1998 and for corn since 2000 and the latter tariff will be suspended upon Taiwan's accession to the WTO, farmers have little chance to stand against the imported grains of these crops.

Table 13. DRC Coefficient for Major Agricultural Products

Year	Ponlai Rice	Corn	Soybeans	Sugarcane	Bananas	Citrus	Cut Flowers	Hogs
1970	0.85	0.96	0.91	0.71	0.58	-	-	-
1972	1.12	1.48	0.82	0.56	0.64	-	-	-
1974	0.75	1.42	0.97	0.35	0.96	-	-	-
1976	1.13	1.29	1.15	0.73	0.67	-	-	-
1978	0.79	1.69	1.11	1.40	0.77	-	-	-
1980	1.13	1.94	1.34	0.73	0.75	-	-	-
1982	1.64	3.00	1.91	1.13	0.63	0.58	0.51	0.57
1984	2.13	1.89	1.44	1.43	0.74	0.39	0.56	0.50
1986	3.23	3.17	1.97	2.82	0.63	0.52	0.58	0.31
1988	2.61	7.16	3.69	0.98	0.77	1.61	0.23	0.47
1990	2.85	7.86	3.02	1.41	1.04	2.08	0.52	0.71
1992	2.82	8.26	11.17	2.96	0.97	3.00	0.55	0.69
1994	1.91	7.10	17.50	-	0.79	3.50	0.19	0.49
1995	2.27	3.39	15.26	3.38	0.83	8.67	0.38	-
1996	2.45	2.11	13.45	3.08	-	11.19	0.36	0.54

Source: Chen, 2000.
Note: "-" data unavailable.

3. ***Sugarcane and Bananas***

The increasing DRC coefficient of sugarcane suggests that since the early 1980s the commodity had turned inefficient to grow domestically with an exception of 1988 when sugar fetched a very high price on world market. For the remaining years of the 1980s and whole of the 1990s, the DRC coefficients was above 1.0.

Although the DRC coefficient for bananas has been consistently below 1.0, reflecting a positive comparative advantage for virtually all years, low domestic price imposed on banana farmers by government contracts have reduced domestic production for virtually all years considered.

The acreage available for banana cultivation was restricted for the purpose of soil conservation and to expand the production of other food crops, thus limiting the ability of domestic banana farmers to respond to favorable world market prices. In addition, neither sugar nor bananas enjoy preferential treatment in export market, where bananas may even be subjected to restrictive quotas.

4. ***Citrus and Cut Flowers***

The DRC coefficients of citrus were below 1.0 during the early and mid-1980s. It shows a comparative advantage for citrus in Taiwan during those years. In more recent year, however, low price of imported citrus from the United States have sharply eroded this advantage.

Low and declining DRC coefficients for domestic cut flowers imply that local flower growers enjoy an increasing comparative advantage with the expansion in demand for cut flowers both at home and abroad.

5. ***Hogs***

Taiwan has a strong comparative advantage in hog production as evident from the DRC coefficient less than one (Table 13). Pork, the number-one product of Taiwan agriculture sector, is not only one of the chief staples of the diet but also a key source of animal protein in the country. Nevertheless, the breed of pig has caused serious environmental pollution. Moreover, an outbreak of foot-and-mouth disease in 1997 has pared back the size of pig herds and has resulted in declining hog production in recent years.

The empirical results of the analysis lead us to believe that agricultural production in Taiwan has entered a secular trend of systemic decline, with most agricultural products having lost their international comparative advantage after 1970s. The major culprit in this loss of competitiveness seems to have been the rising cost of domestic inputs, especially labor. Unless sharp rise in world food prices or improvement in

productivity offset the increase in input costs, this trend promises to worsen as the process of economic liberalization proceeds.

FUTURE PROSPECTS WITH TRADE LIBERALIZATION

Along with the trade liberalization trend, Taiwan's agricultural products have dramatically lost competitiveness on the world market. For example, rice has been one of the exported products in the early 1950s, but its production cost is currently more than three times of the price of the world market. The domestic production cost of corn and soybean feed grains, which livestock industry heavily rely on, is also more than three times of the world market price. In this respect, most traditional farmers cannot survive if those product markets are further liberalized.

Taiwan has been applying for the membership of GATT and WTO since 1990. Our bilateral consultations with interested WTO members have been concluded in February 1998 after the completion of negotiation with the United States. But Taiwan's participation was suspended until Mainland China finishes all the process of entry. Now Taiwan is the member of WTO along with Mainland China.

Tariff reduction and tariffication for agricultural products that are currently banned from importation are two major concessions that Taiwan made in the accession negotiation. We committed to reduce the tariff rate of more then 1,000 agricultural products. The average tariff rate will reduce to 15.2 percent from the current 20-percent level during the first year, which will be further reduced to 12.9 percent at the end year of the implementation period (Table 14). The drastic reduction will seriously affect farmers' income, especially in those products, which lack competitiveness, but they are produced domestically.

Table 14. Tariff Reduction of Agricultural Product after Taiwan's Accession to WTO

	Current Rate[a]	First Year of Accession		Rate in 2002	
		Nominal Rate	Percentage of Reduction	Nominal Rate	Percentage of Reduction
Agricultural product	19.4	14.5	25.3	11.8	39.2
Livestock product	18.2	14.6	19.8	12.4	31.9
Fish product	27.6	20.3	26.4	17.8	35.5
Total	20.0	15.2	24.1	12.9	35.6

Source: COA.

Notes: 1. This table was made in 2001 so that the "current rate" refers to dataof 2001 and before.
2. The data in this table were based on the accession commitment that Taiwan submitted to WTO.
3. Since Taiwan accessed the WTO on 1 January 2002, it was asked to apply "the rate in 2002". The rate for "first year of accession", therefore, was never applied.

Based on the Uruguay Round Agreement on Agriculture (URAA), tariff will be employed on 22 products, whose import is currently completely banned. These usually are products produced on large areas. These 22 products will be imported freely with high tariff rate. Undoubtedly, with the Tariff Rate Quota (TRQ) scheme, the products will be imported with low world price, and definitely will drive our domestic price down. Consequently, it will further reduce farmers' income. The other 18 products, which include apple, orange, potato, etc., will be totally liberalized after our accession to the WTO. The only item excluded from this, applying the Annex 5 of the Agreement on Agriculture, is rice affecting almost 40 percent of our farmer.

Generally speaking, the reduction in the Aggregate Measure of Support (AMS) which was negotiated at URAA will not further affect Taiwan's agriculture significantly. According to the commitments, at the year 2000, our AMS should be reduced by 20 percent (equivalent to NT$3.5 billion). The objective has already been reached.

Under the above concessions, the accession to WTO has already started affecting our agriculture as well as related industries. For example, the rice acreage should reduce more than 30,000 ha during the accession year if the stipulated amount of 144 thousands mt rice is imported (Wang, 2000).

It is anticipated that imports of agricultural products will increase sharply, under the competitive pressure, and the production of less competitive agricultural products will reduce to a great extent. For enhancing the competitiveness, there is a desperate need to adopt structural adjustment programs. In the process of adjustment, agricultural land, water resources, and manpower will be released at a faster speed than had been in the past. Meanwhile the demand for agricultural construction and welfare will be stimulated.

The degree of influence will be enlarged, especially while our domestic products will compete with agricultural products from Mainland China, which has comparative advantage due to cheap production and transportation costs. Fruits, vegetables, meats and fishery are the main industries expected to be affected by liberalization of the agriculture sector.

POLICIES TO ENHANCE AGRICULTURAL COMPETITIVENESS

So far production orientation steps are taken to enhance diversification. These steps did improve production efficiency and increased per ha yield, but failed to improve the competitiveness of Taiwan's agriculture under the increasing trend toward trade liberalization and globalization.

The 21st century is the age of knowledge and information. In the knowledge-based economies, creation, spread, and utilization of knowledge and information will be the main tool of development. In such economies, people with the ability to create knowledge and apply it efficiently will have more power than those controlling traditional inputs like land, capital, and labor. The traditional industries such as agriculture, in these economies, will be transformed into knowledge-intensive industries to promote the value-added of products and to enhance competitiveness.

With this environment in the background, the agricultural policy announced in 2000 goes in two directions. These are:

Establishment of Comprehensive Strategic Alliances

The problems of tiny scale farmers in Taiwan can be solved through the establishment of strategic alliances. Under greater competitive pressure, agriculture must develop through the strength of farmers' associations. Strategic alliance can improve industrial structure, increase competitiveness, integrate production and marketing organizations, enlarge economies of scale, and promote efficiency. The slogan and main idea of this policy is "1 plus 1 is larger than 2".

The "Taiwan Agriculture Strategic Coalition (TASC)" was founded in 2000. It is composed of farmers' associations. The main tasks of TASC are to enhance processing of agricultural products, promote agricultural e-commerce, extend agricultural leisure trip, and set up agricultural marketing network.

Development of Knowledge-based Agricultural Industries

The purpose of this program is to establish institutes or mechanisms that can transform agricultural knowledge related to production technologies, food processing, marketing, and culture, leisure, and ecology to commodities or property rights and then make profit from these commodities or property rights. The main actions of this program are:

1. ***Development of Food Processing Industry***

Agriculture should shift towards industrial and commercial operation. One of the important ways is to develop food processing industry. Through the development of food processing industry, farmers can obtain not only profit from agricultural products, but also from the added value of processed food. Because the Chinese food is so famous and popular in the world, its global demand would be enlarged if the characteristics of Chinese food can be incorporated in the processed food and the proper marketing strategies are adopted. Therefore, for the purposes of increasing farm income, the government encourages farmers to research and develop the processed food, such as traditional meals, health food, etc.

2. ***Enhancement of the Delicate and Leisure Agriculture***

Through organizing cultural activities which reflect national industry's characteristics and local industry's cultural uniqueness, the culture of farming and fishing industries can be developed. We also implement coordinated planning of leisure agricultural zones, provide extensive guidance for the

development of leisure farms, tourism or sport fishing, and boost their service quality and operation management capability.

3. ***Embedding Knowledge in Agriculture***

This strategy stresses on applying scientific technologies, computer and networks, and modern business technologies on agricultural production, management, and marketing. The main actions of this strategy are:

a) *Development of market-oriented agricultural technologies*

The government encourages research on key industrial technologies which can meet following criteria:

* fulfil market demands;
* helpful in the development of exquisite native products which are localized, high-quality and high in added value; and
* enhance the market competitiveness for local and export marketing.

b) *Integrate biological technologies with traditional agricultural technologies to complement each other*

In line with the "Project to Boost Biotech Industry", flowering plant, biological pesticide and animal vaccine are the prioritized items of the government agricultural policies.

c) *Enhancing the economic efficiency for production procedures by*:

* boosting the function of the research groups for agricultural technologies;
* integrating regional extension system for the agricultural industry; and
* combining various levels of labor from production to marketing so as to plan integrated research and development of technologies and technical guidance, promote high-tech production and marketing, and practice agricultural technology on farms.

d) *Promotion and utilization of information technology in agricultural production and marketing*

By applying automation and information technology, we can increase the efficiency of agricultural production, distribution and marketing service, integrate information in the agricultural industry, and ensure a sound information structure for the agricultural industry.

e) *Improvement of agricultural training and education system*

For this, the government will:

* train young farmers;
* enhance ability of farm management;
* groom professional and modern leaders among farmers and fishermen; as well as those who can succeed the operation of the farm management; and
* arrange training required for occupation changes for farmers and fishermen.

CONCLUSIONS

With the trend towards economic globalization and liberalization now, the development of agriculture in Taiwan is facing new challenges. The agriculture has come under greater competitive pressures. Besides, it will soon face severe impact of cheaper imports from Mainland China. So the government is making efforts, the predominant ones are called "the Program of Comprehensive Strategic Alliances" and "the Program of Agricultural Knowledge-based Economy", to improve the competitiveness.

Until Taiwan became a member of WTO in 2002, the farmers did not really know the impacts of liberalization and globalization. Though the government gave much advice to farmers and encouraged less competitive farms to leave the sector, but only a few took the advice. Most of the farmers continued as usual and hoped to be supported by subsidy.

The constraints on the agriculture sector in Taiwan to adjust to the new competitive environments are high ratios of old and low educative farmers and high ratios of part-time and small-scale farms. But the agriculture of Taiwan had many successful development experiences. Taiwan is one of the best economies with information infrastructure and bio-tech industry. Taiwan has venture capitalists and entrepreneurs. Besides, Taiwan has very good free market and democrat politics that provide mechanism to response to the external shocks.

The agricultural policy announced in 2000 promotes knowledge-based agriculture. It intends to expand the value of agricultural products by encouraging the use of advanced agricultural technologies, enhancing

the value of food processing, strengthening agricultural markets, promoting agricultural culture and leisure agriculture, and protecting agricultural ecology. The programs of the policy include development of food processing industry, enhancement of the delicate and leisure agriculture, promotion of the market-oriented agricultural technologies, and utilization of information technology in agricultural production and marketing.

Do they good enough for Taiwan's agriculture? We don't know yet. The only thing that we are sure is that we have to go ahead and do our best.

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3. FIJI

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INTRODUCTION

Agricultural production in South-west Pacific Islands is dominated by traditional root crops for subsistence and local sale, and only a narrow range of commodities are produced for export. The major export commodities include sugar, ginger and taro (in Fiji), kava (in Vanuatu, Fiji, Samoa, and Tonga), squash and vanilla (in Tonga). However, long-term sustainability of market and profitability for traditional export commodities are becoming increasingly doubtful. Major factors contributing to this are:

1) the inability of production systems to maintain cost of production low in order to compete with the production from more developed countries; and
2) vulnerability due to natural hazards, loss of market and price fluctuations in the world market resulting a complete loss of income or reduction in profitability.

In view of the above, Pacific Island countries (PICs) recognized the importance of moving away from heavy dependence on few export commodities. Several countries have also designed and implemented agricultural diversification programs over the last three decades ending 2000. A majority of these programs, however, has had limited success because of the peculiar characteristics and constraints within the agriculture sectors in these countries. Fiji's efforts to diversify agricultural base, particularly in terms of commercial export crops, have met with similar fate. Efforts toward diversification in Fiji started in the 1950s with the introduction of cocoa as an additional export crop. Following independence in 1970, more concerted efforts were made to diversify the export commodities. Ginger, cocoa and passion fruit were singled out for special attention. Despite these efforts, the performance of the agricultural diversification programs remained unsatisfactory. The only exception was ginger, which emerged as a commercial industry. Thus the agricultural diversification program made only a marginal contribution to the national economy until the mid-1980s. From the late 1980s, diversification efforts were pursued with emphasis on the production of food crops for exports and private sector participation in agricultural development. The country seems to have achieved relatively higher rate of success with this strategy but the programs still face several constraints.

STRUCTURAL CHANGES IN FIJI'S AGRICULTURE

The contribution of Fiji's agriculture to GDP has remained at approximately 16 percent during the 1990s. Subsistence production of various crops and sugarcane for export still dominates the crop sector. Foreign exchange earnings of the sector have remained fairly constant in real terms over this decade. Although agricultural workers are frequently underemployed, the sector remains the main source of employment. Albeit significant government investment in various agricultural development projects, the overall pattern of production has changed little.

A summary of the performance and contribution to the economy of the broad segments of the agriculture sector are presented in Table 1.

Fiji's competitive advantage in agriculture lies in high-value and niche-market exports (kava, ginger, papaya, mango, eggplant, etc.), and in traditional food production. Despite the sever drought of 1997-98, the continued growth in niche exports since 1996 has confirmed this area of competitive advantage. In 1998 taro

export were F$8.6 million and kava exports reached F$36 million (F$2.4 million in 1995), while the value of ginger exports stood at F$5.0 million (F$4.4 million in 1996) (ADB and MAFF, 1996, p 64). During the course of 1998, over 390 mt of papaya, mango, and eggplant passed through the industry owned and operated quarantine treatment facility at Nadi airport. This produce had an estimate free-on-board (fob) value of F$1.3 million. Fruit exports would have been significantly greater had the Australian market not remained closed on quarantine ground.

Table 1. Overall Analysis of the Performance of the Fiji Agriculture Sector and Contribution to the Economy

Sub-sector	Value of Production and Trend	Foreign Exchange Earning/Saving	Employment
Subsistence agriculture	30-40 percent of agricultural GDP; steady growth	Substantial in term of foreign exchange saving	Majority of economically active population
Sugar	F$250-300 million; expected to decline	F$250-300 million	23,000 contact growers
Other bulk export crops (copra and cocoa)	F$4 million; in decrease	F$4 million	Large numbers but earning meager income
Horticulture and niche export crops	F$50 million; becoming significant and growing quite rapidly	F$25 million	250,000 days of employment generated by ginger. Equivalent employment estimated for export taro.
Commercial food crops	F$120 million; steady growth	Equivalent to the value of production	70 percent of farms are non-sugarcane
Rice	F$6 million; declining	Almost equivalent to the value of production. Most production is now rainfed.	12,000 farmers grow rice, usually in rotation with sugarcane
Livestock	Poultry: F$35 million; increasing Dairy products: F$23 million; declining Beef: 1,600 mt; declining Pork: 800 mt; increasing	Net savings is small for poultry and pork and high for dairy and beef.	Number of farms: Dairy: 2,000; commercial Beef: 1,800; commercial Pigs: 14,500 (commercial piggeries not included in the census)

Source: Derived and updated from ADB and MAFF, 1996.
Note: F$1.4025 = US$1.00 in 1996.

The 1996 sector review highlighted the impressive quantity and range of traditional food growth in Fiji. These crops are grown through out Fiji and are identified as a "hidden strength" of the economy. This suggested that food supply had been able to expand with increases in demand from a rapidly growing urban population. It was noted that food imports were still comparatively low (by far the lowest among the countries in the Pacific) and had fallen slightly as a percentage of total imports over the last decade despite deregulation. This apparent a high level of food security was severely tested with the sever drought of 1997-98. The sustenance of some vulnerable groups (e.g., those who's livelihood depended on cutting sugarcane or growing rainfed rice) required food ration over an extended period. Since the arrival of rains, there has been a rapid turn around in food production as witnessed by the volume and its price in the municipal markets. Fiji's food production system is again being put to the test with current political crisis.

The contribution of the subsistence crops to total agricultural GDP each year is about 40 percent at the current prices, similar to that of the sugar sub-sector. Although subsistence is an important aspect of agricultural production, farming systems and the growth of subsistence crops have not changed during the 1990s. The nation's food security depend upon continuation improvement of subsistence farming, and its ongoing transformation to semi-commercial farming of crops for which Fiji has a competitive advantage.

The sugar industry remains a fundamental importance to the Fiji economy. Cane occupies over 50 percent of arable land. The industry directly employs 13 percent of labor force, contribute around 9 percent of GDP and generate some 30 percent of total domestic exports. The import cost for growing and processing cane remains relatively small. Moreover, because of its small farming structure, the multiplier linkages are more favorable than for most other foreign exchange generating industries. The economic impact of the drought during 1997-98 is an indication of how dependent the economy is on the sugar industry. With two successive years of low production of sugar, the economy contracted by 4 percent despite a very strong performance of tourism, garments, and kava sectors. A reverse situation is likely to be experienced in 2001. The May 2000 coup had a devastating impact on the tourism and export manufacturing industries, yet the contraction of the economy is likely to be far less than expected. This is because of a bumper sugar crop and a recovery in world sugar prices.

Copra, the traditional cash crop of the outer island, experienced continuing decline over the last few decades. World prices for coconut oil were unfavorable on average, and the financial viability of the sector has relied on the intervention price mechanism supported by the government. The overall trend in copra production continues to be downward, although there are some price-led fluctuations. In 1993, it hit an all-time low of 10,000 mt and the value of oil exports fell below F$4 million. Much of the area under coconuts (65,114 ha) has been abandoned. Since 1968, the proportion of total area under "pure stand" has fallen by over 70 percent.

While Fiji's traditional sector of tree crop is barely surviving; quite a different situation exists for the horticultural export crops. This entirely small farming industry includes ginger, tropical fruits (fresh and processed), kava and eggplant. After many disappointments, the horticulture sector is now the fastest growing part of the agriculture sector. It has certainly been the most successful in each PIC. Ginger, kava, and taro have now surpassed the copra in export earner.

For many years, Fiji's import substitution industries (rice, dairy, poultry, beef, pork and tobacco) had been protected by a complex array of quotas, tariffs and subsidies. During the 1970s and 1980s, rice was strongly promoted and protected from cheaper imports. Since 1992, it was put in direct competition with imports. However, the declining production trend set before the deregulation continued even after this policy reform. The underlying reason has been low returns to farmer. In the early 2000, the government before it was overthrown had decided to reintroduce protection for the rice industry.

Fiji has a substantial livestock sector. Around 43,000 rural households in Fiji graze cattle, by far the highest of any PIC. Fiji is the only PIC with a significant dairy industry, around 2,000 commercial or semi-commercial dairy farmers. However, despite heavy protection through import licensing, domestic production had not been particularly impressive, and a heavy reliance on milk powder and butter imports has persisted. Despite recent deregulation, dairy production has remained stable. There are around 1,800 beef farmers in Fiji, including a few larger commercial operations. Commercial beef production has been on the declining trend, despite government efforts to promote small farmers' beef schemes. However, most beef comes from draught cattle and dairy cows kept on small farms.

DIVERSIFICATION POLICIES AND STRATEGIES

Agricultural diversification in Fiji initially started in the 1950s with the introduction of cocoa in the coconut areas of Cakaudrove and in Tailevu. More concerted efforts, however, were made by the newly-independent government in the 1970s and 1980s, with the realization that the nation was heavily dependent on two major crops, sugarcane and coconuts, to generate export revenue. Another reason for pursuing agricultural diversification was Fiji's increasing reliance on imported food. Thus from 1970s, the Fiji Government embarked on an agricultural diversification program with two-pronged aims of import substitution and expanding the range of export crops.

In the 1970s, a policy of crop diversification and high cost development projects was vigorously promoted. In the 1980s, agricultural development programs based on direct government investment continued. The main goals were to achieve self-sufficiency, and reduce the reliance on imports. The main commodities affected were rice, beef, dairy, poultry and feed grains. The export commodities included in the programs were cocoa, ginger, fruits and vegetables. A series of major loan and grant-aided projects were implemented to achieve the goals. These include:

1. Central Division Agricultural Development Project;
2. Rewa, Navua and Dreketi Rice Projects, Sigatoka Valley Rural Development Project;
3. Yalavou Beef Scheme; and
4. Uluisaivou Rural Development Project.

To implement these projects, the government did virtually everything from setting the policy, providing project managers, and extension and administration staff. The farmers were expected to respond to the incentives and benefits to increase production (ADB and MAFF, 1996). In order to reduce competition from imported food, and to enable local farmers to get a fair price, imports were restricted either by tariff or license. The government also got involved in the processing and marketing of some goods. Despite all these provisions and protection, growth in local food production did not meet the targets of the planners.

This strategy of agricultural development proved to be extremely expensive for the government and raised the price of food for the urban consumer. In addition to expensive project operation, there were a range of hidden subsidies in the form of cheap farm inputs, credit, and mechanization services which consumed a large proportion of the national budget.

After almost two decades of protection and government-led investment projects, the government has become aware of the importance of infrastructure rather than directing the growth of the sector. From 1989, the agriculture sector has become part of the national policy of deregulation with relaxation of import controls and a gradual reduction in tariffs. The marketing agencies lost the monopoly status.

The government policy now is to develop efficient agricultural enterprises those do not depend on protection and direct government involvement, but more on personal initiatives. The government facilitates the efforts of the private sector by providing cost effective technical advice, facilitating the development and transfer of appropriate technologies, negotiating quarantine agreements with importing countries, and providing credit. The main focus of this strategy is to expand niche-market exports and to increase traditional crop production. This policy is already showing signs of success. This is evident by dramatic increase in exports of some crops, especially taro and eggplant, and diversification to high-valued export crops.

CONSTRAINTS TO SMALLHOLDER INVOLVEMENT IN THE DIVERSIFICATION OF CROPS FOR EXPORTS

The smallholder involvement in production of high value export crops is hindered by several factors. The most important among these are:

1) strict quality and supply continuity requirements;
2) land availability;
3) natural hazards;
4) access to credit; and
5) economies of scale.

Strict Quality and Supply Continuity Requirements

Sustained high value export market requires the products to be in the hands of the buyer in the desired amount and at the required time on a regular basis. This is a major problem with Fiji producers and suppliers. In many areas a large number of smallholders are involved in the production of export crops. They are scattered over large areas and follow their own independent planting and harvesting schedules. Moreover, the farmers are slow to adopt appropriate husbandry methods to enable them to produce quality products. These factors contribute to the inability of the exporters to meet the quality and quantity requirements of the export market. This problem is now contained to some degree through the contract farming which is well managed and directed by commercial exporters.

Land Availability

The bulk of smallholders involved in the production of high value export crops are tenants on leased native land administered under the Agricultural, Landlord and Tenants Act (ALTA). Most of these leases are about to expire and a majority of landowners are not willing to renew the leases. This means that land

will not be available to smallholders who are experienced in the production of export crops. This situation is likely to have adverse effect on the export industry. Another dimension of land availability is shortage of fertile lands. Most of the high value export products require good quality fertile land. Very little such new lands are available for further expansion of area under high value export crops.

Natural Hazards

The agriculture in Fiji is highly prone to natural hazards such as cyclones, flooding and droughts. These natural hazards cause major damage to export crops resulting in considerable loss of income to smallholder farmers. They also lead to disruptions of supply of produce and even loss of market of the country. The prolonged drought of 1997-98 and excessive rains and flooding during 1999 are more recent examples of adverse impacts of natural hazards on high value export crops in Fiji.

Access of Credit

The smallholders' access to credit is a major constraint to their involvement in the production for export. Many Indian smallholder farmers cultivate land registered under their parents' or other people's names. A majority of Fijians cultivates *mataqali* land without individual titles. These farmers are unable to secure loans due to lack of collateral. As a result they are not able to develop the land and adopt modern agronomic practices necessary to produce higher quality export crops.

Economies of Scale

Fiji is a small island economy, which faces obstacles in the development process not present in larger countries. With a small population, economies of scale are difficult to achieve on domestic market and investments in infrastructure more costly and often uneconomical. These problems due to inherent small-sized economy make sophisticated infrastructure development difficult, which in turn limit the diversification of smallholders' production with high value crops.

PROSPECTS FOR AGRICULTURAL DIVERSIFICATION IN A COMPETITIVE ENVIRONMENT

Comparative Advantage of the Fiji Agriculture

Despite the above constraints, however, there are offsetting advantages that stem from climate, location, a relatively pest-free and unpolluted environment, natural beauty, and an ability to grow a wide range of nutritional foods. The strategy should be focused on minimizing the Fiji's disadvantages of small size and isolation, but maximizing its advantages of location and environment. The areas that best satisfy these requirements are high value niche exports and traditional food production. With suitable conditions in the right location, these are the crops that can give the highest returns to farmers' land and labor resources.

Comparative Advantage for the Niche Exports

In the new trade environment only those commodities profitable to produce domestically under the free trade regime can compete in the international market. The estimates of gross margin for major crops suggest that almost all crops are profitable to produce in Fiji. The gross margins are especially high for anthurium, kava, mango, and pineapple (Table 2).

The positive profit margins on the domestic production translate into low prices in the domestic and international market. Despite low prices, however, international market are also looking for something special on offer – be it a seasonal window, premium quality, or a perceived contribution to good health and environmental sustainability. Although, Fiji faces a strong competition in the international markets with the produce from Australia, the United States of America, Mexico, Philippines, Cook Islands and Tonga, its high value fruit and vegetable exports have good prospects for long-term sustainable development due to certain non-economic advantages. The more significant among these are:

1) isolation;
2) strategic location;
3) direct transport linkages;

4) duty free access to some markets;
5) new markets;
6) linkages with tourism; and
7) environmental and health concerns.

Table 2. Gross Margins per ha for Selected Crops

Crop	Gross Margin*	Crop	Gross Margin*
Cane	202 - 243	Mango	3,440 - 3,845
Copra	75 - 79	Pineapple	2,792 - 2,954
Cocoa (bulk)	45 - 53	Vanilla (green beans)	486 - 648
Ginger (mature)	1,174 - 1,255	Masi (tapa per square chain)	1,416 - 1,538
Ginger (immature)	688 769	Voivoi (panadanus)	850 971
Taro	567 - 648	Orchids	12,141
Papaya	1,214 - 1,335	Anthurium	14,974 - 16,633
Kava	10,522 - 12,546		

Source: ADB and MAFF, 1996.

Note: * Gross margin is the return from the cultivation of a crop on per ha, i.e., gross return minus operating expense. The gross return is defined as average yield per ha of the crop multiplied by its farm gate price.

1. ***Isolation***

Fiji is reasonably isolated in its location. This isolation means relative freedom from major pests and diseases. This quarantine status has given Fiji's exporter an access to some markets from which competitors are excluded or restricted. An example of this is mango and papaya exports to Japan. Fiji capitalizes on and takes advantage of this situation by supporting the South Pacific Regional Fruit Fly Project (SPRFFP) and using non-chemical high temperature forced air (HTFA) quarantine treatment technology to enhance its fresh fruit export industry.

Fiji has had a serious fruit fly problem for a number of years affecting important export commodities like eggplants, chilies, and breadfruit. This necessitated effective quarantine treatment of produce before export. Initially, Fiji's vegetables and fruits destined for export markets were fumigated with chemicals (ethylene dibromide) prior to shipment. However, after a short while, the importing countries banned the imports of chemically fumigated fruits and vegetables due to health and environment reasons.

In 1994, the Fiji Government decided to adopt HTFA as an alternative treatment to chemical fumigation. The United States Government promised to provide treatment chambers and auxiliary equipment worth of F$384,000. The Fiji Government has constructed a complex to house the chamber and equipment costing F$0.5 million. A decision that the HTFA quarantine treatment would be run as a business by an NGO was also taken. Thus a cooperative organization with exporters and farmers as members, known as Natures Way Cooperative (NWC), was formed to look after the enterprise. Currently, the NWC has 94 financial members of whom 14 are exporters.

2. ***Strategic Location***

Fiji's strategic location in the Southern Hemisphere gives it an opportunity to be a seasonal supplier of a range of horticultural products. These seasonal opportunities are very well-utilized to produce and export fresh ginger to North America, mango to Japan, and eggplant to New Zealand. The strategic location of Fiji also enables it to have direct transportation linkages to major Pacific Rim markets. Fiji exporters have direct air links to Sydney, Melbourne, Auckland, Los Angeles, Tokyo and Seoul. New Zealand, Australia and North American West Coast markets are well-served by competitive shipping services.

3. ***Direct Transportation Linkages***

Fiji's exporters have direct air link to Sydney, Melbourne, Auckland Los Angles, Tokyo and Seoul. However, high airfreight rates, particularly to Japan, pose a constraint that needs to be addressed. New Zealand, Australia and North American West Coast markets contain some 0.5 million loyal Pacific Islander consumers. These provide Fiji assured market, and their needs can be better served through the export from the country.

4. ***Duty Free Access to Markets***

Fiji's products have duty free access to all these markets under various trade agreements: Australia and New Zealand (the South Pacific Regional Trade and Economic Cooperation Agreement [SPARTECA]); Japan and US (General System of Preference [GSP]); and countries of the European Union (the Lome Convention). This presents a major advantage to Fiji's high value exports. With movement towards freer world trade in agriculture, however, the value of duty free access is becoming less important.

5. ***New Markets***

Beyond traditionally perceived geographic markets there are new opportunities emerging. Indonesia, for examples, has 25-30 million people with income levels equal to or above that of the average for Australia or New Zealand. These segments of the population have a high propensity to purchase imported foods. A recent study identified Indonesia agribusiness companies as a target market for Fiji fruit-pulp which has poor and variable quality.

6. ***Linkage with Tourism***

Hawaii provides a model here. The development of Hawaii's large papaya and floriculture export industries was direct bi-product of the outward freight capacity at reasonable cost created by tourist arrivals into Hawaii. For some high value product, tourism can provide a domestic demand base upon which an industry can be established. Hawaii's macadamia nut industry, the largest in the world, is build around exporting via the "suitcases" of tourists. Supply to local hotels is the basis of Hawaii's anthurium, orchid and other floriculture industries. The Kona coffee industry is based entirely on selling the ambience of Hawaii to visitors and former visitors. Tourism offers Fiji's diversified agriculture with similar opportunities.

7. ***Capitalizing on Environmental and Health Concerns***

There is an increasing health and environmental concerns of consumers in importing countries notably in Europe and Japan. This provides an opportunity to develop markets based on those concerns, and supply healthy, hygienic, and environmental sustainable commodities. Fiji has a number of distinct advantages in developing significant certified organic (products grown in a sustainable manner without artificial chemicals) industries. These are:

* an opportunity to build on, and market, existing traditional, sustainable, organic production systems.
* high demand for certain products that are technically feasible to produce organically in Fiji (sugar, cocoa, fresh and processed fruits, coconut products and spices).
* locally available resources (e.g., "mill mud" the residue from the classifier in sugar processing) to provide sufficient nutrients to organically produce quality products.
* a non-chemical quarantine treatment that will allow the export of organic fresh fruit.
* willingness of donors to provide technical assistance to support organic agriculture.
* general market perception (with some justification) that Fiji has unpolluted and relatively unspoiled environment.

A rapidly expanding market for natural pharmaceuticals also provides unique opportunities for Fiji and other PICs. The most prominent example is kava now being sought as raw material by European pharmaceutical companies to produce a natural substitute for valium.

Despite these opportunities, however, some current land use practices have posed serious environmental concerns (e.g., widespread indiscriminate burning, sugar and ginger growing on steep slopes, excessive use of weedicides in expansion of the taro industry and felling of primary forests to plant kava). These environmental concerns should be properly addressed to harness the potential of Fiji in producing environmentally sustainable products and address the concern of the consumer for their health.

SUCCESSFUL EXAMPLES

Ginger

Fiji is the only PIC to have a substantial commercial ginger industry. Samoa, Tonga and Vanuatu had observed Fiji ginger industry and have tried to emulate its apparent success. In the case of Tonga, agronomic conditions are not favorable. In case of Samoa, as with Vanuatu, inadequate marketing infrastructure is the major constraint. The processed ginger industry, based on the brining and syruping immature ginger, dates

from the 1970s. It is now the dominant sector. In 1999, 1,300 mt of ginger were processed, while some 551 mt were exported fresh. This ginger is sold to markets in Europe, Australia and the United States.

The Fiji growers have shown their preferences for growing immature ginger. This is because there is less risk associated with growing a 6-ounce immature ginger than a 10-ounce mature ginger as fungal diseases are manifested only later in the life of the ginger crop. The matured ginger gives somewhat higher returns to land but ties up this land for a longer period and there is the risk of substantial disease losses.

Today there are around 400 ginger growers (down from over 700 in the mid-1990s), 14 ginger exporters and three processing factories. In 1999, the industry produced 551 mt of fresh and 1,500 mt of processed ginger. The total harvested area was approximately 90 ha. In 1999, a total of 1,850 mt of fresh ginger equivalent were exported for a fob value of F$6.31 million.

Fiji's fresh ginger export to North America peaked in 1986, when 2,356 mt were shipped. From that time these have been in steady decline. In 1999, there were only 431 mt of fresh ginger exported to North America, with an additional 120 mt shipped to New Zealand. Although fresh ginger export has declined, but processed ginger export substantially increased over this period.

Taro

Taro has now surpassed ginger as Fiji's second major earner (F$8.6 million in 1998). Farmers and exporters responded to the high price in New Zealand and the United States resulting from the loss of Samoa exports due to disease (taro leaf blight). Around 70 percent of the exported taro now comes from the island of Taveuni.

Kava

Kava for many years played a fundamental role in the development of Fiji economy by transferring income from the sugar industry and urban areas to Fijian growers with fertile land in the mountainous and coconut areas. It also has now passed ginger as an export earner. The value of export reached F$36 million in 1998 compared with only F$2.4 million in 1995. According to MAFF, there were just under 12,000 kava farmers cultivating 3,115 ha in 1998. During 1999, however, the value of these exports fell back significantly as a result of the production impact of the 1997-98 drought and the decline in prices following the downturn in the United States market. MAFF reports that the number of kava farmers declined dramatically to just over 6,000 in 2000. Kava, however, still remains the most profitable crop grown on any scale in Fiji.

Fresh Fruits and Vegetables

Fiji for many years tried to develop fresh fruit exports to markets in the Pacific Rim. After numerous disappointments, the fresh fruit export industry is beginning to take off. The main constraint has been quarantine. With the certification of an industry owned and operated HTFA fruit fly quarantine treatment facility for papaya, mango, eggplant and breadfruit, this constraints has now been effectively removed. In 1998, the facility treated over 600 mt of fresh fruit produce (Table 3).

Table 3. Produce Treated by the HTFA Facility at Nadi, Fiji, 1996-98

(Unit: kg)

Commodities	1996	1997	1998	2000	Total	Total Estimated Value (F$ fob)
Pawpaw	33,037	90,010	85,965	21,938	230,950	836,048
Mango	-	23,072	120,209	1,813	145,094	429,843
Eggplant	-	69,615	185,155	67,140	321,910	891,695
Total	33,037	184,694	393,327	92,891	703,949	2,157,586

Source: Official statistics from NWC.

Papaya

A number of studies had identified papaya as an outstanding export diversification opportunity for Fiji. However, these projections have not been realized until recently. This can partly be explained by the climatic factors. A severe drought of 1997-98 followed by extremely wet conditions in 1999 that continued into 2000

seriously affected papaya production. Overall, however, the recent experience of marketing Fiji papaya in New Zealand has shown that, unless international prices are well below the current level, the market is likely be anywhere near as large as 600 mt. This market has to be shared with produce from Cook Islands and Tonga and potentially with Samoa and Vanuatu as well. The main shortfall in exports has occurred from failing to meet the export target of Australia. Contrary to the expectation, Fiji's HTFA facility is yet to be certified for the Australian market.

Processed Fruit

In additional to fresh tree fruit exports, Fiji has made significant progress in the development of processed fruit. Fruit purees (banana, guava, mango), processed at the South Pacific Foods (owned by the large French food and beverage company SIAS-MPA and Pernod Ricard) have expressed strong growth in recent years. Currently around 1,000 mt of frozen product (valued at approximately $F1 million) is being exported to markets in Europe, Australia and New Zealand. These products recently acquired organic certification enhancing their marketability. The processed fruit is supplied entirely by small farmers.

Eggplant

Once considered to be a relatively minor export product, eggplant has become the cornerstone of the viability of the HTFA facility. Eggplant for export markets is grown in the Sigatoka valley and around the Nadi river delta. Nearly all eggplants destined for export markets are produced alongside other vegetable crops and rice on smallholdings. These farmers produced 2,053 mt for export to the Canada and New Zealand markets. Some 10 exporters are involved in the trade.

SUMMARY AND CONCLUSIONS

Superimposed on the problems of smallness, Fiji is relatively geographically isolated, prone to natural disasters such as typhoon and drought, and operates under a land tenure system that constraints the availability of land and its productivity. Under such circumstances, building sophisticated infrastructure become uneconomical. Albeit these constraints, however, there are offsetting advantages that stem from climate, location, relatively pest-free and unpolluted environment, natural beauty, and ability to grow a wide range of nutritional foods. Fiji's competitive advantage in agriculture lies in high-value and niche-market exports (kava, ginger, papaya, mango, eggplant, etc.), and in traditional food production.

The importance of diversification in Fiji was recognized during the pre-independence time, but more concentrated efforts to diversify the domestic agricultural production system and exports were made following the independence in 1970. Initially, the government planned and executed the diversification projects and programs under protection, but this approach failed because it was too expensive and consumed most of the development budget for agriculture. Then the government took the role of facilitator in providing cost-effective technical advice, transfer of appropriate technologies, negotiating quarantine agreements with importing countries, helping to set up infrastructure and facilities, and providing credit (Ministry of National Planning, 1997). The main focus of this strategy was to expand niche-market exports and increase traditional crop production. This policy is already showing signs of success. This is evident by dramatic increase in exports of some crops, especially taro, eggplant, processed fruits and ginger.

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4. INDIA

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INTRODUCTION

In the present day economic order, agricultural diversification has assumed prime importance from micro as well as macro point of view. At farm level, the diversification means transformation of a mono-cropped farm into a multifaceted enterprise (Murty, 1998). In a wider sense, the diversification would also include moving away from farm to non-farm production like agro-processing.

Agricultural diversification ensures stability in the farm incomes by minimizing risk because the low return from one crop is compensated by the high return from others. It can only happen when "eggs are not all in one basket" (Heady, 1968). The diversification also implies substituting more rewarding crops with less rewarding ones, therefore, resulting a higher level of farm incomes. Agricultural diversification also reduces peaks and depressions in demand for resources and ensures reduction in seasonal unemployment. It helps in maintaining the soil health because sequencing different crops in a rotation is one way to maintain soil fertility.[1] This creates enterprise symbiosis, meaning the positive biological interaction among various enterprises in the production system. The diversification also brings the advantages of complementarities and supplementarities because of multidimensional and intensive use of space, time, capital, labor and enterprise symbiosis.

At macro-level, diversification ensures long-term viability of the sector by developing alternative crops, allied activities and other sources of incomes. However, success of the diversification programs requires corresponding policy initiative in the form of input-output pricing, development of infrastructure, revamp of the marketing and financial systems, reorientation of consumers' preferences through incentives, and improvement in skills by education and extension.

AGREEMENT ON AGRICULTURE

Under the free trade regime of the World Trade Organization (WTO), diversification of agriculture not only has an economic appeal but also a necessary condition for growth. In free trade, different countries have to decide what commodities or products should be produced and exported based on the competitive advantage. Failing to do this, they will progressively lose the ability to protect their production from global competition and making imports inevitable. The international trade is also likely to move from a mere comparative advantage to competitive advantage involving highly segmented markets, differentiated products technology differences, economies of scale, etc. The traditional price-cum-cost comparisons will rather be only a preliminary indicator of competitiveness.

Commitments to Open Up Trade

As per the Agreement on Agriculture (AOA), the member countries, both developed and developing, are required to slowly open up their agriculture sectors to world trade by removing all trade restrictions. As a signatory to the General Agreement on Tariff and Trade (GATT) and founder member of WTO, India is

[1] The frequent shifting of area from one crop to others helps in maintaining soil health because of the differences in the nutrient requirements of different crops. Some crops rebuild the nutrients in the soil by fixing nitrogen or by recycling large quantities of biomass into the soil.

committed to implement various agreements and provisions encompassed in AOA. These include the commitments on:

1) domestic support;
2) market access;
3) export subsidies; and
4) sanitary and phyto-sanitary issues.

The trade related intellectual property right is another issue which would also influence the Indian agriculture. The upper limit of total aggregate measurement of support (AMS or Amber Box), both product-specific and non-product-specific, for developing countries like India has been fixed at 10 percent of the total value of agricultural production. A developing country, whose AMS remains below or up to 10 percent (5 percent in case of developed countries), is not subject to any reduction commitment.

However, two categories of support measures are exempted from AMS to the resource-poor and low-income producers in case of non-product-specific domestic support (World Trade Center, 1994). These measures are: 1) Green Box; and 2) Blue Box.[2]

The exemptions in these boxes can be used to cover up the reduction in AMS. The developed countries are certainly in a better position to manipulate these exemptions in favor of their farmers. The direct support under Blue Box, in fact, indirectly covers the fixed costs (Ghuman, 2001), leaving farmers only to bear the variable costs. This makes even the most inefficient farmers efficient. Several European countries are disguising trade distorting domestic support under Blue Box exemptions (Gulati, 1999).

With regard to market access, all the existing quantitative restrictions and non-tariff barrier (NTBs) are to be replaced by the 'equivalent tariff barriers' (bound tariff rates [BTRs]) during the transitional period, i.e., from 1 January 1995 to 31 December 2004. According to AOA, the unweighted average reduction of 'bound rates' must be 36 percent (24 percent for developing countries) with a minimum cut of 15 percent for each commodity (10 percent for developing countries) over a period of six years (10 years for developing countries) for developed countries. The least developed countries are not required to reduce tariffs.

The minimum market access quota is to be expanded to 5 percent of the total domestic consumption with effect from 1 January 2005. However, there are certain protective provisions in the form of custom duties, anti dumping clauses, etc. The AOA prohibits the export subsidies unless they are specified in a member's list of commitments. The agreement requires WTO members to cut both the amount of export subsidy and the quantities of goods that receive export subsidies. The developing countries are required to reduce the value of export subsidies by 24 percent (36 percent in the case of developed countries) of the 1986-88 base period average, and the quantity of the subsidized exports is to be reduced by 14 percent (21 percent in the case of developed countries) over a 10-year period (six years in the case of developed countries). Here, too, there is limited flexibility. The least developed and net food-importing countries are exempted from such reductions.

Terminator Technology

The development of 'terminator seed technology' is going to be another serious problem for the farmers of the third world countries. Terminator technology is the highest form of intellectual property rights because it has the inbuilt protection against the non-permitted uses instead of legal protection.[3] Small, marginal and medium farmers, in particular of the third world, cannot afford to purchase seed for every sowing. Besides, the developing countries can face various problems from the bio-engineered crops. Contrary to it, the interest of the multinational corporations is restricted in expanding the range of inputs to be purchased by the farmers. Trade-related intellectual property rights (TRIPs) measures under WTO would also influence the developing countries' agriculture by way of patent of seeds and progeny of milking animals.

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[2] See Appendix 1 for what is included in each type of box.

[3] Terminator seeds have in-built mechanisms to manipulate yields, germination, reusability, etc. This means that it will create a continuous dependence on the multinational corporations.

IMPACT OF FREE TRADE AGREEMENT

Indian agriculture would be more prone to internal and external shocks under liberalization, privatization and globalization regime. Many studies have brought out that AMS would not affect Indian agriculture as the total Indian AMS is far below the upper limit (Gulati and Sharma, 1994). Gulati's argument is mainly based on the assumption that Indian agriculture is reasonably efficient and would emerge even more so once the domestic support to agriculture in developed countries is reduced to the agreed level. He also banks on the fact that the product-specific support to Indian agriculture has been highly negative, ranging from -28 to -66 percent, and non-product-specific support has been positive but much below permissible total AMS. However, the assumption that the developed countries may reduce their AMS may not prove true because they are diverting the supportive measures from Amber Box to Green and Blue Boxes. For example, the United States has increased its support under Green Box from US$24,098 million in 1987 to US$51,825 million in 1996. During this period, the product-specific was reduced from US$24,659 to US$6,475 million. Already they have started compensating their agriculture by way of exemptions from reduction commitments provided in the 'Green Box' and 'Blue Box'.

The global competitiveness of Indian agriculture, both on quality and price account, is another factor (Gill and Brar, 1996) which limits the gains for India from free trade. TRIPs, oligopolization of agricultural research,[4] sanitary and phyto-sanitary measures, food security, oligopolization of global agricultural trade, falling trend in global agricultural commodity prices (Table 1), etc. are the other concerns of Indian agriculture.

Table. 1. Trend of Primary Commodity Prices in Global Market

(Unit: US$/mt)

Year	Wheat	Rice	Sugar	Cotton	Tea
1970	250	574	323	-	-
1980	240	571	877	2,843	2,305
1990	136	271	277	1,819	2,058
1995	149	269	246	1,785	1,249
1998	121	293	189	1,389	1,968

Source: World Bank, 1993 and 1999.

The global access clause expects from the member countries to import at least 5 percent of their consumption. The total production and consumption of food grains in India is around 200 million mt. About 30 percent of this is marketed surplus. This means nearly 60 million mt of food grains are marketed and remaining used by the farmers for domestic consumption. The market access clause binds India to import 10 million mt of food grains. This will increase the supply in the market from 60 to 70 million mt. It can result in the collapse of food grain prices.

The regime of minimum support price and public procurement, the backbone of present Indian agriculture and which have worked well for well over three and half decades, is likely to go under the WTO regime. The basic objectives of this present day administrative price policy regime were:

1) to provide remunerative prices to farmers so as to encourage them expand production and adopt new agricultural technology; and
2) to keep domestic food grain prices stable and within the reach of the poor sections of society (Shergill, 1999).

By putting the Indo-US Agreement of 28 December 1999 into practice, India has removed quantitative restrictions (QRs) for 1,429 items on 31 March 2001. Out of these, 825 relate to agriculture and dairy (Ghuman, 2001). In other words, Indian producers of all these commodities would have to face global

[4] Shiva (1991) has shown that the degree of monopoly over agricultural research is increasing day by day due to the acquisitons, alliances and merger of top multinational corporations engaged in agricultural research.

competition in their own domestic market. The removal of NTBs would substantially increase the import of those items into the Indian market.

There is a clear message that in order to survive in international competition, India must identify diversification options for agriculture. Diversification would require the promotion of alternative crops at a return higher than the traditional crops. Besides, it needs region-specific research and planning for various crops. Carefully planned agro-processing and agro-forestry can also help in diversification. That would further require research and development, price support and production-clearing-market network.

PRODUCTION STRUCTURE OF INDIAN AGRICULTURE: MACRO SITUATION

The guiding factor in the agricultural development of India throughout the past five decades was the self-sufficiency in food grains, especially in cereals. Therefore the agricultural policies including those related to input and output prices, technology, credit, marketing, etc. bears the stamp of this guiding factor. To increase the production of food grains, the government ensured the minimum support price and procured the surplus supplies of wheat and paddy. In addition, huge public and private investments were made on the research and development of these crops to increase and stabilize the productivity levels. Apart from this, the free movement of food grains within the country was restricted and the country was divided into food zones to encourage various regions/states to create self-sufficiency for themselves.[5] Consequently, a few pockets of food grains production emerged and these pockets were termed as 'Green Revolution areas'. Therefore, by and large, the agricultural policy helped in specialization in favor of food grains. The macro-level data of GDP shows that changes in the relative shares of the crop and livestock sub-sectors have taken place. The share of the crop sub-sector in GDP was 84 percent in 1971, which declined to 75 percent in 1985 and further to 74 percent in 1999. The share of livestock increased from 16 percent in 1971 to 25 percent in 1986 and 24 percent in 1999. So the structural change in favor of livestock within the agriculture sector was more sharpened in the first phase of the Green Revolution.

The analysis of the area under different crops for the last three decades (1971-2000) show that absolute area under wheat increased from 18.24 million ha in 1971 to 27.50 million ha in 1999 (Table 2) which amounts to 51 percent increase. However, the relative proportion of area witnessed a little change, i.e., from 11.0 to near about 14.6 percent. Similarly, the absolute area under rice, oilseed, cotton and sugarcane, though increased, but no drastic shift in the relative share of area was observed during this period. The only significant shift observed was the sharp decline in the area under coarse cereals. The same has been proved by the index number of area under principal crops (Appendix 2). The corresponding index numbers of agricultural production and the yield of principal crops have been given in the Appendices 3 and 4, respectively.

Contrary to crop diversification, diversification towards allied sectors, i.e., dairy, poultry and fish production, is fairly good. The production of milk increased by 147 percent; eggs, by 213 percent; and fish, by 131 percent during 1980-81 to 1999-2000 (Table 3). However, there is still a large gap between the availability and requirement of these commodities. The export-led diversification is also missing. The total value of agricultural exports of India was to the tune of INR (Indian rupees)79,323 million in 1996, INR77,228 million in 1997 and INR72,706 million in 1998. By and large, the traditional exports are still dominating the Indian agricultural export scene.

The economic reforms, i.e., liberalization and privatization, were started in 1991. Therefore, it will be worthwhile to see whether the economic reforms have any impact on agricultural production structure. The average annual growth rate of agriculture and allied sectors during the post-reform period was 3.6 percent compared to 3.9 percent in pre-reform period. The growth indicators also failed to suggest any changes in the agricultural output mix due to these reforms (Table 4).

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[5] The total country was divided into eight wheat zones in 1964. When this experience failed, then each State was made a food zone. Now the food zones have been abolished too, but the controls like levy system in rice and sugar, based on wheat zones, still exist.

Table 2. Area under Different Crop Sub-groups in India

(Unit: Million ha)

Year	Wheat	Rice	Coarse Cereals	Pulses	Oilseeds	Cotton	Sugarcane	Others	Gross Area
1971	18.24	37.59	45.95	22.54	16.64	7.61	2.62	14.60	165.79
	(11.00)	(22.69)	(27.73)	(13.60)	(10.03)	(4.58)	(1.57)	(8.80)	(100.00)
1976	20.45	39.48	43.80	24.45	16.92	7.35	2.76	16.08	171.29
	(11.94)	(23.05)	(25.57)	(14.27)	(9.88)	(4.29)	(1.61)	(9.39)	(100.00)
1981	22.28	40.15	41.78	22.46	17.60	7.82	2.67	17.87	172.63
	(12.91)	(23.26)	(24.20)	(13.01)	(10.20)	(4.53)	(1.55)	(10.34)	(100.00)
1986	23.00	41.14	39.47	24.42	19.02	7.53	2.85	20.83	178.26
	(12.89)	(23.05)	(22.12)	(13.68)	(10.66)	(4.22)	(1.60)	(11.68)	(99.90)
1991	24.17	42.69	36.32	24.66	24.15	7.44	3.69	22.62	185.74
	(13.01)	(22.98)	(19.55)	(13.28)	(13.00)	(4.01)	(1.99)	(12.18)	(100.00)
1996	25.01	42.84	30.88	22.28	25.96	9.04	4.15	26.20	186.36
	(13.41)	(22.96)	(16.55)	(11.94)	(13.92)	(4.85)	(2.22)	(14.15)	(100.00)
1998	26.69	43.42	31.11	22.85	26.21	8.98	3.97	24.06	187.29
	(14.25)	(23.18)	(16.61)	(12.20)	(13.99)	(4.80)	(2.12)	(12.85)	(100.00)
1999	27.50	49.20	25.30	23.50	26.20	9.30	4.10	22.95	188.05*
	(14.62)	(26.16)	(13.45)	(12.50)	(13.93)	(4.96)	(2.18)	(12.20)	(100.00)
2000	27.40	45.00	25.70	21.20	24.40	8.80	4.20	32.22	188.92*
	(14.50)	(23.82)	(13.60)	(11.22)	(12.92)	(4.66)	(2.22)	(17.06)	(100.00)

Source: Economic and Statistical Organization of Punjab (ESOP), various issues.
Note: Figures in parenthesis are percentages to the gross sown area; and * provisional.

Table 3. Milk, Egg, and Fish Production in India

Year	Milk (million mt)	Eggs (million)	Fish (thousand mt)	Index of Production (1981 = 100)		
				Milk	Eggs	Fish
1971	22.0	6,172	1,756	69.6	61.4	71.9
1981	31.6	10,060	2,442	100.0	100.0	100.0
1986	44.0	16,128	2,876	139.2	160.3	117.8
1991	53.9	21,101	3,836	170.6	209.8	157.1
1996	66.2	27,198	4,949	209.5	270.4	202.7
1998	78.8	28,567	5,388	249.4	284.0	220.6
1999	74.7	30,150	5,260	236.4	299.7	215.4
2000	78.1	31,501	5,650	247.2	313.1	231.4

Source: ECOP, various issues.

Table 4. Pre-reform and Post-reform Annual Growth in Agriculture

(Unit: Percent)

Crop	1981-92	1993-2000	Crop	1981-92	1993-2000
Agriculture and Allied:	3.9	3.6	Crop Sub-sector:	3.4	2.2
Agriculture*	4.2	3.7	Food grains	2.9	2.0
Forestry	-0.1	0.8	Cereals	3.1	2.1
Fishing	5.4	5.5	Rice	3.7	2.2
Coarse cereals	0.0	-1.6	Wheat	3.6	3.6
Pulses	1.4	0.8	Non-food grains	4.3	2.4

Source: Ministry of Finance, 2001.
Note: * All crops, animal husbandry, dairying.

PRODUCTION STRUCTURE OF INDIAN AGRICULTURE: REGIONAL SITUATION

The macro-level data on the agricultural production structure over time may hide interesting regional trends. Here two important regional situations of agricultural development and its impact on diversification have been discussed. The first situation pertains to the West Bengal State, where smallholdings and peasant agriculture prevail dominantly.[6]

West Bengal

In West Bengal, the area under food grains increased by 7 percent, while the area under non-food grain increased by 87 percent during 1971-99 (Table 5). The growth rate of yields of food grains and non-food grains were almost the same, while the index number of food and non-food grains production went up by 99 and 249 percent, respectively during the corresponding period. The rising share of non-food grains production in the gross agricultural output consisted of mainly of traditional crops like oilseeds and potatoes especially during the 1970s and early 1980s (Table 6). However, from the early 1980s to late 1990s, non-crop products like milk, fish and eggs have recorded an impressive growth rates in production. Recently, fruits and other horticultural products are reported to be gaining ground although this is not reflected in the data.

Table 5. Index Number of Area, Production and Yield under Food Grains and Non-food Grains in West Bengal (base crop year 1971-72 = 100)

Period	Area		Production		Yield	
	Food Grains	Non-food Grains	Food Grains	Non-food Grains	Food Grains	Non-food Grains
1981	99.71	134.54	113.82	154.21	114.15	114.62
1986	96.49	164.44	124.15	224.67	128.67	137.63
1991	106.18	158.39	155.94	262.72	146.86	165.87
1996	107.40	167.09	177.92	311.77	165.66	186.59
1998	107.21	186.59	198.23	329.76	184.90	176.73
1999	106.90	186.86	198.54	348.92	185.72	186.73

Source: Saha and Mukhopadhyay, 2001.

Note: Food grains means cereal grains and non-food grains production include oilseeds, potato, etc.

Table 6. Annual Compound Growth Rates for Production of Selected Food Grains and Non-food Grains in West Bengal

(Unit: Percent)

Item		1983-98	1972-98
Food grains		4.16	2.83
Non-food grains:	Oilseeds	5.1	9.04
	Potato	6.68	7.48
	Milk	4.6	-
	Fish	7.81	6.29
	Egg	2.29	-
	Fibers	3.32	2.9

Source: Government of West Bengal, 2000.

[6] The Communist Party of India (Marxist) ruled the West Bengal State for the last 24 years and the State government has vigorously followed land redistribution program. About 76 percent of farm holdings are less than 1 ha and another 17 percent are between 1-2 ha. Out of 9.3 million ha of gross cropped area, only 4.1 million ha (44 percent) are irrigated. However, more than 74 percent of the total area under rice and wheat are under high-yielding varieties.

The changes in the supply and demand situations, in West Bengal, have increased the importance of non-food grains in the agricultural economy. In the predominant peasant agriculture where the production is primarily carried out for domestic consumption, the higher production of food grains due to high-yielding technology has resulted in saving of land and releasing it for non-food grains. The short duration nature of new cereal varieties also released the land days per year used for cereal production, thus enabling to introduce new crops in the rotation and increasing the cropping intensity.

On the demand side, increase in incomes due to higher agricultural production and labor absorption, and resulting decrease in income elasticity of demand for food grains and increase in demand for non-food grains were the factors which induced a shift in favor of non-food grains (Saha and Mukhopadhyay, 2001). The West Bengal experience has thus proved the view that the technological development in cereal crop production can instigate agricultural diversification. The technological breakthrough in a particular crop induces diversification if it generates enough supply for home consumption on the one side, and lower its returns compared to other competing crops on the other. This is a difficult task to achieve, because it requires substantial technological innovations in the competing crops as well.

The gap between the projected level of production and the projected effective demand for food grains and other selected food items in future still brings out the signals for diversification and trade. West Bengal will remain deficit in milk, eggs and fish, and will be surplus in food grains and potatoes by 2020 (Table 7).

Table 7. Gap between Projected Levels of Production and Effective Demand for Food Grains and Other Selected Food Items during 2000-20

(Unit: Million mt)

Item	2000	2010	2020
Food grains	-0.4 - 0.0	0.5 - 2.0	1.8 - 5.0
Oilseeds	0.6 - 1.0	-0.9 - 0.4	-0.3 - 3.6
Potato	1.4 - 2.8	7.3 - 10.5	21.0 - 28.6
Milk	-4.7 - -3.5	-7.3 - -5.7	-11.6 - -9.6
Fish	-0.4 - -0.3	-0.6 - -0.4	-0.9 - -0.6
Egg*	-15,667 - -14,418	-26,090 - -27,774	-48,821 - -46,522

Source: Government of West Bengal, 2000.
Note: * Number in million.

Indian Punjab

The second situation pertains to Punjab State of India popularly known as the 'heart land of the Green Revolution' and the 'food basket of India'. Punjab State was on the forefront in exploiting the gains of new seed, irrigation, and chemical fertilizer technologies due to strong network of canal irrigation system, plain topography of land, groundwater fit for irrigation, and consolidated landholdings. The new crop production technology was supported by the development of rural infrastructure and conducive input and output price policy, which ultimately transformed the traditional and subsistence agriculture into the modern one flushing with food grains production. The production of food grains in the state went up from 5.3 million mt in 1968 to 22.1 million mt in 1999. However, the breakthrough in the technology was confined to only wheat and rice where productivity gains were the maximum. The support-price policy, assured domestic market through government procurement, and nearly stable productivity of these crops tied these two crops in the most profitable cropping rotation in the State. Consequently, the area shifted from other crops to these crops at a large scale converting the somewhat diversified farming system of the state to the mono-cropped system (Table 8).

The proportion of area under rice grown during the wet (or *kharif*) season in the state increased from 6 percent in 1961 to 59 percent of net area sown in 1999. Similarly in the dry (or *rabi*) season, the area under wheat went up from 37 to 79 percent of net area sown in the corresponding period. The area under pulses and oilseed declined drastically.[7] However, just after one and a half decade, the adverse economic and

[7] Another major crop of the State is cotton which was grown in the south-western part of the State. The groundwater of this zone is unfit for irrigation. Recently the up-rise in the water table has resulted in the swear water-logging and the cotton productivity has been adversely effected. Even in this region, the area has shifted

ecological implications of monoculture started emerging (Sidhu, 2000). The average yield of rice that increased at a fast rate during 1968-84 almost stagnated thereafter (Table 9). The annual growth rate of productivity of wheat, which was 2.47 percent up to 1982, came down to 2.14 percent after 1982. At present, increase in the productivity of wheat is mainly due to the reduction in the regional yield gaps.

Table 8. Shift in Cropping Pattern in Indian Punjab

(Unit: Area = 000 ha)

Crop	1961		1971		1981		1999	
	Area	Percent	Area	Percent	Area	Percent	Area	Percent
Wet Season:								
Rice	227	6.04	390	9.62	1,183	28.23	2,519	59.49
Maize	327	8.70	555	13.69	304	7.25	154	3.64
Millets	129	3.43	212	5.23	70	1.67	4	0.09
Groundnut	67	1.78	174	4.29	83	1.98	6	0.14
Cotton	447	11.90	397	9.80	649	15.49	562	13.27
Sugarcane	133	3.54	128	3.16	71	1.69	103	2.43
Kharif pulses	25	0.67	33	0.81	58	1.38	55	1.30
Dry Season:								
Wheat	1,400	37.26	2,299	56.72	2,812	67.10	3,338	78.84
Barley	66	1.76	57	1.41	65	1.55	31	0.73
Gram	838	22.31	358	8.83	258	6.16	13	0.31
Rapeseed & mustard	107	2.85	103	2.54	136	3.25	73	1.72
Linseed	3	0.08	3	0.07	2	0.05	0.2	0.00
Lentil	30	0.80	13	0.32	20	0.48	4.3	0.10
Total cultivated area	3,757	100.00	4,053	100.00	4,191	100.00	4,234	100.00
Gross sown area	4,732	125.95*	5,678	140.09*	6,763	161.37*	7,818	184.65*

Source: ESOP, 2000.
Note: * Also known as cropping intensity.

Table 9. Average Yield of Rice, Wheat and Cotton in Indian Punjab

(Unit: kg/ha)

Period	Wheat	Rice	Cotton American (in lint)
1968-70	2,095	1,392	374
1972-74	2,279	2,113	415
1975-77	2,400	2,410	400
1978-80	2,683	2,818	368
1982-84	2,985	3,055	280
1986-88	3,346	3,230	505
1991-93	3,762	3,292	569
1994-96	3,990	3,341	481
1997-99	4,134	3,337	280
Annual rate of growth (percent)			
1968-82	2.47	6.01	-0.89 NS
1982-99	2.14	0.59 NS	-0.38 NS

Source: ESOP, 2000.

On the one hand productivity has stagnated, but the cost of production of these crops is continuously increasing. The average variable cost at constant prices declined tremendously until 1984 triennium but stagnated afterwards. However the fixed cost which primarily include the maintenance of soil health and

to rice crop on a large scale.

machinery cost started increasing after 1988 (Table 10). Along with this, the ecological degradation in the form of depletion of groundwater due to predominance of water-loving crops in sweet water areas of sub-mountainous and Central zones, up-rise of water in saline water areas of South-west Zone (Table 11), groundwater salination, decline in soil fertility (Table12), and high incidence of insect-pest (Table13) have made this over riding mono culture an unsustainable one.

Table 10. Average Cost of Production of Wheat and Rice Crops in Indian Punjab

(Unit: INR/quintal* in 1971-72 prices)

	Wheat			Rice (paddy)		
	Variable Cost	Fixed Cost	Total Cost	Variable Cost	Fixed Cost	Total Cost
1971-74	39.70	24.25	63.95	33.79	21.31	55.10
1974-77	34.86	23.58	58.44	36.12	22.66	58.78
1981-84	26.81	12.59	39.40	22.56	9.27	31.83
1985-88	26.39	12.74	39.13	22.47	9.79	32.26
1990-93	25.37	14.38	39.75	22.17	11.44	33.61
1993-96	23.63	17.01	40.64	21.88	13.47	35.35

Source: Comprehensive scheme to study cost of cultivation of principal crops in Punjab, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana (official files).

Note: * 1 quintal = 100 kg.

Table 11. Area under Different Water Table Depths in Punjab

(Unit: Million ha)

Water Table Depth (m)	Sub-mountainous and Central Zones		South-west Zone	
	June 1973	June 1996	June 1973	June 1996
<5	1.22 (36.7)	0.47 (14.1)	0.67 (39.2)	0.72 (42.1)
5-10	1.68 (50.6)	1.86 (56.1)	0.43 (25.1)	0.87 (50.9)
>10	0.42 (12.7)	0.99 (29.8)	0.61 (35.7)	0.12 (7.0)

Source: Directorate of Water Resources, Ministry of Irrigation, Government of Punjab, Chandigarh (official files).

Note: Figures in parentheses are percentage to total area of the zone(s).

Table 12. Distribution of the Fertility Deficient Blocks of Soils in Indian Punjab

(Unit: Percent)

Fertility Status	1970-77			1981-90		
	N	P	K	N	P	K
Low	52	16	13	67	44	-
Medium	48	65	58	33	55	43
High	-	19	29	-	1	57

Source: Brar, 1979; and Brar and Chhibba, 1994.

Note: Block is the primary unit of area of agricultural administrative network of the State.

Contrary to West Bengal, the experience of the Punjab shows that technological breakthrough (increased productivity and its stability) in cereal crops and their assured price and marketing improved comparative profitability of these crops, and converted somewhat diversified cropping pattern into a mono-cropped system. However, this mono-cropping system, even without any competition of free trade, is unsustainable because of the ecological imbalance it has created. Apart from this, within the protected economy of India, the food deficit regions are increasingly becoming self-sufficient putting a limit on the demand for rice and wheat produced in the Punjab. So the only option available with the Punjab is to diversify the cropping pattern and marketing system and explore the market (domestic as well as foreign) for other commodities.

Table 13. Incidence of Diseases, Insect-Pests and Weeds for Important Crops in Indian Punjab

Crop	Earlier (around 1970)	In 2001
Diseases		
Wheat	Yellow and brown rust	High-yielding resistant varieties were developed, but some became susceptible to new races of brown rust
	Flat smut	Wheat-rice rotation has started showing some incidence, although at a minimal level
	Karnal bunt	Karnal bunt became widespread. Other diseases becoming important are head scab and leaf blight
Rice	Disease-free crop	Bacterial leaf blight is a major disease in PR106 and Pusa 44 varieties. Other observed diseases are sheath blight, sheath rot, false smut, kernel smut
Cotton	Disease-free crop	Leaf curl virus of cotton
Insect-Pest		
Rice	Pest-free crop	Yellow stem borer and leaf folder are key pests. Other important pests are white-backed plant hopper and rice hispa
Cotton	Cotton white fly was a minor pest	Cotton white fly became key pest due to excessive use of synthetic pyrethroids
	American cotton bollworm was reported in localized areas	American cotton bollworm has become epidemic
Weeds		
Rice	Echinochloa (swank) was predominant	Echinochloa is a predominant new weeds in some pockets: other weeds include *Ischeamum ruzosum* (kanaki), *Ceasulia axillaries* (Ghrilla), *Sphenochlea zylancia*
Wheat	Broad leaf weeds and wild oats were predominant	*Phalaris minor* (Gulli danda) is predominant. New weeds in some areas are *Rumex spinosus* (Jangli palak), *Medicago denticulate* (Maina). *Phalaris minor* has become resistant to Isoproturon due to its continuous use.

Sources: [a] Departments of Entomology, Department of Plant Pathology and Department of Agronomy, Punjab Agricultural University, Ludhiana (official record); and [b] Brar, 1990.

Way back in 1985, the Government of Punjab constituted an Expert Committee (EC) to look into the possibilities of diversification of agriculture in Punjab. The EC recommended to shift 20 percent of marginal lands from wheat-rice rotation to other crops (Johl, 1986). However, the diversification of agriculture in Punjab remained a non-starter. Contrary to this, there was more concentration toward cereal crops. Recently, the efforts are again being made to diversify agriculture. Punjab Agricultural University has recommended to shifting some area from rice and wheat to other crops. The detail is given in the Table 14.

Although the crop production sub-sector in the Indian Punjab lacks diversification yet, sub-sectoral diversification has taken place. The share of crop production sub-sector has gone down from 86 percent in 1961 to 61 percent in 1999. The livestock sub-sector has recorded a tremendous gain during this period (Table 15).

Table 14. Planned Diversification from Rice-Wheat System in Indian Punjab

Crop	Additional Area Proposed (000 ha)	District/Region Where to Be Grown	
Maize	200	Central and Sub-mountainous districts	
Cotton	200	South-west districts	
Oilseeds	100	Sunflower:	Doaba region and Ludhiana and Moga districts
		Rapeseed and mustard:	Gobi Sarson in Amritsar, Jalandhar, Kapurthala and Ludhiana districts
		Raya:	West districts
Pulses	100	Gram:	Patiala, Sangrur, Bathinda, Faridkot, Hoshiarpur districts
		Mung bean:	Whole of Punjab
		Summer mung:	Central districts
		Mash:	Sub-mountainous districts
		Soybean:	Central districts
Durum wheat	100	Patiala, Ludhiana, Fatehgarh districts	
Basmati rice	100	Amritsar and Sub-mountainous districts	
Sugarcane	100	Whole Punjab	
Fodder	10	Whole Punjab	
Agro-forestry	500	Poplar, eucalyptus, dek, etc. along with other crops depending upon suitability for each region	
Fruits	40	South-western and Sub-mountainous districts	
Vegetables	40	Whole Punjab	
Floriculture, medicinal and aromatic crops	20	Areas with assured good quality water, i.e., Amritsar, Jalandhar, Kapurthala, Moga, Ludhiana districts	

Source: Department of Economics and Sociology, Punjab Agricultural University, Ludhiana (official record).

Table 15. Sub-sectoral Composition of Net Domestic Product of Indian Punjab in the Primary Sectors during 1961-99

(Unit: Percent share at current prices)

Year	Crop Production	Livestock	Forestry and Logging	Fishery	Primary Sector
1961	86.45	13.12	0.38	0.05	100
1966	78.28	21.22	0.47	0.05	100
1971	73.96	25.55	0.36	0.06	100
1976	72.96	26.59	0.38	0.07	100
1981	65.08	32.81	1.99	0.07	100
1986	69.22	28.86	1.80	0.12	100
1991	70.77	28.20	0.75	0.28	100
1996	63.56	35.31	0.65	0.48	100
1997	63.52	35.32	0.68	0.48	100
1998	60.84	38.26	0.39	0.51	100
1999	61.31	37.78	0.36	0.55	100

Source: Computed from ESOP, various issues.

NATIONAL AGRICULTURAL POLICY AND DIVERSIFICATION

The Government of India declared its National Agricultural Policy on 28 July 2000. This policy aims at achieving the growth rate of 4 percent by the year 2005 (Ministry of Agriculture, 2000). This growth is to be achieved through a combination of reforms including institutional, and tax for the purpose of inducing positive changes in agronomic practices and technology generation and adoption. The policy envisages to encouraging research and development of human resource and post-harvest and marketing technologies. The oilseeds, cotton and horticultural crops are all set to acquire top priority. The policy also assigns high priority to evolve new location-specific and economically viable improved varieties of farm and horticultural crops and livestock species. Evolving a 'National Livestock Breeding Strategy' to meet the requirement of meat, eggs and livestock products is another highlight of the new policy. The policy also recommends the formulation of commodity-wise strategies and arrangements to protect farmers from adverse impact of undue price fluctuation in world market and to promote exports.

Although the new policy is clearly a shift from the previous food grains-oriented growth policies, yet the implementation part is getting a lack-luster response. The annual budget of the Union Government does not specify any measures to put the policy into practice. Secondly it is not clear how the new policy will be implemented for different segments of the farmers. How diversification will be achieved on small and large farms? How farmers will be motivated to adopt the proposed shifts? All these aspects are missing. Therefore, the government must come out with a time-bound target-oriented action plan otherwise the policy will not serve any purpose and the agriculture sector and the farmers will face a squeeze from external competition. The institutionalization of new National Agricultural Policy must be accorded the top priority. The only silver lining is that a step to institutionalize the new policy has been taken while formulating the new export-import policy.

EXPORT AND IMPORT POLICY AND AGRICULTURAL DIVERSIFICATION

In the wake of the implementation of WTO clauses and the consequent removal of QRs, the Government of India declared its new Export-Import Policy on 31 March 2001. The main highlight of the policy was that "*efforts will be made to provide the access to the agriculture and allied sector's produce/ products in the international market*" (Ministry of Commerce, 2001). The State governments have been asked to identify product specific Agricultural Export Zones (AEZ) for export of specific products from a geographically contiguous area. Comprehensive packages of services to be provided by the State government agencies, State agricultural universities and all institutions and agencies of the Union Government. Such services would include pre/post-harvest treatment and operations, plant protection, processing, packaging, storage and related research and development, etc. Department of Commerce will supplement the efforts of State governments by facilitating the exports of such commodities. The service providers providing infrastructure facilities such as sorting, grading, polishing, packaging, cold storage, transport equipment, refrigerated vans, vapor treatment, heat treatment, x-ray screening facility, etc. shall be entitled for benefits of export promotion schemes.

The import of items like wheat, rice, maize, etc. has been permitted only through designated State trading enterprises. Import of all primary products of plant and animal origin will be subject to import permits to be issued by the Ministry of Agriculture after an import risk analysis based on sanitary and phyto-sanitory measures and provisions.

The subsidies for research, pest and disease control, marketing and promotional services and various infrastructure support services will continue as the AOA does not require the curtailment of these subsidies. The Bound Agricultural Tariffs, i.e., 100 percent tariff on primary agricultural products, 150 percent on processed foods and 300 percent on edible oils will provide adequate leverage to protect the domestic farm production.

In nutshell, the new export policy is an effort towards macro-regional diversification of agriculture because of its product and area specification content. The policy envisages that the import tariffs will be judiciously used to regulate the imports and to protect the domestic producers wherever and whenever needed. The imports will also be subject to import risk analysis.

SUMMARY AND CONCLUSION

The success of any diversification program involves the development of crop- or enterprise-specific technologies, creation or identification of market, and provision of economic incentives. The free trade regime envisages the movement from command to market economies and leaves it on the market, domestic or international, to judge the competitive advantage of any product. The competitive advantage and export potential of a country or region for the production of a specific product will depend upon the four fundamental factors. These are:

1) the crop should be successfully grown in the region and its productivity and cost structure should be comparable with other regions/countries;
2) the cultivation of the crop should be remunerative to the farmers;
3) the product should have export competitiveness in term of prices; and
4) the region should be able to produce the quality product demanded in the international market.

As a signatory of GATT and member of WTO, India is committed to implement the various agreements and provisions of AOA. This creates the fears that traditional agricultural products will face a stiff competition from imports. The diversification of agricultural production in favor of the commodities in which India enjoys the competitive advantage can help to meet this challenge. Various studies show that due to diverse agro-climatic conditions, India has the advantage of producing a number of commodities. Particularly it enjoys the competitive advantage in those commodities and enterprises where the labor requirements are relatively high. Following types of diversification options have been suggested:

1) Items of mass production and consumption such as dairy, poultry, pulses, oilseeds, forestry, etc.;
2) Area-specific enterprises of moderately high value commodities in different agro-climatic regions and sub-regions, e.g., cotton, vegetables, fruits, sugarcane, basmati rice, durum wheat; etc.
3) Limited site-specific diversification through introduction of high value crops for the consumption of elite, e.g., floriculture, exotic vegetables, etc.

However to put the diversification policy into practice demands the gradual restructuring of diversification hindering market, institutions, and credit and fiscal setup into a diversification encouraging ones. It demands revamping of the agricultural financial system and human resource development programs. It requires heavy investments on technological improvements and creating supporting marketing and post-harvest infrastructure. The improvement and fine-tuning of technologies and their dissemination is fairly a long-term process and may take 7-10 years of gestation period. Decrease in the cost of production either through productivity improvement or enhancing the efficiency of resource use or both can go a long way in providing the competitive edge to specified Indian agricultural products.

Global competitiveness also requires the strict adherence to the quality standards. Hence the research and institutional agenda drawn for the future agricultural development and diversification must strive on enhancing productivity, reducing costs, and improving quality. The intensive agricultural region like Punjab must diversify its agriculture. The National Agricultural Policy addresses these vital issues but does not specify any time-bound action plan. However, the National Export-Import Policy gives the clear directions for diversification.

The lack of product-specific data on cost of production and government support that various products enjoy in various countries and regions of the world is a major constraint in identifying the comparative advantage and the diversification options. Therefore, it should be made mandatory, in the clauses of WTO, for the member countries to be transparent in sharing this information. Once this is done, different countries will be able to judge the competitive advantage of their products in a better way and identify the options for diversification.

Certain cautions should also be taken while going for diversification. First, the long-run food security of the country must be kept in mind. Secondly, since the world agricultural trade is likely to witness many ups and downs especially in the initial years, an element of flexibility must be injected in diversification plans. Thirdly degree of risk in the transition from traditional products to new products and enterprises is quite high and may prove detrimental to marginal and small farmers. Therefore, some income insurance

schemes must be evolved to safeguard the interests of the marginal and small farms. The research institutions are also required to evolve a suitable farming system for these categories of the farmers. The overall objective of the policy should be to maximize the gains from diversification and minimize the pains of transition.

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All the supports to agriculture were divided into three boxes. These are:

A. ***Green Box Measures***

These have a minimum impact on trade. These include the following types of assistance:

i) Government assistance on general services like research, pest and disease control, training, extension, and advisory services
ii) Public stock holding for food security purposes
iii) Domestic food aid
iv) De-coupled income support
v) Government financial participation in income insurance and income safety-net programs
vi) Payments (made either directly or by way of government financial participation in crop insurance schemes) for relief from natural disasters
vii) Structural adjustment assistance provided through producer retirement programs; resource retirement programs; and investment aids
viii) Payments under environmental programs
ix) Payments under regional assistance programs.

B. ***Blue Box Measures***

These represent direct payments under production limiting program. These are relevant from the point of view of developed countries alone. Special and differential treatment for developing countries are:

i) investment subsidies which are generally available to 'low income and resource-poor producers' in developing countries.
ii) agricultural input services generally available to 'low income and resource-poor producers' in developing countries.

C. ***The AMS*** (also called Amber Box)

It consists of two parts:

i) Product-specific subsidies, that is, the difference between the administered prices (minimum support prices in India) and external reference prices (c.i.f. prices of imports and f.o.b. prices of exports), times the quantity of production which gets such support.
ii) Non-product-specific subsidies, that is, subsidies on inputs such as fertilizers, electricity, irrigation, etc.

Appendix 2

Index Numbers of Area under Principal Crops (base: triennium ending 1981-82 = 100)

Crops	1971	1981	1991	1995	1996	1997	1998*	1999*	2000*
A. Food Grains	97.9	99.8	100.7	97.6	95.3	97.4	97.6	102.0	97.0
(a) Cereals	97.9	100.1	99.1	96.8	94.8	97.1	97.0	101.9	97.8
Rice	93.6	100.2	106.5	106.8	106.9	108.4	108.4	122.8	112.2
Wheat	82.2	100.4	108.9	115.8	112.7	116.7	120.3	124.0	123.6
Coarse cereals	110.1	99.9	86.7	77.1	73.7	75.9	73.6	70.0	70.3
(b) Pulses	98.0	98.6	108.4	101.2	97.9	98.6	100.5	102.9	93.1
Gram	109.5	92.1	105.3	105.6	99.7	95.9	105.9	117.8	88.3
B. Non-food Grains	91.1	99.4	120.0	126.2	131.7	134.6	133.6	134.9	134.1
(a) Oilseeds	94.2	98.5	122.9	129.7	136.9	138.9	137.0	139.3	133.9
Groundnut	102.8	95.4	116.6	110.2	105.6	106.6	99.5	103.8	96.3
Rapeseed and mustard	84.8	102.2	143.7	150.6	162.7	162.7	175.0	161.9	175.0
(b) Fibers	94.6	98.8	91.1	94.7	107.1	109.8	107.2	111.3	105.2
Cotton	95.1	97.7	92.9	98.3	112.8	113.9	110.8	116.7	109.4
Jute	86.4	108.5	89.7	85.2	85.0	103.5	104.6	97.9	98.0
Mesta	93.1	101.1	67.1	53.4	53.1	57.4	56.4	49.8	52.2
(c) Plantation	79.8	100.5	122.5	135.8	139.6	140.9	142.7	146.9	144.2
Tea	93.2	100.5	110.3	111.1	113.1	113.8	113.8	113.8	113.8
Coffee	64.8	100.6	111.1	140.2	146.0	145.4	146.4	157.5	157.5
Rubber	73.0	100.4	158.2	178.0	184.0	188.8	194.7	199.9	188.8
(d) Others									
Sugarcane	91.5	94.4	130.4	136.8	146.8	147.7	139.1	143.5	149.5
Tobacco	101.5	102.5	93.3	86.7	89.7	97.2	105.3	105.3	105.3
Potato	62.2	100.6	128.6	147.0	152.4	171.7	165.8	176.0	179.1
C. All Commodities	96.3	99.7	105.2	104.2	103.8	106.0	105.9	109.6	105.5

Source: Ministry of Finance, 2001.

Note: * Provisional for plantation crops, tobacco, potato, non-food grains and all commodities.

Appendix 3

Index Numbers of Agricultural Production (base: triennium ending 1981-82 = 100)

Crops	Weight	1971	1981	1991	1995	1996	1997	1998*	1999*	2000*
A. Food Grains	62.92	87.9	104.9	143.7	155.7	146.1	160.9	155.7	165.2	169.0
(a) Cereals	54.98	84.1	105.0	144.2	158.3	149.8	163.9	159.9	168.0	174.4
Rice	29.74	84.4	107.8	149.4	164.5	154.8	164.4	166.0	173.0	179.9
Wheat	14.45	67.7	103.2	156.6	186.8	176.4	197.0	188.5	202.5	214.7
Coarse cereals	10.79	105.4	99.8	113.1	103.2	100.2	118.2	104.9	108.1	105.3
(b) Pulses	7.94	113.6	104.1	140.5	137.4	121.0	140.1	126.9	145.8	131.4
Gram	3.07	126.3	105.4	130.2	156.5	121.1	135.3	149.1	165.3	123.5
B. Non-food Grains	37.08	82.6	97.1	156.3	180.9	185.4	200.9	181.6	199.8	190.0
(a) Oilseeds total	12.64	97.1	95.1	179.5	208.4	212.1	231.3	198.2	231.0	203.0
Groundnut	5.60	101.8	83.4	125.3	134.4	126.4	144.1	122.9	149.7	88.5
Rapeseed and mustard	2.41	97.2	113.0	256.3	282.2	294.0	326.3	230.5	277.6	292.0
(b) Fibers	5.09	65.6	94.2	128.2	151.2	161.8	181.3	142.5	156.9	150.7
Cotton	4.37	63.4	93.2	130.9	158.1	171.0	189.2	144.3	163.4	154.8
Jute	0.55	76.5	100.8	122.6	123.8	118.8	154.2	154.2	136.8	145.8
Mesta	0.14	77.3	96.7	76.7	63.2	66.3	68.4	61.9	57.0	65.1
(c) Plantation	2.29	73.2	76.0	144.9	163.6	176.5	182.4	186.2	188.6	188.6
Tea	1.46	74.7	101.6	132.3	134.4	139.1	144.5	144.5	144.5	144.5
Coffee	0.44	79.1	85.1	122.3	129.6	160.5	148.2	148.2	148.2	148.2
Rubber	0.39	60.8	101.1	217.2	311.4	334.6	362.6	385.3	399.3	399.3
(d) Others										
Sugarcane	8.11	81.2	98.8	154.3	176.3	179.9	177.6	178.9	184.8	191.5
Tobacco	1.12	75.5	100.2	115.8	118.0	111.5	128.7	132.9	146.1	146.1
Potato	2.09	50.2	103.9	163.3	186.9	202.4	260.1	189.5	241.6	240.9
C. All Commodities	100.00	85.9	102.1	148.4	165.0	160.7	175.7	165.3	178.1	176.8

Source: Ministry of Finance, 2001.

Note: * Provisional for plantation crops, tobacco, potato, non-food grains and all commodities.

Appendix 4

Index Numbers of Yield of Principal Crops (base: triennium ending 1981-82 = 100)

Crops	1971	1981	1991	1995	1996	1997	1998*	1999*	2000*
A. Food Grains	93.2	105.1	137.8	150.2	143.1	154.5	148.4	146.8	159.2
(a) Cereals	89.9	104.9	139.3	152.7	146.3	156.7	152.0	148.3	162.0
Rice	90.2	107.7	140.2	154.0	144.8	151.7	153.1	140.8	160.3
Wheat	82.4	102.8	143.8	161.3	156.5	168.9	156.7	163.3	173.7
Coarse cereals	97.0	100.2	128.8	130.9	131.9	151.3	137.8	148.9	142.9
(b) Pulses	114.4	106.6	128.1	132.9	120.3	139.1	123.1	136.2	137.7
Gram	115.3	114.3	123.6	148.1	121.5	141.1	140.7	140.4	139.9
B. Non-food Grains	91.4	99.2	128.0	138.9	135.7	143.8	132.3	141.7	135.7
(a) Oilseeds total	102.2	96.8	132.1	144.1	141.6	152.3	132.0	151.9	138.3
Groundnut	99.0	87.5	107.4	122.0	119.7	135.2	123.6	144.3	91.9
Rapeseed and mustard	114.7	110.6	178.3	187.3	180.7	200.6	131.7	171.5	166.8
(b) Fibers	69.5	95.1	139.9	150.5	150.1	163.6	131.8	139.6	142.0
Cotton	66.7	95.4	140.8	160.8	151.5	166.1	130.3	140.0	141.5
Jute	88.6	92.9	136.6	145.3	139.7	148.9	147.5	139.8	148.7
Mesta	83.1	95.6	114.3	118.3	124.7	119.1	109.7	114.5	124.6
(c) Plantation crops	86.8	97.9	122.2	127.6	134.2	137.5	139.2	137.8	139.8
Tea	80.2	101.1	119.9	121.0	123.0	127.0	127.0	127.0	127.0
Coffee	122.0	84.6	110.2	92.4	110.0	101.9	101.2	94.1	94.1
Rubber	83.2	100.7	137.5	174.1	181.8	192.1	197.9	199.8	211.5
(d) Others									
Sugarcane	88.8	104.6	118.3	128.9	122.6	120.3	128.7	128.8	128.1
Tobacco	74.4	97.7	124.0	136.2	124.3	132.3	126.2	138.8	138.8
Potato	80.7	103.4	127.0	127.1	132.8	151.5	114.3	137.3	134.5
C. All Commodities	92.6	102.9	133.8	145.5	139.8	149.8	141.4	144.7	149.0

Source: Ministry of Finance, 2001.

Note: * Provisional for plantation crops, tobacco, potato, non-food grains and all commodities.

5. ISLAMIC REPUBLIC OF IRAN

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INTRODUCTION

Food needs are estimated to more than double by 2025, with further increase of 50 percent by 2050. The need for food will be influenced primarily by population growth. About 90-100 million people will be added annually for the next several years; at the rate a new India would be added every decade. Some 95 percent of the growth will occur in developing regions where food deficits are already severe, and where alternative employment opportunities and economic growth are limited.

The demand for food will also be affected by the ability of consumers to purchase food, the changing dietary patterns, and urbanization. It is also obvious that for most developing countries, economic growth will only occur if agriculture and related industries are improved. Today, with more favorable economic policies and trade liberalization, agriculture becomes even more important as a primary sector for economic growth, and its products, including inputs and new technologies, have become centerpieces in the debate on free international trade.

In an increasingly competitive world, hundreds of millions of poorly equipped farmers with limited supporting services will have to be facilitated to become competitive or they will be forced to leave their farms. In the later case, unless handled properly, major social and political disruptions will occur. To make resource-poor farmers competitive and to overcome the problems that limit agricultural development need economic cooperation, not foreign aid.

The Islamic Republic of Iran faces tremendous challenges in the next quarter century, including feeding and improving the diets of fast growing population currently at about 65 million, increasing employment, protecting and enhancing natural resources, ensuring security as well thriving for committed for greater national, regional and international competitiveness. Leading experts from many disciplines conferred on how best to meet the challenges and opportunities and to improve people's lives; there is essential agreement on the imperative to increase food production, economic opportunity, access to food, and improve people's lives by reducing poverty.

There is also agreement that the most powerful way to achieve increased agricultural production, protect natural resources, achieve economic growth and reduce poverty is the modernization of the agriculture sector brought about by the effective agricultural research and supporting services. Modes of agricultural operations are needed to be changed in a rapidly-changing, free-trading world struggling to cope with rapid population growth and mounting pressures on natural resources, while at the same time trying to raise incomes, improve nutrition and provide individual opportunities.

An added dimension of the current age problems of agricultural supply is the necessity to meet the nutritional and balance diet requirements. Part of the population may not have access to nutritious food even when supply in quantitative terms meets the requirement of the population. Here the role of agricultural diversification comes in. Not all the nutritional requirements can be met from main food. The consumption and production systems have to be diversified to achieve a balanced diet, which can supply all the necessary nutrients. However, diversification requires reallocation of resources. Before planning for diversification, the effects of the changes must be fully considered. The multidisciplinary and multifunctionality of agricultural diversification requires a collaborative and a well-coordinated program among various sectors.

GENERAL ECONOMIC PERFORMANCE

Economic growth in the Near East and North Africa region as a whole, including Iran, decelerated from 4.8 percent in 1996 to 3.5 percent in 1999 (FAO, 1998). The overall reduction was mainly due to weak revenues from oil and gas exports.

The population growth in the region is quite high at 3.0 percent per annum. Iran's population has doubled in 20 years. The population growth in Iran was as high as 3.2 percent between 1977 and 1986, but reduced to 1.6 percent due to the active family planning efforts.

Agricultural performance in the region over the last decade appears less clearly positive. Among the larger countries, only Iran and Egypt have achieved clear and relatively consistent gains in per capita availability from domestic production. The following major events have affected Iran's economic situation and policy orientation over the last two decades:

1) The 1979 Islamic Revolution and the country's adoption of Islamic rules for the economic and social policy management;
2) The eight-year War with Iraq, which entailed severe human and material losses, a critical dislocation of the economy followed by a protracted period of recovery and reconstruction;
3) The 1986 oil price depression, resulting in significant fall in the country's revenues at a time when its economy was already in recession; and
4) The trade restrictions imposed by the United States.

Despite economic and political isolation since 1979, Iran is now a lower middle-income country, with a GDP of US$82 billion and per capita GDP of US$1,300. The growth in GDP was estimated at 4.2 percent in 1996, and 5.2 percent in 1997, the highest in five years, mainly owing to high crude oil prices in 1996. Subsequent oil price reduction slowed down growth to 3.8 percent in 1999. Oil production contributes 16 percent of the country's GDP and some 80 percent of its export revenue. The government aims at reducing economic dependence on the hydrocarbon sector and vulnerability to oil price movements by promoting other sectors, particularly agriculture.

After the Revolution and the War with Iraq, which had led to emergency policies, the government adopted an economic model combining the objectives of self-reliance with those of liberalization and private sector promotion. The First Five-Years Plan (1990-94) for reconstruction was launched, which aimed at:

1) increasing production and self-sufficiency for all strategic products;
2) raising productivity in key economic sectors and promoting the non-oil export sector; and
3) economic liberalization in the context of a national structural adjustment program, which included correcting price distortions, floating the foreign exchange rate and promoting the private sector.

During this period, Iran's economy expanded at strong a growth rate, and the Plan's ambitious quantitative objectives were achieved to a large extent.

The Second Plan was introduced for the period 1995-2000 setting. Like its predecessor, it has ambitious growth objectives. The new Plan committed to:

1) liberalizing the market (further privatization and less state involvement in market operations).
2) shifting the emphasis from oil to non-oil sectors.
3) adopting a managed unified floating rate.
4) streamlining of customs procedures, and setting of tariffs at the levels that protect domestic producers while maintaining the international comparative advantage.
5) adopting the monetary growth at the non-inflationary rate, with a series of measures regarding incentives for savings and rationalizing bank interest rates, issuing treasury bills, and stimulating private sector participation.
6) reforming the tax system and its administration, introducing a value-added tax system and eliminating subsidies (while creating safety nets and targeted assistance for vulnerable groups).

Iran has made important progress in health, education and population control during the last decade. However, many socio-economic problems remain unsolved. It is estimated that 17 percent of the population live below the poverty line (12.2 and 26 percent in urban and rural areas, respectively). Government statistics indicate that 10-14 percent of the workforce is unemployed. Despite efforts to reduce subsidies, their weight in the national budget remains considerable. External indebtedness and debt servicing remained serious economic problems, despite improvements from the critical situation of the early 1990s.

Iran is not a member of the WTO, and its eventual entry into the organization has been the object of debate. Such a move would mean substantial reforms, particularly in the food pricing policy.

Stabilization efforts have considerably reduced inflation in consumer price, although it still remains high. During the First Plan period, inflation averaged 24 percent per year. After peaking at 32 percent in 1996, it decreased to 23 percent in the year ending March 1997. Latest estimates point to a 13-percent inflation in 2000.

CONTRIBUTION OF AGRICULTURE SECTOR

Agriculture is a major economic sector in Iran, with great potential for development and, as such, is seen as a key strategic policy area. It contributes more than 25 percent of GDP and one-third of total employment. It also contributes substantial export earnings, i.e., one-third of the total non-oil exports.

Iran's population can be considered largely free from food insecurity. The energy supplies, on average, are in the range of 2,900 kcal per capita per day. About 80 percent of the food requirements of the population are covered by domestic production, and domestic supplies cover 90 percent of agro-industry needs.

Agricultural policies over the last two decades have sought to strengthen agricultural activity in order to achieve higher levels of food self-sufficiency and more diversified sources of foreign exchange thus reducing vulnerability to the fluctuations in oil prices. The Second National Development Plan (1995-2000) gave priority to agricultural diversification through production of commodities with higher value-added and vertical movement into processing of different types of agro-industries. These general objectives are also being included in the Third Plan and the 25-year strategy under preparation. A central stated goal is to feed 100 million inhabitants with domestically produced food by 2025.

At the farm level, diversification has involved multiple-cropping, mixed farming (a mixture of livestock, crops and fisheries), and crop rotations to bring natural defenses against weeds, insects, and diseases. In mixed farming, farmers can often make rather efficient use of forages, crop residues, and other potential low-value components of crop rotations. The government has made lots of efforts to extend diversify farm enterprises, but the final decision was left with individuals. To promote a successful agricultural diversification, however, major efforts are needed to strengthen and expand research and development, not only on farm production technology, but also on processing and marketing technologies.

Today, the world is characterized by extreme economic competition. Any country that does not continuously search for methods to reduce costs of production will inevitably loose out in the battle for economic survival. Therefore, unless new commodities and improved farming systems are introduced to the farmers, the chances of their survival in the new competitive era are slim. To bring this diversity in the production system, however, the research system need to design programs to maintain productivity of the staple crops and at the same time exploit potentials for improved productivity in the secondary and export crops, livestock, fruits, vegetables, flowers, fishers, and agro-forestry. Of course, this is a monumental task, especially when the system has been traditionally biased toward staple crops.

NATURAL RESOURCES IN AGRICULTURE

The total area of Iran is 1.65 million km^2. The natural rangelands accounts for 90 million ha. Roughly, 51 million ha are considered as being potentially arable, of which only 36 percent is cultivated, about 8.8 million ha are irrigated under traditional and modern schemes, while rainfed cultivated areas cover 9.7 million ha.

Iran has a great diversity in climatic condition, ranging from arid (central plain and southern coast) to semiarid, Mediterranean (western and northern provinces) and very humid (Caspian Sea). The country's biodiversity is rich, with a total number of plant species estimated to be greater than that of the whole

Europe. Forests cover 11.4 million ha, despite having suffered severe deforestation (more than 5 million ha have been lost since 1960). The fisheries sector is relatively marginal, but has a strong export tradition and potential, based on the combined resources of the Caspian Sea (caviar), the Oman Sea and the Persian Gulf.

Iranian soils, overall, are not considered to be very fertile. The soils of the plains and valleys where the major farming areas are located are affected by varying degrees of salinity and/or water-logging, and those of the plateaus have low organic matter. Only the Caspian basin soils have rather high organic matter contents.

Iran's average precipitation does not exceed 250 mm per year, and most of the territory receives less than 100 mm of rain. Agriculture, household, and industries claims 95, 4 and 1 percent of the total national water supply, respectively. About two-thirds of the available surface water resources are actually used. The groundwater resources, however, are being tapped at their maximum possible level, which causes a recent problem of lowering the water table. In fact, water has become the main limiting factor to both improving the yield and expanding the cultivated areas, as only 36 percent of the arable lands can be plowed with the available water at the farm gate. Therefore, low efficiency of irrigation water use, in the range 30 percent, is considered a major bottleneck for the enhancement of production and productivity. With the increasing population, competing demands for water will further strife, therefore, improvement in water use efficiency in agriculture has become an imperative to meet the additional food requirements of the increasing population.

AGRICULTURAL POLICIES

Before 2001, two separate ministries were in charge of the agriculture sector: the Ministry of Agriculture was responsible for the crop sub-sector (approximately 51 percent of the value of agricultural output); and the Ministry of Jihad-e-Sazandegi was responsible for livestock (47 percent), forestry (1.5 percent) and fisheries (0.5 percent) as well as for rural development and watershed management. Since beginning of the year 2001, these two ministries were integrated.

The government has actively supported the rural sector and agricultural production since 1979. Two key aspects of this strategy have been:

1) price support through guaranteed prices to the producers for selected crops and products; and
2) rural development benefiting thousands of villages.

Prices Support

Subsides was originally important during the War with Iraq to bring exceptional efforts to secure minimum food supplies and living standards. Subsequently, the government maintained an important subsidy program in favor of both consumers and producers of agricultural products. The producers benefit from guaranteed prices for their products, based on estimates of average national production costs, which secured significant farm profit margins. In the meantime, consumer food prices are kept broadly constant in real terms. At present, consumer food subsidies are granted for bread, sugar, milk, cheese, tea, vegetable oil and rice; and producer subsidies for improved seeds and a number of farm inputs. Other sectors such as petrol and electricity also benefit from government subsidies.

At the core of the problem is wheat, the marketing of which is almost entirely controlled by the State and which accounts for 70 percent of food subsidies. Measures are gradually being taken to reduce the high producer-consumer price difference on subsidized food products. Current plans are to accelerate the process by reducing further the list of items concerned. The policy sequence is first to reduce the subsidies on production inputs, then to proceed with the reduction of the producer-consumer price gap. Most likely, guaranteed prices and consumer's subsidies will be maintained for an unforeseeable period, at least for key products such as wheat.

Rural Development

The rural development efforts carried out by the Ministry of Jihad-e-Sazandegi have significantly improved the living conditions of some 28,000 villages over the last decade. Over the last 20 years, 2.2 million ha of marginal lands have been put under cultivation, and 13 billion m^3 of additional irrigation water

have been controlled and managed. In addition, 70,000 km of graveled rural roads and 25,700 km of asphalt rural roads were built, electricity was brought into 28,700 villages, 22,260 villages were provided with drinking-water supply systems, and 26,000 with full sanitary systems; and rural education and agricultural extension for men and women were actively developed.

PRODUCTION PERFORMANCE

Growth in Agricultural Production

As a result of these development efforts and policy support, the growth in food production during the past decade (1989-99) has exceeded that of population. The growth in agricultural production was achieved by the expansion in area due to improved irrigation infrastructure, and increase in yield through improved agricultural research and extension system. This resulted in a significant improvement in per capita availability of food from domestic sources.

Wheat is the core commodity of the Iranian food and agricultural system, providing 40 percent of the energy and 42 percent of the total protein supply. In order to boost production of this commodity, the government launched a comprehensive national wheat program in the 1980s, which included guaranteed purchase prices, subsidized input, intensified research and extension services, as well as providing consumers subsidies on flour and bread. Indirect government support was also provided through subsidized prices for energy, transport and machinery services, and credit. As a result, production has doubled from 6 million mt in 1989 to 12.0 million mt in 1998, although it sharply declined in 1999 due to unfavorable weather. At the same time, average yields in irrigated areas made significant progress, from 2 to more than 3 mt/ha (a 50-percent increase) during this period. Consequently, the country has achieved a self-sufficiency of about 80 percent in wheat during 1998. Similar increases in productivity and production have also been achieved for rice, barley and potato, while the area of perennial crops has continued to expand, reaching now more than 2.7 million ha and consolidating the country's export tradition for pistachio, grapes, dates, apples and citrus (Table 1).

Table 1. Production of Selected Major Crops during 1989-99

(Unit: 000 mt)

Crop	1989	1996	1997	1998	1999	Annual Growth Rate (percent)
Rice paddy	1,854.0	2,684.8	2,350.1	2,770.6	2,300.0	2.2
Wheat	6,010.0	10,015.2	10,044.7	11,955.1	8,686.9	3.7
Maize	60.0	636.6	914.6	941.0	941.0	31.7
Millet	15.2	4.0	4.0	4.0	4.0	-12.5
Cereals (total)	10,786.7	16,076.9	15,812.0	18,971.4	13,851.1	2.5
Potatoes	2,033.0	3,139.9	3,284.1	3,430.4	3,430.4	5.4
Pulses	263.9	705.7	527.5	565.6	565.6	7.9
Soybeans	90.0	140.0	145.0	140.0	140.0	4.5
Fruits (total)	6,520.1	10,143.4	10,894.9	11,172.4	11,172.4	5.5
Citrus fruit (total)	2,146.9	3,168.0	3,484.0	3,522.0	3,522.0	5.1
Vegetables (including melon)	6,312.7	12,092.9	12,575.4	14,193.6	14,193.6	8.4
Tomatoes	1,540.0	2,974.6	2,547.1	3,204.1	3,204.1	7.6
Onions	692.3	1,199.6	1,157.2	1,209.9	1,209.9	5.7
Sugarcane	1,465.6	1,833.2	2,059.0	1,969.8	1,969.8	3.0

Source: FAO, 2000.

Fruit production has grown by 239 percent over the past two decades, especially of citrus and tree nuts, which increased by 769 and 294 percent, respectively. Horticulture production now covers 1.6 million ha, i.e., 10 percent of cultivated land, of which 1.2 million ha is devoted to fruit trees. Thus, there are evidences of growing diversity in the mix of food crops over the past decade.

The production of meat and dairy products has increased during the First Plan by 4.5 percent annually (Table 2). Iran has achieved the 100-percent self-sufficiency in protein availability from animal resources and 100 percent self-sufficiency in milk and cheese. Guaranteed and remunerative producer prices for major commodities have been the essential policy tool behind such performances.

Table 2. Livestock Production during 1988-98

(Unit: 000 mt)

Product	1988	1995	1996	1997	1998	Annual Growth Rate (percent)
Meat	943.4	1,358.5	1,444.1	1,479.9	1,462.9	4.5
Milk	3,400	4,819	4,895	5,122	5,524	5.0
Hen eggs	295	520	470	498	538	6.2

Source: FAO, 2000.

Forestry output has increased with a growth of 2.1 percent per annum from 1.9 million m^3 in 1990 to 2.2 million m^3 in 1997. Production of fisheries has expanded from 208,000 mt in 1988 to 367,000 mt in 1998 with an annual growth rate of 5.8 percent, while the number of fishers is estimated to have increased threefold and the number of vessels twofold, since 1986.

Imports and Exports

Agricultural imports are a major component of the total merchandise imports, and its share has been growing. Despite impressive performance in the production of rice and wheat, their imports have surged during 1988-98 (Table 3). The agricultural imports share in total merchandise imports was about 15 percent over 1989-91, which increased to 27.2 percent in 1995.

Table 3. Agricultural Import and Export

Crop	1988	1995	1996	1997	1998	Annual Growth Rate (1988-98) (percent)
Agricultural exports (US$ million)	394.2	1,099.6	1,130.2	823.7	940.5	10.3
Agricultural imports: (US$ million)	1,586.1	3,540.1	2,988.3	3,254.5	3,550.7	4.4
Cereals (000 mt)	3,226.3	6,398.3	6,280.5	8,710.7	6,340.0	4.0
Rice (000 mt)	209.2	1,633.3	1,150.0	637.5	2,000.0	12.6
Wheat (000 mt)	2,431.3	3,115.3	3,961.5	5,957.9	2,786.0	13.2

Source: FAO, 2000.

Total value of agricultural export has increased with an impressive rate of 10 percent per annum during the 1988-98 (Table 3). This was due to an impressive performance of the agriculture sector during this period. However, trade gap in agriculture remained substantial. The value of the agricultural exports could finance only 24.8 percent of the total value of imports in 1988, which marginally increased to 26.5 percent in 1998.

Sustainability Challenges

An increasing pressure on natural resources has accompanied with the progress in agricultural production. Deforestation and erosion have reached to the alarming proportions. Rangelands have had to support a 50-percent increase in the number of grazing animals over the last 30 years, and because of overgrazing only 16 percent of rangelands is now considered to be in a good condition. Millions of hectares were lost both due to overgrazing and to plowing for expansion of rainfed agriculture. Based on estimates for 1986-92, the pace of deforestation is in the range of 200,000 ha per year. Some 45 percent of arable lands are classified as water-eroded and 60 percent as wind-eroded; average soil loss from arable land is estimated at some 20 mt per ha per year.

Increasing demand for underground water irrigation has developed through the multiplication of wells and pumping stations, resulting in a critical lowering of the water tables. On the other hand, progress in productivity has been achieved to a large extent through guaranteed prices and massive use of subsidized inputs, a process involving market distortions and heavy treasury costs. Thus, a fundamental issue confronting the government is the economic and environmental sustainability of agricultural performances in the years ahead.

Since the formulation of the Second Plan, efforts have started to reduce the degradation of natural resources, through reforestation, soil protection and fighting desertification projects. Measures for the conservation of biodiversity are also being implemented, limited so far to the protected areas (8 million ha, i.e., 5 percent of the territory). Water management enhancement is a major concern and a top priority. Subsidies on pesticides have been removed, and pesticide use has been drastically reduced (by about 75 percent) over the last seven years, and farmers are increasingly adopting integrated pest management practices. However, much remains to be done to control natural resource degradation effectively.

Current government policies emphasize sustainability of agricultural development and better management of natural resources to be achieved, in particular, by securing the participation of resource users and farmers. The Third Plan, a National Strategy for the Environment and Sustainable Development, and the Organization for the Preservation of the Environment provides the institutional framework for environmental protection.

MULTIFUNCTIONAL ASPECTS OF AGRICULTURE

Agriculture faces different conditions throughout the world. Certainly this has to do with variations in natural conditions – a factor of great importance for the sector like agriculture. The sector is integrated in different ecological systems, and its form and position further reflect variations in the social and political roles that the sector plays in different society. While agriculture is a multifunctional undertaking, this reveals that the very substance of multifunctional will vary from country to country and from place to place.

The strong trend of globalization over the last couple of decades has brought the issue of various functions of agriculture. The debate over multifunctional is basically a debate over the legitimacy of various goals and measures within agricultural policy. It should not come as a surprise that there exists no generally accepted list outlining what the multifunctional aspects of agriculture are. Some of the aspects mentioned in the literature are listed as follow:

* Food availability
* Food security
* Aspects of food quality/sanitary conditions
* Rural concerns
* Rural settlement
* Immigration
* Employment
* Local economic activity
* Social concerns
* Environmental effects
* Landscape
* Cultural heritage
* Pollution (changes in matter cycles; genetic pollution, etc.)
* Trade
* Diversification
* Competition.

The list covers both public and private goods, and negative and positive ‘external effects’. It is open for debate whether multifunctinality should only cover so called positive ‘external effects’ of agriculture, i.e., elements like pollution should be handled as a separate problem. The distinction between positive and negative effects is difficult. It cannot be defined on pure physical grounds. Thus the demarcation line

between what is positive and what is negative has to be part of the political agreement itself and it is a political decision to define what becomes an economic opportunity and for whom.

The points made so far are general. When one studies an issue like multifunctional agriculture and moves from the analysis of standard commodity markets, all standard assumptions seem challenged. Goods cannot be traded in markets, they are not homogeneous, resources are not (fully) mobile, and many of the goods are jointly supplied or jointly consumed. That may be a part of their inherent characteristics even. Finally, the goods often are relational, i.e., the value of one good is dependent upon the status of another or the value of one farmer's investment in the production of a public good depends on the investments made by his neighbors.

The agricultural system produces both public and private goods. Type and volume of products are determined both by the level of inputs and the way inputs are combined. The all linkages between private and public products may in principle be both positive and negative. Is it possible to produce the public goods by redirecting agricultural policy through changes in input/output prices, restrictions on technology etc., or is it better to use instruments directly focused on the production of the public goods? Here the issues of competition, diversification, jointness, and complementarity in production and consumption are important.

The multifunctional role of agriculture has evolved parallel with the development towards a freer trade in agricultural products. Does free trade impede the possibilities for supplying/preserving the various public agricultural goods? Different countries develop national policies for protecting the environment and increasing or preserving the production of public goods. Increased concentrations following international competition may lead to negative ecological effects, especially in agriculture (Runge, 1998).

PROSPECTS FOR DIVERSIFICATION

It is obvious that, for most developing countries, economic growth will only occur if agriculture and related industries are improved. Today, with more favorable economic policies and trade liberalization, agriculture becomes even more important as a primary sector for economic growth, and agricultural products, including commodities, inputs, machinery and new technologies have become centerpieces in international trade.

Today, the world is characterized by extreme economic competition. Any country that does not continuously search for methods to reduce costs of production will inevitably loose out in the battle for economic survival. This can be achieved through developing new commodities and farming systems. But this will require initial government support until the production of new commodities becomes competitive in the international market. The picture of the multifunctional agriculture and the related policy options is a complex one. A policy in this field has to take into account that agriculture both has positive and negative effects on the environment, that public good may be a joint product with food production, but that it may also be competing. Still, if it is competing in production, it may be joint in consumption. The goods seem to be largely characterized by non-homogeneity and with a high degree of spatial variation (Scheele, 1997). Thus, diversification and redirection of agricultural subsidies should be in a way that public good provision becomes much more of an integrated part of agriculture. The re-coupling private and public goods will imply a radical change in the perception and role of agriculture. To achieve this goal, some measures are necessary to be combined, such as payment for public goods for positive 'externalities' and taxes/regulations to reduce negative 'externalities' (Vatn and Bromley, 1997).

In addition, prospects for diversification depends on how the main potential sectors overcome the constraints on diversification. The main agents involved in diversification are farmers (individuals/ cooperatives), government, community leaders, agro-industries, and marketing institutions. There should be coordinated efforts among them for promotion and development of commodities that have competitive potential.

Adoption of new technologies or relevant subjects such as diversified cropping, and farming systems should be improved by extension and supporting services. Agricultural diversification should be linked with agro-industrial and marketing development to facilitate production, processing and marketing of the new diversified commodities.

Organizational and institution structures should be directed in a way that facilitates production and marketing of the diversified products for both domestic and export markets.

Policies and programs in terms of providing incentives to the private sector to pursue strategic competitive activities are required for long-term diversification. Research and development should be focused on public policy formulation, project appraisal and evaluation for both short-term and long-term technical productivity and economic efficiency.

Agricultural diversification must integrate and explore the multifunctional aspects of agriculture in a harmonious and synchronized manner. Consistent government policies must be directed towards increase in incomes through agricultural diversification.

Effective strategies should be formulated so that agricultural diversification under rural community can coexist with the development programs at the national level.

SUMMARY

Agriculture is a major economic sector in the Islamic Republic of Iran, with great potential for development. The country has achieved remarkable progress in agriculture and rural development and food security over the past two decades. This was possible through active price support for major agricultural products and massive rural infrastructure development. The country has achieved steady increases in self-sufficiency ratios, estimated in 1998 at about 80 percent for wheat, and 100 percent for livestock products. Large sections of the rural and farm sectors have benefited from improved living conditions and remunerative prices for their products. There are also evidences of growing diversity over the past decade in the mix of food crops. However, these positive results have been achieved at high financial and environmental costs.

The country now faces tremendous challenges in the next quarter century, including feeding and improving the diets, increasing employment and protecting and enhancing natural resources, while at the same time remain increasingly committed to global trade involving greater national, regional and international competitiveness. These challenges can be met only by maintaining a dynamic, competitive and efficient agriculture sector, which ensures economic and environmental sustainability and contains diversified production and processing activities.

To achieve such a sector, however, modes of agricultural operations have to be changed in a rapidly-changing free-trading world. Liberalization, the path chosen for enhancing economic sustainability and efficiency of the whole economy in general and of the agriculture sector in particular, entails a switch from old protective policies and an elimination of subsidies. The political will for such a switch has been clearly stated, but the reaction of both producers and consumers is a delicate issue to handle, especially in the current austerity context. The time may come when the opportunity cost and economic soundness of high farm subsidization are examined, along with the concept of self-sufficiency as the best guarantee of food security. But the current policy setting does not consider such options, as the country's strategic planning for food and agriculture remains firmly based on the self-sufficiency principle. Underlying such a principle are considerations of food security, in a context of uncertain international political and trading relations, and of large oil and gas reserves that provide financial backing for autonomy policies.

Liberalization involves the handing over of the productive and marketing functions formerly assumed by the State to the private sector. This is advancing gradually in Iran. Despite this phenomenon and an ample scope for developing a large range of agricultural and agro-based industrial products in the country, however, investment in the agribusiness sector is not yet forthcoming to any adequate extent. For many investors, the trading and policy environment, infrastructures and services in Iran do not provide adequate guarantees of sure and adequate returns. Small margin between producers' and consumers' price, complex administrative procedures, deficiencies in marketing systems, uncertain land tenure patterns and the complex currency exchange system are all limiting factors to the development of agro-based industries targeting both the domestic and international markets.

Lots of efforts have been made by the private sector and the government to diversify farm enterprises. The government gave priority to agricultural diversification through production of commodities with higher value-added and vertical movement into processing of different types of agro-industries. Prospects for further diversification, however, requires a major effort to strengthen and expand research and extension systems, not only in farm production technology but also in processing and marketing of agricultural products. Agricultural diversification should be linked with agro-industrial and marketing development. Organizational and institution structures should be directed in a way that facilitates production and marketing of the

diversified products for both domestic and export markets. Policies and programs in terms of incentives to the private sector are required for long-term diversification. Research and development should also focus on public policy formulation, project appraisal and evaluation for both short- and long-term technical productivity and economic efficiency. These measures will also facilitate Iran's entry into the WTO.

In planning for agricultural diversification, it is necessary to consider nutritional adequacy as an important goal. However, part of the population may not access to balanced food even when the supply meets the demand of the population in quantitative terms. Some diversification requires reallocation of resources with a full account of effects of the change. The multidisciplinary and multifunctionality of agricultural diversification requires a collaborative and a well-coordinated program among various sectors.

Agricultural diversification must integrate and explore the multifunctional aspects of agriculture in a harmonious and synchronized manner. Consistent government policies must be directed towards increase in incomes through agricultural diversification. Effective strategies should be established so that agricultural diversification under rural community can coexist with the development programs at the national level.

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6. REPUBLIC OF KOREA

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INTRODUCTION

Korean agriculture has evolved dynamically in the 1990s and is set to continue with major changes. As the domestic economy reforms substantially at the turn of the century, the agriculture sector faces far greater interaction with the international community. The financial crisis of the late 1997 plunged the economy into a recession with a 5.8-percent fall in GDP during 1998. Subsequent financial strain and significant depreciation of the won (national currency) had a devastating impact on the agriculture sector of Korea (Kang, *et al*., 1998). Livestock producers who rely on imported feed cereals suffered particularly, and greenhouse fruit and vegetable producers caught in the grip of higher input costs from depreciation of the won.

Economic indicators throughout the 1990s show the changing role of the agriculture sector in the economy (Kang and Lim, 2001). The government enacted new programs and redirected agricultural policies in response with the rapidly changing environment. In particular, programs to improve the structure of the agriculture sector were followed vigorously to enhance agricultural competitiveness and rural welfare. Regulatory reforms and structural adjustments have been pursued extensively to achieve agricultural competitiveness and sustainability, rural viability and economic efficiency.

The objective of this paper is to present recent changes in agricultural production structure and the associated policies in terms of diversification and international competitiveness. Diversification and international competitiveness are measured by several indices to see the impact of revealed changes in agricultural structure and policies on those indices.

RECENT CHANGES IN AGRICULTURAL PRODUCTION STRUCTURE

Small farms and rice-oriented farming generally characterizes agriculture in Korea. As the staple food in the diet, rice remains the dominant crop in terms of production, land use and government support. Livestock products, fruits and vegetables are, however, gaining importance. The rising proportion of women and the elderly in the farming population has been commensurate with the decline in the number of farm households and the farming population. Agricultural trade gained momentum with the Uruguay Round Agreement on Agriculture that encouraged greater access and open competition. However, the Agreement's requirements have challenged Korea's trade policy as well as agricultural policy.

Farmland

The total arable area in 1999 was about 1.9 million ha, of which paddy fields accounted for about 61 percent or 1.2 million ha. The shares of land under fruit and vegetable cropping were 15 percent and 9 percent, respectively. Unlike in the 1970s and 1980s when farmland was converted for non-agricultural uses, policies in the 1990s aimed to improve farm facilities. Average farm size has increased but it remains relatively small at only 1.4 ha in 1999. This is largely due to strict regulations on land transfer and sale, maximum holding laws, and farmers' perception of farmland as a family asset. Most farms are owner-operated.

Farm Labor

There are three distinctive features of farm labor in the 1990s. First, the farming population has decreased to 4.2 million which is 9 percent of the total population in 1999. Second, the proportion of women

and the elderly in the farm population is increasing; about 49 percent of the farm population are aged over 50 (Table 2).

Table 1. Land Use and Farm Size

	Unit	1990	1995	1996	1997	1998	1999
Total area	000 ha	9,927	9,927	9,931	9,937	9,410	9,943
Total planted land:	000 ha	2,109	1,985	1,946	1,924	1,910	1,899
Paddy fields	percent	63.8	60.8	60.5	60.4	60.6	60.7
Upland	percent	36.2	39.3	39.5	39.6	39.4	39.3
Of which:							
Rice	percent	59.0	53.2	53.9	54.7	55.5	56.1
Fruits	percent	6.2	8.8	8.9	9.1	9.1	9.0
Vegetables	percent	13.1	20.3	20.0	18.9	14.6	15.2
Average farm size	ha	1.19	1.32	1.31	1.34	1.35	1.37

Source: Ministry of Agriculture and Forestry (MAF), various issues.

Table 2. Farm Population and Its Characteristics

	Unit	1990	1995	1996	1997	1998	1999
Farm population:	000	6,661	4,851	4,692	4,469	4,400	4,210
Male	percent	49.2	48.9	48.2	48.1	48.4	48.5
Female	percent	50.8	51.1	51.8	51.9	51.6	51.5
Percentage of total population	percent	15.5	10.8	10.3	9.7	9.5	9.0
≥50 years old	percent	34.5	43.8	46.3	47.4	47.4	49.1
Farm employment	000	3,100	2,419	2,322	2,276	2,399	2,264
Share of agriculture in employment*	percent	17.9	12.5	11.6	11.0	12.2	11.2

Source: MAF, various issues.
Note: * The share refers to agriculture and forestry.

Over the period of 1990-99, the share of agriculture in total employment decreased from 18 to 11 percent (Table 2). The absolute numbers of people employed in agriculture also declined from 3.1 to about 2.3 million. Even though agricultural production is progressing through technical improvement, the productivity gap between agriculture and the rest of the economy is still significant.

Production

The composition of agricultural production has shifted to a more balanced system in the 1990s. The value of agricultural production excluding forestry and fisheries was ₩32 trillion (US$1.00 = ₩1,189) in 1999 (Table 3), of which rice accounted for 32 percent. While the share of rice in the total value of agricultural production decreased, the shares of vegetables and fruits increased to 22 percent and 9 percent, respectively. Livestock has become more important in agricultural production, accounting for 25 percent in 1999. Over the period of 1990-99, the volume of livestock production increased to a great extent but it has decreased more recently mainly due to surging costs of imported feed. Figure 1 shows the changes in the composition of agricultural products in the 1990s.

International Trade

Korea was the 14th largest agricultural importer in the world in 1999 (MAF, 2001). The nation imported US$7.4 billion worth of agricultural products (including forest products). The imports totaled more than four times the value of Korea's agricultural exports for that year (Table 4). The liberation ratio for agricultural imports reached 98.9 percent in 2001, an increase from 94.9 percent in 1995.[1] Grains, livestock and forest products are imported mainly from the United States, China, Australia, Indonesia, and Malaysia.

[1] The liberalization ratio refers to the share of liberalized items in total items based upon the harmonized system 10-digit numbers.

Table 3. Agricultural Production during 1990-99

	1990	1995	1996	1997	1998	1999
Agricultural production (₩ trillion)	17.7	25.9	28.1	29.3	29.6	31.6
Production (000 mt)						
Rice	5,606	4,695	5,323	5,450	5,097	5,262
Barley	417	292	299	195	189	241
Soybeans	233	160	160	156	140	116
Garlic	417	462	456	394	393	484
Red pepper	133	193	218	201	147	215
Apples	629	716	651	652	459	490
Pear	159	178	219	260	260	259
Mandarins	493	615	514	649	512	624
Beef	95	155	174	237	264	227
Pork	507	639	692	699	733	701
Chicken	172	263	277	260	244	238

Source: MAF, various issues.

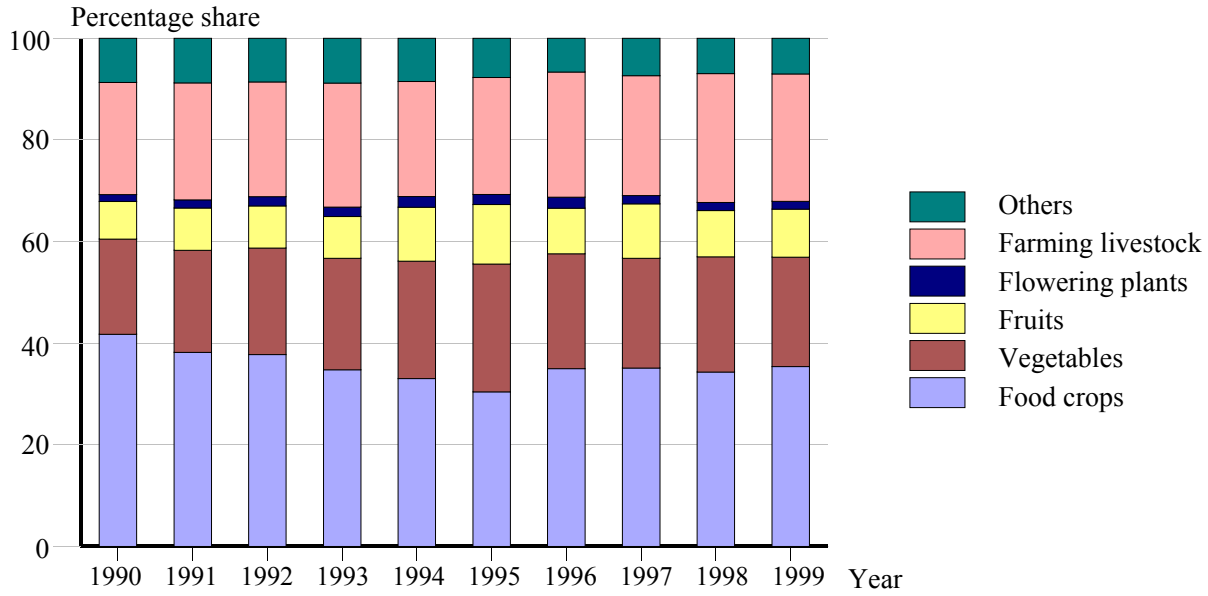

Figure 1. Changes in the Composition of Agricultural Production

Table 4. Agricultural Trade during 1990-99

(Unit: US$ million)

	1990	1995	1996	1997	1998	1999
Total import:	69,844	135,199	150,339	144,616	93,282	119,752
Agriculture	3,308	5,675	6,912	6,336	4,697	4,682
Livestock	446	1,224	1,240	1,283	727	1,245
Forestry	1,665	2,778	2,788	2,584	983	1,460
Total export:	65,016	125,058	129,715	136,164	132,313	143,685
Agriculture	727	1,087	1,164	1,190	1,006	1,004
Livestock	68	156	260	318	385	408
Forestry	610	505	405	339	244	268

Source: MAF, various issues.

The value of agricultural exports, including livestock and forestry, exceeded US$1.4 billion in 1999. Export trends have varied depending upon the commodity. Exports of vegetables and livestock products in particular have shown notable growth in the 1990s although export of forest products has dropped considerably. Leading importers of Korea's agricultural products are Japan, Russia, China, the United States and Taiwan take in more than 85 percent of the Korean exports. Japan was the largest market for pork and specialty product exports. But, since the outbreak of foot-and-mouth diseases (FMD) in 2000, pork export to Japan has been stopped completely.

AGRICULTURAL POLICIES FOR COMPETITIVENESS: OBJECTIVES AND STRATEGIES

Objectives

The objectives of agricultural policies have evolved alongside developments in the national economy. Following have been the fundamentals of the national agricultural policies.

1. ***Self-sufficiency in Rice***

Attaining stable self-sufficiency in staple foods through ensuring stable supply of these food items has retained its place as a key national policy objective. Self-sufficiency in rice has drawn special attention. The overall food self-sufficiency ratio reached 29 percent in 1999. In this respect, the government introduced a direct payment scheme for paddy fields in 2001. This payment is to remunerate the provision of public goods and environmental protection generated by paddy farming.[1] To be eligible for the payment, farmers must keep up with certain cross compliance provisions, including water retention and other requirements for environment-friendly management.

2. ***International Competitiveness***

The government has responded to the imperatives of structural adjustment and international competitiveness, aimed at coping with the opening of agricultural markets. Large budget expenditures on agriculture have supported structural adjustment measures such as farm consolidation and enlargement, promotion of commercial farms, and creation of off-farm income sources.

3. ***Sustainability***

Promoting sustainable agriculture is another driving force in agricultural policy. Environmental labeling is gaining both public attention and consumer confidence. The government also has recently (in 1999) responded to the sustainability concerns by initiating a scheme of direct payment for farmers who adopt environment-friendly farming practices in areas marked for environmental protection.

4. ***Deregulation and Transparency***

Current guidelines for economic reform at the national level pay considerable attention to deregulation and ways to improve transparency and efficiency. These regulatory reforms profoundly influence the agriculture sector, where deregulation and moves to increase efficiency are reshaping most aspects of agricultural production and distribution. The public sector investment continues on rural development projects to improve the standard of rural life and welfare. These projects include establishment of public infrastructures and housing.

Strategies

The followings describe specific policy strategies for enhancing competitiveness.

1. ***Human Capital Development***

Human capital development is a core requirement for productivity gains. Educated and trained farmers are able to cope with rapidly changing environment in a successful way. Management skills are also required to operate modern farms and specialized and tailored farming. As part of policy, stronger efforts have been made to enhance the quality of life of those living in rural areas with improvements in rural education, farmers' pension and medical insurance programs beyond urban areas.

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[1] Some of public goods generated by rice farming include food security, flood control, environmental protection, and rural viability.

Recognizing the importance of this software approach, the government has initiated specific programs to foster young farmers or successors, expert farmers for large-scale (greater than 5 ha) farming, and farm firms. By 2004, the government plans to designate and support about 140,000 farmers as farming successors and 100,000 rice farmers as expert farmers. As of 1999, 7,650 farm firms have been established and contributed to the improvement of agricultural productivity and mixed farming activities, including marketing, processing, and agent operation.

2. ***Mechanization and Modernization***

As farming operation is diversified and specialized, stronger demand for specific farm machines is arising. The mechanization for rice production was close to 97 percent in 1999. But, farm machines are of limited use for upland crops, such as tilling and pest control, showing about 42 percent of the mechanization rate in these crops. In addition, more farm machines need to be developed for livestock production and for women.

To facilitate the development and spread of advanced farm machines, the government has deregulated entry barriers for being selected as certified farm machines and fortified infrastructure such as repairing centers in rural areas. A number of programs have been introduced to develop specific machines in collaboration with research institutes.

3. ***Technology and Information***

High-technology agriculture is now the norm in agricultural production. The government addresses this issue largely with research and development (R&D). Venture capital in agriculture has been encouraged and hi-tech products have swiftly disseminated into producers and processors. As part of the national campaign, namely 'Cyber Korea 21', all 196 counties in the country will be connected to the so-called Asymmetric Digital Subscribers Line (ADSL) until 2005. Internet portal sites have been increasingly constructed not only for information but also for *e*-commerce.

4. ***Sustainable Agriculture***

Recently, an increasing emphasis has been placed on agricultural sustainability. Major government programs embrace pollution reduction from fertilizer and pesticide use, soil quality improvement by adding other soils and silicic acid, support for environment-friendly family farms, and establishment of organic products' markets. With this respect, since 1993, the government has practiced a certification scheme for organic or no-pesticide farm production. As of 1999, about 1,300 farms or 30,000 mt of farm products received certifications by the government and about 14,000 farms or 209,000 mt of farm products by autonomous measures.

5. ***Advanced Livestock Production and Management***

With an increasing trend of specialization and large-scale operation in livestock production, the sector calls for greater management skills and marketing systems in order to provide quality and safe products. To enhance competitiveness, the government introduced a price stabilization scheme for calves. Advanced breeding skills using biotechnology are also introduced to improve meat quality. Grading and certifications have contributed to 'getting right prices' for quality products in the market places.

Since 1994, Livestock Packing Centers (LPCs) have been constructed to expedite the process of livestock products. LPCs serve to ensure efficient marketing and food safety. For a food safety purpose, the government has introduced HACCP (Hazard Analysis Critical Control Point) to slaughterhouses and processing facilities. At the same time, higher interests in environment-friendly livestock production structure have revealed. Recycling wastes and use of feedstuffs grown in the local areas have been increasingly accepted in terms of conserving resources.

DIVERSIFICATION AND INTERNATIONAL COMPETITIVENESS

Measuring Diversification

Definitions of diversification vary depending on strategic management and industrial organization studies (Ramanujan and Varadarajan, 1989). But, a diversified firm is defined as one that produces a number of different products and services in the most general sense. Empirical studies suggest that there is a positive relationship between diversification and firm performance or profitability. But, this positive link of diversification and performance is shown to be weak for some cases (Ding, *et al*., 1997).

There are various indices for measuring diversification. As shown by Tauer and Seleka (1994), most common indices are special cases of the form:

$$I\Phi = \left(\sum_{i=1}^{n} S_i^{\Phi} \right)^{1/(1-\Phi)} \qquad (1)$$

where $i = 1 \ldots, S_i$ is the share of the ith item and Φ is a parameter, $\Phi \geq 0$ and $\Phi \neq 1$. With $\Phi = 2$, the index becomes the inverse of the Herfindahl index (or $1 = 1/(\Sigma S_i^2)$] that commonly used to measure industry concentration (Escalante and Barry, 2001). The parameter Φ determines the weight between the number of items and the evenness. The higher the value of Φ is, the greater the emphasis on evenness is. For $\Phi = 0$, this index only counts the number of items. As unevenness grows, the index value becomes smaller at any Φ.

This study uses average gross farm receipts per farm to measure diversification. The data consists of 16 commodity groups over the period 1959-99, obtained from *Agricultural and Forestry Statistical Yearbook*, MAF. It uses the parameter Φ value of 2, being equivalent to the inverse of the Herfindahl index.

Another way to look at diversification is through concentration measures. The changes in market share in terms of value of major crops reveal useful information about market power variations. This study uses the data of grains, including rice, barley, wheat and pulses and traces the changes of their market shares over the sample period.

Diversification Analysis

Table 5 shows the estimated diversification index. The index was measured in a yearly basis but it was shown in average figures during the period. The diversification index increased from 2.92 in the 1960s to 4.06 in the 1990s. This clearly indicates that diversification occurs in the long run.

Table 5. Diversification Indices

Period	Diversification Index	Grain Concentration Rate (percent)
1960-69	2.92	71
1979-79	2.85	66
1980-89	3.43	53
1990-99	4.06	42

On the other hand, the grain concentrate rate showed a rate of decrease, supporting the progress of diversification. Over the same period, the market share of grains fell from 71 to 42 percent.

To confirm a general increase in diversification or decrease in grains' market power, these indices were regressed with a trend variable as the following form:

$$D_t \text{ or } C_t = \alpha + \beta T \qquad (2)$$

where D_t is the annual value of diversification index, C_t represents the grain concentration rate and T is a trend variable. For serial correlation detected by the Durbin-Watson statistic, an auto-regressive process of order 1, auto-regressive of degree 1, i.e., AR(1) was also added in the equation. Table 6 shows the summary of the estimation results.

Table 6. Trends in Diversification Index and Grain Concentration Rate

Index	Constant	Trend	AR(1)	R^2	DW
Diversification index	2.44 (10.21)	0.04 (4.32)	0.60 (4.70)	0.77	2.32
Grain concentration rate	0.81 (27.69)	-0.1 (-9.19)	0.58 (4.86)	0.93	1.19

Note: Numbers in parenthesis indicate t values.

The estimated results support the postulation that diversification occurs and the grains' market share decreases over the study period. Note that the estimated parameter for trend variable is positive in the diversification index equation and it is negative in the grain concentration rate equation. However, when data of the 1990s was used only, neither of the coefficients for the diversification index nor the grain concentration rate was statistically significant. This result implies that the degree of diversification may have been saturated in recent years.

Measuring International Competitiveness

International competitiveness is a substantially equivalent concept of comparative advantage. But, unlike in the case of comparative advantage, a country may have international competitiveness over all products. Measuring international competitiveness is challenging since accurate price comparison is not straightforward. This is why there are a variety of methods to estimate international competitiveness, depending on concepts and purposes.

One can measure international competitiveness by group (farmer or country), by market (domestic or international markets), or by subject (product, technology or capital). These methods can be further grouped by *ex-post* and *ex-ante* approaches. The *ex-post* approach embodies macroeconomic factors explaining the real changes of realized outcomes in markets. The *ex-ante* approach encompasses microeconomic factors having effects on the changes in competitiveness and consists of price, quality, and technology competitiveness. The *ex-post* approach is more comprehensive while the *ex-ante* approach renders easier evaluation of competitiveness (Shin and Choi, 1996).

As *ex-post* evaluation, this study considered the Revealed Comparative Advantage (RCA) index and the Revealed Competitive Advantage (RC) index. The RCA index is one of most general measures for international competitiveness. This index refers to the ratio of a product market share to all products for a country. As such, it shows relative importance of the product in the world export. Advantages in using the RCA index lie on the fact that it takes into account of price and quality competitive factors comprehensively and allows easier access to data. A disadvantage is related to the lack of import-side information. The RCA index has the following form (Shin and Choi, 1996):

$$RCA = \left(X_{ij} / X_{wj}\right) / \left(X_{it} / X_{wt}\right) \tag{3}$$

where X_{ij} is export of product j by country i. X_{wj} is export of product j by the world, X_{it} is total export of goods by country i, and X_{wt} is total export of goods by the world. When the index is greater than one, it reveals competitiveness. The larger the index is, the greater the competitiveness is.

On the other hand, the RC index reflects the country's import structure. The RC index is defined as (Shin and Choi, 1996):

$$RC = RCA - \left(M_{ij} / M_{wj}\right) / \left(M_{it} / M_{wt}\right) \tag{4}$$

where M represents import and the others are the same as in equation (3). When the RC index is greater than 1, it is said to have competitiveness. When the index turns out negative, it has weak competitiveness.

This study uses data obtained from *Agricultural and Forestry Statistical Yearbook* by the MAF and FAO (various issues). The sample period ranges from 1991 to 1998. The indices were estimated for selected crops, grouped by fruit and vegetable and meat and milk products. Grains were excluded because of their scant level of export.

International Competitiveness Analysis

The estimated RCA index was summarized in Tables 7 and 8. As expected, all agricultural products show weak international competitiveness except pork of 1998. The weak competitiveness mainly resulted from the fact that agricultural exports were far little than those of other goods in Korea.

Table 7. The RCA Index for Meats and Milk Products

Year	Beef	Pork	Poultry	Milk*
1991	0.001	0.000	0.003	0.004
1992	0.000	0.232	0.000	0.004
1993	0.001	0.371	0.003	0.008
1994	0.001	0.317	0.003	0.005
1995	0.004	0.347	0.005	0.007
1996	0.004	0.672	0.004	0.010
1997	0.003	0.953	0.007	0.008
1998	0.004	1.472	0.008	0.012

Note: * The data for milk for Korea includes fresh milk, condensed milk, whole milk powder, skim milk powder, and modified milk powder. But, the world's data refers to milk and cream, evaporated, condensed, and dried or fresh.

Table 8. The RCA Index for Fruits and Vegetables

Year	Apple	Pear	Grape	Mandarin	Red Pepper	Onion
1991	0.043	0.175	0.043	0.097	0.170	0.004
1992	0.510	0.245	0.030	0.131	0.573	0.076
1993	0.166	0.309	0.021	0.134	0.387	0.165
1994	0.075	0.334	0.049	0.083	0.469	0.020
1995	0.184	0.303	0.036	0.082	0.488	0.332
1996	0.131	0.398	0.022	0.086	0.683	0.011
1997	0.092	0.349	0.024	0.219	0.628	0.003
1998	0.054	0.317	0.013	0.403	0.877	0.111

The recent changes in pork export were well captured by the index. The share of pork in agricultural exports was 19 percent in 1998 and further increased to 20percent in 1999. But, its share fell down to 5 percent in 2000 attributable to the outbreak of FMD. As for other products, mandarin and red pepper showed improvement while grape deteriorated in competitiveness.

Tables 9 and 10 show the estimated results for the RC index. According to the indices, pear, apple and mandarin appear to show competitiveness in addition to pork. This result sheds some light on a positive link between diversification and international competitiveness by considering the fact that diversification has been occurred over the same period for which the RCA indices were measured. But, more rigorous studies are needed to confirm this premise.

Table 9. The RC Index for Meats and Milk products

Year	Beef	Pork	Poultry	Milk*
1991	-0.638	-0.189	-0.064	-0.032
1992	-1.428	0.186	0.000	-0.057
1993	-1.046	0.322	-0.286	-0.105
1994	-1.202	-0.123	-0.270	-0.098
1995	-1.313	-0.134	-0.276	-0.065
1996	-1.324	0.188	-0.295	-0.022
1997	-1.308	0.097	-0.341	-0.038
1998	-1.157	0.541	-0.231	-0.032

Note: The data for milk for Korea includes fresh milk, condensed milk, whole milk powder, skim milk powder, and modified milk powder. But, the world's data refers to milk and cream, evaporated, condensed, and dried or fresh.

Table 10. The RC Index for Fruits and Vegetables

Year	Apple	Pear	Grape	Mandarin	Red Pepper	Onion
1991	0.043	0.173	-0.023	0.097	-0.499	-0.093
1992	0.510	0.242	0.017	0.131	-0.694	0.073
1993	0.165	0.307	-0.108	0.134	0.230	0.061
1994	0.068	0.330	-0.065	0.083	0.372	-0.973
1995	0.180	0.301	-0.315	0.069	-0.881	0.155
1996	0.092	0.373	-0.316	0.064	-0.980	-0.726
1997	0.067	0.013	-0.726	-	-0.229	-0.260
1998	0.049	0.177	-0.463	-	-1.222	-0.033

SUMMARY AND CONCLUSION

Korean agriculture has developed dynamically over the past 40 years. Rapidly changing environment surrounding the domestic economy and world markets has challenged survival of the agriculture sector in many aspects. In particular, international trade rules including Uruguay Round Agreement on Agriculture have facilitated open competition in the agriculture sector within a country and across the markets of different countries.

Recent changes in agricultural production structure represent farm sectors' response to newly emerging driving forces, including market signals and public policies. Farmland use has diversified and changed into the orientation of profitable crops, including fruits and vegetables. The farming population has decreased with a rising proportion of women and the elderly in the farm population and share of part-time farm households. The composition of agricultural production has shifted to a more diversified system with an increasing share of livestock production, and decreasing share of grains.

Agricultural policies have influenced on shaping agricultural structure as it is. As a software-type approach, human capital development has been extensively pursued in terms of fostering farming successors and expert farmers. Continued efforts to boost mechanization and modernization have been made. Agriculture R&D has focused on technological development and dissemination and the establishment of ultra-speed information network at the county level. The government has also introduced many programs, addressing agricultural sustainability from the perspectives of ensuring environment and rural welfare. Advanced management skills combined with various safety measures resulted in the competitive and safe livestock production system.

Agricultural diversification and international competitiveness were estimated by relevant indices in this paper. These estimates suggest that, over the period 1959-99, the degree of diversification has widened. The grain concentrate rate also indicated that the share of grains in agricultural production has decreased to a certain extent. However, evidence of further diversification turned out to be weak in the 1990s.

International competitiveness was measured by the RCA index and the RC index. The estimated results suggested that all agricultural products had weak international competitiveness except pork. This weak competitiveness mainly resulted from the fact that agricultural exports were far little than those of other goods in Korea. Nevertheless, increases in competitiveness noted for some of products, such as pear, apple and mandarin. Future work remains to further explore a potential linkage between diversification and international competitiveness.

Public policies should be considered as a determining factor of international competitiveness. A good example is export promotions driven by public sectors. Recently, the government has exuberantly campaigned to promote fruit exports to the world market and designated pear and mandarin as part of 10 strategic export commodities. As a result, exports of pear and mandarin increased and their oversea marketing systems strengthened.

The government will continue to vigorously follow the agricultural policies in Korea to enhance agricultural competitiveness and rural welfare, and improve policy transparency, efficiency and effectiveness by carrying out regulatory reforms and structural adjustments in the agriculture sector. At the same time, farmer and farm sectors must respond to increased demand for safe and stable food supply and provision of public goods, including environmental protection and rural amenity. In this sense, it requires greater

interactions between farmers and consumers, and the agriculture sector and markets upon which optimal decision-makings can rest. Then, agricultural policies can step to deal with emerging issues and provide appropriate guidelines and directions.

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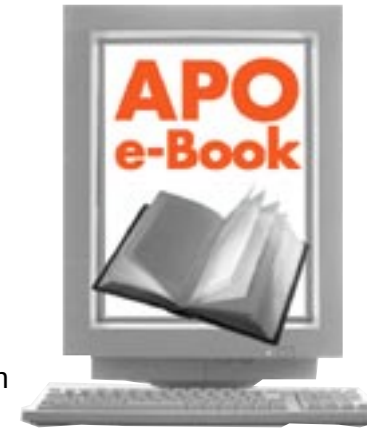

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7. MALAYSIA

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INTRODUCTION

This paper describes the role of agriculture in development and sketches the agricultural production structure in Malaysia by highlighting the relative shares of food crops in terms of cultivated area, production and export earnings. It discusses the objectives of diversification and reviews the strategies adopted for this purpose since the independence of the country. Then the relevance of diversification with the competitiveness of agriculture in the country is described. Finally, it looks at the prospects of agricultural diversification in the context of the increasing globalization trend, and present conclusions.

IMPORTANCE OF AGRICULTURE TO THE ECONOMY

Agriculture continues to be accorded high priority in national development planning of Malaysia because of the following:

* The agriculture sector is vital for eradicating poverty and achieving national unity as relatively high incidence of poverty still exists within agriculture, especially among paddy farmers, coconut and rubber smallholders, fishermen and agricultural workers. The eradication of poverty is an important national agenda.
* The agriculture sector is an important source of employment (albeit on a declining scale) and hence continues to be an important source of income and livelihood to the majority of rural population. A growing agriculture sector is vital for rural development and to reduce rural-urban disparity. Activities in agriculture also result in the creation of other industries and services through backward, forward and inter-industry linkages. Jobs are created outside agriculture, such as in the inputs industry, feed milling, seed production, agricultural machinery and equipment, packaging, warehousing, distribution, transportation, marketing, insurance, credit, extension and advisory, etc.
* Agriculture is vital in fulfilling the food requirements of the nation at affordable prices. It is an important source of foreign exchange earnings for the government. Agriculture is also critical as a supplier of raw materials (Aziz, 2000) for the agro-base industrialization, which can enhance value-added activities in agriculture.
* The agriculture sector is seen as critical in the attainment of sustainable development of the country as the need to preserve environmental quality and to conserve national resources and biodiversity will impose a strong pressure on agriculture to adopt sustainable practices and systems.

AGRICULTURAL PRODUCTION STRUCTURE AND PERFORMANCE

Changing Overall Contribution

Despite the rapid development of the manufacturing and services sectors in Malaysia, the agriculture sector has been a significant contributor to the economy since the independence in 1957. The share of the agriculture sector in the economy, however, has been declining over the years. In 1950, it accounted for 50 percent of the country's GDP, which declined to 32 percent in 1970. In 1980 and 1990, its contribution

further declined to 23 and 19 percent, respectively. By 2000, agriculture's share of the GDP was less than 9 percent (Table 1).

Table 1. GDP Contribution by Sector

(Unit: Percent)

Sector	1950[a]	1960[b]	1970[c]	1980[c]	1990[c]	2000[d]
Agriculture	50.0	38.0	32.0	22.9	18.7	8.7
Manufacturing	9.0	9.0	13.9	21.2	27.0	33.4
Construction	41.0	3.0	4.0	4.6	3.5	3.3
Mining		6.0	6.6	4.8	9.8	6.6
Services		44.0	43.5	46.5	41.0	48.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Sources: Economic Planning Unit (EPU) in Prime Minister's Office (PMO), various issues.

Notes: [a] For 1950, construction, mining and services were reported in one group; [b] in 1960 prices; [c] in 1978 prices; and [d] in 1987 prices.

Similar, the agriculture sector accounted for almost 60 percent of total employment in 1960. By 1980, its share in employment reduced to only 37.2 percent. In 1990 and 2000, the share further dropped to 26.0 and 15.2 percent, respectively (Table 2).

Table 2. Employment by Sector

(Unit: Percent)

Sector	1960[a]	1970[b]	1980	1990	2000
Agriculture	58.7	49.5	37.2	26.0	15.2
Manufacturing	9.0	9.2	15.5	19.9	27.6
Construction	6.9	3.5	5.7	6.3	8.1
Mining	-	2.2	1.3	0.6	0.4
Government services[c]	9.2	-	13.3	12.7	20.3
Other services[d]	16.2	35.6	27.0	34.5	28.4
Total	100.0	100.0	100.0	100.0	100.0

Sources: EPU in PMO, various issues; and EPU in PMO, 2001.

Notes: [a] The percent values of mining in 1960 were included in manufacturing; [b] the percent values of government services in 1970 were included in other services; [c] include public administration, health, education, defense, public and private community services; and [d] include electricity, gas and water, wholesale and retail trade, hotels and restaurants and other services, transport, storage and communication, finance, insurance, business service and real estate.

In terms of exports, agriculture sector contributed about 60 percent of the total value of national exports in 1960. By 1980, the share of the sector accounted for 40 percent. Its contribution in the export earning further declined to 19.6 percent in 1990, and by 2000 it dwindled to only 6.0 percent (Table 3).

Table 3. Export Earnings by Sector

(Unit: Percent)

Sector	1960	1970	1980	1990	2000
Agriculture	60.4	55.7	40.3	19.6	6.0
Manufacturing	15.0	8.4	20.6	58.8	85.2
Mining	16.4	26.2	34.5	18.3	7.3
Others	8.2	9.7	4.6	3.3	1.5
Total	100.0	100.0	100.0	100.0	100.0

Sources: EPU in PMO, various issues; and 2001.

The declining share of agriculture in various development parameters is a normal process of the structural changes accompanying economic development in which other sectors, especially manufacturing and in more recent times the services sector, grow faster than the agriculture sector. In absolute terms, however, agriculture's contribution to total GDP of the economy has been increasing.

Agricultural Land Use

The industrial crops comprising oil palm, rubber, cocoa, pepper, pineapple and tobacco dominate the Malaysian agriculture sector. The next group is the food commodities consisting of paddy, coconut, vegetables, fruits and others (mainly tea, coffee, sugarcane, maize, sago, and cassava). Another new-emerging industrial sub-sector is floriculture.

The structural composition of the crop sub-sector, in the broader sense, has not changed very much over the last few decades. The export-oriented industrial crops, which includes oil palm, rubber and cocoa, remained dominant on the agriculture scenario. In 1985, these crops accounted for 78.1 percent of the total land use in agriculture. In 1995, the composition decreased marginally to about 78.01 percent, but the three major crops share surged up to 80.2 percent in 2000 (Table 4).

Table 4. Agricultural Land Use, Malaysia 1974-2000

(Unit: 000 ha)

Crops	1974		1985		1990		1995		2000	
Oil palm	485.1	(13.97)	1,468.2	(30.87)	2,029.5	(36.65)	2,507.6	(43.58)	3,460.0	(55.53)
Rubber	1,938.9	(55.86)	1,950.4	(41.01)	1,823.1	(32.93)	1,727.0	(30.02)	1,430.7	(22.96)
Cocoa	13.1	(0.38)	304.0	(6.39)	419.8	(7.58)	254.5	(4.42)	105.0	(1.69)
Paddy	428.6	(12.35)	661.4	(13.91)	662.6	(11.97)	592.4	(10.30)	572.2	(9.18)
Coconut	197.2	(5.68)	224.1	(4.71)	314.1	(5.67)	298.7	(5.19)	220.0	(3.53)
Pepper	1.0	(0.03)	5.4	(0.11)	11.5	(0.21)	8.6	(0.15)	11.5	(0.19)
Vegetables	5.9	(0.17)	9.8	(0.21)	31.4	(0.57)	42.0	(0.73)	51.4	(0.83)
Fruits	43.2	(1.24)	116.8	(2.45)	177.3	(3.20)	244.5	(4.25)	297.4	(4.77)
Tobacco	-		16.2	(0.34)	10.2	(0.18)	10.5	(0.18)	15.0	(0.24)
Others*	358.1	(10.32)	-		57.5	(1.04)	68.1	(1.18)	67.5	(1.08)
Total	3,471.1	(100.00)	4,756.3	(100.00)	5,537.0	(100.00)	5,753.9	(100.00)	6,230.7	(100.00)

Sources: EPU in PMO, various issues.

Note: Figures in bracket are percentage share of each crop in the total sown area; and* tea, coffee, and other crops.

However, noticeable structural changes can be observed within the industrial crops. For example, a substantial decline occurred in the rubber and cocoa area and a significant increase in the land area devoted to oil palm. Rubber and cocoa areas declined at an average rate of 2.4 and 13.9 percent per annum, respectively. This was due to the continuing decline in international prices of both commodities and a general shortage of labor in the agriculture sector making these enterprises less economically attractive. Strengthening prices of palm oil resulted in substantial areas of rubber and cocoa being converted to oil palm. For the period 1990-2000, the area under oil palm increased from about 2.0 to more than 3.4 million ha, registering an annual growth of 5.5 percent per annum. Oil palm now accounts for about 56 percent of the total land area devoted to agriculture, up from only 14 percent during 1974.

Next to industrial crops, the most important crop is paddy. The area under paddy continuously decreased during 1992-2000 at an average rate of 1.5 percent per annum from of 662.6 thousand ha in 1990 to 572.2 thousand ha in 2000.

Coconut is the next most important crop in terms of land area. Once it was considered as an important traditional crop providing output of multiple uses with coconut oil as its core product. It was grown by both plantation and smallholders. However, with the advent of oil palm as a more efficient producer of edible oil, coconut is now considered a sunset industry with many abandoned holdings. The area under coconut has dwindled to 220.0 thousand ha in 2000, from 314.1 thousand ha in 1990, a reduction of about 30 percent in land area during the period.

With the launch of the First National Agricultural Policy (NAP) in 1984, the cultivation of fruits and vegetables was actively encouraged resulting an increase in the planted area of these crops at more than 10 percent per annum rate between 1985-2000. In 1985, the area under fruits and vegetables (including pepper) was 43.2 and 6.9 thousand ha, which increased to 297.4 and 62.9 thousand ha, respectively in 2000 (Table 4).

Agricultural Production

In terms of production, crude palm oil (CPO) and palm kernel oil increased about nine and 30 times during 1975 to 2000 (Table 5). This was due to favorable prices in the international market, which induced farmers to bring more area under palm oil. The CPO production increased by 7.8 percent per annum, from 7.8 million mt in 1995 to 10.8 million mt in 2000 due to improvement in yield and expansion in area under matured trees.

Table 5. Agricultural Production, 1975-2000

(Unit: 000 mt)

Commodity		1975	1985	1990	1995	2000
Industrial commodities:	Rubber	1,459.0	1,470.0	1,291.0	1,089.0	616.0
	CPO	1,258.0	4,133.0	6,094.6	7,811.0	10,840.0
	Palm kernel oil	108.0	511.0	1,844.7	2,396.0	3,220.0
	Cocoa	13.0	103.0	247.0	131.0	70.0
	Pepper	32.9	19.0	31.0	13.0	24.0
	Pineapple	215.3	151.7	168.3	140.0	184.0
	Tobacco	9.2	10.5	10.2	10.0	11.0
	Flowers[a]	n.a.	n.a.	56,474.8	365,070.0	501,697.0
Food commodities:	Paddy	1,996.0	1,953.0	2,016.3	2,159.2	2,235.0
	Fruits[b]	422.3	638.1	1,530.8	2,190.5	3,300.0
	Vegetables[b]	401.4	540.7	693.9	718.0	1,019.0
	Coconut[c]	125.7	127.4	1,257.0	1,389.0	550.0
Fisheries:	Marine	356.5	618.6	951.3	1,108.0	1,256.0
	Aquaculture	12.3	55.0	52.3	133.0	255.0
Livestock:	Beef	12.1	16.5	12.8	17.0	28.0
	Mutton	0.8	0.6	0.8	0.8	1.0
	Pork	129.1	164.3	227.9	283.0	150.0
	Poultry	126.2	220.0	385.9	687.0	1,050.0
	Eggs[c]	1,906.0	3,285.0	5,505.0	6,242.0	8,291.0
	Milk[d]	1.4	23.8	28.9	37.0	50.0

Sources: EPU in PMO, various is; and Ministry of Agriculture, 1980.
Notes: [a] 000 stalks; [b] refer to commercial cultivation; [c] million units; and [d] million liters.

The production of rubber, on the other hand, declined at 3.1 percent per annum during 1990-95. It plummeted during the period 1995-2000 when the production declined from 1,089 thousand mt in 1995 to about 616 thousand mt. This drastic reduction in production was caused by the decrease in tapped area and yields, labor shortages, high cost of production and protracted low rubber prices.

Similarly, the production of cocoa declined at 9.3 and 14.8 percent per annum, respectively, during the period 1990-95 and 1995-2000. Between 1990-95, prolonged low prices discouraged producers from attending to the cocoa trees and led to reduce planted area to cocoa. During the period 1995-2000, adverse weather conditions, labor shortages and the high cost of production contributed to the decline.

Floriculture was another industry which was successfully promoted following the launching Second Industrial Master Plan (IMP2) in 1996. In 1990, 56.5 million stalks of flowers were produced. By 1995, the production reached 365.1 million stalks and in 2000, the figure recorded was 501.7 million stalks (Table 5). The industry achieved a fantastic average rate of increase of more than 21 percent per annum over the decade.

Despite decrease in the area under rice during 1985-2000, its production continued to expand during this period. The production of paddy increased by 1.4 percent per annum during 1990-95 reached at 2.1 million mt in 1995, up from 2.0 million mt in 1990. Through productivity improvements, a further growth of 1.0 percent per annum was achieved, thus recording a production of 2.2 million mt in 2000 (Table 5). Almost all farming operations in the major paddy growing areas were fully mechanized resulting in lower labor input and reduced cost of production. Average yields also improved following the intensification to promote commercialization through group farming and greater private sector involvement.

The production of fruits and vegetables expanded during the whole period of 1975-2000 to meet the local and export demands following the active participation of plantation companies and State enterprises. This contributed significantly to the development of the agriculture sector, especially during the 1995-2000 period. Between 1990-95, fruits output increased by 7.4 percent per annum while vegetables recorded a moderate growth of 0.7 percent per annum. During 1995-2000, both fruits and vegetables registered strong annual growths of 9 and 7 percent per annum, respectively. The major fruit types include banana, papaya, pineapple, watermelon, star fruit, mango, durian, rambutan, guava and citrus fruits. The increasing trend in fruits and vegetables production, especially during 1995-2000, was due to expansion in planted areas, and provision of basic infrastructure and inputs as well as organized and commercial cultivation.

With the exception of pig, the production of other food commodities; namely, livestock products, marine and aquaculture fisheries also increased at varying rates during 1990-2000 (Table 5). The increase in the production of beef, mutton and milk was due to an enhanced participation by land development agencies through integration of livestock rearing in oil palm and rubber plantations coupled with effective veterinary and extension services. The abolishment of import duty on animal feeds since 1991 also helped boosting livestock production.

The poultry industry was the main source of growth for the livestock sector, registering strong growth through out 1975-2000. Production increased from 126 thousand mt in1975 to over 1 million mt in 2000 (Table 5). Egg production also increased at an average rate of 10.3 percent per annum during 1975-2000 to meet the local and export market demands.

Fishery production increased by 2.5 percent per annum from 1.1 million mt in 1995 to 1.3 million mt in 2000, of which 85 percent was from marine catch and the rest from aquaculture. The positive performance in the fishery sub-sector was due mainly to the promotional efforts by the government in attracting the private sector to participate in commercial ventures and in using new technologies. In aquaculture production, the expansion was also due to greater participation by State and foreign enterprises.

Structural Changes in Agricultural Export

Since the early 1950s, Malaysia's economy was predominantly based on the production and export of tin and rubber as raw materials with very little value-added activities in the domestic sector. During that period there were already some 1.5 million ha of rubber in the country spearheaded by the expanding world automobile and transport industry. With the advent of synthetic rubber, the Malaysian rubber industry was under the threat of cheaper substitutes. This led to fall as rubber prices and drastic reductions in incomes of those involved in the industry as well as foreign exchange earning of the country. The share of rubber in total export value from agriculture progressively declined from 25.4 percent in 1985 to 13.4 percent during 2000, while the share of palm oil increased from 37.0 to 51.9 percent during this period (Table 6).

As noticed in the last section, the palm oil production increased during 1995-2000 but the export earnings from palm oil declined by 4.3 percent between 1995 and 2000 (Table 6). This was due to the fluctuation in the price of CPO from MR (Malaysian ringgit) 1,472/mt in 1995 to its highest peak at RM2,377.5/mt in 1998 before falling to RM1,000/mt in 2000. The price fluctuation was caused by an increase in world production and build-up in stocks as well as competition from other edible oils. This fluctuation in prices, however, did not change the relative position of palm oil in the total export, as it is still the major export earning commodity in agriculture and export from agriculture remained highly concentrated on rubber palm oil (Table 6).

Table 6. Agricultural Export Earnings by Commodity

(Unit: RM million[a])

Commodity	1990	1995	2000
Rubber	3,028.1 (25.4)	4,038.3 (21.2)	2,571.0 (13.4)
Palm oil	4,411.0 (37.0)	10,395.0 (54.5)	9,948.0 (51.9)
Cocoa	448.5 (3.8)	172.0 (0.9)	33.0 (0.2)
Fruits	306.1 (2.6)	335.1 (1.8)	701.2[b] (3.7)
Vegetables	125.4 (1.0)	160.5 (0.8)	n.a.
Live animals	385.0 (3.2)	552.5 (2.9)	736.9 (3.9)
Meat and meat preparation	44.4 (0.4)	21.3 (0.1)	26.6 (0.1)
Dairy products	157.4 (1.3)	245.8 (1.3)	403.1 (2.1)
Fish, crustaceans, mollusks and preparation thereof	606.8 (5.1)	824.6 (4.3)	1,236.1 (6.5)
Feeding stuff for animals	280.5 (2.3)	326.1 (1.7)	597.8 (3.1)
Others	2,138.1 (17.9)	1,997.8 (10.5)	2,895.7 (15.1)

Sources: Ministry of Agriculture, 1999; EPU in PMO, various issues.

Note: Figures in parenthesis are percentage share of the commodity in the value of total export; [a] approximately RM3.0 = US$1.00 during 1996-2001; and [b] including vegetables.

STRATEGIES FOR AGRICULTURAL DIVERSIFICATION

Diversification may be viewed as enhancing the production and consumption choices available to an economy. In the context of this study, we have focus our attention to the diversification in production, which means undertaking activities to increase the array of crops and products in the agriculture sector's portfolio (Hasan, *et al*., 1990). Opposite to specialization, diversification usually leads to expansion and deepening of the agricultural production base.

Diversification may be horizontal or vertical. The horizontal diversification relates to the cultivation of an increasing number of crops within the agriculture sector. The vertical diversification, on the other hand, refers to the manufacture of production inputs as well as the intermediate or finished products. This involves both upstream and downstream activities, or the backward and forward linkages.

In pursuing the diversification policy, both horizontal and vertical diversification was promoted. The horizontal diversification has been the major approach taken in the initial development plans following independence and is still being applied selectively in recent times. Vertical diversification, on the other hand, was aimed at realizing the full potential and benefits from the whole food chain. Following strategies were adopted to diversify agriculture production in Malaysia.

Government Commitments

Malaysia's success in implementing the diversification policy in agriculture production can be attributed to the commitment by the government through complementary programs undertaken by public agencies. These commitments have been laid down in the five-year development plans as well as in specific sectoral plans; namely the IMP and the NAP. Active participation by public land development agencies at the Federal and State levels as well as by the private plantation houses have all contributed to the expansion of cultivated areas in oil palm and cocoa, and to a certain extent, in fruits.

Infrastructure and Institutional Development

In addition, the government also invested in physical infrastructures such as drainage and irrigation facilities and farm roads, provided credit, subsidies, and training and extension, and strengthened marketing. More importantly, diversification from traditional crops into new crops and from raw materials and waste products into downstream processing of intermediate and finished products was made possible due to the capable support of research and development (R&D) institutions in developing appropriate technologies and product.

As an example, the success story on oil palm is not only attributed to R&D but also to accompanied by other initiatives, such as penetrating and deepening of markets, and providing conducive regulatory framework. Three main institutions involved in the oil palm industry are the Palm Oil Registration and Licensing Authority (PORLA), the Palm Oil Research Institute of Malaysia (PORIM) and the Malaysian Palm Oil Promotion Council (MPOPC). Lately, the PORLA and PORIM have been merged to form the Malaysian Palm Oil Board (MPOB), responsible for regulatory measures, marketing and R&D.

Food crops, like sugarcane, soybean, maize, groundnuts, cassava, among other faced some constraints and targets in these crops did not fully materialize. This group of crops is considered to be a minor group. Its contribution to agricultural output is negligible. The development of these crops is very much left to market forces and there was very little government intervention.

OBJECTIVES OF DIVERSIFICATION

Searching for Alternatives

Since the introduction of synthetic rubber, the need to diversify the country's agricultural base were pressing and crop diversification policies were inevitable to find a more viable alternative to rubber. The main concern surrounding diversification stemmed from the fact that Malaysia was the world's largest producer and exporter of rubber, and later, also of palm oil. Moreover, Malaysia was also at the forefront in terms of exports for cocoa and timber. All these implied that the country could not continue to expanding production and exporting these commodities indefinitely, without eventually adversely affecting or being affected by their prices.

Adjusting to the Changing Environment

In addition, Malaysia's diversification policy was established on varying premises to suit the changing needs. During the time of falling prices for major export commodities, the government used diversification to broaden the nation's agricultural base and stabilize income and employment. While at other times, especially when food prices and food import bills are disproportionately high, attention was drawn to the need for more food production for food security reasons. In any case, the long-term objective of diversification was to widen the sources of growth and a strategy to insure against extreme fluctuation in prices and earning risks.

Achieving Stability and Growth

As the contribution of agriculture in terms of its share to economic growth declined, diversification was pursued to revitalize the sector and thereby secure and generate new sources of growth. In this regard the diversification policy and strategy was aimed not only to achieve stability for the economy but also to achieve growth with stability for welfare improvement.

Ensuring Food Security

Concerns over the instability and inadequacy of agricultural income, especially following the recession of 1985-86, coupled with concerns about the rising import bill for agricultural products, the diversification approach was implemented to ensure partial food security through domestic production.

Widening Inter-sectoral Linkages

With the commitment to accelerate industrialization plan and as the country aspires to attain a developed nation status, the objective of diversification was to exploit the value-added from increasing downstream activities through processing of agricultural raw materials and food crop outputs, thereby widening the inter- and intra-sectoral linkages and providing additional income and employment in the farm and non-farm sectors.

AGRICULTURAL DIVERSIFICATION AND INTERNATIONAL COMPETITIVENESS

Agricultural development strategies in the years following independence were mainly focused on providing employment, enhancing earnings and saving foreign exchange. Through the diversification policy,

the country aggressively pursued an expansionist policy for export crops such as rubber, oil palm and cocoa. Import substitution strategy was also adopted by promoting food commodities, such as fruits and vegetables in order to save foreign exchange.

Policy Interventions

During 1970-90, many sub-sectors in agriculture were protected through tariffs and non-tariff barriers such as quotas and other import barriers. At the same time, the exports were heavily taxed to generate revenues for the government to finance its operating and development costs.

It was only during the launching of the NAP2 (1992-2010) that greater emphasis was given to address productivity, efficiency and competitiveness in the agriculture sector. The NAP2 did recognize the importance of liberalization of the agriculture sector, although the country had already started to reduce tariffs for intermediate products and raw materials during the Second (1971-75) and Third (1976-80) Malaysia Plan periods. Efforts to further liberalize the sector were intensified. Protective interventions were replaced with incentives. Subsequently, the government launched the NAP3 in 1999, the Third Outline Perspective Plan (2001-10) and the Eighth Malaysia Plan (2001-05), where firm commitments are made to liberalize the sector as well as create conducive environment to make the sector more competitive in the perspective of globalization and liberalization of trade.

Competitiveness Indicators

Ariff (1998) analyzed competitive indicators for some major commodities using specific ratios such as FOB and CIF prices and wholesale prices to world prices. He found that Malaysian palm oil was competitive in the international market, although its competitiveness had lowered in recent years. This is due to high cost of inputs, especially labor. The less than one ratio of farm price to world price of palm oil is also an indicative of Malaysian competitive in palm oil production.

For rubber the situation is opposite. The FOB to world price and the farm price to world price ratios, both less than one, showed that Malaysian rubber was competitive until 1993 despite the invention of synthetic rubber as substitute. However, the ratios for the last three consecutive years has increased pointing to reduced competitiveness of Malaysian natural rubber in the international market. This loss of competitiveness may be due to the emergence of other lower cost rubber producing countries, prolonged depressed prices and a general rise in the cost of rubber production in Malaysia.

For cocoa beans production, Malaysia is still competitive. However, the situation is changing as many producers are switching to oil palm due to high labor requirements for cocoa production and also better returns in oil palm.

On the food front, the food trade balance continued to widen in favor of imports. Food imports increased by 10.7 percent per annum, from RM7.8 billion in 1995 to RM13 billion in 2000, mainly due to the depreciation of the ringgit as well as the varied taste of consumers. Potential exists to narrow down this gap.

By looking at the value of exports in some of the other commodities targeted under the diversification policy, we are fairly confident that the fruits and vegetables industry as well as the poultry and egg industry are still competitive in the international market. This is evident from the increasing trend in the volume and value of exports of these commodities. For fruits and vegetables, the value of exports increased from RM379.2 million in 1990 to RM496.0 million in 1995 and further to RM701.2 million in 2000. The increasing trend in export started in 1990, when the value was RM379.2 million.

The factors contributing to the successful implementation of the diversification policy and strategy also contributed in enhancing the competitiveness of these commodities. For example, strong support for R&D to generate science-based low cost technologies and improve product quality along with monetary and fiscal backup from government has generated the desired results. Additional factors include political stability and improvement in infrastructure and utilities especially with the advent of the information and communication technologies (ICT) and the development of the knowledge-based economy enhancing business and commerce. All this has attracted investments in the knowledge-intensive enterprises, which helped achieving and sustaining the competitiveness of agriculture sector.

FUTURE PROSPECTS OF AGRICULTURAL DIVERSIFICATION

The country's new National Vision Policy emphasizes the need to build a resilient and competitive economy, as well as an equitable society to ensure unity and political stability. In view of the increasing globalization and liberalization trend, Malaysian agriculture is confronted with serious challenges and strategic choices have to be made in positioning itself.

The Agreement on Agriculture (AOA) provides a basis for commodity-based diversification in developing countries in general. The new trade and tariff rules should increase transparency, stability and predictability in the agricultural market. For Malaysian agriculture, it is clear that the way ahead is to pursue both horizontal and vertical diversification. The IMP2 and NAP3 have identified new activities with good market prospects and high potential to attract private sector investments. In the crop sub-sector ample opportunities exist to promote pharmaceutical, natural and bio-products, tropical fruits and vegetables, and floriculture. The emergence of numerous ethnic and niche markets provides opportunities for the food crops sub-sector. There is now increasing demand for organically produced foods and raw materials. Beverage crops and selected herbs also offer good prospects given the consumers' preferences for non-alcoholic and health beverages. The livestock industry can expand on the potential demand of exotic meat products as well as equine and exotic animals for exports. Aquarium or ornamental fish and aquatic plants are yet another option to be considered.

Decisions to diversify into new enterprises are usually made by the private sector. However, government should provide appropriate incentives to attract investment in potentially rewarding areas. As the new economy is strongly based on knowledge, government role in strengthening R&D services and providing highly trained and qualified human resources has dramatically increased. In the face of globalization, securing market opportunities through contractual farming will become a major determinant in achieving international competitiveness. Last, but not least, the infrastructure to establish new and emerging enterprises and to cope with the new international order of sustainable development requires attention.

CONCLUSION

The success of agricultural diversification depends on maintaining the competitiveness in world market in combination with the capacity of the human resources to grab new markets by using low cost technologies. All this can be achieved only if the government continues transforming the agriculture sector into knowledge-intensive. For this purpose, all necessary support to develop human resource, infrastructure, R&D and other institution need to be continued at much higher level. Such efforts will generate highly qualified trained manpower and technological environment to garb new profitable products in new markets. This will not only enhance competitiveness, but also promote diversification in the domestic production and consumption system.

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8. MONGOLIA

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STATUS OF AGRICULTURAL DIVERSIFICATION

Mongolia faces a severe continental climate. Temperature can drop to -40ºC generally remain in the range of -17ºC to -24ºC in winter, although during the brief summer it occasionally exceeds 40ºC. Magnolia is divided into five agro-ecological zones (Table 1).

Table 1. Climatic and Environmental Characteristics by Agro-ecological Zone

Region	Average Elevation (m)	Average Temperature (ºC)		Frost-free Days (No.)	Annual Precipitation (mm)	Wind Speed (m/sec)
		January	July			
Hangai-Hobsgol	3,000	-18 to -24	8-15	60- 80	>400	2-4
Central and eastern steppe	900-1,500	-20 to -21	19-22	120-140	150-250	4-6
Selenge-Onon	1,500-2,000	-21 to -22	15-19	100-120	300-400	4-6
Altai	2,500-3,000	-18 to -23	13-19	87-113	400-500	3-6
Gobi desert	700-1,300	-17 to -19	19-22	120-140	120-250	4-5

Source: Metrological and Hydrological Institute of Mongolia, 1999, Ulaanbaatar (official files).

In the North, towards the Siberian border (Hangai-Hobsgol), annual precipitation reaches >400 mm and average frost-free days are only 60-80. Towards the southern border with China, the Gobi desert region may have 140 frost-free days per year, but precipitation levels may drop as low as 120 mm. Lakes and tree cover are present only in the northern regions of the country close to the Siberian border. Large areas in the center and east are covered by steppe, characterized by rolling grassland and low mountains. In south, the Gobi desert area is largely flat with gravel and rebel-strewn surface broken only by isolated hills where local snow run-off may create seasonal streams.

Overall, Mongolian climate is unfavorable for crop production. The climatic condition, scarcity of accessible water, and extensive grasslands has combined to make Mongolia a pastoral country. Therefore, since centuries, Mongols depend almost exclusively on vast herds of grazing animals, including cattle, yaks, sheep, goats, horses and camels. The commercial crop production in the country did not commence until the late 1950s.

Mongolia still has the lowest population in the world: 1.4 persons per km^2. Settlements are widely scattered, with limited infrastructure and communication.

Few crops can be grown only under irrigated condition to avoid frequent crop failure. The limited productivity of grasslands necessitates extensive and transhumance grazing patterns.

Livestock dominates the agriculture sector in Mongolia. In 1999 some 33.6 million animals were recorded (Table 2). About 78 percent of livestock population consists of sheep and goats, 21 percent are cattle and horses, and only about 1 percent are camels.

Livestock numbers in Mongolia expanded rapidly, especially since 1990, due to policy shift from a centrally planned to the privately managed system. Despite substantial technical assistance from Russia over the last three decades, arable farming still accounts for less than 0.8 percent of the land area in Mongolia. The farming is highly concentrated to cereals, mostly wheat although limited quantities of barley and rye are also produced. For example, for over 93.0 percent of planted area during 2000 went to cereals (Table 3). Potato and other vegetables accounted for only 3.8 and 2.6 percent of planted area, respectively. Arable production is also highly seasonal in nature as it is mainly limited from July to October.

Table 2. Number of Livestock

(Unit: 000 head)

Animal Type	1990	1995	1996	1997	1998	1999
Camel	537.5	367.5	357.9	355.4	356.5	355.6
Horse	2,262.0	2,648.4	2,770.5	2,893.2	3,059.1	3,163.5
Cattle	2,848.7	3,317.1	3,476.3	3,612.8	3,725.8	3,824.7
Sheep	15,083.0	13,718.6	13,560.6	14,165.6	14,694.2	15,191.3
Goat	5,125.7	8,520.7	9,134.8	10,265.3	11,061.9	11,053.9
Total	25,856.9	28,572.3	29,300.1	31,292.3	32,897.5	33,589.0

Source: National Statistical Office of Mongolia, 2000.

Table 3. Sown Area during 2000

(Unit: 000 ha)

Type	1990	1995	1996	1997	1998	1999	2000
Cereals	651.1	356.5	332.6	316.9	306.9	279.1	194.7
Potato	12.2	6.1	6.9	6.6	8.1	8.8	7.9
Vegetables	3.6	3.2	3.2	4.3	5.5	4.8	5.4
Fodder crops	8.0	6.0	4.3	4.7	4.9	1.7	0.8
Total	674.9	371.8	347.0	332.5	325.4	294.4	208.8

Source: National Statistical Office of Mongolia, 2000.

Until now, productivity of the Mongolian agriculture sector has remained very low with high level of risk involved. Farmers and companies use diversification as main tool to spread agricultural risk. Therefore, they have many types of farming-related enterprises, such as livestock and agro-processing. For example, farmers grow fodder crops to diversify their incomes from crops to the livestock products. It is one example of diversification at the micro level.

In order to improve productivity of animals, our specialists and herders have achieved big successes in improving the herd's origin and breed. As a result of these efforts, farmers now have fine-wool breeding-sheep (*Khangai* and *Orkhon*), cashmere breeding-goat (Gobi *gurvan saikhan*), and meat breeding-cattle (*Selenge*). At the same time, many new varieties of wheat, potatoes and vegetables, which adapt very well to Mongolian natural and climatic conditions, have been developed. Also dairy cow farms have been developed in order to meet the milk demands of the population in big cities.

As a short-term consequence of restructuring of the Mongolian economy including privatization of agriculture sector since 1990, the volume of crop production such as wheat, potato and egg have plummeted (Table 4). This is because of reduction in input use, increase in imported goods and scarcity of raw materials for agricultural processing. However, the livestock products such as meat and cashmere, which have comparative advantage in the Mongolian economy, have increased whereas wool production remained almost stagnant during the 1990s. Among the crop sector, the production of vegetables is picking up again, after an initial decline due to the adjustment process.

Table 4. Output of Main Agricultural Products

(Unit: 000 mt)

Product/Type	1990	1995	1996	1997	1998	1999
Meat, slaughter weight	248.9	211.7	259.9	240.5	268.3	289.0
Sheep's wool	21.1	19.6	19.5	18.3	20.1	20.9
Cashmere	1.5	2.1	2.5	2.6	2.9	3.3
Egg (million pieces)	718.3	261.4	220.1	240.0	194.9	169.5
Wheat	596.2	256.2	215.3	237.7	191.8	168.4
Potato	131.1	52.0	46.0	54.2	65.2	63.8
Vegetable	41.7	27.3	23.8	34.0	45.7	39.0

Source: National Statistical Office of Mongolia, 2000.

GLOBALIZATION AND INTERNATIONAL COMPETITIVENESS

Mongolia is at the top in the world in raising animals, but the growth in the industry and its share in world export are dismal. This suggests that Mongolian enterprises are not efficient producers of raw material and high value products, or selling products internationally. This is because Mongols have little experience in competing with other countries due to decades of isolation from the world economy, leading to slower growth and relative poverty. Unless businessmen are trained to face competition from international market, this situation may get worse with the globalization and integration of the Mongolian economy into the international economy as the competition, especially in the agriculture sector, will be more sever in the near future.

In the present globalization scenario, Mongolia has no choice except to compete, but it does have a choice with regard to how and where to compete. There are several industries in Mongolia that has a comparative advantage or can achieve global competitiveness in the next few years. These industries include cashmere, meat and skin and cattle-hides. But Mongolia lacks the certification necessary for export of meat. To produce quality meat for international standard and to qualify for export certification need investment on the modernization of the processing of livestock products.

Meat

Exports of casings for sausages are growing rapidly and its demand particularly from Germany is very strong. Potential demand for meat to East Asian markets, including Japan and Korea may also be gained. But competition from Australia and New Zealand in these high-income markets will be strong, and Mongolia will find it hard to penetrate the market unless transport links and slaughterhouse facilities are improved substantially.

The major short- to medium-term market for Mongolian meat is considered to be Siberia. But the share of Mongolia in the Siberian meat market, once a sole supplier, has declined during the transition period from a socialist economy to a market economy.

Hides, Skin and Leather

Mongolia would appear to possess considerable comparative advantages in the hides, skins and leather, due to its enormous livestock population and low labor costs. However, the quality of the final product produced may need improvement. Mongolian industry is not able to meet international quality standards. Part of the problem lies with the immediate bereavement of hides and skins particularly for those animals slaughtered away from slaughterhouses. The prospects of these products in the Siberia market is positive, but in this market Mongolia have to compete with Turkey, currently a major supplier. Interviews with buyers in Irkutsk and Ulan-ude revealed that the quality of Mongolian leather products was still perceived better than the Turkish ones.

Cashmere

One of the most widespread industries in Mongolia is cashmere. About one-fourth of the world's supply of cashmere in 1998 came from Mongolia (Table 5). In this product, Mongolia competes against China, Australia, Nepal, and Afghanistan.

Table 5. Volume of Cashmere Produced in the World during 1998

Country	Volume (mt)	Percentage Share
China	6,250.0	54.8
Mongolia	2,720.3	23.9
Pakistan	400.0	3.5
Afghanistan	2,000.0	17.5
Australia	20.0	0.2
New Zealand	8.0	0.1
Total	11,398.3	100.0

Source: Information of Market Researching Institute of Mongolia, 1999, Ulaanbaatar (official files).

Until 1994, Mongolia exported only raw cashmere. However, it can earn many times more if instead value-added products are exported. This is because the prices of processed output are many times more than of raw material (Table 6). The processing of cashmere in the country can bring sustainable development as it can bring value-added and generate income and employment for the Mongols.

Table 6. World Market Price of Cashmere

(Unit: Mongolian tugrik [MNT] 000/mt)

Product Type	1993	1994	1995	1996	1997
Goat down	11-16	33- 45	20-30	13-18	11-15
Processed cashmere	60-70	100-120	80-90	70-80	50-55

Source: Information of Market Researching Institute of Mongolia, 1999, Ulaanbaatar (official files).
Note: MNT1,102 = US$1.00 during 1999.

In 1995, governments decided to export processed cashmere. Mongolian processors compete with processors in Italy, Scotland, China and the United States, who design and produce clothing out of cashmere. However, there are only three plants in Mongolia that produce final garments from cashmere for sale in retail stores in the United States, Europe and Japan.

Despite its development role, the Mongolian cashmere processing industry has number of constraints. Credit is one of the major constraints. Today many processors cannot afford to buy raw material. This is true particularly for those that do not have foreign partners. Therefore, encouragement of the private sector financial institution can help to alleviate this constraint. The supply of credit through government institutions should be managed in a way not to crowd out the private sector operation.

Lack of information about the world cashmere markets and their customers is another major constraint. Mongolian cashmere garments are almost unknown in the world. The first step to greater international competitiveness for an industry is to learn about the world's markets and customers, so that it can tailor goods to suit those needs. Just as it is essential to get information from customers it is also essential to give information to customers about the quality of the product. Therefore, the second step is to improve the marketing strategies for the Mongolian cashmere products. For this purpose, aggressive marketing search and campaign needs to be organized. This will not only increase customers' demand but also industry's revenue.

The processors' requirement is clean and properly sorted cashmere that can be used to make proudest quality. The consumer wants fine cashmere, preferably fewer than 16 microns, and are willing to pay even higher prices for cashmere of 14 or 15 microns. Fiber length is also important as it makes yarn stronger, and processors can use such fiber in many alternative uses. However, about 80 percent of Mongolian cashmere produced in 1999 have more than 16 microns. Moreover, cashmere microns have deteriorated overtime as only 37 percent of cashmeres produced in 1999 were having higher than 16 microns in 1991 (Table 7).

Table 7. Structural Changes in the Cashmere Microns during 1991-99

(Unit: Percent)

Range of Fiber Micron	1991	1996	1997	1998	1999
Below 14.5	0	0	0	4	0
14.51-15.0	0	3	0	10	2
15.01-15.5	0	17	41	14	7
15.51-16.0	64	68	32	43	21
16.01-16.5	20	6	10	22	37
16.51-17.0	16	3	3	3	17
17.01-17.5	0	3	5	1	6
Above 17.5	0	0	9	3	10
Total	100	100	100	100	100

Source: Institute of Animal Husbandry 1999, Ulaanbaatar (official files).

The herder needs to focus on improving the herd's origin and breed, and make it priority to acquire fine cashmere breeding goats. This is important for the long-term competitiveness of Mongolian cashmere. Although, scientists have developed fine-wool breeding-sheep (such as *Khangai* and *Orkhon*), but the adoption of these breeds at the herd level is very limited. So there is a need to disseminate these breeds to the herders. For this purpose, government should take following steps:

1) Establishing artificial insemination facilities in major sheep raring areas;
2) Training and educating herders about maintaining the quality of wool;
3) Providing incentive to initiate contractual arrangements between herders and wool processing; and
4) Providing breeding sires for the herders on rotation basis so that they can develop their own breeds.

ENHANCING COMPETITIVE ADVANTAGE IN AGRICULTURE

Mongolian agriculture has the following advantages to compete internationally:

1) The ancient tradition of pastoral livestock has big advantage to produce ecological pure and quality livestock products at low cost.
2) The pastoral livestock production has the potential to expand.
3) Animal products, especially through pastoral raising of livestock, can be produced at a low price in Mongolia. Mongolians have to use these advantages in enhancing its competitiveness.

In the 1990, about 96 percent of livestock population belonged to the private sector. As a result of livestock privatization, this share has increasing very rapidly over the time. The growth of livestock industry during 1995-99 is averaged at 5.5 percent per annum (Table 8).

Table 8. Gross Livestock Output and Its Growth (at constant price 1995)

(Unit: MNT million)

	1995	1996	1997	1998	1999
Total value	227,874.4	247,665.6	248,485.2	266,161.3	282,509.6
Annual percentage change	-	8.7	0.3	7.1	6.1

Source: National Statistical office of Mongolia, 2000.

This impressive growth has led to overgrazing and poor quality pastures. This is because of:

1) scarcity of livestock fodder;
2) poor financial capacity of the households; and
3) lack of collateral to secure bank loans.

To overcome these constraints and achieve comparative advantage in the Mongolian livestock production, following strategies may be adopted.

Enhance Productivity

In order to improve agricultural growth in Mongolia, herders have to focus on increasing productivity of animals. Improving origin and breed of animals can helpful to achieve this objective. They also need to produce more fodder. For this purpose, high-yielding, fast-growing and cold- and frost-tolerant varieties of fodder and shrubs should be introduced to the farmers. Incentives should be provided to increase the proportion of fodder area in the arable farming.

Foster Cooperation

Small herders scattered all over the country have little marketable surplus. Hence they have poor negotiation power. Although, they may have good quality output, but they get low prices, because of limited market information. In order to solve these problems, herders need to organize themselves in cooperatives. These cooperatives can help improving the negotiation power of the individual herders by establishing good

relationships with processors. These cooperatives can be extended to get inputs, especially credit and animal healthcare. This can reduce the cost of inputs and help to improve the output quality.

Improve Quality

The best way to earn profit and sustain in the industry is to continually strive to improve the quality of livestock products. In order to do this, however, herders must be trained about proper trimming methods, quality maintenance, handling and storage and grading of the output. For example, herders need to be trained for sorting cashmere by color, age, sex, and the part of the goat from which it was combed. This will help herders to get premium prices for the high quality products, and improve the competitiveness of Mongolian livestock products.

FUTURE PROSPECT OF AGRICULTURAL DIVERSIFICATION

To meet the challenges of new economic order of competitiveness in the perspective of globalization, government encouraged the private sector since 1990. With the privatization, the number of livestock has increased at the rate of 5.5 percent per annum. However, overgrazing has becoming a problem and pasture quality is getting worse. This may influence the livestock production in the future, and deteriorate the competitive in the international market, thus limiting the opportunity to improve market share of Mongolian livestock products, such as meat, cashmere, hide and skin.

An important related issue is the poor development of infrastructure, and transport creating difficulties in collecting produce from herders, maintaining its quality, receiving information about world market, and advertising their products internationally.

However, Mongolian agriculture has enormous potential to compete in the international market. Following measures need to be adopted to enhance its competitiveness.

1. The livestock industry should learn more about the world's market place and customers, and then approach them with an appropriate product of their need. For this purpose, livestock product producers should be encouraged to participate in the international exhibitions.
2. The livestock industry needs to inform and educate consumers throughout the world about the quality, uniqueness, and diversified traditional Mongolian livestock products. For this purpose, government and the private sector should organize exhibition in industrialized countries.
3. It should establish better methods of buying and selling livestock products inside Mongolia, so that herders and producers can come closer and understand each other's demands and problems.
4. It is important to see the industry as an interrelated chain. All the player need to recognize their utmost responsibility to the industry as a whole, and create the quality and diversified products and services that can be exported for higher prices.
5. Foreign investors should be attracted through appropriate investment incentives.

Strategies to achieve the above should include:

1. improve communication and information infrastructure system through aggressive marketing;
2. integrated approach to develop the livestock sector to improve coordination between different sub-sectors of the livestock sector;
3. organize herders into cooperatives to reduce marketing and input supply costs; and
4. foster appropriate legislation to address the financial needs of the herders and attract foreign investment.

SUMMARY AND CONCLUSIONS

Owing to climatic and socioeconomic conditions, livestock sub-sector dominates the agriculture sector in Mongolia. In 1999 some 33.6 million animals were recorded: about 78.1 percent of them are sheep and goats; 20.8 percent, cattle and horses; and only 1 percent are camels.

Arable farming still accounts for less than 0.8 percent of the land area. The total sown area was some 208.8 thousand ha in 2000 and cereals accounted for over 93.3 percent of it. Farmers and companies use diversification as main tool to spread agricultural risk and increase their income. They have many types of related and unrelated enterprises, like livestock, crop and agro-processing.

Mongolia is at the top in the world in raising animals, but the efficiency of livestock production and the quality of its produce are very low. Therefore, the share of Mongolian livestock products in the world export is dismal.

Mongolia has a little experience in competing against other countries due to decades of isolation from the world economy. But the country has no choice except to compete internationally. There are several products in Mongolia that have comparative advantage. These include cashmere, meat, skin and cattle hide. But Mongolia lacks the certification, necessary for export products. To produce quality products of international standard need investment on the modernization of the whole slaughtering and preparing operations.

Mongolian agriculture has the following advantage to compete internationally:

1. The ancient tradition pastoral livestock production system has big advantage to produce ecological pure and quality livestock products;
2. The system has the potential to expand; and
3. The economic situation in the country is such that the animal products can be produced at low prices.

Mongolians have to use these advantages in enhancing its competitiveness. Strategies to enhance these advantages include launching aggressive marketing both to promote Mongolian products and understand the consumers' preferences, working on integrated approach to develop the livestock sector by looking the requirements of each component of the industry, developing cooperatives of herders to reduce marketing and input supply costs, and fostering appropriate legislation for the financial need of various component of the industry and to attract the foreign investment.

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9. NEPAL

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INTRODUCTION

The Kingdom of Nepal is a landlocked country situated between China in the north and India in the east, west and south. It has a territory of 147,181 km^2 and a population of 23 million during 2000. It is mainly a mountainous country with 80º4'-88º12' longitudes and 26º22'-30º27' latitudes. It has a spatial extension of 800 km length from east to west and the average north south breadth is about 193 km.

The country can be divided into three different ecological belts according to climate and topography. These are the Mountains, the Hills or mid-Mountains and the Terai plains. The Mountain region is divided into high Mountain and high Himal; and valleys between mid-Mountains and Terai are classified as Siwaliks. Together with the Hills and Terai, there are therefore five physiographic regions in the country. Valleys, perennial and non-perennial rivers and gorges also exist. The altitude varies from 66 m above sea level in the southern Terai to 8,848 m in the north.

With the diversity of terrain, location and seasonal characteristics, varieties of climatic features are present such as subtropical warm temperate in Terai and Siwaliks, cool climate in mid-Mountains, alpine type in high Mountains, and arctic type above 4,500 m. Total annual rainfall ranges from less than 200 to over 5,000 mm. Over 80 percent of rains in Nepal are associated with the eastern monsoons in the summer season, which occurs between June to September. As the physiography of the country varies from north to south and east to west, people, ethnicity, lifestyle and culture also varies accordingly.

Reflecting these ecosystems, agricultural system also varies. The economy of the country is still agrarian as 40 percent of the GDP is originated from the sector; 80 percent of the labor force is engaged in this sector, and even the activities of manufacturing and trading sectors are primarily dependent on agriculture. The overall economic growth in the past two decades averages around 4.5 percent per annum, and per capita income is increasing by about 2.0 percent per annum. Per capita GDP in 2000 stands at around US$250.

LAND USE AND AGRICULTURAL HOLDINGS

Nepal being a mountainous country with a rugged topography has a limited land suitable for agriculture and habitation. The agriculture census of 1991 shows the total area of 2.6 million ha operated by all agricultural holdings (Table 1). Excluding non-agricultural land (such as woodland and forest, permanent crops, pastures and ponds, etc.), the total arable land available for seasonal crop cultivation comes to about 2.3 million ha or 15.8 percent of the total area of the Kingdom during 1991, up from 10.8 percent in 1961. This increase, especially during the 1980s, was apparently contributed by the massive deforestation of the public forestland (not shown here). The total number of landholdings has increased from 1.5 million in 1961 to 2.7 million in 1991, an indication of increasing population pressure on land. Around 98 percent of the arable land is cultivated for temporary crops, and 55 percent of it is in the Terai. Some 38 percent of the arable land is in the Hills and 7 percent in the Mountain belt.

Food security is the major concern of Nepali farmers, as suggested by nearly four-fifth of the arable land allocated to cereals (Table 2). There are only marginal changes in the land use pattern during 1989-2000. The share of cereal crops in the gross area sown to all crops has declined by one percentage point, while the share of cash crop increased by the same one percentage point during 1989-2000. The shares of fruits and vegetables have slightly decreased, suggesting that the expansion of other cash crops is partly at

the cost of fruit tree and vegetable areas. The share of pulses and spices stayed almost stagnant during the period.

Table 1. Agricultural Land Use

(Unit: 000 ha)

Land-use Type		1962	1972	1982	1992
Total land area		14,718.1	14,718.1	14,718.1	14,718.1
Total arable land:	Land under seasonal crops	1,550.5	1,537.1	2,250.2	2,284.6
	Other arable land	41.4	29.9	37.3	38.8
	Sub-total	1,591.9	1,567.0	2,287.5	2,323.4
Land under permanent crops		12.2	15.0	29.2	29.4
Land under permanent pasture		22.3	10.3	42.5	36.9
Woodland and forest		13.8	4.7	15.0	108.8
Other land		45.2	57.1	89.5	95.7
Ponds		n.a.	n.a.	n.a.	3.3
Total area of holdings		1,685.4	1,654.1	2,463.7	2,597.5
Arable land as percent of total land area		10.8	10.6	15.5	15.8

Source: His Majesty Government (HMG), 1995.

Table 2. Land Use Pattern Across Crop Group during 1989 and 2000

(Unit: 000 ha)

Crop Group	1989		2000	
Cereals	3,073.6	(80.3)	3,490.0	(79.4)
Cash crops	286.8	(7.5)	390.0	(8.9)
Pulses	265.7	(6.9)	305.3	(7.0)
Fruits	54.7	(1.4)	46.5	(1.1)
Vegetables	140.5	(3.7)	150.5	(3.4)
Spices	7.0	(0.2)	10.6	(0.2)
Gross area sown	3,828.3	(100.0)	4,392.9	(100.0)

Source: HMG, 1990 and 2001.

Note: Figures in parentheses are percent of the gross area to all crops.

CROPPING PATTERN AND INTENSITY

Cropping Pattern

Cropping system vary greatly in Nepal. The cropping systems adopted by farmers are decided by the climatic, physiographic, and socioeconomic factors. These factors include altitudes, rainfall and temperatures, irrigation and transport facilities, turn-around period between two crops, labor availability, input-output prices, and the ethno-social behavior of the farmers. Agriculture in Nepal is mostly subsistence in nature, and household food security is the major factor determining the crop choices.

Rice is the most important crop in Nepal. In Terai and the irrigated low lands of Hills and even Mountains, the most common cropping pattern is a wet season paddy followed by a dry season winter crop (wheat). In the dry season, when temperatures are high and supplement irrigation water is not available, pulses such as lentil are also grown. In some eastern Terai district of the country, jute is cultivated as a wet season crop followed by paddy, dry season wheat, mustard or winter maize. In the lowlands, where irrigation facilities are not available, paddy is cultivated as a wet season crop and is followed by mustard, lentil, mung bean, linseed or wheat. Alternatively, two crops of paddy with fallow in-between is a pattern adopted by most lowland farmers. This practice is also followed in some Hill regions but it is not possible in the Mountain regions of Nepal. In Hills, where most of the land is unirrigated, maize is the most important crop. It is grown during the wet season followed by relayed planting of finger millet. In Mountains, the cropping patterns are

also maize-based, but the maize crop is followed by buckwheat, or naked barley or barley. In some cases maize is followed by potato.

The main aims of farmers in adopting diversified cropping patterns are to maintain soil fertility and to get the maximum advantage out of the resources available under their particular geo-climatic environment. Therefore, mixed cropping, relay planting, and growing of perennials are common practices in all the ecological regions of the country. In almost all upland areas, maize, for example, is cultivated as a mixed crop with either soybean, or other beans. Before harvesting maize, finger millet is relayed to save the available moisture and to improve productivity of sequential crops. In other situations, maize is grown as a wet season crop followed by soybean and mustard. Where irrigation is possible wet season maize is followed by potato in winter. Under lowland conditions such as in the Kathmandu valley, where the demand for vegetables is high, farmers grow early paddy followed by vegetables and then potato.

Although agricultural crops grown are dictated by input-output prices, topography and climate, crop priorities of the Nepalese people are also influenced by their unique food habits. Decisions on what and how much to produce are taken by the individual farming families and depend mostly upon farmers' preference for consumption and the local geo-climatic conditions. Major crops paddy, maize, wheat, and potato are cultivated in almost all ecological regions though their importance varies considerably from region to region as a result of varying topography and food habits. Farmers in Nepal still have to learn to cultivate alternative crops which can improve the profitability of farming under their own conditions.

Cropping Intensity

Normally, almost all of the cultivated land is brought under some crop during the wet season. But in the dry season, crops and their planted area depend upon the available moisture and the socioeconomic conditions of the farmers. The cropping intensity in Nepal is not high despite the diversified cropping system. In general, it is high where irrigation facilities are available, although other factors are also important in determining the intensity.

The cropping intensity has increased from an average of 115 percent during 1961 to about 170 percent in 2000. In some places, where short duration paddy is grown and irrigation facility is available, the cropping intensity can be as high as 300 percent. In the peri-urban production systems such as in Kathmandu valley, where demand for vegetables is high, the cropping intensity can also be as high as 300 percent. On the other extreme, the cropping intensity ranges from 67 to 95 percent in the case of Bara district of the Terai. In Hills, lands are usually fully exploited if black gram, soybean, or other legumes are grown in the dry season.

CROP PRODUCTION

In the following paragraphs, growth trends in area and production of various crops are presented in order to examine the changing patterns of diversification during 1965-2000.

Cereals

Overall production of cereals (paddy, maize, wheat, millet and barley) has increased by 114 percent from 3.3 to nearly 7 million mt during 1965-2000 at an average growth rate of 2.2 percent per annum (Table 3). During this period, the area under cereals increased by 89 percent and overall yields 9 percent. The effect of Green Revolution technologies like high-yielding varieties, fertilizer, and water was relatively pronounced for rice, wheat, and millet. However, overtime decline in maize yield had reduced the effect on overall cereal yield. Moreover, the effect of Green Revolution on cereal yield was relatively small compared to other Asian neighboring countries like Pakistan, India, and Bangladesh. The growth was faster during the later decade particularly in the 1990s.

Among the cereals, paddy still occupies 47 percent of total cereal area, although the proportion has declined in the last three and a half decades. The production of wheat has increased by more than nine folds during the period with an average annual rate of 6.6 percent (Table 3).

Table 3. Change in Area, Production and Yield of Major Crops during 1965-2000

(Unit: Area = 000 ha; production = 000 mt; and yield = mt/ha)

Crop		Paddy	Maize	Wheat	Millet	Barley	Cereals Total
Area	1965	1,150	450	107	47	70	1,824
	2000	1,618	840	704	55	273	3,490
Production	1965	2,201	854	126	26	63	3,270
	2000	4,030	1,445	1,183	57	300	7,015
Average yield	1965	1.91	1.90	1.18	0.55	0.90	1.79
	2000	2.49	1.72	1.68	1.04	1.10	2.01
Percentage change (1965-2000)	Area	41 (1.0)	87 (1.8)	558 (5.5)	17 (0.5)	290 (4.0)	91 (1.8)
	Production	83 (1.7)	69 (1.5)	839 (6.6)	119 (2.3)	376 (4.6)	115 (2.2)
	Yield	30 (0.7)	-9 (-0.4)	42 (0.9)	89 (1.3)	22 (0.1)	12 (0.3)

Source: HMG, 1990 and 2001.

Note: Figures in parenthesis are average annual growth rates during 1965-2000.

Cash Crops

Cash crops, such as sugarcane, oilseed, and potato, except tobacco and jute, experienced an impressive growth in their production during 1965-2000. Overall, the area of these crops doubled from little over 200 thousand ha in 1965 to about 400 thousand ha in 2000 (Table 4). However, increase in production was more impressive, because of the gain in productivity of these crops. For example, the production of sugarcane has dramatically increased during 1985-2000. Likewise, the volume of potato production has also increased nearly three times during the same period. But, jute and tobacco experienced decreasing trends (Table 5). Production of legumes, fruits, and vegetables has increased with an average annual growth rate of 3.3, 1.8 and 4.7 percent, respectively over this period.

Table 4. Area of Cash Crops

(Unit: 000 ha)

Crop	1965	1975	1985	1995	2000	Growth Rate (1985-2000)
Sugarcane	9	15	18	42	58	8.1
Jute	32	33	27	9	15	-3.8
Oilseed	132	112	151	170	190	1.5
Tobacco	8	7	9	7	4	-5.3
Potato	29	54	80	97	123	2.9
Total	210	221	285	325	390	2.1

Source: HMG, 1990 and 2001.

Table 5. Production of Cash Crops

(Unit: 000 mt)

Crop	1965	1975	1985	1995	2000	Growth Rate (1985-2000)
Sugarcane	126	251	408	1,469	2,103	11.6
Jute	39	41	n.a.	n.a.	15	-
Oilseed	51	65	84	116	123	2.6
Tobacco	9	5	6	5	4	-2.7
Potato	286	307	420	840	1,182	7.1
Total cash crops	511	669	918	2,430	3,427	9.2
Pulses	-	-	146	202	237	3.3
Fruits	-	-	343	398	447	1.8
Vegetables	-	-	742	1,212	1,483	4.7

Source: HMG, 1990 and 2001.

Horticultural Crops

In Nepal, the varied climatic condition has made possible to grow almost all types of fruits and vegetables. Fruit trees can be planted in marginal land of the Hills and provide a good source of income to farmers in this region. Vegetables are mainly grown around urban centers and highways. Horticultural crops (including fruits, vegetables and spices) were grown on about 400 thousand ha during 2000. It comprised of 4.8 percent of total cropped area and contributed about 14 percent of total agricultural GDP in 2000.

1. ***Fruits***

Temperate fruit production in Nepal has lot of potential because of the temperate climate in mountain. Despite poor infrastructure, some fruits from Nepal are famous worldwide. For example, apples of Nepal such as Royal Delicious, Red Delicious and Golden Delicious are popular verities all over the world.

The rate of increase in fruit production is less than 1 percent during the 1990s. The increase in production mainly originated from the increase in yield while area under fruits has declined (Table 6). This suggests that unless fruit security problem is solved at the farm level and appropriate infrastructure is developed to connect farm with markets, there is little chance of improving the horticultural crops.

Table 6. Area and Production of Fruits in 2000

(Unit: Area = ha; production = mt; and yield = mt/ha)

Fruit Type		1998			2000		
		Area	Production	Yield	Area	Production	Yield
Tropical:	Mango	-	-	-	11,223	90,976	8.1
	Banana	-	-	-	4,401	48,005	10.9
	Guava	-	-	-	3,138	36,115	11.5
	Papaya	-	-	-	2,054	28,892	14.1
	Jack-fruit	-	-	-	1,392	16,169	11.6
	Pineapple	-	-	-	701	9,980	14.2
	Litchi	-	-	-	1,870	14,387	7.7
	Areca nut	-	-	-	98	146	1.5
	Coconut	-	-	-	170	345	2.0
	Sub-total	30,295	-	-	25,047	245,015	9.8
Subtropical (citrus):	Orange	-	-	-	6,588	70,824	10.8
	Sweet orange	-	-	-	2,311	26,337	11.4
	Lime	-	-	-	1,867	14,072	7.5
	Lemon	-	-	-	401	2,993	7.5
	Others	-	-	-	110	841	7.6
	Sub-total	10,233	-	-	11,277	115,067	10.2
Temperate:	Apple	-	-	-	3,278	31,197	9.5
	Pear	-	-	-	2,550	29,256	11.5
	Walnuts	-	-	-	976	3,783	3.9
	Peach nuts	-	-	-	1,879	12,886	6.9
	Plum	-	-	-	1,251	8,790	7.0
	Apricot	-	-	-	82	560	6.8
	Persimmon	-	-	-	53	358	6.8
	Pomegranate	-	-	-	90	411	4.6
	Almond	-	-	-	11	11	1.0
	Sub-total	14,196	-	-	10,170	87,252	8.6
Grand total		54,724	405,463	7.4	46,494	447,334	9.6

Source: HMG, 1990 and 2001.

2. ***Spices***

Cardamom, dry ginger and dry chilies have been prioritized in Agricultural Perspective Plan (APP) as high-value export-oriented commodities. The area under cardamom is rapidly expanding. Importance of this

crop has been realized by farmers of marginal land with perennial source of irrigation in the Hills. Currently these crops occupy about 10 thousand ha (Table 7).

Table 7. Area and Production of Cardamom and Ginger, 1999-2000

Year	Cardamon		Ginger	
	Area (ha)	Production (mt)	Area (ha)	Production (mt)
1999	9,770	4,335	8,841	81,799
2000	10,627	6,530	8,314	74,994

Source: HMG, 1990 and 2001.

3. ***Vegetables***

There are ample opportunities of producing seasonal and off-season vegetables because of geographically and climatic diversity of Nepal. HMG Nepal has given priority in Eighth and Ninth Five-Year Plan (1993-2002) to produce vegetable along the highway and peri-urban areas. Vegetable can be a good source of income and employment to farmer. In order to meet the increasing demand for vegetables due to population growth, income increase, growing concern for nutritious foods, increase in foreign tourist and growing urbanization have necessitated expanding the area under vegetables. Vegetable can assist in transforming the traditional farming system dominated by cereal crops to a commercial system of high value. Major commodities of vegetable are cauliflower (228,000 mt), cabbage (192,000 mt), tomato (144,000 mt), onion (135,000 mt) and radish (108,000 mt).

According to the available statistics for the period 1974-95, vegetable production is the fastest growing crop in Nepal. Over the 21-year period, both vegetable area and yield grew at an annual rate of about 3.0 percent, so total vegetable production in Nepal increased by 5.9 percent per year (Table 8). However, the improvements did not follow a consistent pattern. In the first decade, vegetable area expanded rapidly, but yields increased only marginally. During the following decade, there was little increase in vegetable area, but yields increased significantly, due mainly to the spread of improved varieties and increase in the use of other complementary inputs in irrigated areas. Vegetable development program under Ministry of Agriculture and Cooperatives may be the main driving force behind this increase.

Table 8. Trend in Total Area, Production, and Yield of Vegetables during 1974-2000

Period	Area	Yield	Production
1974-95	2.95	2.91	5.86
1974-83	5.68	0.59	6.19
1984-95	0.13	5.03	5.16

Source: Thapa and Paudyal, 2000.

Increase in domestic vegetable production gradually substituted import and promoted export. This has created substantial revenue in terms of exports of vegetables, mainly to Bangladesh (Table 9).

Table 9. Export of Vegetables[a]

Commodity	Year	Quantity (mt)	Value (NPR[b])	Country of Export
Vegetable seed	1998	12,550	1,381,510	Bangladesh
Garlic	1998	10,000	559,200	South Africa
Radish seeds	1999	16,285	1,678,815	Bangladesh
Radish seeds	1999	20	2,000	Nigeria
Tomato	1999	4,642	81,768	Bangladesh
Onion	1999	90,000	119,248	Bangladesh

Source: Official files, Ministry of Agriculture, Agricultural Statistics Division, Singha Durbar, Kathmandu, Nepal.

Note: [a] The Table does not include the informal export to India through a long porous border; and [b] Nepalese rupee.

4. ***Pulses***

These products offer opportunity of diversifying the dominant cereal-based cropping system in the country. With the primary objective of economic growth in rural areas of the mid-western region of Nepal, HMG Nepal and Asian Development Bank signed a project on "Secondary Crop Development" to enhance production of pulses in Nepal. This project was found satisfactory in achieving its objectives.

During the 1990s, pulses production increased from 0.16 to 0.23 million mt or by about 50 percent (Table 10). During this period, the area under pulses increased from 0.27 to 0.30 million ha, or only 15 percent. Therefore, there was surge in pulses productivity, as per ha yield of pulses more than doubled from 0.6 mt/ha in 1989 to 1.3 mt/ha in 2000.

Lentil remained the most important pulse during the 1990s. Actually, its importance has increased overtime, as its share in the total pulse area increased from 42 percent in 1989 to 52 percent in 2000. However, the relative importance of black gram and pigeon pea has improved while of grass pea and chickpea has decreased overtime.

Pulses crops, especially lentil, are export crops and a source of foreign exchange earning in Nepal. They are exported mainly to Bangladesh, Pakistan, and Sri Lanka. Overall, the country has been surplus in pulses trade until 2000. However, the exports of pulses remained almost stagnant, while their imports have increased more than six times from NPR37.8 million in 1997 to NPR237.1 million in 2000 (Table 11). Unless, productivity of pulses is increased within the country, with this rate of increase in imports, it can quickly become deficit in pulses trade.

LIVESTOCK PRODUCTION

Livestock is an integral part of Nepalese agricultural system as some 32 thousand holdings were reported to have livestock in the 1991 census. The livestock population in terms of Standard Animal Unit (SAU) has increased at the rate of 1.4 percent per annum from 1.1 million SAU in 1989 to 1.3 million SAU in 2000 (Table 12).

The cattle population estimated for 2000 is around 7 millions and 3.5 million buffaloes. In addition, 0.8 and 0.9 million milking cows and buffaloes were present in the country. Among the small ruminants, goat population was highest at 6.3 million. The number of sheep and pigs were estimated over 800 thousand each. The population of fowls were over 18 millions (Table 12).

The structure of livestock population has changed during the 1990s, as population of fowls, laying hen, duck, and laying duck increased at the highest rate, while increase in goat population was slowest.

The production of milk and milk products has increased at an annual rate of 2.5 percent from 834 thousand mt in 1989 to 1,097 thousand mt in 2000 (Table 13). This increase came from the expansion in the population of milking cattle (both buffalo and cow) at the rate of about 1.85 percent. However, as the rate of increase in milk production was higher than the rate of increase in milking cattle, there was some improvement in yield per milking animals. Our estimate suggests that the yield has increased at the rate of 0.67 percent per annum from 0.58 mt per milking animal in 1989 to 0.62 mt per milking animal in 2000. Despite some improvement, the milk yield per milking animal in Nepal is about half than the yield in Pakistan. The poor feeding quality and living conditions of the animals along with insufficient health facilities may be the main cause of the low milking yield in Nepal.

The production of total meat increased at an annual rate of 2.7 percent from 141 thousand mt in 1989 to 189 thousand mt in 2000. However, during the same period, the rate of increase in poultry and pig meat production was much higher at 6.6 and 4.5 percent per annum, respectively. The rate of increase in sheep meat was lowest. Egg production increased at the rate of 4.8 percent per annum from 288 million in 1989 to 481 million in 2000 (Table 13). The increase in livestock products, except sheep meat, was higher than the growth in human population, therefore, per capita availability of livestock products has increased significantly during the 1990s.

AGRICULTURAL MARKETING

Cereal production in Nepal is mostly subsistence-oriented, hence a little marketed surplus is generated. The problems related to agricultural marketing are as follows:

Table 10. Area and Production of Pulses Crop

		1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Area (ha)	Lentil	120,360	121,970	119,490	119,820	169,350	171,425	147,670	157,080	160,250	162,390	174,594	180,750
	Chick pea	28,830	28,190	27,040	26,970	28,140	24,098	22,793	19,080	19,030	19,280	16,046	14,756
	Pigeon pea	17,920	18,870	17,930	17,520	22,800	22,561	26,066	25,530	25,420	26,020	22,692	22,711
	Black gram	17,730	18,410	18,830	17,920	18,240	18,363	25,180	25,500	26,520	27,030	27,363	27,609
	Grass pea	38,580	38,130	40,860	38,720	40,060	40,880	36,435	34,240	30,780	26,344	16,549	11,087
	Horse gram	8,770	8,810	8,000	7,670	7,710	11,988	11,242	11,640	11,400	10,309	9,016	8,394
	Soybean	20,710	20,660	21,340	19,690	20,220	19,150	21,543	20,770	20,980	21,245	23,046	19,759
	Others*	12,830	13,500	14,230	13,550	13,260	13,440	17,472	17,810	17,880	17,952	18,702	20,249
	Sub-total	265,730	268,540	267,720	261,860	319,780	321,905	308,401	311,650	312,260	310,570	308,008	305,315
Production (mt)	Lentil	74,360	76,250	73,020	72,960	105,000	109,162	99,771	117,720	123,820	113,520	132,290	137,343
	Chick pea	17,090	16,620	16,700	16,570	15,950	13,565	16,058	13,640	13,650	13,512	12,798	12,154
	Pigeon pea	12,260	13,300	12,030	11,310	16,520	16,403	19,205	19,300	18,940	18,978	18,335	22,471
	Black gram	10,070	10,570	11,260	10,140	10,480	10,689	16,089	15,300	16,620	17,674	18,329	19,779
	Grass pea	19,810	21,190	22,990	20,700	20,040	21,002	20,681	18,170	17,340	14,303	10,486	8,169
	Horse gram	4,350	4,480	4,080	3,730	3,830	5,821	5,954	5,610	6,159	5,626	5,606	5,229
	Soybean	11,680	12,840	12,730	11,430	11,750	11,213	14,090	13,710	14,420	15,533	17,820	16,780
	Others*	7,060	7,980	8,510	7,700	7,570	7,630	10,220	11,400	12,051	12,104	13,176	15,400
	Sub-total	156,680	163,230	161,320	154,540	191,140	195,485	202,068	214,850	223,000	211,250	228,840	237,325
Yield (mt/ha)	Lentil	617.8	625.2	611.1	608.9	620.0	636.8	675.6	749.4	772.7	699.1	757.7	759.9
	Chick pea	592.8	589.6	617.6	614.4	566.8	562.9	704.5	714.9	717.3	700.8	797.6	823.7
	Pigeon pea	684.2	704.8	670.9	645.5	724.6	727.1	736.8	756.0	745.1	729.4	808.0	989.4
	Black gram	568.0	574.1	598.0	565.8	574.6	582.1	639.0	600.0	626.7	653.9	669.8	716.4
	Grass pea	513.5	555.7	562.7	534.6	500.2	513.7	567.6	530.7	563.4	542.9	633.6	736.8
	Horse gram	496.0	508.5	510.0	486.3	496.8	485.6	529.6	482.0	540.3	545.7	621.8	622.9
	Soybean	564.0	621.5	596.5	580.5	581.1	585.5	654.0	660.1	687.3	731.1	773.2	849.2
	Others*	550.3	591.1	598.0	568.3	570.9	567.7	584.9	640.1	674.0	674.2	704.5	760.5
	Sub-total	589.6	607.8	602.6	590.2	597.7	607.3	655.2	689.4	714.1	680.2	743.0	777.3

Source: HMG, 1990 and 2001.
Note: * Include field pea, cowpea, broad bean, phaseolus, masyng, mung bean, etc.

Table 11. Exports and Import of Pulses

(Unit: NPR 000)

Fiscal Year	With India		Other Countries		Total	
	Import	Export	Import	Export	Import	Export
1997	37,800	500,000	-	496,845	37,800	996,845
1998	76,100	192,400	-	824,788	76,100	1,017,188
1999	145,800	275,500	334	913,413	146,134	1,188,913
2000	237,100	957,200	-	77,675	237,100	1,034,875

Source: Official files, Ministry of Agriculture, Agricultural Statistics Division, Singha Durbar, Kathmandu, Nepal.

Table 12. Livestock Population in Nepal (1989-2000)

Category	1989	1990	1991	1992	1993	1994
Cattle	6,284,918	6,280,852	6,254,819	6,245,682	6,237,231	6,546,177
Buffaloes	3,002,803	3,012,565	3,043,920	3,058,341	3,072,682	3,175,553
Milking cow	688,615	689,374	689,685	695,130	698,931	738,709
Milking buffaloes	744,716	746,563	750,253	751,920	755,996	786,001
Goat	5,302,344	5,323,645	5,366,946	5,405,793	5,451,710	5,524,657
Sheep	910,471	892,296	906,493	912,372	911,279	913,968
Pigs	547,655	574,197	591,602	598,955	604,902	612,027
Fowl	10,158,851	13,113,008	13,558,874	13,496,245	13,600,807	13,854,820
Duck	356,684	385,498	391,723	389,542	391,718	394,363
Laying hen	3,421,258	4,052,418	4,206,459	4,187,282	4,217,864	4,295,410
Laying duck	183,450	199,839	202,411	202,352	204,806	206,706
SAU*	11,133,421	11,181,029	11,223,563	11,252,496	11,284,073	11,714,992
Category	1995	1996	1997	1998	1999	2000
Cattle	6,837,913	7,008,420	7,024,775	7,048,660	7,030,698	7,023,166
Buffaloes	3,278,255	3,302,200	3,362,435	3,419,150	3,470,660	3,525,952
Milking cow	766,451	784,940	816,270	826,320	828,214	840,673
Milking buffaloes	811,182	820,920	857,420	882,140	896,415	910,753
Goat	5,649,056	5,783,140	5,921,956	6,080,060	6,204,616	6,325,144
Sheep	918,885	859,000	869,582	869,142	855,159	851,913
Pigs	636,024	670,340	723,613	765,718	825,132	877,681
Fowl	14,063,581	14,521,100	15,576,525	16,664,730	17,796,826	18,619,636
Duck	403,705	416,100	415,758	416,943	421,423	425,160
Laying hen	4,405,505	4,548,000	4,886,764	5,181,880	5,420,900	5,667,817
Laying duck	211,758	218,240	218,065	218,687	220,400	222,401
SAU*	12,137,186	12,358,815	12,579,276	12,762,595	12,884,754	13,025,336

Source: HMG, 1990 and 2001.

Note: * SAU1 = (dry cattle*0.75) + (milking cattle*1) + (dry buffalo*0.94) + (female buffalo*1.25) + (sheep or goat*0.26) + (pig*0.5) + (fowl*0.0067) + (duck*0.01) + (laying hen*0.0067) + (laying duck*0.01).

Table 13. Changes in Livestock Products by Type and Animal, 1989-2000

Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Milk (mt):												
Cow	243,879	255,545	256,398	259,230	260,786	278,065	288,822	296,620	310,183	318,680	328,920	337,455
Buffalo	590,012	603,223	608,433	612,004	615,808	640,544	652,551	664,940	701,980	729,360	744,025	759,568
Sub-total	833,891	858,768	864,831	871,234	876,594	918,609	941,373	961,560	1,012,163	1,048,040	1,072,945	1,097,023
Net meat (mt):												
Buffalo	93,928	94,478	95,312	96,013	96,574	100,383	104,070	104,830	113,482	117,350	119,562	121,769
Mutton	2,997	2,986	3,029	3,044	3,032	3,055	3,067	2,860	2,900	2,903	2,873	2,860
Goat	28,378	28,896	29,372	29,844	30,377	30,702	30,908	32,040	34,550	35,640	36,235	36,930
Pig	9,399	9,911	10,242	10,407	10,447	10,642	11,027	11,800	12,374	13,090	13,924	14,646
Chicken	6,295	8,861	9,138	9,119	9,195	9,291	9,396	9,700	10,671	11,400	12,146	12,659
Duck	229	249	254	268	268	270	280	290	291	292	294	296
Sub-total	141,226	145,381	147,347	148,695	149,893	154,343	158,748	161,520	174,268	180,675	185,034	189,160
Egg (number 000):												
Hen	274,433	342,147	354,296	352,983	355,539	362,589	367,378	380,400	405,462	424,910	444,500	464,530
Duck	13,624	14,980	15,223	15,181	15,389	15,490	15,744	16,000	15,998	16,000	16,125	16,270
Sub-total	288,057	357,127	369,519	368,164	370,928	378,079	383,122	396,400	421,460	440,910	460,625	480,800
Wool (kg)	774,324	757,091	767,391	620,413	619,574	621,325	624,943	618,480	623,624	623,300	615,713	615,081

Source: HMG, 1990 and 2001.

1) Poor marketing infrastructure and related marketing institutions;
2) Isolation of the rural communities from the consumption centers; and
3) The open long-boarder with India, which has unpredictable impact of trade with India on the national supply system.

Nepal Food Corporation (NFC) fixes minimum support price for major cereal and cash crops. Besides, NFC supplies food to the remote districts at a subsidized price. However, the government has recently adopted policies to withdraw subsidy and help farmers to increase the production of those crops which are economically viable under local conditions. For this purpose, the government has developed market centers in different part of the Kingdom where farmers and marketing agents can interact. As a result, the farmers of Hills where transportation facilities are relatively developed have benefitted, especially from the marketing of horticultural crops.

AGRICULTURAL DIVERSIFICATION: POLICIES AND STRATEGIES

The agriculture sector has been given priority since the beginning of the planned effort for development in Nepal. During 1965-2000, fairly a large amount of fund has been invested in the development of infrastructure like road, irrigation, electricity, etc. A significant number of agricultural technicians and scientists have been produced. Research and extension programs have been strengthened to develop technologies suited to the specific agro-climatic zones of the country. Similarly, the increased use of improved seed, chemical fertilizer and irrigation facilities has enhanced the growth of agriculture.

In 1995, HMG Nepal has launched a comprehensive and inter-sectoral APP (1995 015). The primary goal of APP is to generate economic growth through agricultural commercialization. The Plan's strategy is anchored in a prioritized productive package in the pocket-package approach to be implemented by the Ministry of Agriculture and Cooperative at the field level. The main thrust of the agricultural development in Nepal is to gradually modernize the agriculture thereby increase farmers' income. Diversification of agricultural production system, which enables farmers to grow different cultivars of permanent and temporary crops, can best help to achieve this goal. The agro-climate and topographic advantage along with road accessibility, irrigation and electricity facilities are necessary condition to undertake new enterprises. Availability of the marketing and efficient selling mechanism is equally important for the success of these enterprises.

Therefore, HMG Nepal has adopted a 20-year APP which was formulated focusing on the interrelation of the agriculture sector with population. The 20-year plan embodies various policies and strategies specific for Hills and Terai and other agro-climatic zones. It gives an integrated approach to:

i) provide services such as irrigation, agricultural road, technologies, finance, research and extensions and market access to the farmers; and
ii) implement mechanism that operates priority productivity package at the local and national level, etc.

The plan considers the agriculture as the engine of growth, and embarks to accelerate Nepal's agricultural growth by 2 percent (from about 3 to 5 percent per annum). Combined with the expected decline in the population growth rate, from 2.5 to 2.0 percent, the growth in per capita agricultural output is expected to increase six folds from the present 0.5 to 3 percent. Since the sector is employment-intensive, the growth in agriculture will generate new jobs, reduce unemployment, raise farm incomes and is expected to gradually alleviate poverty particularly in rural area.

The Ninth Five-Year Plan, the APP has adopted the Pocket-Package Strategy for the agriculture sector which aims to boost the sector level production by prioritizing the suitable crops in suitable area and providing a package of support of technology, irrigation facility, training to farmers, loans and market facilities in an integrated approach. In fact, the planners have realized that the effort to increase agricultural production cannot be accomplished without commercialization. Therefore, diversification in crop cultivation from traditional to high-value commercial crops was felt necessary to achieve the goal of enhanced productivity. This is achieved as agricultural diversification promotes production and marketing of more

profitable crops especially horticulture crops like fruits, vegetables and spices, livestock, and processed products. Following strategies were suggested to promote agricultural diversification.

(a) Developing technology based on Green Revolution in agriculture and identification of appropriate area for these technologies;
(b) Focusing and prioritizing of inputs-investments for shallow tube-well irrigation in the Terai, agricultural roads, power, and fertilizer;
(c) Focusing on a small number of high-value commodity, such as citrus and apples in Hills, and off-season vegetable and seed in Hills and Terai;
(d) Adopting the group approach in agricultural extension;
(e) Promoting the client-oriented research;
(f) Involving the private sector through appropriate policies; and
(g) Making investment on institution and infrastructure development.

CROP DIVERSIFICATION PROJECT

HMG Nepal, Ministry of Agriculture and Cooperatives and Asian Development Bank signed an agreement to launch the Crop Diversification Project (CDP) in 12 districts of mid- and far-western regions of Nepal. The selection of the districts was based on the following criteria:

a) District covered under the secondary crops development project;
b) Potential for the production and marketing of secondary crops like pulses, oilseed etc.; and
c) High food self-sufficiency status.

Objective and Scope

The objective of this project is to increase farmers' income by promoting production and marketing of agricultural crops with a particular focus on secondary crops in potential areas. The ultimate goal of the project is to reduce poverty in the poverty-stricken mid- and far-western development regions. Activities will be based on a group approach in agricultural extension. The project has been formulated with due emphasis on the active participation of the private sector as well as of the involvement of women farmers. The project covers following activities:

a) Extension services for farmer group;
b) Promotion of private extension services; and
c) Promotion of client-oriented research.

The project focuses on secondary crops that have good potential to raise production and income. For this purpose, the project has identified maize, oilseed, lentil, chickpea, soybean vegetables, and fruits as important secondary crops to be given priority for diversification. Following are the targets of the project:

(i) Diversified secondary crops grown in 205 pocket areas covering a total increment area of about 16,300 ha.
(ii) Increase in the volume of secondary crops and processed products in the local, national, and international markets.
(iii) Increase in areas of marketable secondary crops by more than 40 percent in the lowland region, and by more than 90 percent in the Hilly region.
(iv) Improvement in the regular supply and quality of agricultural products traded in the project area.

IMPACT AND CONSTRAINTS ON AGRICULTURAL DIVERSIFICATION

The Eighth Five-Year Plan (1993-97) and Ninth Five-Year Plan (1998-2002) of Nepal more especially APP (1995-2015) put great stress on agricultural diversification to develop high-value agricultural produces especially livestock, horticulture and pulses products. Livestock is the main source of draft power, milk,

meat, and manure for crop production. So, farmer especially along the major high way and peri-urban areas has taken livestock as an income-generating enterprise. As discussed before, the share of commercial agricultural commodities such as fruits, vegetable and livestock products in the total area sown to all crops has increased in recent years.

However, initiation of the plan is confronting immense problems. Funds allocated in yearly budget are far less than planned in the document. On the other hand, implementing agencies find it difficult to invest the allocated funds. National Support Committee (NSC) designed to steer the plan at the apex and local coordinating bodies are still to be geared. Above all, the shredded commitments at the bureaucratic and political levels are detrimental in achieving the goals.

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10. PAKISTAN

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INTRODUCTION

Pakistan is situated at the western most side of South Asia at the mouth of the Persian Gulf. With a population of 139 million people during 2000 and a total cultivated area of about 22 million ha, the per capita availability of cultivated land stands at 0.17 ha. The fast increasing population at a rate of 2.6 percent per annum has reduced the per capita availability of land. About two-thirds of the population live in rural areas, and 44 percent of labor force is directly or indirectly engaged in agriculture. The per capita income in the country is around US$414 during 2000 (Government of Pakistan, 2002).

Rains in most part of the country are scanty (ranging mostly from 100 to 200 mm per annum), therefore crop cultivation heavily depends upon supplementary irrigations. About three-fourths of the cultivated lands are irrigated and the remaining one-fourth is rainfed. The main sources of irrigation are canal, connected with the five main rivers bringing water from the Himalayan mountains, and wells and tube-wells. Over the last few years, however, the country has suffered from severe drought due to reduced precipitation.

Pakistani farmers grow a wide variety of crops around the year including cereals, fiber crops, sugar crops, oilseeds, fodder crops, pulses, fruits, vegetables, and spices. The cropping intensity in the country is around 140 percent.

In irrigated areas, cotton-wheat, rice-wheat or mung-wheat rotations are common, while in rainfed area maize-wheat or pulses-wheat rotations are popular. Other crops grown in these areas include horticulture, legumes, oilseed, fodders and spices. Overtime, there are some changes in Pakistan's cropping pattern. Cotton and its products are getting important because of expansion in the textile industry. Horticulture, livestock and fisheries sectors are also getting more prominent because of opportunities and increased demand in domestic and foreign markets.

The diversification in agriculture is a slow process, as farmers tend to stick to known cropping patterns, farm inputs and marketing outlets. However, the process can be enhanced through extending appropriate knowledge to farmers about new products, inputs, and markets, developing infrastructure especially markets and roads, and strengthening research and development to introduce profitable technologies in the primary, secondary and tertiary sectors. The increased diversity in the production system can help reducing risk and expanding avenues of farmers' income, therefore alleviating poverty.

This paper looks into the changes that took place in the agriculture sector relevant to its diversification. The coming sections discuss the structure of Pakistan agriculture, the performance of its various sub-sectors like crop, livestock and fisheries, changes in the structure of international trade, state of competitiveness of domestic crop production, government polices in the context of diversification, and finally some successful examples. The last section summarizes the discussion into policy recommendation.

AGRICULTURAL STRUCTURE

Topography and Climate

Major coastal areas of the south lie at the sea level. Elevations begin to rise gradually through the major plains of the Indus valley and then meet steeply rising mountains in the north and northwest. The Indus valley plains contain the country's most fertile land, and most crop production is concentrated there.

Much of Pakistan is classified as arid to semiarid with a tropical or subtropical climate. Four somewhat distinct seasons are: winter (December-February), spring (March-April), summer (May-September), and autumn (October-November). During the spring and autumn seasons, daily temperatures do not exceed 10-25ºC, while the temperatures fall to single digit figures with occasional frost. Summers are considerably warmer with day temperatures between 40 and 50ºC. In the mountainous areas, sub-zero temperatures are common during the winter, while summer is mild, hardly exceeding 25ºC. The coastal areas are characterized by a lack of extreme temperature variation (Chaudhry and Ahmad, 2000).

Crop periods are classified into two main growing seasons viz. *kharif* (summer) and *rabi* (winter). The *rabi* season lasts from November to April, and *kharif* extends through May-October.

Land Structure and Ownership

Although average farm size in Pakistan has declined from 4.7 ha in 1980 to 3.9 ha in 1990, it is still the largest in South and Southeast Asia. The landholding, however, is highly skewed. For example, during 1990, 27 percent of farmers with farm size less than a ha owned only 4 percent land, while about 5 percent farmers having farm size greater than 20 ha owned 26 percent land (Table 1). Under such a skewed land distribution, policy and technological options for diversification may vary for various farm sizes.

Table 1. Number and Area of Farms by Size of Farm, 1980 and 1990

Farm Size (ha)	1980			1990		
	Farm (000)	Farm Area (000 ha)	Average Size (ha)	Farm (000)	Farm Area (000 ha)	Average Size (ha)
<1.0	701.4 (17.2)	370.6 (2.0)	0.5	1,367.7 (27.0)	703.5 (3.7)	0.5
1.0-<3.0	1,369.6 (33.7)	2,599.4 (13.6)	1.9	1,877.6 (37.0)	3,420.6 (17.9)	1.8
3.0-<5.0	917.5 (22.5)	3,566.4 (18.7)	3.9	857.4 (16.9)	3,309.4 (17.3)	3.9
5.0-<10.0	706.4 (17.4)	4,703.8 (24.7)	6.7	623.1 (12.3)	4,134.3 (21.6)	6.6
10.0-<20.0	264.0 (6.5)	3,392.7 (17.8)	12.9	237.9 (4.7)	3,032.9 (15.8)	12.7
20.0-<60.0	96.5 (2.4)	2,802.5 (14.7)	29.0	91.8 (1.8)	2,613.8 (13.6)	28.5
60.0 and over	14.0 (0.3)	1,623.6 (8.5)	116.0	15.4 (0.3)	1,935.1 (10.1)	125.7
All farms	4,069.4 (100)	19,059.0 (100)	4.7	5,070.9 (100)	19,149.6 (100)	3.8

Source: Ministry of Food, Agriculture and Cooperatives (MINFAC), 1986; and Ministry of Food, Agriculture and Livestock (MINFAL), 2000.

Note: Figures in parenthesis indicate the percentage shares.

Over the years, more and more farmers tend to cultivate their own land, and number of tenant farms and area under tenancy is reducing (Table 2). This structural change in the ownership of land may have implications for crop diversity in Pakistan.

Table 2. Land Tenure System, 1980 and 1990

Type of Ownership	1980		1990	
	Farm (000)	Farm Area (ha)	Farm (000)	Farm Area (ha)
Owner cultivator	2,227 (54.8)	9,928 (52.1)	3,491 (68.8)	12,434 (64.9)
Owner-cum tenant	789 (19.4)	5,016 (26.3)	626 (12.4)	3,635 (19.0)
Tenant	1,050 (25.8)	4,114 (21.6)	954 (18.8)	3,081 (16.1)
Total	4,066 (100.0)	19,058 (100.0)	5,071 (100.0)	19,150 (100.0)

Source: MINFAC, 1986; and MINFAL, 2000.
Note: Figures in parenthesis indicate the percentage shares.

Irrigation System

Pakistan has the most extensive irrigation system in the world. More than three-fourths of the gross sown area is irrigated by different sources (Table 3).

Table 3. Area Irrigated by Different Sources

Source of Irrigation	Area (million ha)			Share (percent)		
	1980	1990	1999	1980	1990	1999
Canal	8.14	7.89	7.56	54.9	47.1	41.8
Tube-well	1.83	2.56	3.10	12.3	15.3	17.1
Well	0.21	0.13	0.18	1.4	0.8	1.0
Canal + tube-well	3.95	5.87	6.99	26.6	35.0	38.7
Canal + well	0.10	0.08	0.09	0.7	0.5	0.5
Others	0.61	0.22	0.17	4.1	1.3	0.9
Total irrigated area	14.84	16.75	18.09	100 (76.8)	100 (76.8)	100 (79.5)
Gross sown area	19.33	21.82	22.76	100.0	100.0	100.0

Source: MINFAL, 2000.
Note: The figures in parenthesis indicate the percentage of the total area irrigated in the country.

There are some structural changes in the source of irrigation water. As the number of tube-wells more than doubled from about 200 thousand in 1980 to 531 thousand in 1999 (MINFAL, 2000), their share in irrigating crop area solely has increased from 12 to 17 percent during this period. On the other hand, the share of wells and "others" have declined during this period. The share of canals also declined during the 1990s because of the failure of the government to arrive consensus among provinces to build new dams. The installation of new tube-wells also induced an increase in the share of area irrigated by combined tube-wells and canal (Table 3).

These changes may be good or bad for diversification. The failure of building new dams decreased the growth in water availability, which will adversely affect the diversification of the crop sub-sector. Moreover, heavy dependence on tube-wells may over-exploit the aquifer, resulting the decline in water availability in the medium and long terms. As canal water supply is usually uncertain, increasing dependence on tube-wells, however, may increase the control of farmers on water supply, which is essential to grow high-value crops such as fruits and vegetables.

Pakistan has suffered from severe drought and water shortage over the last few years. The intensity of rain and snowfall reduced considerably resulting from the famous phenomenon called El niño. The water requirements for agricultural purpose are 17.3 million-ha meter (MHM). The water flows in the rivers have reduced, dropping the water availability in canals from 12.7 MHM in 1998 to 9.0 MHM in 2001 (Government of Pakistan, 2002). Pakistan pumps additional 4.9 MHM water from the sub-surface aquifer. The situation here is also disappointing. The underground water table has lowered to 5-10 m and a large number of wells/tube-wells have dried down. As a result of the shortfall in water supply caused by reduced precipitation, the damage to crops is enormous. Livestock has been affected as rangelands have dried and fodders fell in short supply. The cumulative damages in the sector are estimated at US$1.5 billion. In addition, the reduced canal water supplies have caused serious problem of potable water in areas with brackish groundwater.

OVERALL PERFORMANCE OF THE AGRICULTURE SECTOR

Gross Domestic Product

Despite a hick up during 2000 when the growth in GDP was negative as country went through international sanctions, the GDP of Pakistan increased at a rate of 5.0 percent per annum during 1980-2000, which was higher than the growth in agriculture (4 percent per annum) during the same period. Therefore, the share of agriculture in GDP declined from 32 percent in 1980 to 25 percent in 2000. There were changes within the agriculture sector as well. The share of the major crops declined, while the share of the livestock sector improved during this period (Table 4). This suggests some degree of vertical diversification as pointed by the higher share of non-farm activities.

Table 4. Contributions of the Agriculture Sector and Sub-sectors in GDP at Constant Factor Prices

Sector	GDP (PKR million)*			Percentage Share		
	1980	1990	2000	1980	1990	2000
Total GDP	247,831	446,005	665,582	100.0	100.0	100.0
Major crops	39,626	54,741	67,080	51.9	47.8	40.9
Minor crops	13,162	19,820	27,575	17.2	17.3	16.8
Livestock	20,139	34,105	61,768	26.4	29.8	37.7
Fisheries	2,695	4,430	5,785	3.5	3.9	3.5
Forestry	777	1,446	1,804	1.0	1.2	1.1
Agriculture total	76,399	114,542	164,012	100 (30.8)	100 (25.7)	100 (24.6)

Source: Government of Pakistan (2002).

Note: The figures in parenthesis indicate percentage share of the agriculture sector in total GDP of the country, while percentage shares for the sub-sectors in agriculture were estimated from GDP of the agriculture sector.

* 58 Pakistani rupees (PKR) = US$1.00 during 1999.

However, when we look at the crop group-level within the crop sub-sector, there was a little change overtime. The food crops including wheat, rice and maize dominated the crop sector, occupying 55-56 percent of the total area during 1980-2000 (Table 5). There is only a marginal increase in the relative share of cash crops at the cost of "other" crops. This suggests that the food security concern, rather than diversity, has been dominated in the crop production system in Pakistan.

Table 5. Changes in Crop Mix in Pakistan's Agriculture during 1981-2000

Sector	1980		1990		2000	
	Area (000 ha)	Percent	Area (000 ha)	Percent	Area (000 ha)	Percent
Food grains	10,745	55.6	11,933	54.7	12,359	54.3
Cash crops	2,934	15.2	3,546	16.2	3,888	17.1
Oilseeds[a]	506	2.6	413	1.9	501[b]	2.2
Pulses	1,253	6.5	1,238	5.7	1,419[b]	6.2
Vegetables and condiments[c]	283	1.4	416	1.9	547[b]	2.4
Fruits	306	1.6	456	2.1	658[b]	2.9
Others	3,303	17.1	3,818	17.5	3,388	14.9
Total	19,330	100.0	21,820	100	22,760	100.0

Sources: MINFAL, 2000; and Government of Pakistan, 2002.

Notes: [a] The oilseeds include rapeseed and mustard, sesame, sunflower, soybean, safflower, linseed and castor seed; [b] the figures are for 1999-2000; and [c] these include potato, onion, chili, garlic, turmeric, coriander, and all other fresh vegetables.

Employment

The agriculture sector continues absorbing, at least partially, the additional labor supply from increasing population. Therefore, labor engaged in the sector has increased in absolute terms from 13.5 million in 1980 to 18.7 million in 2000. This suggests that diversification out of agriculture failed to absorb enough labor, and agriculture keep on absorbing the surplus labor. However, the relative share of the agriculture sector has declined from 52.7 percent in 1980 to 44.1 percent in 2000 (Table 6).

Table 6. Distribution of Labor Force during 1980-2000

(Unit: Million)

Sector	1980	1990	2000
Agriculture, forestry and fishing	13.5 (52.7)	15.1 (47.5)	18.7 (44.1)
Manufacturing and mining	3.6 (14.1)	3.9 (12.3)	4.2 (10.0)
Other services	8.5 (33.2)	12.8 (40.2)	19.4 (45.9)

Source: Government of Pakistan, 2002.

Note: Figures in parenthesis are percentage shares of the sector in total labor.

CROP PRODUCTION PERFORMANCE

Wheat

The Green Revolution of the late 1960s through the instrument of improvement in photosynthetic efficiency and responsive cultivars along with governments' support to encourage the use of modern inputs like fertilizer and irrigation water helped to raise the productivity and production of wheat. The wheat yields more than doubled from 1.0 mt/ha in 1965 to 1.6 mt/ha in 1980 and then 2.3 mt/ha in 2000.[1] The area under wheat also increased at 0.79 percent per annum during 1980-2000 (Table 7).

Despite these improvements, however, Pakistan remained deficit in wheat production until 1999, as achievements in production were just enough to balance the population growth. However Pakistan made a breakthrough in wheat production in 2000 harvesting a record crop of the size of 21.1 million mt. This transformed Pakistan from a wheat-importing country to a wheat-exporting country on a sustainable basis for the last three years. The average wheat export was 0.0183 million mt in 2000-01, 1.04 million mt in 2001-02 and 1.12 million mt in 2002-03. These impressive achievements were made despite the fact that Pakistan is suffering from severe drought and the shortages of surface water supplies make 40-50 percent of total water in the canal system. This was possible by rotating water in canals in such a way that it was made available at the critical growth stages of the wheat crop. Continuous improvements in crop varieties by excellent breeding programs, active programs on transfer of technologies to farmers field, and supply of farm inputs through a strong public-private sector partnership also contributed in this achievement. However, Pakistan is producing wheat far below the potential. The main areas of focus in wheat production in Pakistan are:

1. ***Introduction of Short-duration Cotton and Rice Cultivars***

The introduction of short-duration cotton cultivars has helped to vacate cotton fields for sowing of wheat at an early date. The sowing period of cotton has been reduced from 180 to 150 days and now there are cotton cultivars in pipeline that will vacate cotton fields in 120 days. Similar attempts are being made through rice breeding program. This is likely to produce additional 1.5-2.0 million mt of wheat.

2. ***Reduction in Weed Infestation from Wheat Fields***

Pakistan's wheat fields have high infestation of weeds viz. wild oats, Phlaris minor, and wild spinach. Byerlee, *et al*. (1984) estimated that weeds could cause a yield loss as high as 500 kg/ha, or approximately 20 percent, depriving Pakistan of a wheat equivalent of about 4 million mt annually.[2] Pakistan must strive to minimize these losses.

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[1] The progressive farms obtain yield in the range of 4-5 mt/ha.

[2] Grandma's time was an era of *Chajj* (an old device to clean weeds, dirt, off-types) culture and womenfolk would ensure to clean each bag of wheat seed before it is sown. That strong tradition is dying down because of the increased wage rate even in rural areas. The result is that large number of today's farming community is seeding weeds along with wheat. This has raised the population density of weeds in wheat fields alarmingly.

Table 7. Overtime Changes in Crop Production during 1980-2000

Crop	Cereals				Cash Crops		Oilseed[b]	Vegetables and Spices[c]	All Fruits	All Pulses
	Wheat	Rice	Maize	Other Cereals	Cotton	Sugarcane[a]				
Area (000 ha):										
1980	6,984	1,933	769	1,059	2,109	825	506	283	306	1,253
1990	7,911	2,113	845	1,064	2,662	884	413	416	456	1,238
2000	8,181	2,377	944	857	2,927	961	501[d]	547[d]	658[d]	1,419[d]
Growth 1980-2000 (percent)	0.79	1.04	1.03	-1.05	1.65	0.77	-0.04	3.40	3.90	0.62
Production (000 mt):										
1980	11,475	3,123	970	619	715	32,359	303	2,568	2,532	526
1990	14,565	3,261	1,185	576	1,637	35,989	299	4,396	3,955	732
2000	19,024	4,803	1,643	517	1,826	43,606	439	6,618	5,846	802
Growth 1980-2000 (percent)	2.56	2.18	2.67	-0.90	4.80	1.50	1.88	4.85	4.27	2.13
Yield (kg/ha):										
1980	1,643	1,616	1,261	585	339	39,223	599	9,074	8,275	420
1990	1,841	1,543	1,402	541	615	40,711	724	10,567	8,673	591
2000	2,325	2,021	1,740	603	624	45,376	876	12,099	8,884	565
Growth 1980-2000 (percent)	1.75	1.12	1.62	0.17	3.10	0.72	1.92	1.44	0.36	1.51

Sources: MINFAL, 2000; and Government of Pakistan, 2002.

Notes: [a] Excluding sugar beet; [b] include rapeseed and mustard, sesame, sunflower, soybean, safflower, linseed and caster seed; [c] include potato, onion, chili, garlic, turmeric, coriander, and all other fresh vegetables; and [d] the figures are for 1999-2000.

3. ***Supplying Clean Seed***

During 2000, nearly one-tenth of the total wheat seed demand is fulfilled through the supply system of improved seed in the country (MINFAL, 2000). Centralized mega seed processing units are not a solution to the problem. We need decentralized mini seed plant that satisfies the local needs. New plants that clean wheat seed quite efficiently are now coming. Punjab Government in recent years has introduced wheat seed graders. These graders are quite effective in cleaning farmer's seeds through removal of weed seeds, shriveled and broken grains of wheat. The price per unit is around PKR30,000 (US$500).

The Government of Pakistan has made changes in its procurement policies. Pakistan used to procure up to 8.3 million mt wheat worth of US$1.1 billion. During 2001-02, only 4.3 million mt of wheat was procured. The new policy has also allowed free movement across provincial and national frontiers so that the private sector can come in and stabilize prices. Simultaneously a policy has been enforced to introduce cascading issue prices of wheat from public sector stores that increase with advancement in season. This will help to minimize financial burden on the public sector, and encourage the private sector to involve in wheat marketing. In addition the private sector has been allowed to build silos at ports for export and distribute wheat to the upcountry. The private sector has been further inducted in procurement of wheat and a credit line has been provided to the private sector on the same terms and conditions as for public sector.

Rice

Pakistan is known for its long grain aromatic *Basmati* rice grown in Kallar (or saline) tract, mainly for export purpose. Since the introduction of modern rice varieties from the International Rice Research Institute (IRRI) during the late 1960s, Pakistan has also started growing coarse rice. The production of rice during 2000 stands at 4.8 million mt from an area of 2.4 million ha. Out of this, 1.92 million mt (0.57 million mt *Basmati* and 1.35 million mt coarse grain) are exported (MINFAL, 2000).

Growth in production and yield of rice during 1980-2000 was lower than in wheat and cotton, although the growth in area under rice was higher than wheat (Table 7). Sluggish growth in rice yield was mainly due to slow pace of turnover of new rice cultivars and relatively less responsiveness of *Basmati* rice to the use of modern inputs.

Plant population density, like in any other crop, is highly important parameter in rice production. The sowing condition is unique for rice due to scorching heat. The rice is grown in puddled fields in a high temperature that peak to 45ºC plus. The humidity is high and the drudgeries are further aggravated by sun reflections in hot water that is blinding. With these circumstances population density in rice fields hardly exceeds 125-150 thousand plants per ha compared to the recommended level of 200 thousand per ha.

To overcome this problem, the Pakistan Agricultural Research Council has introduced a rice transplanter costing PKR150 thousand. This transplanter has a special requirements of rice seedling grown on plastic sheets, nursery age of 25 days and precise leveling of rice fields. The successful experimentation in rice growing areas of Punjab has demonstrated that rice population can be increased to more than 500 thousand plants per ha. This factor alone can raise rice production by 1 million mt.

Another one-million mt rice production can be added by adopting appropriate technologies in agronomy, plant protection, irrigation and fertilizer management and post-harvest husking of rice. By 2005, Pakistan has a potential to produce 7 million mt of rice, against the requirement of 2.5 million mt with a surplus of 4.5 million mt for export. This requires, however, a yield increase to 3 mt/ha from 2 mt/ ha.

Rice is a tropical crop, having high water requirement of 1.83-ha m. The total water requirement of rice is 4.3 MHM, which is equivalent to almost five *Tarbela* dams or double the total water reservoir capacity of the country. This is a huge quantity of water. In view of present squeeze on water resources due to El niño phenomenon, it appears appropriate to shift to crops with low water requirements to conserve the scarce water resources of the country. About half a million ha of rice area with low or marginal productivity can be taken out for growing low water requirement crops such as sunflower, vegetables, or others. This will release stress on already constrained water supplies.

Increasing plant population, water use efficiency, introduction of hybrid seed, and other cultural practices can substantially increase productivity of rice. Pakistan's *Basmati* is a ceremonial feast with residents of sub-continent, Iran and Arab States. However, market in the Middle East has been saturated. Therefore, new markets for aromatic rice in Europe and America should be searched.

Cotton

Cotton is the crop that has a capacity to generate huge chain of employment ranging from farm to finished textile-goods industries, provide raw material to Pakistan's biggest industry of textile, generate cash flows in the rural areas of Pakistan, especially to women cotton-pickers, therefore help alleviating poverty.

Pakistan touched a peak cotton production of 12.8 million bales (or 2.2 million mt) during 1992-93. Situation thereafter, changed as cotton crop was affected by cotton leaf curl virus (CLCV) syndrome. This placed the forward-moving cotton vehicle in a reverse gear. Eventually, however, our scientists came up with varietal and cultural management solution to this problem. Therefore, despite the virus problem for many years during 1990s, the growth in its production at 4.8 percent per annum was among the highest in the crop sub-sector during 1980-2000 (Table 7). This growth is mainly attributed to increase in per ha yield, although area under cotton also expanded due to improved profitability brought by the technological innovations in cotton production during this period.

Pakistan since its inception followed protectionist industrial policies. Therefore, textile industry thrived and prospered on cheap cotton adding to the travails of the resource poor farming community. A major shift in policy was made during recent years allowing free imports and exports of cotton.

Marketing of cotton, like any other commodity, poses a serious problem. Pakistan's economy cannot afford a heavy public sector investment on intervention in commodity procurement operation. The privatization of ginning factories helped improving cotton marketing.

Pakistan is now focusing on clean cotton program to provide quality cotton for textile made-ups and for export of raw cotton. The idea is push Pakistan's cotton from B index to A index to fetch better prices. Institutional support and legislative cover has been provided for the purpose.

Sugar Crops

Sugarcane is the main sugar crop of Pakistan, followed by sugar beet. The area under sugarcane is about 1 million ha. The maximum production so far has been 55 million mt in 1998. While the productivity of sugarcane has increased form 39 mt/ha in 1980 to about 45 mt/ha in 2000 after reaching a maximum of 50 mt/ha during 1998 (MINFAL, 2000). However, it is still lower than the major sugarcane-producing countries which are getting the yields of 100-110 mt/ha. The potential of the crop remains to be exploited because growth in yield during 1980-2000 has been in sugarcane was one of the lowest in the crop sector (Table 7).

The crop is basically tropical in nature. With average water requirement of 1.8-ha m, the total water requirement of sugarcane is 1.85 MHM, which is equal to two *Tarbela* dams. At present levels of productivity, it is one of the most inefficient users of water resource. Moreover, it occupies the land over long period of time equal to wheat plus cotton or rice crop period. Sugarcane needs to be substituted at least partially by sugar beet. Contrary to this, however, the area under sugar beet has decreased from 8 thousand ha in1996 to 5 thousand ha in 2000.

The relationship between sugarcane producers and sugar manufacturing industry are suffering from conflicting interests. In early days, the zoning policy brought windfall profit to the millers. The farmers, not willing to sell their cane, were harassed. Later, the zoning was abolished in 1987 and the farmers were allowed to sell their cane to millers of their choice. That brought inefficient logistics as de-zoning competition led lifting cane from far off areas. The payment of cane remained a big headache for growers. Over last few years many mills defaulted and thrived at the cost of growers. The old instrument of 1950 "The Cane Act" failed to protect the interests of the growers. There is a need to revamp the whole cane payment system.

The cane cess fund also remained controversial and mystery shrouded on its usage. Many millers did not pay their share of cess. Even farmer's deductions by millers were not paid. The cess payment system needs to be revised.

The installation of sugar mills and cane cultivation in areas of marginal productivity needs to be discouraged. The huge quantities of water thus saved should be used to grow such crops where Pakistan has a comparative advantage. The beet crop, which is more water efficient, needs to be encouraged. However, care needs to be exercised to assure that this does not substitute the productive fields of wheat. Pakistan so far depends upon imported hybrid seed of beet from Germany. Local hybrid seed production of beet needs to be undertaken. Pakistan needs to abandon the idea of achieving self-sufficiency at all cost in sugar and should not hesitate to import cheap, good quality sugar.

Oilseed Crops

Pakistan did make some success in oilseed crop production. It increased at the rate of 1.88 percent per annum from 303 thousand mt in 1980 to 439 thousand mt in 2000. All of the increase came through increase in yield, while area under oilseed production remained almost stagnant during this period (Table 7). The low-yielding traditional types of oilseeds, such as linseed and castor seed, were partially replaced with non-traditional high-yielding oilseed crops, such as sunflower. Moreover, edible oil supply from domestic sources also increased due to improvement in the production of seed cotton.

A number of efforts were made to popularize sunflower cultivation, and its production increased from 17.6 thousand mt in 1985 to a maximum of 194.5 thousand mt in 1998. However, due to decrease in international prices of palm oil, the sunflower production got a setback during 2000-01.

Despite achievements in oilseed crop production, however, Pakistan's deficit in oilseed production has increased overtime due to increase in population and per capita consumption. The domestic requirement of edible oil in Pakistan is 1.9 million mt compared to domestic production of only o.6 million mt. About two-thirds of this come from cotton seed and remaining from brassica and sunflower.

The average oil output from sunflower and canola is about 500 kg/ha. Pakistan needs to bring an additional area of about 2.6 million ha under sunflower or canola to achieve self-sufficiency if this deficit is to be met from crops alone. Such a large fallow cultivable land does not exist. Alternatively, if this area has to come from replacing other crops, at present level of productivity, it may displace about one-third of the area from wheat or some other crop.

The solution to our problem lies in oil palm cultivation. At a yield level of 50-kg oil per plant, Pakistan needs an oil palm plantation of 26 million plants to meet the current deficit.[3] At a 150-plants per ha, Pakistan needs to bring an area of 0.17 million ha under oil palm. This area is available in coastal areas of Sindh and Balochistan. Initially Pakistan has planted about 100,000 plants in Sindh and Balochistan. The earlier experimentation has borne fruit successfully. However with oil palm prices falling, we intend to keep our programs in this area on a low key, till it becomes commercially viable for us to run programs in oilseeds. Once that is the case, step should be taken to establish processing industry in this area. Private sector needs to be involved in the industry as well.

Olive cultivation is another area where Pakistan can make advancement. Wild olive is growing successfully in sub-mountainous areas. The experiments at Tarnab, Peshawar has shown that the domesticated scions of olives can be successfully grafted with its wild rootstocks. Pakistan has successfully grown 100,000 saplings of olives at Tarnab and in next three years, the number may exceed one million plants of olive.

At a time when Pakistan is hard pressed for its foreign exchange, we should also focus on demand management. Efforts should be directed to educate consumers about the negative consequences of high use of oil needs to be carried out to cut down its increasing per capita consumption. This will further help to reduce the gap between its production and consumption.

Another area where Pakistan needs to focus is the substitution of indigenous rapeseed and mustard crop with the commercial high-yielding varieties of canola. Canola oil is fairly popular and is a talk of the town. The planners need to encash this opportunity to popularize canola cultivation.

The sick solvent industry and marketing remained a major hurdle in the promotion of oilseed production. Pakistan's extraction efficiency of oilseed has a big gap for improvement. Efficient solvent plants are the ultimate solution. The government policies must aim at assuring that the solvent units remains commercially viable.

Consumers should have the right to know what they are eating in the name of edible oils. This area needs to be addressed through establishing a series of quality testing labs all over the country with appropriate legislation.

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[3] We cannot assume that all the supply of edible oil come from oil palm. The melting point of palm oil is higher than human body temperature. A certain blend of soft oil has to be ensured with palm oil to lower the melting point of the edible oils so that it has a melting point lower than human temperature.

Pulses

The growth rate in pulses production stands at 2.1 percent per annum during 1980-99, less than the population growth. The main increase in overall production of all pulses came through improvement in productivity, although there was some expansion in area as well (Table 7).

Pulses are cheaper sources of protein for poor people. Lower growth in their production than population growth is depriving poor people from consuming this cheaper source of protein. Despite foreign exchange expenditure on the imports of pulses, which stood at PKR2.8 billion during 1997 (MINFAL, 2000), their short supply has pushed their prices up during 1980-99. Lack of technological innovations and policy support, and widespread adoption of cereal-based rotations are the main factors behind the slow growth in pulses production.

Gram

Gram is the major pulse of Pakistan, therefore, fluctuation in its production has a cascading effect on prices of other pulses. Black gram is used as roasted, dhal (split gram), and making gram flour. White gram, popularly called *Kabli Chana*, is used in dishes as chats, and shawls (rice). The consumption requirement of Pakistan is 700 thousand mt, out of which 50 thousand mt is for white gram. The country is mainly self-sufficient in black gram, while the production of white gram is deficit by 40 thousand mt, which is met through imports. Pakistan has released some varieties of white grams. This area needs to be further focused.

The terrain of gram area is such that resource-poor farmers with minimal farm inputs and almost invisible management can grow it on sand dunes, slopes and the depressions. During 1999-2000, because of prolonged drought, the growth of crop and grain formation was affected, leading to a reduced production by 564 thousand mt.

Moisture is the major limitation in gram production. About 95 percent of gram area are grown under high-yielding, disease-resistant improved cultivars. The bright aspect of advancement in gram research and seed multiplication program brought Pakistan out of the danger of gram blight. However, gram yield remained highly fluctuating, and not a significant improvement in yield occurred until 1994. Only during 1995-99, there was some improvement in yield, and gram production touched to it maximum of 767 thousand mt, which was just enough to meet the domestic demand.

Mash and Lentil

Not much technological innovations were introduced in mash and lentil production. The stature of mash is faulty as it sometimes grows up to over 1 m resulting in low or no productivity. The breeders need to focus on plant engineering to remedy the situation. The production of mash is 23 thousand mt and consumption is 45 thousand mt.

Lentil is another important area where Pakistan can make a breakthrough. This crop can fit into autumn sown sugarcane or other crops as intercrop. The production of lentil is 37 thousand mt and consumption requirement is 65 thousand mt.

Mung Bean

Area under mung bean cultivation increased from 67 thousand ha in 1980 to 202 thousand mt in 1999. Successive introduction of high-yielding, short-duration, uniformly mature, and yellow mosaic virus-resistant varieties were the main force behind this dramatic expansion in mung bean area. Although statistics show no increase in mung bean yield during 1980-99, but farm surveys suggest an average of 55 percent higher yield of the latest released mung bean variety NM92 compared to traditional Desi variety (Ali, *et al*., 1997).

Fruits

Pakistan grows a wide variety of fruits. Important of these are citrus, mango, apples, guava, banana, dates, pears, peaches, and plums, apricot grape almonds, walnuts and a large number of others. The production of fruits stands at about 5.8 million mt during 2000.

Fruits production increased at a rate of 4.3 percent per annum during 1980-2000, one of the fastest in the crop sub-sector after vegetables and cotton (Table 7). However, most of the increase came through expansion in area, rather than improvement in yield.

Due to poor infrastructure and storage facilities, the post-harvest losses amounts to 25 percent, equivalent to PKR32 billion each year. To increase exports, the post-harvest management including hydro-cooling, refrigerated containers, cold storage at ports need to be improved. Sanitary and phyto-sanitary (SPS) facilities should be established in line with the import requirements of different countries. Moreover, logistical support, especially farm to market roads and market information system, should be given high priority in the development plans.

Vegetables and Spices

The major vegetable and spice crops grown in the country are potato, onion, chilies, garlic, tomato, root-type and leafy. In the crop sub-sector, the vegetable production increased at the highest rate of 4.9 percent per annum from 2.6 million mt in 1980 to 6.6 million mt in 1999. Both expansion in area and improvement in productivity contributed to the phenomenal increase in vegetable production during this period. The major expansion came in potato and onion crops, which had a ready market and good profits. Introduction of new vegetable varieties in collaboration with the concerned international research institutions, involvement of the private sector in seed distribution, some improvement in infrastructure such as farm-to-market roads, and floating exchange rate which induced vegetable production for exports are the main driving forces behind the impressive growth in vegetable production.

Vegetable crops are perishable in nature, and need high investment and modern technology. More importantly they need human skill that can understand the market niche and adapt their production system accordingly. The successful cultivation also requires sophisticated transport, communication, and storage systems, so that vegetables can be transported quickly and efficiently from farm to consumers' table. As Pakistan lack sufficient of these infrastructures, post-harvest losses in vegetables amount to about PKR18 billion each year. The steps to be taken to boost the exports of vegetables are similar to those in fruits including improvements in cold storage and SPS facilities and logistical support.

LIVESTOCK AND FISHERIES SUB-SECTORS

Livestock

The livestock population of Pakistan increased at the rate of 2.2 percent per annum from 37.8 million SAU (Standard Animal Unit) in 1980 to 58.2 million SAU in 1990 (Table 8). The poultry birds increased at the highest rate. However, recently the Marriage Functions Legislation has prohibited serving meals at marriage and follow-up functions. This has badly affected profitability in poultry sector.

The number of camels and horses decreased during 1980-2000 because of the spread of automobile transport system in the country. The number of sheep remained almost stagnant. The rate of increase in cattle was relatively low while the growth in buffalo population was high, because of the substitution of bullocks with milking buffaloes as a consequence of tractorization of farm operations.

The high growth in the livestock sub-sector, which improved its share in the agriculture sector, was originated from the rapid increase in the production of poultry meat and milk. The expansion in poultry meat production was achieved through introducing the fast growing hybrid poultry breads, fiscal incentives in the form of credit and tax shoot for establishing poultry farms, hatcheries and feed mills, and improvement in the infrastructure such as roads.

The high growth in milk came both with the increase in milking animals and higher milk yield per animals. The latter is reflected by the high rate of growth in milk production than in milking animal population (Tables 8 and 9). Our estimate for annual milk yield per milking buffalo suggests that it has increased from 1.6 mt in 1980 to 1.9 mt in 1990. Similarly, annual milk yield per milking cow has increased from 0.9 to 1.5 mt in the corresponding period. This enhancement in yield may be stimulated with the improvement in milk supply system, which improved profitability therefore instigated farmers to give better feeding to milking animals.

Improvements in feed supply due to fiscal incentives for the domestic feed industry, increased coverage of artificial insemination, greater coverage of the livestock health facilities, and generous credit facilities for setting up commercial dairy farms and feeding units were the other factors behind enhancement of milk yield. However, empirical studies need to be conducted to quantify the contribution of these factors.

Table 8. Livestock Population during 1960-2000

(Unit: Million)

Livestock	1980	1990	2000	Growth (1980-2000) (percent)
Cattle	15.8	17.7	22.4	1.8
Buffaloes	11.9	17.8	23.3	3.4
Sheep	22.1	26.3	24.2	0.5
Goats	25.8	37.0	49.1	3.3
Camels	0.9	1.1	0.8	-0.6
Horses	0.4	0.4	0.3	-1.4
Asses	2.5	3.6	4.1	2.5
Poultry birds	67.4	146.9	292.4	7.6
Total SAU[a]	37.8	48.2	58.2	2.2

Sources: MINFAC, 1986; MINFAL, 1999; and Government of Pakistan, 2002.

Note: [a] 1 SAU = (male cattle*1.3) + (female cattle*1) + (heifer cattle*0.75) + (young cattle*0.5) + (male buffalo*1.5) + (female buffalo*1.25) + (heifer buffalo*0.94) + (young buffalo*0.5) + (male sheep or goat*0.26) + (female sheep or goat*0.2) + (young stock of sheep or goat*0.1) + (adult horse or mule*0.8) + (young horse or mule*0.4) + (adult camel*1.5) + (young camel*0.75) + (adult ass*0.5) + (young ass*0.25) + (poultry*0.0067).

Table 9. Livestock Products

(Unit: Million mt)

Livestock Products	1980	1990	2000	Growth (1980-2000) (percent)
Milk available for consumption	7.49	12.50	26.28	6.8
Meat:	0.852	1.57	2.00	4.6
Beef	0.43	0.76	1.00	4.5
Mutton	0.37	0.66	0.66	3.1
Poultry meat	0.052	0.15	0.34	10.4
Eggs (million)	2,349	4,490	8,463	7.0

Sources: MINFAC, 1986; MINFAL, 1999; and Government of Pakistan, 2002.

The improvements in meat production per cattle population can also be observed, although at a lesser scale. On the other hand, higher growth in meat supply than animal growth may be simply because of increased slaughtering of the stock of animals as a consequence of drought, poverty, and substitution of cattle with buffalos due to enhanced profitability in milk production.

Despite some improvements, the feeding quality and phyto-sanitory conditions remained substandard in general. These coupled with poor health-cover are major constraints in the livestock sector. There are some improvements in the collection system for milk and egg supply through commercial poultry farms. However, slaughtering of animals and its marketing need major reforms.

The prolonged drought in the country cost heavy tolls to the livestock sector during 2001-02. A massive human and livestock migration took place from the hard hit drought areas. A large population of livestock either died or was subjected to malnutrition and disease problems.

Fisheries

Pakistan has vast fresh water resources with a network of rivers, streams and water reservoirs for inland fisheries. In addition, it has large coastal lines for marine fisheries. The fisheries production increased at the rate of 4.6 percent per annum from 279.3 million mt in 1980 to 654.2 million mt in 1999 (Table 10). There was some change in fisheries production, as the production of inland fisheries increased at a higher rate than the marine fisheries.

Table 10. Fisheries Production

(Unit: 000 mt)

Type of Fish	1980	1990	1999	Growth (1980-99) (percent)
Island	46.3	113.2	179.8	7.4
Marine	233.0	369.8	474.4	3.8
Total	279.3	483.0	654.2	4.6

Sources: MINFAC, 1986; and MINFAL, 1999 and 2000.

Pakistan has, over the last few years, upgraded its fishing capacity and improved quality of fish products, meeting international standards, particularly those of European Union. A fishing policy was declared suggesting improvements in fishing boats, installation of global positioning system and SPS measures. There is a large potential for Pakistan to meet protein requirements within country and also earn a sizable foreign exchange.

INTERNATIONAL TRADE

Export Performance

The total export in Pakistan (in rupee term) increased at the rate of 15.4 percent per annum during 1980-99. However, when the export value is converted in U.S. dollar term, the rate is only 4.9 percent per annum. The agricultural exports (in dollar terms) increased at the rate of 4.6 percent per annum. Therefore, Pakistan made a moderate progress in diversifying its export out of agriculture (Table 11). From the total export of PKR443.7 billion during 1999, agricultural export contributed about 78 percent, which has decline from 83 percent in 1980. This process needs to be further strengthened to diversify export share out of agriculture, and reduce vulnerability in the export earnings on climatic situation.

Table 11. Export Values by Agricultural Product during 1980-99

(Unit: PKR million)

Commodity	Export Value			Percentage Share		
	1980	1990	1999	1980	1990	1999
Raw Items:	11,825	22,800	48,152	40.4	16.5	10.8
Cotton and wool	5,283	10,896	5,630	18.0	7.9	1.3
Rice	5,602	7,848	27,944	19.1	5.7	6.3
Fruits and vegetables	243	1,241	6,722	0.8	0.9	1.5
Fish	531	2,571	7,150	1.8	1.9	1.6
Others	166	244	706	0.6	0.2	0.2
Semi-manufactured:	3,466	34,084	67,677	11.8	24.6	15.3
Cotton yarn	2,050	26,675	55,820	7.0	19.3	12.6
Leather	892	6,155	8,998	3.0	4.5	2.0
Molasses	341	824	2,200	1.2	0.6	0.5
Others	183	430	659	0.6	0.3	0.1
Manufactured Items:	9,013	52,827	228,773	30.8	38.2	51.6
Cloth and thread	2,490	10,240	75,398	8.5	7.4	17.0
Garments and towels	1,220	17,791	79,082	4.2	12.9	17.8
Sports good	312	3,107	14,490	1.1	2.2	3.3
Carpets	2,243	4,977	10,068	7.7	3.6	2.3
Others	2,748	16,712	49,735	9.4	12.1	11.2
Total agricultural products	24,304	109,711	344,602	83.0	79.3	77.7
Non-agricultural products	4,976	28,572	99,076	17.0	20.7	22.3
Total exports	29,280	138,283	443,678	100.0	100.0	100.0

Sources: MINFAC, 1986; and MINFAL, 1995 and 1999.

Within agriculture sector, however, a greater success was achieved in diversifying its export from raw materials towards semi-manufactured and manufactured items. For example, the share of raw items in the value of total exports decreased from 40 percent in 1980 to 11 percent in 1999. On the other hand, the share of manufactured items increased from 31 to 52 percent during the corresponding period. The share of semi-manufactured items increased first from 12 percent in 1980 to 26 percent in 1990 but then declined to 15 percent in 1999, mainly because of the poor performance in exporting cotton yarn as emphasis shifted from yarn to more value-added product of cloth and thread.

Rice is the major raw commodity exported from Pakistan. The value of rice export has increased from PKR5.6 billion in 1980 to PKR27.9 billion in 1999, mainly because of the devaluation from PKR10 to PKR58/US$1 during this period. The devaluation, however, increased the demand for Pakistani rice abroad from 1.2 million mt in 1980 to 1.9 million mt in 1999. Despite increasing demand, the share of rice export in the value of total export has decreased from 19 to 6 percent in the period. This is because the price of rice decreased in the international market from US$702 to US$440/mt for *Basmati* rice and US$327 to US$160/mt for coarse rice during this period.

Cotton yarn is the major semi-manufactured commodity exported from Pakistan during the 1980s and 1990s. The value of cotton yarn exported increased from PKR2 billion in 1980 to PKR55 billion in 2000. The devaluation in rupee, government encouragement for the export of cotton yarn, and overall good performance in the production of cotton (despite virus problem during mid-1990s) are the major factors in the increase of the value of cotton yarn export.

Cloths and threads and garments are the major manufactured or value-added agricultural commodities exported from Pakistan. During 2000, these products claim more than one-third of the total value of exports from the country. The favorable government policies and active participation of the private sector contributed the major role in this boom.

Structural Changes in Import

The total import value of agriculture-related products increased about nine folds from PKR17.4 billion in 1980 to PKR134.1 billion in 2000. The share of the imports of agriculture-related products remained almost stagnant at around 30 percent during this period (Table 12). Following structural changes in the imports are vivid during this period.

Table 12. Imports of Agricultural Products and Their Share in Total Imports during 1980-98

(Unit: PKR million)

Commodity Imported	Import Value			Percentage Share		
	1980	1990	1998	1980	1990	1998
Animal and vegetable oil and fats	3,137	10,433	36,605	18.7	23.2	27.4
Fertilizer	3,537	5,911	9,079	21.1	13.1	6.8
Agricultural manufactured goods[a]	2,255	3,888	7,921	13.4	8.6	5.9
Wood and wood products	1,015	3,830	9,164	6.0	8.5	6.9
Tea	1,184	3,729	9,818	7.1	8.3	7.4
Agricultural machinery and implements	1,048	137	606	6.2	0.3	0.5
Wheat	633	3,119	30,349	3.8	6.9	22.7
Refined sugar	473	3,593	1,686	2.8	8.0	1.3
Milk, milk products and eggs	393	721	982	2.3	1.6	0.7
Pesticide	225	1,489	3,010	1.3	3.3	2.3
Others[b]	2,912	8,179	24,187	17.3	18.2	18.1
Total agriculture and its products	16,812	45,029	133,407	100.0 (31.4)	100.0 (26.3)	100.0 (30.6)
Grand total imports	53,544	171,114	436,338	-	-	-

Source: Government of Pakistan, 1988 and 1999.

Notes: Figures in parenthesis show percentage share of imports of agriculture products in the total value of imports.

[a] Agricultural manufactured goods include leather, rubber, cotton and textile-based products, clothing, and manufactured tobacco; and [b] "others" include food and lives animals excluding wheat, milk-based products and eggs, sugar and tea, raw tobacco, and crude inedible material excluding wood-based products and minerals-based products.

i) The share of fertilizer imports decreased from over 13 percent during 1980 to less than 6 percent during 1998 because of the government policy to encourage import substitute for agricultural inputs. For example, new nitrogen and phosphate fertilizer plants were established in the country to substitute imported fertilizer with domestic production during the 1990s.

ii) The share of manufactured agricultural imports decreased during 1990s. This is because of the revival of the agricultural business sector in the country since the process of denationalization of agro-based industries started in the mid-1980s. This is also an indication of vertical diversification of the agriculture sector.

iii) The share of agricultural machinery also reduced from 6.2 percent during 1980 to less than 1 percent during 1990s. Again, import substitution policy of the government has played a role in encouraging the domestic machinery production such as tractor, thresher, reaper, drill and zero-tillage drill. The development of domestic steel industry also contributed in expanding farm machinery manufacturing in the country.

iv) The imports of milk and milk products also declined due to improvement in the milk production and distribution system in the country.

v) Imports of pesticide increased first during 1980s, but then declined during 1990s, perhaps because of the successful adoption of Integrated Pest Management (IPM) practices especially in cotton production.

vi) The import of refined sugar reached to its peak of PKR9.9 billion during 1996, but normally fluctuates depending upon the domestic production, stock, and international prices. The domestic requirement of refined sugar is 2.95 million mt, while the supply from domestic sources varies from 2.4 million mt in 1999 to 3.5 million mt in 1997 and 1998, depending upon the production of sugarcane. Therefore, Pakistan has to import up to 0.5 million mt during low production years. Although there was a substantial increase in the capacity of refined sugar industry as sugar mills increased from 34 in 1980 to 74 in 2000, its fluctuating supply from domestic sources roots from the cyclical production trend in sugarcane.

vii) Despite government efforts to increase oilseed production in the country, the share of edible gradually increased from 18.7 percent in 1980 to 27.4 percent during 1998. This is because of the continuous increase in per capita consumption of edible oil, rise in population and discouraged domestic production due to decreased international prices especially of palm oil.

viii) Increase in the share of wheat import from 3.8 to 22.7 percent during the corresponding period, mainly because of the low domestic production of wheat due to sever drought in the country during the late 1990s. Pakistan remained a wheat deficit country in the 1980s and 1990s. The main reasons were:

   a) slow adoption in transferring the modern wheat technologies, especially improved management practices available with the researcher/progressive growers to the majority of small farmers.
   b) government's policy to keep wheat price low to arrange cheap wheat supplies for the vocal urban community for most of the 1980s and 1990s.
   c) high input prices, especially fertilizer and oil, due to devaluation of rupee.
   d) late maturing cotton and rice cultivars leading to delay wheat planting and its low yield.
   e) population growth higher than the rate of increase in wheat production.
   f) deficit nations around Pakistan causing lot of illegal wheat outflows to these countries.

Pakistan would not only have been self-sufficient in wheat but might actually become net exporter had wheat prices not kept very low compared to the international market prices during the 1980s and 1990s. This opportunity, however, has gone when international wheat prices touched to its lowest level, mainly due to heavy subsidy on agricultural products by the developed countries.[4] Currently, Pakistan aims to meet its

[4] After decades of comparative advantage in wheat production, the cost of wheat production in the country has surpassed the international market prices during 2001-02. The Agricultural Prices Commission of Pakistan has worked out the average export parity price at Karachi port at PKR204 per 40 kg from the international price of US$113/mt for the year 2001-02. The cost of production of Pakistan's wheat was at PKR307 per 40 kg for the same year.

wheat requirements and strategic reserves, and cannot enter into export market in a big way, as at present level of productivity, the domestic wheat production is not competitive in the international market. Therefore, appropriate price policy within the country can make the country self-sufficient in wheat production, and decrease in international subsidies can turn Pakistan's competitiveness in the international wheat market.

COMPETITIVENESS OF DOMESTIC CROPS PRODUCTION

Most major crops cultivated in Pakistan have been so far competitive in the international market, as depicted by the Domestic Resource Cost (DRC) estimates (Table 13). Cotton is considered to be the most internationally competitive crop as it has the lowest DRC ratio. However, sugarcane and sunflower became uncompetitive during the early 1990s, although each was also competitive until the late 1980s. Wheat, rice, soybean and rapeseed and mustard are internationally competitive provided farmers are assured international market prices.

Chaudhry (1999) have shown that during 1996-98 the average parity prices of wheat, sugarcane, *Basmati* rice, IRRI rice, and seed cotton were higher than the support prices announced for these crops. This implies that these crops were competitive in the international market until 1998.

Chaudhry and Sahibzada (1994b) estimated the social profitability of various oilseed products, and concluded that sunflower, rapeseed and mustard, sunflower, soybean and cottonseed all are competitive to produce domestically during the early 1990s.

However, recently due to heavy subsidies on agricultural products from the developed countries, many agricultural commodities produced in developing countries, including wheat from Pakistan, became uncompetitive. This is despite a steep decline in the value of rupee during the late 1990s as the country went under international sanctions. The developing countries should continue pressurizing the developed world to reduce subsidies and open up their markets for agricultural products from developing countries through the World Trade Organization (WTO).

GOVERNMENT POLICIES

Following are the main parameters for Pakistan's agricultural policy which brought an impressive growth in the agriculture sector during 1980-2000 (despite a hick-up during the latter part of the century), and helped to some extent diversifying the sector, especially vertically.

Food Security

Food self-sufficiency has been the major tenant of agricultural policies. Major emphasis of agricultural research for the last four decades or so has been on achieving wheat self-sufficiency. The government attempted to make sure appropriate input supplies, especially fertilizer, seed and water during the wheat cultivation period. Usually, an extension campaign is launched before the cultivation of wheat to ensure input supply, guiding the farmers about appropriate wheat management practices. The farm-gate prices assured through announcing the minimum wheat prices and protected by procuring the surplus wheat at the farm level also contributed toward increased wheat production. All this helped the country to beat the demand pressure due to high population growth and keep the wheat prices low. However, controlling the wheat prices far lower than the international market prices and overvalued exchange rate during the 1980s had discouraging effect on wheat production. Moreover, advanced crop management practices did not trickled down to the majority of small farmers. Therefore, Pakistan continued to be an importer of wheat.

Technological Innovations

Pakistan has established a network of agricultural research institutes and extension organizations to generate technologies and disseminate knowledge to growers. A total of 57 high-yielding and rust-resistant wheat varieties were released during 1980-2000 (Farooq and Iqbal, 2000). The development of high-yielding, virus-resistant, and short-duration cotton varieties gave a boost to cotton production. In rice, new *Basmati* and coarse grain varieties improved rice productivity. Similarly, high-yielding, short-duration, yellow mosaic virus-resistant, uniformly maturing mung bean varieties have revolutionaries the mung bean production in the mung bean-growing areas of Pakistan. New vegetable varieties also produced impact in terms of high yield.

Table 13. Review of Domestic Resource Cost Coefficients for Different Crops in Pakistan

Authors/Study/Year	Wheat	Rice	Cotton	Sugarcane	Cotton Seed	Soybeans	Rapeseed/ Mustard	Sunflower
Appleyard (Punjab)								
1982-83	0.91	0.40	0.70	-	-	-	-	-
1983-84	0.72	0.39	0.53	-	-	-	-	-
Appleyard (Sindh)								
1982-83	0.83	0.52	0.38	-	-	-	-	-
1983-84	0.66	0.50	0.31	-	-	-	-	-
Amir Mahmood								
1987	-	-	-	-	0.50	0.51	0.54	0.61
AERC (Sindh)								
1987-88	0.48	0.82	0.21	0.79	-	-	-	-
Mahmood Ahmed (Punjab)								
1989-90	0.51	0.77	0.45	-	-	-	-	-
Longmire and Debord (1990-91)								
Punjab	0.82	0.56	0.25	1.35	-	-	-	1.03
Sindh	0.74	0.92	0.23	1.20	-	-	-	-
Maan and Khawaja (Punjab)								
1991	0.86	-	-	-	-	-	-	-

Source: Chaudhry and Sahibzada, 1994a.

Advance crop management techniques were introduced to the farmers to reduce cost, protect crops from natural calamities, insects and diseases, and improve profitability. Two such techniques are worth mentioning here. One is the zero-tillage in wheat which has reduced the cultivation cost and improved its profitability, and IPM in cotton which help minimizing the virus attack on the crop. In vegetables, protected cultivation in plastic houses is becoming increasingly popular.

The collaborations with international organization, such as IRRI, Centro Investigacion para la Mejoramiento Mais Y Trig (CIMMYT), Asian Vegetable Research and Development Center (AVRDC), International Center for Agricultural Research in the Dry Areas (ICARDA), and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) have been very successful in developing new verities and technologies. Such collaboration not only provided access to germless and elite lines of various crops, it also provided on the job training to hundreds of agricultural scientists in the country.

Dismantling of Government Monopolies

During 1970s, marketing of many agricultural commodities were controlled through announcing the floor, domestic release, and export prices all very close to each other, which dampened incentives for the private sector investment in agricultural marketing. These controls were reinforced through banning the inter-regional movements of agricultural products. To institute agricultural monopolies, the government created public sector export corporations, nationalized agribusiness sector, and Pakistan Agricultural Supply and Services Corporation (PASSCO), which launched expensive procurement, processing and export operations in cotton, rice, and wheat.

The input supplies were also controlled by the public sector through various corporations and regulations. Fertilizer, seed, pesticide, water, and credit were all one time controlled by the public sector organizations. However, these monopolies and controls failed to provide enough incentives to farmers to modernize production processes, supply inputs efficiently to farmers, and expand markets for export commodities. On the contrary, they created big burden on the exchequer as large-scale anomalies loom in the public sector corporations.

The government had to put up a big deregulation/privatization drive in an attempt to get out from doing business by the public sector monopolies, and reducing burden on the exchequer. The first step in this direction was of dismantling the public sector rice and cotton export corporations during the late 1980s. This helped boosting the export and expanded production of these crops.

The support price concept is now changing to indicative prices. The number of commodities covered under this concept has been confined to wheat, cotton, rice and sugarcane. The government has already planned to minimize the public sector procurement of wheat and wind up the public sector seed corporations and provincial food departments and allow all these activities in the private sector.

Denationalization of Agribusiness Sector

Nationalizing the agro-based industries during early 1970s imposed one of the control mechanisms in the agriculture sector. This stopped investment in agribusiness sector with detrimental effects on the growth of the commodities used as inputs in the sector. These commodities include wheat, cotton, sugarcane, rice and milk. The denationalization process started during the mid-1980s had positive effects on the production of these commodities. For example, handing over the milk plant to the private sector helped improving the milk distribution system in the country. Similarly, privatization of sugar mills, ginning and edible oil factories and rice mills improved productivity of the respective commodity by offering competitive output prices and in some cases introducing new technologies to the farmers.

Input Subsidies

To achieve the full yield potential of input responsive cereal varieties became available to farmers in the mid-1960s, input subsidies were given initially to introduce modern inputs, like fertilizer, water and machinery to the farmers. However, these subsidies stayed beyond the introduction stage. In the 1970s, the subsidies became part of the government campaign to control the agriculture sector through various input supply corporations. By the early 1980s, these became a symbol of farmers' welfare and prestige. Ironically, most of these subsidies later were used to cover the bureaucratic costs including anomalies in the supply of

these inputs, rather than financing the low-price inputs. Therefore, it became politically and administratively difficult to remove input subsidies.

However, the government took a courageous decision during the early 1980s to phase out these subsidies. As a first step, pesticide supply was given to the private sector, and aerial sprays by the public sector were stopped. Then fertilizer marketing was handed over to the private sector in the early 1990s. Later private seed companies were encouraged to do business, especially in vegetables and hybrid maize. The interest rate on credit given through public sector institutions has been increased to reflect the market interest rate. Now the government is trying to increase water charges to fully recover the canal maintenance cost from farmers.

The government also encouraged the private sector in various agricultural business activities, such as input distribution, plant protection technologies and imports and exports. The restrictions on inter-district and inter-provincial movements of wheat and other farm commodities have been withdrawn to facilitate payment to farmers on competitive basis and to ensure supplies in the deficit regions at reasonable prices.

These steps have positive impact on the development of the agriculture sector. Pesticide companies mainly pushed the cotton revolution in the country. The private sector seed companies are mainly responsible for the distribution of improved vegetable seed and technologies. The hybrid seed of maize reached to the farmers mainly through the private sector, which improved productivity and competitiveness of the crop. The fertilizer distribution and its availability has improved since its marketing is handed over to the private sector. The private sector searched for new opportunities to make profit, which let the sector to diversify towards new business activities.

Free-floating Exchange Rate

The free-floating exchange rate policy adopted since the early 1980s had very encouraging effect on the production of export crops, like rice, cotton, fruits and vegetables. Under this policy, the rupee was allowed to fall freely to adjust to the economic crisis, especially during the late 1990s. This improved the prices and profitability of export crops by making them competitive in the international market.

Infrastructure

The emphasis on infrastructure development has benefitted the agricultural diversification in terms of linking the far-flung production areas with the markets in urban areas and abroad. For example, construction of the motor way connecting Islamabad and Lahore has given a boost to vegetable and fruit areas and brought many new poultry farms around the road. Similarly, consistent emphasis of various governments on building rural infrastructure, such as farm to market roads and new markets, has improved the vegetable and fruit production and milk distribution system in the country.

SUCCESS STORIES

Cotton

As a result of continuing varietal development, the ginning out-turn increased from 30 to 45 percent and above, fiber length from 25 to 32 mm, fiber strength from about 63.5 to about 68.2 kg/mm^2, and roughness decreased from 5.8 to 4.5 micronaire. Lately, CLCV-resistant varieties have been developed. Crop management practices, especially IPM, have been improved. These achievements in research doubled the cotton yield from 339 kg/ha in 1980 to 624 kg/ha in 2000. Progressive farmers are now getting cotton yields up to 3-4 mt/ha.

These achievements in research were complimented by favorable government policies. Encouragement and regularization of the private sector, especially pesticide companies, free-floating exchange rate, denationalization of ginning factories all collectively contributed in achieving a boom in cotton production. Despite the virus problem for couple of years in the mid-1990s, the production has increased from 4.8 million bales (715 thousand mt) in 1980 to 12.2 million bales (1.8 million mt) during 2000. Hopefully we expect to cross the level of 15 million bales (2.55 million mt) of cotton by the year 2005. These achievements have far-reaching consequences on the expansion of textile industry, cotton-based exports, and jobs creation in production, marketing and processing of cotton.

The impressive achievements in cotton research not only contributed in boosting cotton production, but also favorably affected wheat production in the wheat-cotton rotation. Now researchers have developed cultivars that vacate cotton fields by the end of October or early November. These will be helpful to increasing areas and productivity through cultivating long-duration wheat varieties early in the season after the harvest of cotton.

Mung Bean

Mung bean is major *kharif* crop grown in July-August and harvested in September-October followed by wheat cultivation during November-May. In Pakistan, mung bean is currently cultivated on relatively light soils, marginal for cereal cultivation in Layyah, Bhakar, and Mianwali districts. Farmers in these districts have relatively poor infrastructure and meager resource.

The collaborative efforts between National Institute for Agriculture Biology (NIAB), National Agriculture Research Center (NARC), and AVRDC resulted in releasing and adoption of a number of high-yielding mung bean varieties, vis., NIAB Mung (NM) 28 introduced in 1983, NM 121-25, 19-19, 20-21, 13-1 released in 1986, Mung 88 in 1988, NM 51, 54 approved for cultivation in 1990, and NM 92 introduced in 1993. These varieties were able to push the yield frontier up by 100 percent, increase the seed size by about 33 percent, develop resistance to yellow mosaic virus, and improve shining of the seed coat. Other two important achievements are shortening the duration from 90 to about 60 days, and synchronizing maturity.

Farmers quickly adopted the modern varieties. By 1996, almost all mung bean area was under these varieties. The introduction of modern varieties brought about a series of changes in the management practices of mung bean cultivation. The research-based technologies enhanced mung bean productivity. The average yield of the NM92 was 55 percent higher than Desi (indigenous) variety.

The technological innovations also improved the investment opportunities in the marginal farm areas as the benefit/cost ratio of NM19-19, NM54, and NM92 was 1.87, 1.90, and 2.21, respectively, compared to 1.31 in the cultivation of Desi variety. The higher benefit cost ratio of wheat cultivation in wheat-mung bean rotation (1.77) compared to that in wheat-other crop rotation (1.30) was enjoyed by many more farmers as mung bean area expanded in fallow period after wheat.

The gains in productivity due to the adoption of science-based innovation resulted in a substantial increase in the share of mung bean area in total pulses from 3 percent in 1980 to 14 percent in 1999. On the other hand per capita consumption of mung bean enhanced from 1.1 kg/annum in 1984 to 1.7 kg/annum in 1994.

The benefits of technological innovation to the society were estimated to be about US$20 million per annum. These advantages came from: i) substituting the area under Desi with high-yielding variety, keeping total mung bean area at the level before adoption of the innovation (US$5.3 million); ii) increased in mung bean area induced with the introduction of modern varieties (US$3.6 million); iii) improvement in quality (US$4.4 million); and iv) residual effect of mung bean on the following wheat crop (US$6.4 million). The effect of improvement in land quality is pronounced contributing about one-third of the total welfare generated (Ali, *et al*., 1997).

New innovations not only enriched the quality of life of mung bean growers in the country who otherwise had meager income-generating opportunities, it also benefitted the consumers by supplying improved quality mung bean at cheaper prices. Thirty-eight percent of the total benefits of the Green Revolution in mung bean were shared by consumers and 62 percent by producers (Ali, *et al*., 1997). This is in contrast to the Green Revolution in cereals where most of the benefits go to the consumers.

SUMMARY AND POLICY IMPLICATIONS

Pakistan did achieve some degree of vertical diversification out of agriculture, as the share of agriculture in GDP and export has reduced. Moreover, Pakistan exported more of manufactured goods rather than raw materials, and reduced the import of manufactured agricultural commodities, in an attempt to develop import substitute industries within the country. However, the agriculture sector continued absorbing the surplus labor available through high population growth. Therefore, diversification out of agriculture or development in the non-agriculture sectors was not enough to absorb in these sectors all the additional labor supply.

Within the agriculture sector, Pakistan has achieved some success in diversification from the crop sub-sector to the livestock sub-sector. This improvement mainly came from the high increase in the production of poultry meat and milk. The increase in poultry meat was the results of introduction of technological innovations, fiscal measures aimed to encourage commercial poultry farms, and improvements in infrastructure. The growth in milk production came through improvement in yield per milking animals and increase in milking animals. The former was the results of improvement in the milk supply system organized by the private sector as milk plants were denationalized. The numbers of milking animals also increased at relatively high rate, as buffaloes were substituted with bullocks. The privatization of the milk plants, improvements in animal feeding, increased coverage of artificial insemination, greater coverage of the livestock health facilities, and generous credit facilities for setting up commercial dairy farms were the factors behind diversification towards milk and milk products.

In the crop sub-sector, food security issues overshadowed Pakistan's diversification policy. The major focus of researchers and planners has been to assure wheat supply in the country. Therefore, only limited success was achieved in diversifying the crop sector by a marginal increase in the shares of area under cash crops, vegetables and fruits. The pulses and minor crops were generally neglected, although there was a success story in mung bean. Therefore, as noted elsewhere in this proceeding, crop diversity in terms of area allocated to different crops has actually decreased overtime.

The strenuous efforts of policy-makers and researchers could not bring self-sufficiency in wheat production. The country has to spend increasing share of import bills on wheat. Control of wheat prices far below the international prices during most of the 1980s and1990s, failure in the transfer of improved crop management practices to majority of small farmers, adoption of late maturing cotton varieties, unsuccessful population control policies and wheat-deficit countries in the neighbor toned down the tremendous achievements made through wheat research. Lately, serious water shortage due to prolonged drought during 2000-01 has further widened the gap between domestic production and demand.

Pakistan's success in diversifying the crop sector is limited towards increasing the share of cotton, fruits and vegetables, However, its effect is enormous in terms of expansion in the textile industry, job creation in the marketing and agricultural business activities related to cotton, fruits and vegetables, and export earnings. In fact, the cotton-based industry has been the major source of non-agricultural growth during this period. The major factors behind diversification of the crop sector towards cash crops have been the introduction of technological innovations especially in cotton and vegetables, improvement in infrastructure, free floating exchange rate, and fiscal measures to encourage the private sector involvement. The denationalization of ginning factories and dismantling of cotton export monopolies also played a role.

The country enjoyed the comparative advantage in producing most of agricultural products during most of the years in the period 1980-2000. With the declining international prices, however, Pakistan may have lost comparative advantage in few traditional crops and commodities, such as wheat and palm oil. Therefore, the country has to look for new commodities and opportunities in the international markets, and continue knocking the door of WTO for opening up the markets of agricultural products in developed and industrialized countries.

Pakistan has a unique opportunity to diversify its production system from traditional cereal crops to a variety of fruits, vegetables and cash crops as the country is blessed with the most intensive irrigation system in the world, relatively large farm-size majority of it is self-owned, and diversified climatic situation. With relatively large farm size, the tendency for most farmers will be to move towards specialization, while diversification will happen across regions, as different regions will specialize in different crops and livestock products depending upon the region-specific environments.

To achieve the potential of diversification, Pakistan should continue encouraging the private sector involvement in agricultural production, marketing, and processing activities and get out of doing business by herself. The government should focus on the development of infrastructure, reorganization of research and extension systems to focus on non-traditional crops and products, implementation of the ani-trust laws to avoid monopolies and provide a level playing fields for all the actors involved, regulation of the private sector in a way to improve its efficiency, and provision of information regarding opportunities in the domestic and oversea markets. The fiscal and monetary incentives should focus on those crops and products having comparative advantage. To facilitate agricultural production diversification, Pakistan must improve

the efficiency and capacity of its irrigation supply system both by improving water use efficiency at the farm level as well as enhancing the water storage capacity.

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11. PHILIPPINES

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INTRODUCTION

The Philippines is largely an agricultural country. The agriculture sector provides the food requirements of the country's 76 million people and about 40 percent of the country's workforce is employed in the agriculture sector. While majority depends on agriculture for their livelihood including farming and farm-related industries, three out of every four Filipino families that are poor live in the rural areas. Even urban poverty is an indirect effect of rural poverty, since low rural incomes push migrants into the cities. The development of the agriculture sector is therefore viewed as a critical element in the strategy to achieve rapid growth, reduce poverty and attain food security.

The Government of the Philippine like other governments, therefore, needs to lift up the lives of its poorest citizens by fighting poverty at the source, i.e., in the agriculture sector. Agriculture diversification, which increase farmers' incomes by encouraging high-value crops, and generates farm, non-farm and off-farm jobs, should be the key to alleviate poverty. To achieve diversification, Government of the Philippines has chalked out a comprehensive program to modernize the agricultural system in the country.

PRODUCTION ENVIRONMENT AND STRUCTURE

Climate

The Philippines has a generally mild tropical climate characterized by relatively high temperatures, high humidity, and abundant rainfall. The country has four main types of climate, classified according to the presence or absence of a dry season and the duration of the rainy period:

Type I. ***Two Pronounced Seasons***: dry from November to April and wet the rest of the year. The western parts of Luzon, Western Mindanao, Negros, and Palawan have this type of climate.

Type II. ***No Dry Season***: some rain continues throughout the year with most of the rain falling from November to January. Catanduanes, Sorsogon, the eastern part of Albay, the eastern and northern parts of Camarines Norte and Camarines Sur, and a large portion of eastern Mindanao have this type of climate.

Type III. ***Seasons are not Very Pronounced***: relatively dry from November to April and wet the rest of the year. The maximum rainfall periods are not very pronounced, but the short dry season lasts only from one to three months. This type of climate is found in the western parts of Cagayan, Isabela, Nueva Vizcaya, the eastern portion of Mountain Province, southern Quezon, Masbate, Romblon, eastern Negros, central and southern Cebu, part of Northern Mindanao, and most of eastern Palawan.

Type IV. ***Uniformly Distributed Rainy Season***: rainfall is more or less evenly distributed throughout the year, such as in the area of Batanes, north-eastern Luzon, the south-eastern part of Camarines Norte, western parts of Camarines Sur and Albay, eastern Mindanao, Marinduque, western Leyte, northern Cebu, Bohol, and most of Central and Southern Mindanao.

The mean temperature in the Philippines is 27ºC. January is the coolest month, with a mean temperature of 25ºC, while the warmest month is May, with a mean temperature of 28ºC. Baguio, with an elevation of more than 1,500 m, has a mean annual temperature of 18ºC (Librero and Rola, 2000).

Topography

The Philippines has a varied topography, with lofty highlands and lush valleys. The four major lowland production areas are the Central plain and Cagayan valley in Luzon, and Agusan and Cotabato valley in Mindanao. These lowlands contrast sharply with the adjacent highland areas of Central and East Cordillera and the Zambales mountains. There are also several plateaus, among them the Bukidnon and Lanao plateaus in Mindanao are more prominent.

The Sierra Madre and the Cordillera of Luzon are mountain ranges that run almost parallel. The Sierra Madre extends from the north-east of Cagayan to a point east of Laguna lake. The Cordillera runs along the western side of Luzon (Librero and Rola, 2000).

Areas Planted

During 1999, over 6 million ha were planted to rice and corn, the country's primary crops. While the hectarage planted to rice has been rising since 1994 except for a sharp fall in 1998, that of corn has been declining due to conversion of lands into real estate or industrial parks. A large area of agricultural lands is likewise planted to coconut, which maintained stable over the two decades. Meanwhile, the land areas planted to abaca, cassava and rubber have either remained unchanged or have been increasing slowly over time, areas planted to tobacco since the early 1990s have been declining.

Type of Farms

Owing to a favorable climate, the country grows a variety of crops. Among the temporary crops planted, as reported in the early 1990s census, rice had the most number of farms at 3.4 million, followed by corn at 1.8 million (Table 1). Other temporary crops with over a million farms during the same period were tubers, roots and bulbs, as well as fruit-bearing vegetables, which are popularly grown in the backyards of many rural households. Most extensively grown fruit-bearing trees, classified as permanent crops, were banana, mango, guava and jackfruit.

Table 1. Number of Farms of Various Crops in 1991

Type/Name of Crop	No. of Farms	Percentage	Type/Name of Crop	No. of Farms	Percentage
Temporary:			Permanent:		
Rice	3,367,084	36.1	Banana	3,258,942	26.0
Corn	1,771,618	19.0	Mango	1,565,340	12.5
Tubers, roots and bulbs	1,396,237	15.0	Jackfruit	1,372,597	10.9
Fruit-bearing vegetables	1,023,098	11.0	Guava	1,033,759	8.2
Leguminous crops	689,981	7.4	Papaya	880,608	7.0
Leafy vegetables, stems			Star apple	853,637	6.8
and flowers	427,954	4.6	Malunggay	807,813	6.4
Pineapple	211,521	2.3	Santol	737,548	5.9
Sugarcane	208,618	2.2	Avocado	653,395	5.2
Peanuts	129,933	1.4	Soursop	531,117	4.2
Tobacco	99,527	1.0	Kalamansi	323,703	2.6
			Pomelo	276,069	2.2
			Lanzones	259,568	2.1
Total	9,325,571	100.0	Total	12,554,096	100.0

Source: National Census and Statistics Office, 1991.

Aside from crop farms, there are also a number of livestock and poultry farms in the country. The highest numbers are under commercial livestock, hogs and cattle farming. The country also had about 50,923 aquaculture farms in 1997.

Farm Size

The average farm size has decline from 3.6 ha in the 1960s and 1970s to only 2.2 ha in the 1990s (Table 2). While only a little above 10 percent of all farms had less than a hectare of land in the 1960s, this

figure increased to about one-third of all farms in the early 1990s. In contrast, the share of farmers with land areas above 5 ha has declined from 18.9 percent in 1960 to 9.5 percent in 1991.

Table 2. Area and Number of Farms, and Their Distribution by Land Size

Land Size (ha)	1960	1971	1980	1991
Number of farms	2,166,216	2,354,469	3,420,323	4,610,042
Percentage share of all farms				
Under 1.00	11.5	13.6	22.7	36.6
1.00-2.99	50.8	47.5	46.1	42.7
3.00-4.99	18.7	23.7	17.2	11.3
5.00-9.00	13.4	10.4	10.5	7.1
10.00-24.99	5.0	4.3	3.0	2.1
25.00 and over	0.5	0.6	0.4	0.3
Total farm area (ha)	7,772,474	8,493,735	9,725,200	9,974,871
Percentage share of all farms				
Under 1.00	1.6	1.9	3.8	7.3
1.00-2.99	23.1	22.2	25.9	30.5
3.00-4.99	18.4	23.7	21.3	18.4
5.00-9.00	23.7	18.3	23.1	20.5
10.00-24.99	18.0	16.6	14.5	13.0
25.00 and over	15.2	17.2	11.5	10.4
Average farm size (ha)	3.6	3.6	2.8	2.2

Source: Bureau of Agricultural Statistics, Philippines (official files).

The overtime decline in the concentration of land distribution is further revealed from the data on the distribution of area over farm size. While in the early 1960s about 56.9 percent of the total land tilled by farmers having over 5 ha, by 1991 only 43.9 percent of the total land areas were farmed by those with this farm size. The decline in farm sizes have resulted from rising population pressure together with limited growth of employment opportunities in the non-agriculture sectors.

AGRICULTURAL PRODUCTION PERFORMANCE

For the past two decades, agricultural performance in the Philippines was considered poor by the global standards (Table 3). In the 1980s, for instance, agriculture sectors of other Asian countries registered faster growth. In the 1990s, while the Philippine agriculture sector had somewhat recovered, it was still growing at far slower pace relative to most of its neighboring countries.

Table 3. Comparative Growth of the Agriculture Sector by Country, 1960s to 1990s

(Unit: Percent per annum)

Country	1960-70	1970-80	1980-90	1990-98	Country	1960-70	1970-80	1980-90	1990-98
Philippines	4.3	4.9	1.0	1.5	India	1.9	1.9	3.1	3.4
Indonesia	2.7	3.8	3.4	2.8	Pakistan	4.9	2.3	4.3	3.8
Malaysia	n.a.	5.1	3.8	2.0	Brazil	n.a.	4.9	2.8	3.1
Thailand	5.6	4.7	4.0	3.1	Colombia	3.5	4.9	3.0	2.6
Vietnam	n.a.	n.a.	4.3	5.1	Chile	2.6	2.3	5.9	5.2
China	1.6	3.2	5.9	4.3					

Source: World Bank, 1982 and 2000.

The poor growth rates have many causes but it can be summarized into three:

1) Lack of basic support services from the government particularly in irrigation, transport and diffusion of improved technology in the form of higher-yielding seeds, crop management practices, etc.;

2) Farmers' lack of access to land due to the slow implementation of the agrarian reform program; and
3) Poor agricultural diversification.

During the 1980s, rice, corn, coconut, sugar, and banana accounted for majority of the total value of goods and services produced by the agriculture sector. In the 1990s, this composition is hardly changed, except for some dramatic increases in exports of some high-value commercial crops (HVCCs). This indicates rigidity in the sector and its inability to diversify production and take advantage of new opportunities. A closer look at each sub-sector is presented below:

Crops

While crop production has the biggest share in the agricultural Gross Value Added (GVA), it demonstrated the slowest growth during the last two decades, expanding by an average of only 1 percent a year, which is lower than the rate of increase in population. One reason for this is the slowdown in new lands brought into cultivation, from about 3.6 percent a year in the 1970s to only 0.8 percent in the 1980s and early 1990s. Adding to the deceleration of crop production, especially in the 1980s, are the declines in world commodity prices affecting the country's traditional export crops (e.g., sugar and coconut), a series of natural calamities and droughts, and virtual completion of the Green Revolution by the early 1980s. However, crop production grew by 10.3 percent in 1999 as the government succeeded in putting in place the building blocks for the modernization of the agriculture and fishery sectors and partly because of favorable weather conditions.

Among the major crops, rice has the highest average growth, as well as the biggest share to the total agriculture GVA (Table 4). In 1999, it registered a growth of 37.8 percent. Although corn has the second biggest output share, it posted a very low growth in the 1990s as an effect of its declining hectarage, but recovered in 1999 when it demonstrated a 19.9-percent increase. Some major crops like sugarcane and banana attained a negative output growth in the 1980s but exhibited an upward trend in the 1990s, while coconut continued to decelerate although at a slower rate in 1990s as compared to 1980s.

Table 4. Changing Structure of Growth in Crop Production, 1981-2000

Crop	Percent Share to Total Agricultural GVA		Annual Growth (percent)	
	1981-90	1991-2000	1981-90	1991-2000
Rice	14.9	16.0	2.66	3.92
Corn	6.2	6.0	3.53	0.14
Coconut	6.8	3.9	-4.62	-0.37
Sugarcane	2.9	2.7	-1.63	4.34
Banana	2.3	1.7	-3.51	3.09
Other crops	21.6	23.0	1.48	1.18

Source: National Economic Development Authority (NEDA) Report, 1980-2000 (official files).

In terms of productivity or yield per ha, rice and corn improved in the 1990s but of banana and abaca remained stagnant (not reported in the Table). Among the export crops, pineapple registered the most impressive growth in productivity.

Livestock and Poultry

From 7 percent in 1981, the share of the livestock sub-sector to the total agricultural GVA almost doubled by the late 1990s. Livestock output has grown at an annual average of 5 percent over the last 20 years. While in the 1980s, the livestock sub-sector was marked by erratic growth, it was relatively stable during the 1990s (Table 5). Cattle and hogs have been the sub-sector's consistent source of growth.

Despite the output of poultry decelerated until the mid-1980s, with the sharpest decline at 16 percent in 1985, the sub-sector produced the strongest growth both during the 1980s and 1990s due to advances in production technology (e.g., shorter, fattening/growing-to-market days, etc.) and incentives enjoyed by large commercial producers (e.g., duty free importation of grandparents/parents poultry stocks) since mid-1980s. From a growth of only 1 percent in 1999, poultry expanded by 5.4 percent in 2000.

Table 5. Changing Structure of Livestock and Poultry Production Growth, 1981-2000

Sub-sector		1981-90	1991-2000
Livestock:	Carabao	7.58	2.38
	Cattle	4.43	5.96
	Hog	8.55	4.12
	Goat	11.65	3.02
	Diary	7.94	-6.31
Poultry:	Chicken	12.94	6.24
	Duck	34.48	4.17
	Chicken eggs	4.14	4.10
	Duck eggs	0.94	5.54

Source: Estimated from the data obtained from the Office of Bureau of Agricultural Statistics.

Fishery

The 1980s was a period of both high growth and sharp contraction in the fishery's real output (Table 6). In the 1990s, the fishery sector slowed down, growing by an average of only 1.1 percent a year, with production constrained by the fast depletion of marine resources.

Table 6. Changing Structure of Fishery Production Growth, 1981-2000

(Unit: Percent)

Sub-sector	Growth in Output		Share	
	1981-90	1991-2000	1981-90	1991-2000
Commercial	3.75	2.51	26.7	32.1
Municipal	2.54	-2.08	50.3	36.0
Aquaculture	9.01	4.04	23.0	31.9
Total fishery sector	4.18	1.12	100.0	100.0

Source: Estimated from the data obtained from the Office of Bureau of Agricultural Statistics.

Municipal fishing used to account half of the fishery's output in the 1980s, but its share dropped to an average of only 36 percent in the 1990s. This is owing to overfishing in the past, encroachment of commercial fishing vessels in municipal fishing grounds, and massive degradation of aquatic resources. Meanwhile, the output shares of both commercial and aquaculture fishing expanded, with the latter posting a more rapid growth.

AGRICULTURAL DIVERSIFICATION: PROGRAMS AND STRATEGIES

Faced with these challenges, the Philippine Government started putting in place the building blocks for the modernization of the agriculture and fishery sectors. A law was promulgated to serve as a roadmap for agricultural and fisheries modernization. In particular, Republic Act 8435 – the Agriculture and Fisheries Modernization Act (AFMA) of 1997 – now guides the Philippine Government in addressing the urgent needs of the sectors.

The government adopts the following strategies to raise productivity and encourage agricultural diversification:

Creation of Strategic Agriculture and Fisheries Development Zones (SAFDZs)

The creation of SAFDZs, as mandated by AFMA, is aimed to improve the resource allocation efficiency by allowing the Department of Agriculture to allocate its scarce resources in areas where they can be of optimum use. A SAFDZ is a contiguous agricultural area suitable for the production of the priority agricultural commodities. These areas are linked to each other by roads, bridges, ports and even airports, and are located near growth centers. In the SAFDZ, active organized groups of small farmers and fishers actively practice relatively advanced farm production techniques. Each SAFDZ has an integrated development plan covering production, processing, investment, marketing, human resources development and environmental protection. The SAFDZs represent the followings:

* Best of the prime and well-endowed lands;
* Areas of focus for public and private investments; and
* Centers of development and modernization in agriculture and fisheries.

***Agrikulturang MakaMASA* Programs**

These programs are focused on the production of rice, sugar, coconut, corn, HVCCs, abaca, livestock and fisheries. The general objective of each commodity production program is to increase production and transform farmers into viable producers and entrepreneurs through specific interventions. The strategies of *Agrikulturang MakaMASA* Program separately for each crop, livestock and fisheries are outlined below:

1. ***Rice***

In order to achieve self-sufficiency in the production of rice, the staple food of Filipinos, this Program focuses its implementation in areas with high comparative advantage in rice production. These areas are those fully irrigated, and where certified rice seeds, technicians, and post-harvest facilities exist. The Program has the following strategies:

1) Adopts production-enhancing technologies, i.e., those that would increase yields by as much as 1.0 mt/ha. These technologies include hybrid and certified rice seeds make available, accessible and affordable to rice farmers;
2) Implement interventions aims to transform rice farming from a subsistence activity to a viable enterprise. These interventions include the provision of post-harvest facilities such as mechanical dryers, threshers, and mini-warehouses including the dissemination of post-harvest technologies; and
3) Deployment of well-trained agricultural technologists in farmers' fields as the main vehicles for technology transfer by providing proper and timely advice to farmers.

2. ***Corn***

This Program develops farm clusters, each composed of 400 contiguous ha of prime corn areas within SAFDZs, in order to take advantage of economies of scale. The following strategies are adopted to develop these corn clusters:

* Supported the productivity and production-enhancing intervention such as providing information on appropriate technologies, pest disease management practices, post-harvest facilities;
* Increase access to credit, irrigation, and farm equipment and machinery;
* Encourage contract-growing arrangements and other such schemes;
* Provide post-harvest facilities, farm-to-market roads and information to ensure better prices for farmers within the clusters;
* Implement the capability-building interventions for farmers and farmers' organizations;
* Adopt the participatory approach in program planning, monitoring, and evaluation, involving all stakeholders; and
* Taps local government units to manage and implement interventions at the local level.

3. ***High-value Commercial Crops***

The Program classifies HVCCs into those on which the country's potential to achieve international competitiveness is high, such as mango, banana, calamansi, papaya, guyabano, ornamental and cut-flowers, and those that are required for domestic consumption such as banana, mango, garlic, onions, tomatoes, asparagus, coffee, pineapple, peanut, papaya and legumes, among others. As a strategy, the Program will implement in the SAFDZs Commodity Producer Linkage with User Scheme (PLUS). Under the PLUS, different modalities of marketing agreements geared toward vertical integration and horizontal expansion and backward linkages between processors and producers will be adopted. The Program has following strategies:

* Conduct commercial testing and establish techno-demos of integrated systems;
* Encourage privatization of post-harvest and processing facilities, so that private sector can establish these facilities through various modes such as Build-Operate-and-Own (BOO), Build-Lease-and-Transfer (BLT), and Rehabilitate-Operate-and-Transfer (ROT); and
* Development of guides and manuals and disseminate information for product safety, manufacturing and distributions standards.

4. ***Abaca***

This Program seeks to make the Philippines a major exporter of world-class fibers and fiber products from the crops even currently the industry is being strengthened to fulfill the domestic demand only. In order to achieve this, the Program have following strategies:

* Organize and strengthens cooperative organizations of abaca producers and/or manufacturers;
* Develop abaca development programs at the municipal and provincial levels;
* Provide technical support to local government units in implementing and monitoring local abaca development programs;
* Promote efficient technologies through an efficient and effective agricultural extension support program;
* Focus national government support on strategic abaca areas;
* Improve production marketing systems; and
* Ensure availability of quality seeds, materials, and other inputs to farmers.

5. ***Coconut***

The overall strategy of the Program is setting up of model coconut farms at appropriate locations using an integrated farming approach aimed at making coconut farming a viable business venture. A model coconut farm is a cluster of small but contiguous coconut farms, totaling from 15 to 20 ha owned and/or operated by small coconut farmers, and located with SAFDZs. The model farm is:

* fully intercropped with cash and commercial crops;
* posses 10 heads of cattle for fattening, five heads of carabao for use as work animals and for breeding and 250 heads of chicken and 10 heads of swine for meat production;
* access to adequate supply of water for irrigation, livestock use, and/or aquaculture activities;
* organized and viable cooperatives undertaking of entrepreneurial ventures; and
* contains essential production and processing facilities such as irrigation systems, farm implements, and post-harvest facilities operated by farmers.

6. ***Sugar***

This Program motivates producers to:

* adopt proven agronomic practices and technologies in their operations;
* promote farm mechanization;
* enhance soil productivity through balanced fertilization, soil acidity correction, appropriate soil ameliorations, and control of soil erosion;
* saturate farms with at least three different high-yielding varieties of sugar; and
* minimize the incidence of pests and diseases, among others.

7. ***Livestock***

This Program has the following components:

* Livestock enterprise development wherein modular and/or cluster livestock production modules are encouraged and supported through the provision of credit and capability-building interventions;
* Techno-transfer and capability-building that aims to strengthen the promotion and dissemination of appropriate production and post-production technologies through farmer and technician training, and the use of selected stock-farms, and research, development and training centers;
* Genetic improvement component which involves the establishment of nucleus and multiplier farms that are expected to produce genetically-superior animals and genetic materials. This Programs also aims to intensify the artificial and natural breeding programs using genetically improved germ plasm and sires;
* Animal health component which aims to intensify efforts to prevent, control and eradicate the foot-and-mouth disease through an intensified vaccination program; and
* Post-production and marketing component through the improvement and upgrading of post-production facilities such as abattoirs and livestock markets.

8. ***Fisheries***

This Program in fisheries aims to:

* increase productivity through the promotion and dissemination of appropriate fisheries technologies;

* the rehabilitation of fish farms, and the establishment of a seed fund for credit to be used to purchase production inputs;
* integrated coastal and marine resource management through its conservation and management component;
* strict enforcement of fisheries law, rules, and regulations and rehabilitate habitats; and
* ensures the dissemination of technologies and information needed to increase productivity through its fisheries training and extension component.

Agro-industry Modernization Credit and Financing Program

Republic Act 8435, otherwise known as the "Agriculture and Fisheries Modernization Act" was enacted in 1997. The Act phases out all direct credit programs of the government, and creates the Agro-industry Modernization Credit and Financing Program (AMCFP). This Program aims to rationalizing the provision of credit from agencies of the Department of Agriculture and limit lending to financial institutions including qualified cooperatives and NGOs.

Empirical findings indicate that government line agencies do not have the capacity to function like banks since past government credit programs have been found to be costly and inefficient. At the time when government lending was at its peak particularly in the 1970s, the proportion of loans from banks and the borrowing incidence among small farmers rose to significant levels but only for a brief period. After some time, farmers defaulted in their loan repayments, government funds dwindled, and some of the participating rural banks that were saddled with large arrearage became bankrupt. The Law, thus, provides for the consolidation of all funds from the various other credit programs of the Department of Agriculture into the AMCFP in order to make credit delivery more effective and efficient. All income-generating projects in agriculture and fisheries can qualify for funding assistance. Meanwhile, the Department continues to develop innovative financing schemes for farmers and fishers that would encourage the provision of credit not only for production activities but for off-farm and non-farm micro-enterprises as well.

ALTERNATIVE SCENARIOS

Present Scenario

Given the government's efforts to raise productivity and encourage diversification, coupled with favorable weather conditions, the Philippine agriculture seemed to have responded almost instantaneously. The agriculture sector recovered from the slump and posted a 6.5-percent expansion in output in 1999, at levels close to the 1997 (pre-El Niño) performance. Gross value of output in the same year expanded by 9.6 percent. Crop production grew by 10.3 percent banner by rice (37.8 percent) and corn (19.9 percent). Most other crops, particularly HVCCs, also posted gains indicative of recovery. Livestock production resumed its high growth path, after slumping in 1998 and expanded by 4.2 percent. Fisheries production expanded by 2.7 percent and registered one of its highest growths for the 1990s, with gross earnings amounting to PhP (Philippine peso) 90.6 billion or an expansion of 6.7 percent.

Future Scenario

There is a lot to look forward to as the country has yet to experience the full impact of its programs and policy reforms. The challenge is how to modernize Philippine agriculture, how to reverse its decline in productivity, enhance its profitability and prepare it for competition in a globalize economy by the year 2010 when the WTO protocol takes effect and the tariff on all products including the sensitive products (corn, pork and poultry meat) are reduced to a range of 0-5 percent and by the year 2020 when the Asia Pacific Economic Cooperation (APEC) free trade zone takes effect. Guided by the mandates and directions under the AFMA coupled with careful analysis, the Department of Agriculture's efforts and resources in interventions are expected to result the greatest impact with the least cost. The Department will continue to organize its interventions into programs focused at priority commodities and regions, so that the most economically significant commodities in the most productive regions of the country are accorded the greatest levels of support.

The tasks are enormous and the players are many. The name of the game is cooperation, collaboration, linkages and unity of purpose. There is sufficient time to prepare Philippine agriculture to compete. The die is cast. There is no turning back.

SUMMARY

The Philippine agriculture and fishery sector has been performing below expectations and potential in the past two decades. The other countries' agriculture sectors were growing faster than that of the Philippines. In the 1990s, while the Philippine agriculture sector had somewhat recovered, it was still growing far slower than most of its neighboring countries. The poor growth rates have many causes but it can be summarized into three:

(a) Inadequate government support in the form of basic infrastructure like irrigation, farm to market roads and of improved production technologies;
(b) Farmers' low access to land due to the slow implementation of the agrarian reform program; and
(c) Poor agricultural diversification.

The agriculture and fishery sectors have been unable to diversify production and rural employment opportunities. During the 1980s, rice and corn, coconut, sugar, and banana accounted for majority of the total value of goods and services produced by the sector. In the 1990s, this hardly changed.

Given the dismal performance of the sector, the Philippine Government is challenged to accelerate diversification particularly from traditional crops to HVCCs by modernizing the agriculture sector. Therefore, in 1997, the AFMA was passed into law to serve as a roadmap for agricultural and fisheries modernization. It now guides the Department of Agriculture in addressing the urgent needs of the agriculture and fishery sectors. In this Act, the following general strategies were adopted to achieve diversification.

(a) Creation of the Strategic Agriculture and Fisheries Development Zones which are strategically-located areas of prime agricultural land where agricultural modernization programs are being focused; and
(b) Implementation of the *Agrikulturang MakaMASA* Programs on rice, corn, sugar, coconut, HVCCs, abaca, livestock and fisheries. The idea is to organize its interventions into programs focused at priority commodities and regions, so that the most economically significant commodities in the most productive regions of the country are accorded the greatest levels of support.

The priority interventions for each area and commodity-production program can be summarized as:

(a) irrigation and water management;
(b) research and development;
(c) seed systems to ensure availability and accessibility of enough high-yielding planting materials to farmers and fishers;
(d) information, communication, extension and advocacy;
(e) rural finance;
(f) farm-to-market roads and infrastructure;
(g) post-harvest facilities;
(h) marketing assistance; and
(i) food safety through quality assurance systems.

So far, the sector has responded almost instantaneously to the above strategies partly because of favorable weather conditions. The sector recovered from the 1998 slump and posted a big expansion in output in 1999.

There is a lot to look forward to as the country has yet to experience the full impact of its programs and interventions. The real challenge is to modernize agriculture in order to prepare for global competitiveness.

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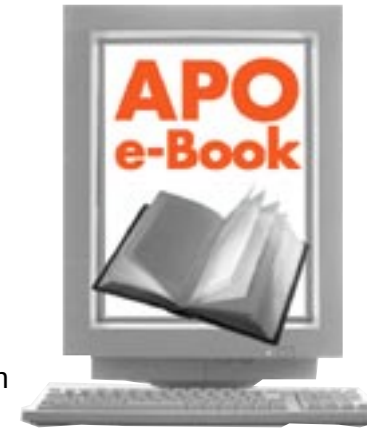

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12. SRI LANKA

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INTRODUCTION

Geographical Characteristics of Sri Lanka

Sri Lanka is an island in the Indian Ocean situated at the southern tip of the Indian subcontinent within the equatorial belt. The country has a land area of 65,610 km^2 (6.56 million ha) of which approximately 2 million ha are arable lands. Rainfall over the island follows a bimodal pattern under the influence of the Northeast (November to February) and Southwest (May to August) monsoons resulting in two distinct cropping seasons; '*Maha*' and '*Yala*' coinciding with the two monsoons, respectively.* On the basis of the rainfall and soils, the country has been divided into three major agro-ecological zones: Dry Zone (4.17 million ha), Wet Zone (1.54 million ha) and Intermediate Zone (0.85 million ha) and these are further sub-divided into 22 agro-ecological regions (Figure 1). According to the elevation, the island is divided into a low-country (from sea level to 305 m above sea level), mid-country (300-900 m) and up-country (over 900 m). The soils of Sri Lanka have been surveyed at a reconnaissance level and mapped.

Socioeconomic Characteristics of Sri Lanka

The total population of the country was 18.3 million in 1996, of which about 70 percent live in the rural areas of the island. The rate of growth of population is 1.1 percent, much lower than the rates in other developing countries in the region.

Agriculture has been the mainstay of the Sri Lankan economy. In 1999, it accounted for 20.7 percent of the GDP and about 35 percent of total foreign exchange earnings. The per capita GNP for 1995 was at US$719 and it rose to US$829 in 1999. The agriculture sector provides most of the country's food requirements, raw materials for agro-based industries and employment to about 40 percent of the population. These contributions exceed the contribution of any other sector of the economy. An estimated 1.8 million families are engaged in farming. Smallholdings dominate Sri Lankan agriculture, as over 64 percent of the farm families operate less than 0.8 ha of land.

In 1977 Sri Lanka adopted an open market policy, which focused on trade liberalization, export orientation and private sector participation in the development process. This policy change has brought some desirable benefits as well as some negative economic and social implications. The situation needs to be reviewed to mitigate the negative impact, and to enhance the overall efficiency of the policy.

With the introduction of open market policy in 1977, the economic and social structure of the country has gradually changed. The relative share of agriculture in GDP has declined from 27.7 percent in 1981 to 19.4 percent in 2000. Only fisheries sub-sector had maintained its share. The major factors contributed to the economic restructure include rapid increase of industries, foreign employment opportunities and trade liberalization (Table1).

* The remaining months of the year are dry, and almost no cultivation occurs during this period.

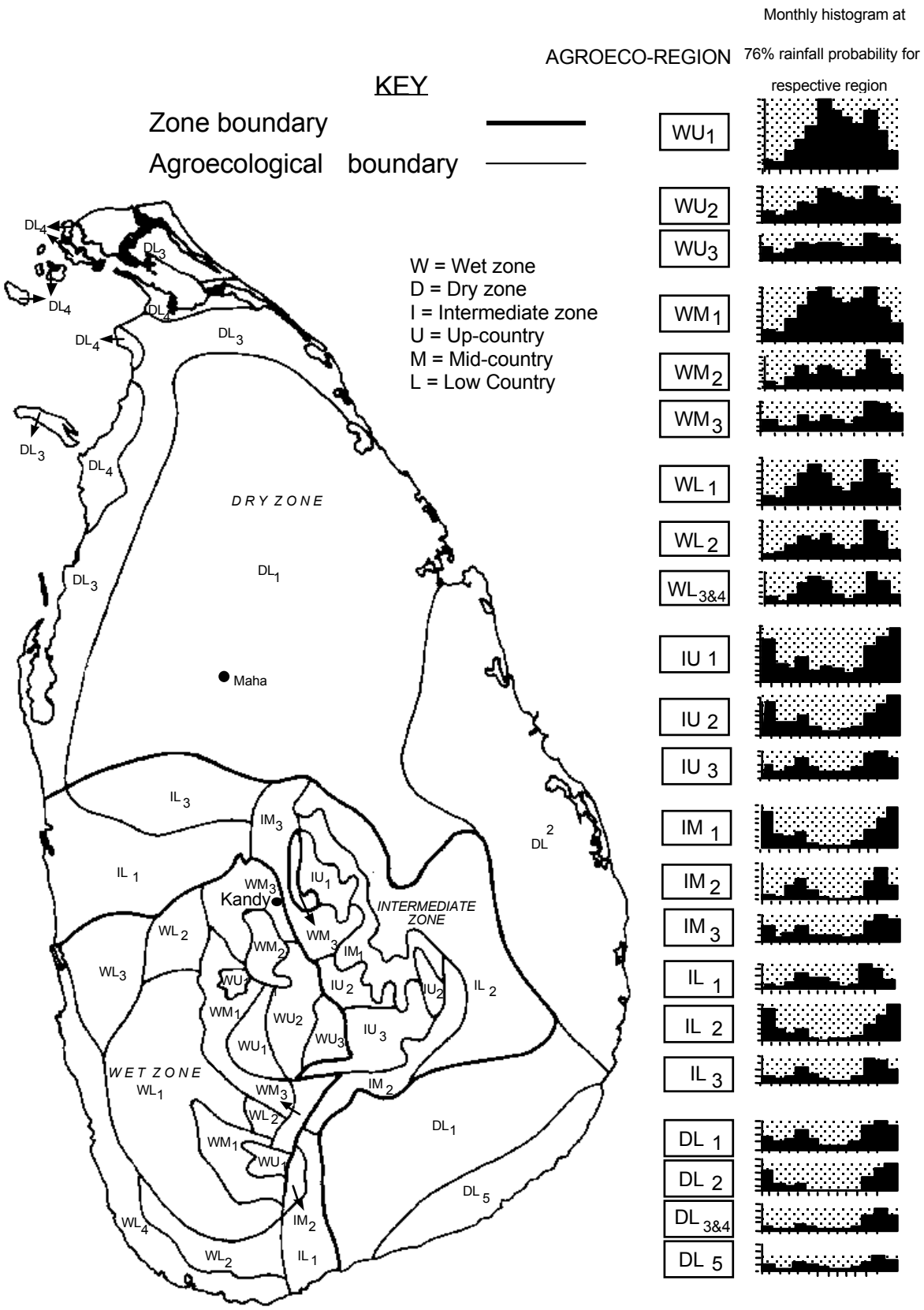

Figure 1. Agro-ecological Map of Sri Lanka

Table 1. Relative Contribution of Major Agriculture Sectors in the GDP

Year	GDP at Current Factor Cost	Percentage Contribution in GDP			
		Crops and Livestock	Forestry	Fishery	Agriculture
1981	79,337	-	-	-	22.7
1982	94,679	21.9	1.8	2.6	26.3
1983	113,878	23.8	1.7	2.8	28.3
1984	140,039	25.0	1.6	2.1	28.7
1985	148,321	24.0	1.7	2.0	27.7
1986	163,713	23.1	1.9	2.1	27.1
1987	177,731	22.8	2.1	2.1	27.0
1988	203,516	22.4	2.0	2.0	26.4
1989	228,138	21.4	2.0	2.2	25.6
1990	290,615	22.4	1.9	2.0	26.3
1991	337,399	22.3	2.2	2.3	26.8
1992	386,999	21.0	2.2	2.7	25.9
1993	453,092	19.9	2.1	2.6	24.6
1994	523,300	18.8	2.2	2.8	23.8
1995	598,327	17.8	2.4	2.8	23.0
1996	695,934	17.6	2.1	2.7	22.4
1997	803,698	17.3	1.9	2.7	21.9
1998	912,839	16.8	1.7	2.6	21.1
1999	994,730	16.4	1.6	2.6	20.6
2000	1,125,259	15.3	1.5	2.6	19.4

Source: Central Bank of Sri Lanka, various issues.

During 1991-2000, there is no considerable change in the share of imported food consumed in Sri Lanka (Table 2).

Table 2. Share of Agricultural Products in Total Imports, 1991-2000

Year	Total Import (LKR million)*	Percentage Contribution					
		Rice	Flour	Sugar	Milk and Milk Products	Fish	Other Imports
1991	126,643	1.255	0.001	4.058	2.208	1.650	4.055
1992	153,555	1.857	0.002	3.225	1.915	1.592	3.388
1993	193,550	1.233	0.285	2.904	1.888	1.269	2.788
1994	235,576	0.278	0.008	3.767	1.827	1.255	3.016
1995	272,200	0.045	0.001	3.210	2.068	1.270	3.232
1996	301,075	1.700	0.001	2.666	2.008	1.224	3.398
1997	346,026	1.252	0.055	3.118	1.646	1.246	3.627
1998	380,138	0.689	0.207	2.206	1.977	1.070	3.956
1999	421,888	0.780	0.106	1.765	1.788	0.898	3.854
2000	554,290	0.052	0.101	1.944	1.614	0.931	3.108

Source: Central Bank of Sri Lanka, various issues.
Note: * Sri Lanka rupee (LKR) 66.7 = US$1.0 during 1998.

Except few items such as fruits, the relative contribution of most of the export agricultural products had fallen during 1981-2000 (Table 3).

Table 3. Value of Export of Agricultural Products, 1981-2000

Year	Total Export (LKR million)	Percentage Contribution									
		Tea	Rubber	Coconut	Vegetables	Fruits	Areca Nuts	Coffee	Pepper	Cinnamon	Cloves
1981	21,043	30.623	13.729	6.834	0.128	0.090	0.157	0.309	0.247	2.015	1.202
1982	21,454	29.561	10.828	6.978	0.536	0.228	0.168	0.513	0.158	1.347	1.011
1983	25,096	33.053	11.364	7.655	0.705	0.056	0.124	0.650	0.151	0.805	1.486
1984	37,347	42.210	8.839	5.671	0.163	0.029	0.083	0.627	0.249	0.766	0.511
1985	36,207	33.151	7.087	8.543	0.146	0.232	0.030	0.806	0.309	0.878	0.110
1986	34,072	27.157	7.695	7.012	0.170	0.041	0.056	0.660	0.470	0.963	0.475
1987	41,133	25.901	7.121	5.203	0.168	0.107	0.034	0.109	0.695	1.082	0.105
1988	46,928	26.208	7.897	3.279	0.324	0.060	0.034	0.494	0.622	1.438	0.539
1989	56,175	24.324	5.540	5.100	0.198	0.110	0.027	0.169	0.271	1.883	0.028
1990	79,481	24.941	3.875	3.501	0.386	0.067	0.101	0.052	0.136	1.425	0.277
1991	62,985	28.367	4.193	2.809	0.397	0.111	0.152	0.121	0.222	2.280	0.102
1992	79,906	18.638	3.704	3.335	0.282	0.099	0.041	0.061	0.154	1.907	0.076
1993	100,221	19.867	3.079	1.643	0.385	0.106	0.009	0.044	0.395	1.641	0.072
1994	110,227	19.019	3.250	2.246	0.559	0.115	0.016	0.341	0.288	1.475	0.037
1995	133,979	18.389	4.264	2.627	0.222	0.148	0.083	0.095	0.267	1.285	0.049
1996	155,909	21.851	3.690	2.866	0.162	0.188	0.086	0.035	0.250	1.233	0.055
1997	191,969	22.156	2.417	2.534	0.144	0.111	0.076	0.047	0.421	1.435	0.069
1998	218,318	23.031	1.286	1.664	0.153	0.062	0.127	0.064	0.787	1.496	0.065
1999	228,354	19.149	1.009	2.616	0.109	0.191	0.172	0.034	0.572	1.546	0.181
2000	293,746	18.088	0.742	1.970	0.086	0.115	0.015	0.002	0.540	1.172	0.104

Source: Central Bank of Sri Lanka, various issues.

A REVIEW OF THE CROP SUB-SECTOR OF SRI LANKA

The wide range of climatic conditions in Sri Lanka (Appendix 1) permits the cultivation of a variety of crops ranging from tropical to temperate. Food crops dominate farming in the Dry and Intermediate Zones with paddy being grown on the lowlands and irrigation schemes. Other food crops are cultivated under rainfed condition on highlands.

Virtually, almost all types of soils in Sri Lanka are suitable to grow rice, while low humic gley, solodized solonetz, grumusols, bog soils and lithosols are not suitable for upland crops. Tea, rubber and coconut are predominant in the highlands of the Wet Zone. The minor export crops, which include five spice crops (cinnamon, cardamom, pepper, clove, and nutmeg) and the two beverage crops (coffee and cocoa), are grown mainly in home gardens in the Wet and Intermediate Zones. In the following paragraphs the performance of various important crops is reviewed.

Tea

It is grown in the Wet Zone on approximately 3.5 percent (234.9 thousand ha) of the total land area of the country. These lands are divided into:

i) up-country tea representing (32 percent of total tea area);
ii) mid-country tea occupies (39 percent of total tea area); and
iii) low-country tea (29 percent of total tea area).

The economic prospects for up- and low-country tea are considered more favorable then mid-country tea. Due to heavy soil erosion for a long period, gradual withdrawal of the management of tea plantation by foreign companies and fragmentation of large tea states to small tea lands, the tea output fell at an annual rate of 0.96 percent during 1970-77.

As a result of the restructuring in the Plantation Corporation and the Tea Smallholding Authority, which are the driving bodies of the tea development sector, tea production increased and came to a record level of 306 thousand mt in 2000 (Table 4). Although, tea area decreased at the rate of 1.59 percent per annum, tea production and yield per ha have increased at the rate of 2.15 and 3.74 percent, respectively during 1981-2000. Introduction of high-yielding tea clones by the Tea Research Institute, tea subsidy schemes from the government and new management techniques especially increased fertilizer use in production were other major contributing factors behind the yield improvement. The decline in the ratio of export price to production cost may explain the declining trend in tea area during 1981-2000.

Rubber

Both the area and production of rubber have been declining since early 1980s. After 1996, the decline in rubber production was sharper than fall in the area. One of the underlying reasons was the rapid fall of its export price reflected in low farm gate price, and rise in the cost of production. Therefore, the ratio of export price (f.o.b.) to production cost deteriorated rapidly. In 1999, Sri Lanka decided to withdraw from the International Natural Rubber Agreement (INRA). This was in response to the failure of the price-stabilizing arm of the INRA. An improvement in the price is expected with increased demand from the U.S.A., Republic of Korea and China. The rate of uprooting of rubber plantation was higher than re-plantation, therefore area under rubber was nearly one thousand ha less during 2000 as compared with 1999.

The growth in area, production and yield of rubber during 1981-2000 were estimated at -1.81, -2.05 and -0.24 percent, respectively (Table 5). This implies that plummet in the rubber production was faster than decline in the area indicating deterioration in per ha yield as well. The national average yield of rubber in Sri Lanka ranges 600-700 kg/ha far below the potential yield in the range of 1,500-2,000 kg/ha. Hence, there is a strong need rubber research to improve its national average yield in order to maintain comparative advantage in its production. The domestic consumption of rubber in the industrial sector has shown a steady increase over the last few years.

Table 4. Tea Production and Market Statistics, 1981-2000

Year	Area (000 ha)	Production (000 mt)	Yield (kg/ha)	Production Cost (LKR/kg)	Export Price (f.o.b.) (LKR/kg)	Fertilizer Use (kg/ha)	Ratio of Export Price to Cost of Production
1981	244.9	210.0	857	18.79	35.14	422	1.87
1982	242.1	188.0	777	22.68	35.03	424	1.54
1983	230.1	179.0	778	26.37	52.52	502	1.99
1984	227.9	208.0	913	34.00	77.20	602	2.27
1985	231.7	214.0	924	35.00	60.62	647	1.73
1986	222.9	211.0	947	38.00	44.52	578	1.17
1987	221.5	213.0	962	41.00	52.97	617	1.29
1988	221.7	227.0	1,024	43.98	55.95	623	1.27
1989	221.1	207.0	936	49.70	66.91	578	1.35
1990	221.8	233.0	1,050	57.65	91.78	606	1.59
1991	221.7	240.7	1,086	60.68	84.12	536	1.39
1992	221.8	178.9	807	72.26	81.98	497	1.13
1993	192.7	231.9	1,203	75.81	91.16	764	1.20
1994	187.4	242.2	1,292	75.67	91.32	674	1.21
1995	189.0	245.9	1,301	76.74	102.31	637	1.33
1996	189.4	258.4	1,364	87.04	139.56	813	1.60
1997	193.7	276.9	1,430	90.26	158.39	835	1.75
1998	194.7	280.1	1,439	100.71	184.94	933	1.84
1999	179.8	283.7	1,578	101.29	162.39	913	1.60
2000	180.0	305.8	1,699	109.80	184.37	1,098	1.68
Growth rate (%)	-1.59	2.15	3.74	8.74	8.21	3.70	-0.53

Source: Central Bank of Sri Lanka, various issues.

Table 5. Rubber Production and Market Statistics, 1981-2000

Year	Area (000 ha)	Production (000 mt)	Yield (kg/ha)	Production Cost (LKR/kg)	Export Price (f.o.b.) (LKR/kg)	Fertilizer Use (kg/ha)	Ratio of Export Price to Cost of Production
1981	205.6	124.0	603	8.92	21.80	82	2.44
1982	205.7	125.0	608	9.66	17.68	80	1.83
1983	205.7	140.0	681	9.90	48.62	90	4.91
1984	205.6	142.0	691	12.06	55.30	114	4.59
1985	204.3	137.5	673	13.67	66.94	118	4.90
1986	202.8	137.8	679	13.70	59.11	130	4.31
1987	201.9	121.8	603	13.95	56.35	116	4.04
1988	200.2	122.4	611	13.41	41.67	125	3.11
1989	199.6	110.7	555	15.06	61.47	113	4.08
1990	199.0	114.0	573	17.96	52.03	108	2.90
1991	198.5	103.9	523	22.92	34.55	74	1.51
1992	194.6	106.1	545	24.50	37.65	76	1.54
1993	161.5	104.2	645	30.22	44.34	74	1.47
1994	160.9	105.3	654	30.85	51.81	75	1.68
1995	161.6	105.7	654	33.37	83.69	77	2.51
1996	162.6	112.5	692	36.70	79.78	75	2.17
1997	158.2	105.8	669	40.37	75.42	78	1.87
1998	158.1	95.7	605	42.00	67.72	79	1.61
1999	159.1	96.6	607	43.50	53.90	80	1.24
2000	158.0	87.2	552	44.50	66.15	79	1.49
Growth rate (%)	-1.81	-2.05	-0.24	9.30	3.91	-1.84	-5.39

Source: Central Bank of Sri Lanka, various issues.

Coconut

The coconut cultivation is dominated by small-sized holdings and the majority of coconut plantations are maintained as monoculture. From 1981 to 1992 the area under coconut decreased and later it increased with an overall trend of 0.32 percent per annum during 1981-2000 (Table 6). The production fluctuated between 1.9 to 3.1 million my, with an overall increasing trend of 0.88 percent per annum. The yield also improved during this period at the rate of 0.57 percent per annum. The rise in coconut production was the result of the implementation of coconut subsidy schemes, introduction of improved hybrid varieties and modern technologies. On the other hand, export price-production cost ratio declined at -1.64 percent per annum, suggesting that increasing in production cost was higher than the export price. The fertilizer use also declined at an annual rate of 0.63 percent (Table 6).

The domestic coconut oil industry was indirectly affected by the low international prices of vegetable and palm oils, resulting in the stagnation of farm gate prices of coconut. The coconut plantations maintained as monoculture, showing an inefficient land use pattern and generating low economic returns to the grower.

Paddy

Paddy production has increased steadily since 1977 and Sri Lanka is on the threshold of self-sufficiency in rice. Between 1981-2000, the area, production and yield per ha of paddy increased at annual rates of 0.01, 0.74 and 0.73 percent, respectively (Table 7). Widespread utilization of improved varieties and easy accessibility to production inputs has played a major role for such achievements. However, stagnation in the guaranteed price since 1993 has adversely affected the profitability of rice production. Farmers seems least interested in paddy cultivation, hence fallow paddy fields is becoming a serious issue in Sri Lanka. In the *yala* season more than 30 percent of cultivable paddy lands are not cultivated.

Vegetables

Beans, carrot, cabbage, eggplant, okra and tomato are some of the major vegetables grown in Sri Lanka. Except eggplant and okra, the area under vegetables increased to varying extents during 1981-96. The largest growth in area was of carrots and lowest of beans. On the other hand, except cabbage, the production of all major vegetables increased during 1981-96, with largest growth in carrots and lowest in eggplant (Table 8). A positive growth in yield per ha was taken place for all major vegetables except cabbage. Effective extension services provided by the Department of Agriculture and the introduction of high-yielding varieties in collaboration with the Asian Vegetable Research and Development Center were the major reasons for such a yield increase. Well-established marketing channels operated in the country maintained farmers' interest for increased cultivation of vegetables. The tariff structure for imported vegetables was highly protective for the local growers (Appendix 2). There is a very high demand for organic vegetables, both in the domestic and international markets. Growing vegetables under protected structure has become a very popular event among growers.

Sugar

During 1981-2000, the area and production of sugarcane increased with impressive rate of 5.5 and 6.2 percent per annum, respectively, while the rate of increase in yield per ha was less impressive at 0.67 percent per annum. The recovery rates of sugar from sugarcane also improved during this period. However, domestic sugar production remained much below the requirements (Table 9). For instance, 65 thousand mt of sugar was produced during 1999, but it was adequate to meet less than 15 percent of the total domestic consumption. The short fall in domestic supply was met from the import of 479 thousand mt.

The local sugar industry is heavily protected by an import duty of LKR3,500/mt. The financial viability of the sugar industry in Sri Lanka has been threatened by the high cost of production compared with that in other countries in the region. Strong research and extension efforts are needed to achieve higher growth rate in sugarcane yield per ha and sugar recovery percentage.

Table 6. Coconut Production and Market Statistics, 1981-2000

Year	Area (000 ha)	Production (000 mt)	Yield (kg/ha)	Production Cost (LKR/mt)	Export Price (f.o.b.) (LKR/kg)	Fertilizer Use (kg/ha)	Ratio of Export Price to Cost of Production
1981	420	2,258	5,376	0.55	2.52	90	4.58
1982	416	2,521	6,060	0.57	1.76	73	3.09
1983	412	2,312	5,612	0.60	2.42	87	4.03
1984	408	1,942	4,760	0.63	4.75	123	7.54
1985	404	2,958	7,322	0.64	2.55	101	3.98
1986	400	3,039	7,598	0.60	1.46	79	2.43
1987	396	2,292	5,788	0.73	2.64	107	3.62
1988	392	1,937	4,941	0.81	4.00	107	4.94
1989	388	2,484	6,402	0.85	3.36	99	3.95
1990	384	2,532	6,594	1.11	3.63	59	3.27
1991	380	2,184	5,747	1.70	4.82	78	2.84
1992	376	2,296	6,106	1.97	6.47	91	3.28
1993	416	2,164	5,202	2.03	6.31	84	3.11
1994	416	2,622	6,303	1.84	5.67	75	3.08
1995	416	2,755	6,623	2.02	6.08	81	3.01
1996	417	2,561	6,141	2.18	9.42	94	4.32
1997	417	2,631	6,309	2.26	9.63	81	4.26
1998	439	2,552	5,813	2.40	8.31	82	3.46
1999	439	2,828	6,442	2.75	9.95	89	3.62
2000	439	3,055	6,959	3.27	7.35	84	2.25
Growth rate (%)	0.32	0.88	0.57	10.26	8.61	-0.63	-1.64

Source: Central Bank of Sri Lanka, various issues.

Table 7. Paddy Production and Guaranteed Price Statistics, 1981-2000

Year	Area (000 ha)	Production (000 mt)	Yield (kg/ha)	Fertilizer Use (kg/ha)	Guaranteed Price (LKR/bushel)
1981	837	2,230	2,664	197	57.5
1982	747	2,156	2,886	189	57.5
1983	778	2,484	3,193	206	62.5
1984	886	2,420	2,731	193	62.5
1985	865	2,661	3,076	177	70.0
1986	835	2,588	3,099	236	70.0
1987	679	2,128	3,134	222	70.0
1988	816	2,477	3,036	250	80.0
1989	690	2,063	2,990	226	80.0
1990	828	2,538	3,065	173	110.0
1991	791	2,389	3,020	227	136.0
1992	766	2,340	3,055	271	136.0
1993	820	2,570	3,134	302	155.0
1994	897	2,684	2,992	301	155.0
1995	890	2,810	3,157	289	155.0
1996	660	2,061	3,123	360	155.0
1997	690	2,239	3,245	355	155.0
1998	829	2,692	3,247	424	155.0
1999	874	2,868	3,281	367	155.0
2000	832	2,859	3,436	310	155.0
Growth rate (%)	0.01	0.74	0.73	3.92	6.59

Source: Central Bank of Sri Lanka, various issues.

Table 8. Area and Production of Major Vegetables in Sri Lanka, 1981-96

Year/Growth Rate	Beans	Carrot	Cabbage	Eggplant	Okra	Tomato
Area (ha)						
1981	6,264	756	2,817	11,858	7,987	5,164
1982	5,505	827	2,617	10,081	7,403	4,257
1983	5,970	891	2,721	9,886	7,511	4,356
1984	6,484	866	2,751	9,554	7,674	3,924
1985	6,472	1,049	2,857	9,959	7,571	4,668
1986	6,505	1,061	2,728	9,484	7,223	4,394
1987	7,087	1,038	2,537	9,447	7,439	4,479
1988	7,037	1,134	2,649	9,651	8,328	4,822
1989	7,018	1,179	2,557	9,534	7,616	4,427
1990	6,518	1,263	2,667	9,493	7,596	4,867
1991	6,772	1,608	2,747	9,363	7,584	4,518
1992	6,738	1,844	2,792	9,062	7,423	4,566
1993	6,429	1,957	2,907	9,055	7,240	4,246
1994	6,398	1,999	3,026	8,832	7,046	4,405
1995	6,462	2,076	3,053	9,099	7,292	4,560
1996	7,108	2,170	3,242	9,408	6,993	6,718
Growth rate (%)	0.72	7.45	0.85	-1.07	-0.49	0.86

... To be continued

Table 8. Continuation

Year/Growth Rate	Beans	Carrot	Cabbage	Eggplant	Okra	Tomato
Production (mt)						
1981	18,146	3,915	40,778	45,462	22,750	26,667
1982	17,493	2,741	35,088	37,748	18,733	13,333
1983	31,687	9,424	45,412	74,214	37,549	26,109
1984	36,337	8,359	44,371	87,701	44,311	28,820
1985	35,567	10,210	50,643	90,279	43,706	33,864
1986	36,976	11,038	45,077	82,732	41,402	32,945
1987	37,333	11,111	35,957	74,268	44,554	27,059
1988	37,733	10,337	45,870	80,906	43,320	35,182
1989	36,144	11,907	37,580	73,631	40,245	33,031
1990	35,716	13,121	36,378	69,725	39,969	34,528
1991	35,040	20,601	38,053	65,583	38,799	32,234
1992	35,481	25,439	34,732	62,824	37,949	34,708
1993	28,028	24,621	34,021	62,841	37,856	30,932
1994	26,158	23,415	34,781	62,601	37,653	31,746
1995	27,595	24,668	34,836	65,158	38,716	31,986
1996	28,931	24,374	40,114	67,653	37,020	42,415
Growth rate (%)	1.18	12.63	-1.37	0.62	2.01	3.21
Yield (mt/ha)						
1981	2,897	5,179	14,476	3,834	2,848	5,164
1982	3,178	3,314	13,408	3,744	2,530	3,132
1983	5,308	10,577	16,689	7,507	4,999	5,994
1984	5,604	9,652	16,129	9,180	5,774	7,345
1985	5,496	9,733	17,726	9,065	5,773	7,254
1986	5,684	10,403	16,524	8,723	5,732	7,498
1987	5,268	10,704	14,173	7,862	5,989	6,041
1988	5,362	9,116	17,316	8,383	5,202	7,296
1989	5,150	10,099	14,697	7,723	5,284	7,461
1990	5,480	10,389	13,640	7,345	5,262	7,094
1991	5,174	12,812	13,853	7,004	5,116	7,135
1992	5,266	13,796	12,440	6,933	5,112	7,601
1993	4,360	12,581	11,703	6,940	5,229	7,285
1994	4,088	11,713	11,494	7,088	5,344	7,207
1995	4,270	11,882	11,410	7,161	5,309	7,014
1996	4,070	11,232	12,373	7,191	5,294	6,314
Growth rate (%)	0.46	5.18	-2.22	1.68	2.50	2.36

Source: Hector Kobbekaduwa Agrarian Research and Training Institute (HKARTI), various issues.

Table 9. Sugarcane Cultivation and Sugar Production in Sri Lanka, 1981-2000

Year/Growth Rate	Sugarcane			Sugar Production (mt)	Sugar Recovery (percent)
	Area (ha)	Production (mt)	Yield (mt/ha)		
1981	6,252	322,706	51.6	24,997	7.7
1982	5,889	302,445	51.4	23,705	7.8
1983	6,196	296,612	47.9	21,825	7.4
1984	5,659	264,190	46.7	19,650	7.4
1985	6,001	269,187	44.9	19,501	7.2
1986	8,666	472,979	54.6	37,716	8.0
1987	10,093	458,595	45.4	34,502	7.5
1988	12,083	724,346	59.9	53,521	7.4
1989	12,093	686,345	56.8	53,839	7.8
1990	13,865	759,770	54.8	57,165	7.5
1991	15,320	850,824	55.5	66,450	7.8
1992	14,611	731,108	50.0	59,710	8.2
1993	14,687	809,734	55.1	68,603	8.5
1994	17,450	873,990	50.1	72,275	8.3
1995	13,773	857,126	62.2	70,568	8.2
1996	18,042	818,000	45.3	70,414	8.6
1997	15,339	773,000	50.4	63,897	8.3
1998	13,537	729,000	53.9	61,549	8.4
1999	12,758	745,000	58.4	65,220	8.8
2000	12,613	787,000	62.4	64,000	8.1
Growth rate (%)	5.48	6.22	0.73	6.96	0.75

Sources: Central Bank of Sri Lanka, various issues; and official files from Sri Lanka Sugar Corporation.

Other Minor Food Crops

The area and production of all minor crops, except onion, has decreased during 1982-2000 (Table 10). The increase in onion production was mainly due to the expansion in the area of big onion at an annual rate of 18.72 percent (not shown in the table). Largest decline in production was recorded for soybean, millet, sesame and cowpea, mainly due to the fast decline in their area. The yield of maize, gram, soybean, millet, sesame and cowpea actually improved. On the other hand, the yield per ha of cassava, chili, onion, groundnut and potato declined during 1982-2000 (Table 10). It can be concluded that minor crops are gradually substituted with major crops like coconut, and sugarcane.

Other Minor Export Crops

Other minor export crops include cinnamon, clove, nutmeg, mace, pepper, cardamoms; commodities such as coffee, cocoa, sesame seeds, cashew nut; and other agricultural products such as areca nuts, betel leaves and essential oils. These crops gained more importance during 1990s as their exports became more lucrative than that of rubber and coconut. Just in 1999, earnings from other export crops grew by 5 percent to LKR11,598 million.

Sri Lanka is the largest producer of cinnamon in the world and contributing about two-thirds of the global production. In view of the higher international prices, cultivation of pepper has increased rapidly in recent years. According to the estimates of the Department of Export Agriculture, the export of cinnamon, cloves, nutmeg, and mace also increased during 1999. The price of cloves improved significantly due to a global shortage owing to reduced production in Indonesia. The exports of cashew nuts declined markedly during the year 1999. Heavy rains during the flowering period leading to less fruiting, the domestic price of cashew increased sharply in this tight supply situation.

The area and production of cocoa declined at the rate of 3.0 and 0.6 percent, respectively during 1982-2000, while its yield increased at 2.4 percent per annum. In case of cinnamon, area, production and yield improved at 1.06, 1.46 and 0.40 percent per annum, respectively during the same period. On the other hand, expansion in area, production and yield of cardamom was estimated as -1.29, 8.11 and 9.41 percent per annum, respectively (Table 11).

Table 10. Performance of Minor Food Crops during 1982-2000

Year/Growth Rate	Cassava	Maize	Chilies	Onion	Gram	Groundnut	Soybean	Potato	Millet	Sesame	Cowpea
Area (000 ha)											
1982	52.9	44.9	28.4	8.4	31.3	14.4	16.4	5.7	17.9	32.7	35.7
1983	37.5	47.2	32.0	11.7	46.0	13.6	14.6	6.6	20.8	35.1	45.8
1984	38.3	45.4	30.8	8.5	62.9	7.6	11.8	7.9	17.6	5.0	31.3
1985	35.5	37.9	32.1	6.0	33.7	8.0	2.4	8.4	11.1	14.1	22.3
1986	27.6	36.4	39.9	9.2	34.5	10.3	6.3	7.9	12.0	11.5	22.7
1987	28.3	39.2	26.4	11.4	48.9	8.8	6.7	7.1	10.8	17.4	21.8
1988	31.8	50.4	32.7	11.7	51.7	12.5	8.3	6.6	11.4	17.5	24.9
1989	25.1	37.2	27.0	11.2	36.0	10.3	4.7	6.8	5.2	15.6	19.9
1990	32.4	46.5	39.4	10.3	52.9	11.4	6.1	7.1	7.5	17.1	29.4
1991	39.7	40.2	34.2	8.7	52.9	10.1	2.9	3.5	7.4	16.3	27.6
1992	34.2	41.1	31.4	10.6	57.2	9.6	2.0	5.3	6.7	10.8	25.9
1993	33.9	49.9	42.8	12.3	48.9	10.6	1.5	7.7	6.5	11.8	22.3
1994	33.4	54.5	36.5	15.3	46.2	14.0	2.5	8.5	7.2	5.3	21.3
1995	32.9	45.9	28.1	12.2	34.0	12.5	3.0	9.0	5.0	8.7	15.0
1996	30.9	30.9	26.1	9.2	27.3	8.8	0.8	7.9	6.2	7.6	18.9
1997	28.9	25.8	24.1	9.4	25.4	9.2	0.5	6.5	5.6	11.8	16.2
1998	30.1	29.8	21.6	7.1	27.7	10.1	0.6	2.3	6.1	10.4	14.8
1999	29.4	28.9	21.8	10.7	24.0	10.2	0.8	2.2	6.5	8.6	13.1
2000	29.5	28.6	19.8	8.9	19.7	10.5	0.7	3.6	6.6	7.8	12.9
Growth rate (%)	-1.43	-2.23	-1.99	0.46	-3.35	-0.25	-17.8	-3.8	-6.56	-5.19	-5.10

... To be continued

Table 10. Continuation

Year/Growth Rate	Cassava	Maize	Chilies	Onion	Gram	Groundnut	Soybean	Potato	Millet	Sesame	Cowpea
Production (000 mt)											
1982	637.8	44.6	26.8	94.5	26.7	13.8	11.1	65.2	14.6	23.2	35.6
1983	737.6	51.0	29.4	137.2	28.0	17.3	10.6	82.5	12.7	9.2	26.1
1984	476.7	39.1	26.8	40.0	22.8	6.5	8.0	98.4	8.0	2.5	22.5
1985	460.0	33.7	35.6	55.1	24.2	8.3	2.8	118.2	7.3	6.9	17.3
1986	503.1	40.6	46.1	82.1	25.0	9.8	7.3	108.1	6.7	6.3	16.8
1987	353.1	45.2	27.6	116.8	35.7	17.2	10.1	91.6	7.1	10.3	17.4
1988	489.2	70.6	40.3	120.4	36.3	11.9	9.9	78.2	8.1	9.0	18.1
1989	276.1	36.4	30.0	118.8	25.8	8.8	2.9	93.7	3.7	3.5	14.9
1990	324.0	57.6	52.4	101.9	37.2	9.1	7.9	92.0	4.8	7.5	21.9
1991	358.8	48.5	33.2	98.5	44.3	11.5	3.6	41.5	4.5	13.1	20.0
1992	301.8	46.9	23.5	114.6	29.9	9.8	2.5	45.0	4.9	9.4	21.6
1993	299.5	69.3	40.4	129.0	42.5	12.3	2.2	77.2	4.7	6.1	20.0
1994	298.4	67.2	31.9	163.7	37.4	16.3	3.2	70.6	5.2	3.5	18.0
1995	288.9	66.7	28.0	112.6	31.3	14.2	4.2	101.6	3.9	6.1	12.3
1996	270.6	33.0	18.4	63.3	24.0	5.1	0.7	100.8	4.0	3.8	17.0
1997	249.8	22.8	17.9	73.5	20.1	8.9	0.4	65.8	3.4	6.8	12.8
1998	257.2	33.9	15.6	55.4	23.8	6.3	0.6	25.9	4.5	5.7	13.4
1999	251.5	31.4	15.0	105.3	20.5	6.5	0.8	27.2	4.9	4.8	12.0
2000	249.1	31.0	14.0	79.1	17.1	7.0	0.6	48.4	5.0	4.6	12.1
Growth rate (%)	-5.32	-1.59	-4.31	0.01	-1.26	-2.83	-16.96	-4.57	-5.56	-3.53	-3.88

... To be continued

Table 10. Continuation

Year/Growth Rate	Cassava	Maize	Chilies	Onion	Gram	Groundnut	Soybean	Potato	Millet	Sesame	Cowpea
Yield (mt/ha)											
1982	12.1	1.0	0.9	11.3	0.85	1.0	0.7	11.4	0.82	0.7	1.0
1983	19.7	1.1	0.9	11.7	0.61	1.3	0.7	12.5	0.61	0.3	0.6
1984	12.4	0.9	0.9	4.7	0.36	0.9	0.7	12.5	0.45	0.5	0.7
1985	13.0	0.9	1.1	9.2	0.72	1.0	1.2	14.1	0.66	0.5	0.8
1986	18.2	1.1	1.2	8.9	0.72	1.0	1.2	13.7	0.56	0.5	0.7
1987	12.5	1.2	1.0	10.2	0.73	2.0	1.5	12.9	0.66	0.6	0.8
1988	15.4	1.4	1.2	10.3	0.70	1.0	1.2	11.8	0.71	0.5	0.7
1989	11.0	1.0	1.1	10.6	0.72	0.9	0.6	13.8	0.71	0.2	0.7
1990	10.0	1.2	1.3	9.9	0.70	0.8	1.3	13.0	0.64	0.4	0.7
1991	9.0	1.2	1.0	11.3	0.84	1.1	1.2	11.9	0.61	0.8	0.7
1992	8.8	1.1	0.7	10.8	0.52	1.0	1.3	8.5	0.73	0.9	0.8
1993	8.8	1.4	0.9	10.5	0.87	1.2	1.5	10.0	0.72	0.5	0.9
1994	8.9	1.2	0.9	10.7	0.81	1.2	1.3	8.3	0.72	0.7	0.8
1995	8.8	1.5	1.0	9.2	0.92	1.1	1.4	11.3	0.78	0.7	0.8
1996	8.8	1.1	0.7	6.9	0.88	0.6	0.9	12.8	0.65	0.5	0.9
1997	8.6	0.9	0.7	7.8	0.79	1.0	0.8	10.1	0.61	0.6	0.8
1998	8.5	1.1	0.7	7.8	0.86	0.6	1.0	11.3	0.74	0.5	0.9
1999	8.6	1.1	0.7	9.8	0.85	0.6	1.0	12.4	0.75	0.6	0.9
2000	8.4	1.1	0.7	8.9	0.87	0.7	0.9	13.4	0.76	0.6	0.9
Growth rate (%)	-3.89	0.65	-2.32	-0.45	2.09	-2.57	0.84	-0.77	0.99	1.66	1.22

Source: Central Bank of Sri Lanka, various issues.

Table 11. Area, Production and Yield of Minor Export Crops, 1982-2000

Year/Growth Rate	Cocoa			Cinnamon			Cardamon		
	Area (ha)	Production (mt)	Yield (kg/ha)	Area (ha)	Production (mt)	Yield (kg/ha)	Area (ha)	Production (mt)	Yield (kg/ha)
1982	8,520	4,132	485	22,090	10,554	478	5,350	428	80
1983	8,486	4,119	485	22,183	10,593	478	5,333	425	80
1984	8,200	3,861	471	21,083	9,793	464	5,213	448	86
1985	7,963	4,105	516	20,900	9,722	465	5,110	438	86
1986	8,320	3,735	449	20,715	9,335	451	5,210	432	83
1987	8,620	3,636	422	21,056	9,369	445	4,327	261	60
1988	8,750	3,635	415	20,361	9,657	474	4,351	323	74
1989	8,647	3,901	451	20,420	10,235	501	4,452	326	73
1990	8,566	4,178	488	20,199	10,453	518	4,391	546	124
1991	8,660	4,700	543	20,310	9,900	487	4,440	800	180
1992	8,530	4,100	481	20,210	10,500	520	4,510	1,000	222
1993	5,470	3,338	610	24,257	12,232	504	4,487	1,017	227
1994	5,716	3,414	597	24,218	11,924	492	4,510	1,068	237
1995	5,733	3,591	626	24,248	11,797	487	4,535	1,118	247
1996	5,810	3,650	629	24,300	11,970	493	4,550	1,210	266
1997	5,840	3,700	634	24,360	12,170	500	4,410	1,170	265
1998	5,760	3,760	653	24,510	11,740	479	4,350	1,190	274
1999	5,640	3,720	660	24,570	12,220	497	4,110	1,120	273
2000	5,430	3,710	683	24,671	12,320	499	3,920	1,080	276
Growth rate (%)	-3.00	-0.57	2.43	1.06	1.46	0.40	-1.29	8.11	9.41

Source: Central Bank of Sri Lanka, various issues.

Foliage and Cut-flowers

Commercial cultivation of foliage and cut-flowers has increased in recent years, as it is becoming a good export market. Major markets for live foliage plants are the Netherlands and Japan. Cut-flowers such as carnation, rose and anthurium are exported to Japan and the Middle East. Export earnings from foliage and cut-flowers amounted to LKR573 million in 1999.

LIVESTOCK DEVELOPMENT SYSTEM

During 1981-99, poultry industry has shown a remarkable progress of 57.6 percent by growing at an annual rate of 2.63 percent (Table 12). Private sector involvement in broiler and layer chick production, well-organized veterinary extension service provided by the Department of Animal Production and Health and increased demand for poultry products had positively contributed to such a significant progress. At present the country's milk production is adequate to meet only about 25 percent of the domestic requirement.

Table 12. Livestock Population in Sri Lanka during 1981-99

(Unit: 000 heads)

Year/Growth Rate	Neat Cattle	Buffaloes	Goats	Sheep	Pigs	Poultry	Ducks
1981	1,720	898	512	30	94	6,296	25
1982	1,699	879	512	28	75	6,249	23
1983	1,700	910	519	29	77	6,457	24
1984	1,738	951	535	29	85	6,113	25
1985	1,782	967	539	27	84	7,097	28
1986	1,783	964	534	29	86	7,638	30
1987	1,807	1,007	502	27	96	8,588	30
1988	1,788	963	510	28	94	8,645	29
1989	1,820	967	518	30	94	8,833	31
1990	1,433	823	415	22	81	8,250	18
1991	1,477	825	460	20	84	8,261	17
1992	1,604	897	528	22	91	8,852	18
1993	1,716	831	583	20	90	9,264	19
1994	1,704	620	588	20	94	9,466	16
1995	1,704	764	591	19	87	9,573	16
1996	1,644	761	535	11	85	9,137	12
1997	1,579	726	521	11	80	9,243	10
1998	1,599	721	519	12	76	9,568	13
1999	1,617	728	514	12	74	9,923	10
Growth rate (%)	-0.50	-1.79	0.25	-5.73	-0.28	2.63	-5.54

Source: Department of Animal Production and Health, 1987 and 2000.

On the other hand, the goat population has shown a marginal growth of 0.25 percent per annum whereas the population of other animals has declined. The sharpest decline was in the population of sheep and duck followed by buffalo (Table 12).

FISHERIES SUB-SYSTEM

The fisheries sector plays a vital role in the economy of Sri Lanka. In 2000, total fish production in the marine and inland sector improved to more than 284 thousand mt. The largest growth rate was recorded for fishing from deep-sea and offshore fishing followed by inland fish production whereas costal fishing showed a negative growth rate (Table 13). Despite a high potential to develop the fishery sector of the country, a large quantity of dry and canned fish is imported. Due to outbreaks of white-spot and yellow-head diseases in the prawn farming, the export of fish product has declined.

Table 13. Fish Population in Sri Lanka, 1991-2000

Year	Coastal	Deep-sea and Off-shore	Inland	Total
1991	159,151	15,080	23,832	198,063
1992	163,168	22,000	21,000	206,168
1993	169,900	33,000	18,000	220,900
1994	174,500	37,500	12,000	224,000
1995	157,550	60,000	20,000	237,550
1996	149,550	57,000	22,250	228,800
1997	152,750	62,000	27,250	242,000
1998	163,750	73,250	29,900	266,900
1999	169,950	76,500	31,450	277,900
2000	163,200	84,200	36,700	284,100
Growth rate (percent)	-0.08	17.97	7.16	3.93

Source: Central Bank of Sri Lanka, 2000.

FORESTRY SUB-SYSTEM

As a result of the initiation of major irrigation schemes and *chena* (shifting) cultivation, considerable forestlands have been destroyed (Table14). Due to the extreme population pressure on available land resource and extreme poverty, Dry Zone forestlands are seriously threatened and deforestation has become a serious environmental issue. With the structural changes of the Department of Forestry has led to many effective changes in the forestry sector such as social forestry and extension and training programs. Strengthened institution and organization involved in forestry sector and implementation and monitoring of environmental management activities provide technical support to the national forestry development program and provided legal protection to forestry resources.

Table 14. Statistics of the Forestry Sector

Item	Unit	1981	1997	1998	1999
Total forest cover	000 ha	8,193	2,119	2,119	2,119

Source: Official files from Department of Forest, Sri Lanka.

POLICIES AND STRATEGIES ON AGRICULTURAL DIVERSIFICATION

The Government of Sri Lanka has recognized that the existing farming sector is not performing as expected and is on the declining trend. Farmers' income has dropped and farming has become less attractive as farmers are moving out of farming business. This is because of increased cost of production for most agricultural crops and lower profits for farmers.

Agriculture Policy in Sri Lanka

The present government policy is directed toward gradual withdrawal from the production of crops and seeds, liberalization of extension services and insurance, while developing market based methods of enhancing farmers' welfare.

The future vision for agricultural development is to make agricultural production and distribution system in Sri Lanka the most efficient in the region by 2010. To materialize this vision will require integrating the Sri Lanka's agricultural production and distribution system in the global system more efficiently than that of the neighboring countries, and fulfilling the domestic socioeconomic needs satisfactorily. To achieve such objectives, agricultural diversification is expected to play a vital role in the country.

Strategies/Activities on Agricultural Diversification

The following strategies and measures will be adopted to realize the vision:

i) Present list of crops generally cultivated in Sri Lanka will be thoroughly evaluated and new crops with better potential will be introduced to replace the inefficient products.
ii) Sri Lanka will develop 3-4 products those can earn international recognition like tea. There will be a special research and development program to identify these crops.
iii) In addition to the present approach, which is primarily benefiting the farmers operating in favorable environment, the Department of Agriculture will develop separate research, development and extension systems for resource poor and marginalized farmers.
iv) The Department of Agriculture, Department of Export Agriculture and the private sector will develop and make available to farmers the seeds and planting material of international standard. The research and development in this regard will be further strengthened.
v) Government will encourage the formation of associations, chambers, etc. to represent private sector groups engaged in agriculture.
vi) Private sector will be encouraged and supported to undertake agricultural research works.
vii) Developing agricultural marketing with special emphasis on the following:
    a. Physical infrastructure, such as roads, warehouses, communication network, market centers, etc.
    b. Product development
    c. Product promotion
    d. Market surveys
    e. Enterprise development
    f. Human resources development in the field of marketing
viii) Quarantine services of the Department of Agriculture will be developed to the highest international standards.
ix) Mechanization of agricultural operations will be effectively facilitated where it is found to be necessary and feasible.
x) Forest conservation will be an essential activity.

AGRICULTURAL DIVERSIFICATION PROGRAMS

Several crop diversification programs are in operation in the country in order to ensure food security and increase national production while giving adequate consideration to safeguard the environment and the sustainability in their operations.

Agricultural Diversification of Marginal Tea Lands

Minor export crops such as coffee, pepper, cocoa and fodder are introduced on marginal tea lands situated in the mid-country. This will help increasing the total national production of coffee, pepper and cocoa, thus enabling to enhance the foreign exchange earnings. Establishment of pasture and fodder is expected to promote dairy industry in these areas.

Intercropping Coconut Lands

In order to ensure more efficient land use system on coconut lands and to increase the income per unit area, several crops have been introduced as intercrops with coconut in the wet mid-country. The crops introduced include fruits like rambutan, banana and pineapple, and minor export crops like pepper, coffee, yams, manioc, ginger and pasture. Tremendous progress is expected in terms of increasing the national production of fruits and roots crops for domestic consumption and export purposes.

Introduction of Fruit Crops in Dry Zone Uplands

The Dry Zone uplands had been traditionally used for shifting cultivation during the rainy season. Due to low income from farming in these areas, majority of the labor force had given up farming and absorbed in other sectors, thus creating agricultural labor shortage in these areas. This has led to the diffusion of less labor-intensive perennial fruit crops like cashew, mango, pomegranate, lime and orange in these lands. Cultivation of other fruit crops best suited to the climatic conditions of these areas will help enhancing the farmers' income besides creating employment opportunities.

Diversification of Paddy Lands

Paddy is grown throughout the country. Other crops grown in this cropping system are local and exotic vegetables, chili, groundnut, maize, sweet potato and pulses. A significant increase in the production of these crops has been achieved by further promoting the cultivation of these crops for increasing farmers' income, especially in the in Dry and Intermediate Zones during the dry season.

Homestead Development

Majority of the homesteads consists of lands below 0.4 ha. There have been numerous programs to diversify these fragmented lands with fruits, vegetables and coconuts. The coconut cultivation board has implemented a widespread program to promote coconut cultivation in home garden. Under the fruit subsidy scheme supported by the Food and Agriculture Organization (FAO), a large number of fruit orchards was establish and the Department of Agriculture is continuing the program.

FUTURE PROSPECTS OF AGRICULTURAL DIVERSIFICATION

Further improvement in agricultural diversification is possible through the introduction of new crops and crop varieties that can be marketed both locally and abroad thus ensuring a higher income to the farmers. As the present tariff rates range from 0 to 45 percent (Appendix 2), crops with low tariff rates have a better opportunity for expansion. Except during the peak production seasons, there is a scarcity of many fruits in Sri Lanka. Most of these fruits have a vast unexploited export-potential as well. Hence there are greater opportunities to introduce different kinds of fruits in newly planted rubber and coconut lands with irrigation facilities in uplands and Dry Zone and also in fragmented homesteads.

A significant proportion of paddy lands remain fallow for one season of the year. Most of these fallow paddy lands, especially in the Dry Zone can be utilized to grow high income crops like chili, big onions, vegetables, etc.

When compared to the labor wages in most of the developed countries, labor wages in Sri Lanka are at a low level. Hence there is a vast potential to expand labor-intensive floriculture industry most of which can be successfully grown without controlled environmental conditions.

Another area given low priority so far but has great potential is the cultivation of medicinal plants. Although Sri Lanka possess the basic genetic materials, the majority of the local requirements is imported. Hence there is a vast potential to expand the cultivation of various medicinal herbs of high demand through a properly developed diversification program.

SUMMARY AND CONCLUSION

Agriculture is the mainstay of Sri Lankan economy and its population of more than 18 million. Rice is the main cereal crop cultivated all over the country, and cassava, maize, potato and millets are some of the other food crops grown under various environments and cropping zones. Tea, rubber, coconut and some spices are major export crops of Sri Lanka.

Over the past two decades (1981-2000), growth in the area under rice is almost stagnant whereas area under cassava and maize has been declining. The area under export crops like tea and rubber and most minor food crops has also declined during 1982-2000. One of the reasons is the depressed international prices of these crops in view of continuously increasing cost of production. On the other hand, due to heavy protection from the government, the area under sugarcane has dramatically increased, however, total sugar production is just sufficient to fulfill 15 percent of the national requirements.

Many structural changes occurred in the area under different types of vegetables. In the livestock sector, poultry population increased at a commendable rate of 2.63 percent per annum and goats, at 0.25 percent per annum during 1981-99. The population of other types of livestock such as cattle, buffaloes, sheep, pigs and duck experienced a declining trend during this period. In case of fisheries, a growth rate of nearly 4 percent per annum was estimated for the period 1991-2000.

There is a strong need of introducing structural changes in the agriculture sector of Sri Lanka not only to enhance farmers' income but also to increase agricultural exports and generate new employment opportunities within the agriculture sector. Great potential exists in the paddy-based single cropping system,

monoculture of coconut growing areas and Dry Zone uplands. Some interventions are delineated for these production systems, which can be helpful in achieving the objective of increasing farmers' income through diversified crop and livestock products. There is a need to improve the implementation efficiency of these policies.

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Appendix 1. Soil Groups and Recommended Crops

Soil Group	Suited Crops
Reddish brown earths	Cereals, pulses, cassava, sugarcane, castor, onion, chili, cotton, tobacco, vegetables, fruit crops, pasture grasses, timber trees
Low humic gley	Puddled rice, adapted pasture grasses
Non-calcic brow	Cereals, pulses, cassava, sugarcane, castor, onions, chili, cotton, tobacco, vegetables, fruit crops, pasture grasses, timber trees
Red yellow latosols	Cereals, pulses, cassava, sugarcane, castor, onions, chili, cotton, tobacco, vegetables, fruit crops, pasture grasses, timber trees, asparagus
Immature brown loams	Conservation forestry for steep slopes; cereals, pulses, cassava, sugarcane, castor, onions, chili, cotton, tobacco, vegetables, fruit crops, pasture grasses, timber trees for gentler slopes
Solodized solonetz	Puddled rice after reclamation
Grumusols	Puddled rice
Red yellow podsolic	Tea, rubber, coconut, coffee, cocoa, cinnamon, pepper, mulberry, cloves, nutmeg, vegetables, fruit crops
Alluvial soils	Paddy, pasture
Regosols	Coconuts, palmyrah, cashew, vegetables
Bog soils	Reeds for basket weaving, specific rice varieties
Lithosols	Conservation forestry

Source: Data from Baseline Socio-Economic Survey in North Western Province under Water Resources Development Project (NWP-WRDP).

Appendix 2. Revised Tariff Rates for Agricultural Items on 2 February 2000

(Unit: Percent)

Items	Tariff Rate
Wheat	Free
Lentils	5
Dates	5
Coriander, cumin, fennel seeds, etc.	5
Maize	5
Milk in powder	10
Garlic	10
Black gram	10
Anise, caraway seeds	10
Rye, barley, oats	10
Wheat flour, black gram flour	10
Betel leaves	10
Coconut shell pieces, shell powder, husk chips	10
Other sugars and sugar syrups	10
Meat, fresh, chilled, frozen	25
Bird eggs	25
Vegetables	25
Coconuts and other nuts, copra	25
Fruits	25
Tea, coffee	25
Spices	25
Edible vegetable oils	25 + LKR20/kg surcharge
Sucrose	25
Preserved fruits and vegetables	25
Fresh or chilled/frozen potatoes	LKR20/kg
Red onions, B' onions, chilies	35
Green gram, cowpea	35
Rice, paddy, broken rice, rice flour	35 under licensing
Raw/white sugar	LKR3.5/kg

Source: Official files from Sri Lanka Customs Department.

13. THAILAND (1)

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INTRODUCTION

Thailand is predominantly an agricultural country as nearly 59 percent of the labor force mainly depends upon agriculture for their livelihood. The agriculture sector of Thailand has a history of ups and downs. During 1960-97, the country has experienced rapid economic expansion. One fundamental feature of the high growth in Thai agriculture during the 1960s and 1970s was increased availability of land for agricultural use. Between 1950 and 1978, Thailand was probably the only Asian developing country where agricultural land per farm worker increased due to bringing large forest area under crop cultivation. Secondly, the cultivation of upland was made possible by the introduction of tractor. The use of tractor also promoted large farming, thus taking the advantages of economies of scale in farming. Rapid expansion of road network has provided better marketing link to the farmers in remote areas. As a result, during 1960-90, Thai economy experienced a commendable high growth rate of around 7.4 percent per annum (Siamwalla, *et al*., 1991). However, the growth rate fell to 4.7 percent during the 1990s.

At the beginning of the Eighth National Economic and Social Development Plan (1997), Thai economy faced major economic crisis. Collapse of many financial institutions generated a domino effect for all sectors of the economy. The industry sector has shown a strong contraction followed by an increasing unemployment rate. As a result, GDP growth rate started falling from 5.9 percent per annum in 1996 to -1.4 percent in 1997 and -10.8 percent in 1998. Thai Government has to borrow money from the International Monetary Fund (IMF) in order to recover its economy. During this time the agriculture sector seems to be the only hope to help supporting the economy. Therefore, the government adjusted its policy in order to gain back competitiveness in the agriculture sector again. Agricultural diversification has become one of the strategies for enhancing profitability, as well as stability of the agriculture sector.

STRUCTURAL CHANGES IN AGRICULTURE AT THE SUB-SECTOR LEVEL

The crops, fisheries and agricultural processing are major sub-sectors of Thai agriculture collectively contributing over 80 percent of the value-added of the sector. During the 1990s, the total value of agricultural production in nominal terms has been increasing at an annual rate of more than 8 percent per annum. Although all agriculture sub-sectors except forestry have grown in nominal terms, however, the shares of crop, livestock, forestry, and agricultural services in total value of agricultural output has declined while the shares of fishery and agricultural processing have increased during the 1990s (Table 1).

Several factors influenced the changes in production structure of the agriculture sector during the 1990s. While improving technology has given way for increasing fishery and livestock production, expansion in irrigated land has provided opportunity for crop diversification. The progressive expansion of irrigated land and introduction of many new crops happened as prelude of the economic boom in the late 1980s. On the other hand, due to pro-industrial policy of the government, the industry sector expanded. As a result, many agricultural lands have been occupied by industries and the land prices shoot up. Many farmers sold their fertile agricultural land for high price and migrated to major cities to work in industries or moved to less fertile lands. As a result, the share of crop sub-sector declined.

Table 1. Product Value and Share of Various Sub-sectors in Total Agricultural Production in Thailand

(Unit: Value = ฿ billion; and share* = percent)

Year		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Growth Rate (percent)
Crop:	Value	164.6	191.4	198.8	170.7	208.8	263.2	293.2	303.1	330.0	267.6	7.36
	Share	58.93	60.42	57.13	52.90	53.20	56.06	57.04	57.78	56.28	51.77	-0.80
Livestock:	Value	33.0	37.6	34.9	32.3	35.7	42.5	43.9	43.9	43.8	49.9	4.26
	Share	11.82	11.87	10.03	10.01	9.10	9.05	8.54	8.37	7.47	9.65	-3.91
Fishery:	Value	32.3	34.4	55.7	58.8	76.2	84.3	87.8	94.9	126.1	109.3	14.57
	Share	11.56	10.86	16.00	18.22	19.41	17.95	17.08	18.09	21.50	21.15	6.40
Forestry:	Value	6.8	6.2	5.7	5.2	6.0	5.9	8.2	6.7	5.6	5.2	-0.59
	Share	2.43	1.96	1.64	1.61	1.53	1.26	1.60	1.28	0.96	1.01	-8.76
Agricultural services:	Value	10.8	10.6	11.3	10.9	12.5	12.8	14.1	14.4	15.2	15.0	4.54
	Share	3.87	3.34	3.25	3.38	3.18	2.73	2.74	2.74	2.59	2.90	-3.63
Agricultural processing:	Value	31.8	36.6	41.6	44.8	53.3	60.8	66.8	61.6	65.7	69.9	8.77
	Share	11.39	11.55	11.95	13.88	13.58	12.95	13.00	11.74	11.20	13.52	0.61
Total value of agricultural production		279.3	316.8	348.0	322.7	392.5	469.5	514.0	524.6	586.4	516.9	8.17
Change (percent)		-	13.43	9.85	-7.27	21.63	19.62	9.48	2.06	11.78	-11.85	

Sources: National Bank of Thailand, various issues (1994, 1996 and 2000); and Office of Agricultural Economics (OAE), various issues (1994, 1996 and 2000).

Note: * Percentage of the total value of agricultural production.

AGRICULTURAL PRODUCTION STRUCTURE

In the following paragraphs, the performance of various agriculture sub-sectors is reviewed in detail.

Crops

1. ***Major Crops***

Rice has been the most important food crop in Thailand for centuries in term of staple food consumption and export earning. Cultivated area for rice is the highest among major crops. Planted area for wet season rice experienced a decline during 1988-2002, however, its production increased due to improvement in yield per ha backed by adoption of improved technologies. On the other hand, the area, production and yield per ha of dry season rice increased at 5.17, 6.72 and 1.54 percent, respectively during the same period (Table 2). The expansion in irrigated area and adoption of modern technologies contributed in an impressive increase in the dry season rice production. Although the total area under rice remained almost stagnant during the 1990s, however, total rice production has increased. This implies that redistribution of total rice area from wet to dry season positively contributed towards increasing total rice production.

Corn and cassava are the third and forth largest crops in term of planted area. Production of corn is mainly for domestic consumption as animal feed. The annual growth in area, production and yield per ha of corn during 1988-2002 were -2.03, 1.59 and 3.62 percent, respectively. The decline in area under corn is partially because of the decline in the share of livestock in the total value of agricultural production.

The demand for cassava was highly associated with its export to Europe. During 1988-2002, both the area and production of cassava declined at the rate of 3.43 and 2.09 percent per annum, respectively (Table 2). This is because of the self-sufficiency-oriented import policy of EU for cassava in the 1990s, therefore, its demand dropped dramatically. As a result, farmers who have been enjoying the export market for decades have to diversify their land for cassava in favor of other crops.

Rubber is one of the major commodities for export. Thailand is the world's third largest producer of natural rubber after Malaysia and Indonesia. During the 1988-2002, annual growth in area, production and yield per ha of rubber was estimated at 1.20, 5.74 and 4.55 percent, respectively (Table 2). The high growth rates in rubber were mainly stimulated by the substantial increase in demand for rubber in the world market. To gain more competitiveness in the world market, Thai marketing of rubbers is diversifying into value-added industries.

Among major crops, sugarcane also experienced a high growth rate in area during 1988-2002. The expansion in area, production and yield of sugarcane was estimated at 2.92, 4.13 and 1.20 percent per annum, respectively (Table 2). In the past, sugarcane enjoyed a great degree of protection in government policies. Despite these protections, domestic sugarcane production can supply only 15 percent of the national demand.

Coffee is also one of the important major crops of Thailand. The growth in area, production and yield of this crop was estimated at 1.7, 2.6 and 0.9 percent per annum, respectively. On the other hand, the area under palm oil and its production experienced the highest growth rate among major crops at 8.0 and 11.1 percent per annum, respectively. The yield per ha of palm oil also increased at 3.2 percent per annum (Table 2).

In summary, the area under wet season rice, corn and cassava declined, whereas of dry season rice, rubber, sugarcane, coffee and palm oil increased during 1988-2002. On the hand production declined only in case of cassava. Yield improvement of various degrees were recorded in all major crops during this period.

2. ***Minor Crops***

In Thailand, soybean, mung bean, sorghum, cotton, jute, kapok, black *matpe* bean, barley, and potato are classified as minor crops. The area and production of all these crops, except kapok, barley and potato have declined during the 1988-2002 (Table 3). The decline in production occurred despite a positive growth in per ha yield in most minor crops. The underlying reason was the government's push for some specific crops under the agricultural diversification program initiated during December 1993.

Table 2. Area, Production and Yield of Major Crops in Thailand, 1988-2002

(Unit: Area = million ha; production = million mt; and yield = mt/ha)

Year/Growth Rate	Wet Season Rice			Dry Season Rice			Total Rice		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1987-88	8.43	15.66	1.86	0.72	2.77	3.85	9.15	18.43	2.01
1988-89	9.06	17.88	1.97	0.84	3.38	4.02	9.90	21.26	2.15
1989-90	9.15	18.48	2.02	0.73	2.12	2.90	9.88	20.60	2.09
1990-91	8.21	14.90	1.81	0.58	2.29	3.95	8.79	17.19	1.96
1991-92	8.35	17.52	2.10	0.70	2.88	4.11	9.05	20.40	2.25
1992-93	8.51	17.30	2.03	0.65	2.62	4.03	9.16	19.92	2.17
1993-94	8.00	16.48	2.06	0.48	1.96	4.08	8.48	18.44	2.17
1994-95	8.30	18.16	2.19	0.68	2.95	4.34	8.98	21.11	2.35
1995-96	8.17	17.73	2.17	0.95	4.29	4.52	9.12	22.02	2.41
1996-97	8.25	17.78	2.16	1.01	4.55	4.50	9.26	22.33	2.41
1997-98	8.78	18.79	2.14	1.13	4.79	4.24	9.91	23.58	2.38
1998-99	8.49	18.66	2.20	1.02	4.34	4.25	9.51	23.00	2.42
1999-2000	8.76	19.02	2.17	1.21	5.16	4.26	9.97	24.18	2.43
2000-01	8.37	19.55	2.34	1.39	6.06	4.36	9.76	25.61	2.62
2001-02	-	-	-	-	-	-	-	-	-
Growth rate (percent)	-0.18	1.21	1.39	5.17	6.72	1.54	0.34	2.15	1.81

... To be continued

Table 2. Continuation

Year/Growth Rate	Corn			Cassava			Rubber		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1987-88	1.36	2.78	2.04	1.55	22.31	14.39	1.35	1.06	0.79
1988-89	1.79	4.68	2.61	1.59	24.26	15.26	1.35	1.15	0.85
1989-90	1.71	4.39	2.57	1.49	20.70	13.89	1.37	1.31	0.96
1990-91	1.55	3.72	2.40	1.43	19.71	13.78	1.40	1.42	1.01
1991-92	1.40	3.79	2.71	1.45	20.36	14.04	1.41	1.50	1.06
1992-93	1.24	3.67	2.96	1.44	20.20	14.03	1.42	1.71	1.20
1993-94	1.22	3.33	2.73	1.38	19.09	13.83	1.45	1.81	1.25
1994-95	1.35	3.97	2.94	1.25	16.22	12.98	1.47	1.99	1.35
1995-96	1.26	4.16	3.30	1.23	17.39	14.14	1.50	2.06	1.37
1996-97	1.31	4.53	3.46	1.23	18.08	14.70	1.52	2.12	1.39
1997-98	1.20	3.83	3.19	1.04	15.59	14.99	1.53	2.17	1.42
1998-99	1.38	4.62	3.35	1.07	16.51	15.43	1.54	2.16	1.40
1999-2000	1.21	4.29	3.55	1.13	19.06	16.87	1.55	2.20	1.42
2000-01	1.22	4.46	3.66	1.05	18.40	17.52	1.56	2.38	1.53
2001-02	1.20	4.47	3.73	0.99	16.87	17.04	1.58	2.42	1.53
Growth rate (percent)	-2.03	1.59	3.62	-3.43	-2.09	1.34	1.20	5.74	4.55

... To be continued

Table 2. Continuation

Year/Growth Rate	Coffee			Sugarcane			Palm Oil		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1987-88	0.041	0.035	0.85	0.57	27.19	47.70	0.083	0.885	10.66
1988-89	0.051	0.060	1.18	0.66	36.67	55.56	0.091	1.098	12.07
1989-90	0.060	0.071	1.18	0.69	33.56	48.63	0.096	1.192	12.42
1990-91	0.067	0.047	0.70	0.78	40.66	52.13	0.103	1.316	12.78
1991-92	0.075	0.080	1.07	0.92	47.48	51.61	0.108	1.352	12.52
1992-93	0.067	0.070	1.04	0.99	39.83	40.23	0.133	1.827	13.74
1993-94	0.070	0.078	1.11	0.80	37.82	47.28	0.139	1.923	13.83
1994-95	0.071	0.086	1.21	0.92	50.60	55.00	0.147	2.255	15.34
1995-96	0.069	0.080	1.16	0.98	57.97	59.15	0.164	2.688	16.39
1996-97	0.068	0.084	1.24	0.98	56.39	57.54	0.176	2.681	15.23
1997-98	0.066	0.078	1.18	0.94	46.87	49.86	0.181	2.465	13.62
1998-99	0.065	0.055	0.85	0.92	50.33	54.71	0.200	3.514	17.57
1999-2000	0.065	0.081	1.25	0.94	52.81	56.18	0.208	3.256	15.65
2000-01	0.066	0.085	1.29	0.88	49.56	56.32	0.233	4.089	17.55
2001-02	0.067	0.060	0.90	1.01	60.01	59.42	-	-	-
Growth rate (percent)	1.75	2.65	0.88	2.92	4.13	1.20	7.96	11.15	3.19

Source: OAE, various issues, 1988-2002.

Table 3. Area, Production and Yield of Minor Crops in Thailand, 1990-2002

(Unit: Area = million ha; production = million mt; and yield = mt/ha)

Year/Growth Rate	Soybean			Mung Bean			Sorghum		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1987-88	0.303	0.338	1.11	0.438	0.267	0.61	0.160	0.192	1.20
1988-89	0.392	0.517	1.32	0.462	0.333	0.72	0.174	0.215	1.24
1989-90	0.502	0.672	1.34	0.496	0.356	0.72	0.178	0.231	1.30
1990-91	0.408	0.530	1.30	0.428	0.303	0.71	0.188	0.237	1.26
1991-92	0.318	0.436	1.37	0.418	0.304	0.73	0.192	0.250	1.30
1992-93	0.343	0.480	1.40	0.350	0.261	0.75	0.173	0.250	1.45
1993-94	0.380	0.513	1.35	0.315	0.231	0.73	0.146	0.208	1.42
1994-95	0.395	0.528	1.34	0.335	0.256	0.76	0.167	0.228	1.37
1995-96	0.275	0.386	1.40	0.333	0.234	0.70	0.129	0.194	1.50
1996-97	0.256	0.359	1.40	0.303	0.215	0.71	0.134	0.225	1.68
1997-98	0.236	0.338	1.43	0.273	0.200	0.73	0.104	0.156	1.50
1998-99	0.219	0.321	1.46	0.289	0.226	0.78	0.097	0.146	1.51
1999-2000	0.225	0.319	1.42	0.308	0.249	0.81	0.087	0.142	1.63
2000-01	0.215	0.312	1.45	0.280	0.226	0.81	0.085	0.148	1.74
2001-02	0.206	0.292	1.42	0.295	0.238	0.81	0.083	0.145	1.75
Growth rate (percent)	-5.23	-4.08	1.15	-4.01	-2.76	1.25	-6.25	-3.67	2.58

... To be continued

Table 3. Continuation

Year/Growth Rate	Cotton			Jute			Kapok		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1987-88	0.064	0.074	1.16	0.146	0.158	1.08	0.035	0.040	1.14
1988-89	0.071	0.106	1.49	0.126	0.157	1.25	0.036	0.038	1.06
1989-90	0.063	0.086	1.37	0.119	0.149	1.25	0.035	0.038	1.09
1990-91	0.071	0.097	1.37	0.122	0.157	1.29	0.035	0.040	1.14
1991-92	0.098	0.129	1.32	0.094	0.127	1.35	0.036	0.037	1.03
1992-93	0.071	0.099	1.39	0.092	0.126	1.37	0.038	0.037	0.97
1993-94	0.049	0.067	1.37	0.086	0.127	1.48	0.037	0.040	1.08
1994-95	0.055	0.078	1.42	0.075	0.116	1.55	0.040	0.041	1.03
1995-96	0.055	0.081	1.47	0.070	0.105	1.50	0.039	0.043	1.10
1996-97	0.051	0.075	1.47	0.066	0.099	1.50	0.040	0.046	1.15
1997-98	0.035	0.051	1.46	0.062	0.090	1.45	0.040	0.045	1.13
1998-99	0.029	0.040	1.38	0.028	0.045	1.61	0.039	0.042	1.08
1999-2000	0.025	0.035	1.40	0.017	0.030	1.76	0.038	0.043	1.13
2000-01	0.026	0.036	1.38	0.016	0.029	1.81	0.038	0.045	1.18
2001-02	0.042	0.061	1.45	0.032	0.056	1.75	0.038	0.045	1.18
Growth rate (percent)	-7.43	-6.79	0.64	-14.46	-11.47	2.99	0.81	1.34	0.53

... To be continued

Table 3. Continuation

Year/Growth Rate	Barley			Black *Matpe* Bean			Potato		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1987-88	-	-	-	-	-	-	-	-	-
1988-89	-	-	-	-	-	-	-	-	-
1989-90	0.971	1.00	1.03	-	-	-	-	-	-
1990-91	1.538	1.10	0.72	0.114	0.083	0.73	-	-	-
1991-92	1.902	1.40	0.74	0.121	0.097	0.80	-	-	-
1992-93	2.833	1.90	0.67	0.063	0.050	0.79	-	-	-
1993-94	2.954	1.10	0.37	0.093	0.068	0.73	-	-	-
1994-95	3.723	1.40	0.38	0.070	0.055	0.79	-	-	-
1995-96	4.452	1.80	0.40	0.084	0.060	0.71	-	-	-
1996-97	4.694	3.10	0.66	0.058	0.052	0.90	5.23	89.55	17.12
1997-98	4.937	1.70	0.34	0.050	0.044	0.88	5.60	93.32	16.66
1998-99	3.440	1.30	0.38	0.052	0.038	0.73	7.32	90.38	12.35
1999-2000	0.445	0.40	0.90	0.054	0.041	0.76	7.66	100.12	13.07
2000-01	-	-	-	-	-	-	7.52	90.94	12.09
2001-02	-	-	-	-	-	-	8.07	97.37	12.07
Growth rate (percent)	3.27	-1.69	-4.96	-9.07	-9.64	0.42	8.85	1.27	-7.59

Sources: OAE, various issues (1988-2002); and for "Barley", Division of Planning, various issues (1990-2000).

3. ***Fruits and Vegetables***

The diversification in crop production mainly occurred due to the expansion in fruits and vegetable area. The area under vegetables more than doubled from 178 thousand ha in 1988 to 396 thousand ha in 2000. The ratio of vegetable to cereal area has increased from 2.6 percent in 1991 to 3.4 percent in 2000. Due to expansion in area, vegetable production showed an impressive growth of 4.62 percent per annum during 1988-2002. Per ha yield of vegetables experienced a slight declining trend (Table 4), perhaps because of the substitution of the bulky vegetables with low volume crops.

The main vegetable crops in Thailand are bird pepper, baby corn, cucumber, chili, and garlic contributing 11.5, 6.9, 6.1, 5.9, and 5.5 percent, respectively in total vegetable area during 2000. The area of garlic and shallot has declined, while per ha yields of chili and bird pepper were on the declining trend during 1988-2002 (Table 4).

Similarly, fruit crops have become more important in Thai economy. During 1992-2001, the area under all fruits has expanded to various extents (see Table 3 in country report of Thailand-2). Among major fruits, the highest growth in production was estimated for longan. Due to expansion in fruit area, per ha fruit yield experienced a decline for some fruits, as young fruit trees did not start bearing fruit (Table 5).

Livestock

Swine and poultry are two major livestock products in Thailand. Diversification of livestock in Thailand occurs mainly in production practices from traditional raisers to large commercial producers. Both broiler and swine production are under an oligopolistic control as few large firms enjoy major share of the market. The improvement of livestock industry is vertically integrated with feed mills, large swine and poultry farmers, processors, and exporters of meat products. Meat processing industry has expanded greatly in the past decades due to increased demand both in the domestic and international markets. Frozen chicken has become one of the major export commodities. The production of swine has increased from 8.34 million heads in 1992 to 10.5 million heads in 1999. In poultry, the production of broiler has increased from 725.6 million heads in 1992 to 855.2 million heads in 1999. The growth in production of swine and poultry was estimated at 3.32 and 2.95 percent per annum, respectively (Table 6).

On the other hand, some diversification in the livestock sector occurred in the dairy sector. However, the dairy production in Thailand is still at the stage of import substitution. Despite the government has been trying to improve competitiveness of the industry, production cost of raw milk is still higher than world price.

Fishery

Fishery is the second major contributor in total value of agricultural production after the crop sub-sector. The value of fishery output increased from just ฿32.3 billion in 1990 to ฿109.3 billion in 1999 while its share has been doubled during this period (Table 1). Diversification in fishery industry was from natural catch and marine fishing to commercial shrimp farming. Production of marine fishing in Thailand has been improved dramatically in the past decade. Canned fish and shrimp also contributed to large export earning. The other source of high growth in fishery sector was black tiger shrimp. Although a minor growth of 0.64 percent per annum in total cultivated area of shrimps, however, total production of shrimps and of black tiger shrimp increased at 15.1 and 17.5 percent per annum, respectively (Table 7).

DIVERSIFICATION IN EXPORT EARNINGS

The strong growth in the agricultural processing sector lead to increaser in the earnings from agricultural export until 1997 when it reached to the peak of ฿585.7 billion (Table 8). About 25 percent of the total foreign exchange earnings were coming from agricultural export, especially rice, tapioca, rubber, livestock, fishery and sugar. A rapid expansion of food processing industry also provided new opportunities for diversification in agricultural production by providing raw material for canned pineapple, canned seafood, and pet food industries. Increase in the production of frozen fish, shrimp and chicken also contributed to the expansion of export market for agricultural product. During this period Thailand also experienced a strong increase in fruits, vegetables and livestock production.

Table 4. Area, Production and Yield of Vegetables in Thailand, 1990-2002

(Unit: Area = 000 ha; production = 000 mt; and yield = mt/ha)

Year/Growth Rate	Garlic			Shallot			Onion		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1987-88	34.40	122.0	3.55	16.87	222.04	13.16	2.409	44.739	18.57
1988-89	37.28	134.0	3.59	15.96	223.54	14.01	2.731	45.707	16.74
1989-90	28.96	111.0	3.83	18.80	257.30	13.69	2.301	38.789	16.86
1990-91	25.60	104.0	4.06	11.77	164.39	13.97	2.599	49.903	19.20
1991-92	24.16	108.0	4.47	21.47	136.91	6.38	3.412	73.149	21.44
1992-93	24.61	115.6	4.70	13.85	156.00	11.20	3.164	52.815	16.69
1993-94	24.27	110.4	4.55	13.75	159.53	11.61	3.139	52.770	16.81
1994-95	25.41	121.3	4.77	14.36	179.24	12.48	3.504	68.172	19.46
1995-96	26.24	132.0	5.03	14.98	198.16	13.23	3.518	88.214	25.08
1996-97	27.04	147.0	5.44	15.01	203.79	13.58	3.839	99.003	25.79
1997-98	23.52	119.0	5.06	14.11	175.91	12.47	3.907	92.176	23.59
1998-99	21.60	118.0	5.46	15.28	200.77	13.14	3.719	77.824	20.93
1999-2000	21.76	126.0	5.79	16.65	225.26	13.53	3.296	90.341	27.41
2000-01	23.52	132.0	5.61	16.15	198.53	12.29	3.171	78.469	24.75
2001-02	22.08	126.0	5.71	16.07	193.90	12.07	2.819	71.674	25.43
Growth rate (percent)	-2.78	0.80	3.58	-0.30	-0.01	0.29	2.19	5.36	3.17

... To be continued

Table 4. Continuation

Year/Growth Rate	Baby Corn			Cucumber			Bird Pepper		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1987-88	4.53	46.96	10.37	20.42	118.71	5.81	22.21	157.81	7.11
1988-89	5.73	70.30	12.27	22.44	142.90	6.37	28.51	210.26	7.37
1989-90	13.68	200.55	14.66	21.59	232.21	10.76	44.79	341.15	7.62
1990-91	12.95	171.85	13.27	25.20	270.73	10.74	39.20	339.75	8.67
1991-92	23.33	152.78	6.55	25.78	204.75	7.94	52.44	418.33	7.98
1992-93	22.93	181.03	7.89	25.42	229.02	9.01	54.36	418.33	7.70
1993-94	16.36	125.98	7.70	24.04	204.12	8.49	43.30	245.40	5.67
1994-95	20.78	140.77	6.77	24.06	200.91	8.35	39.26	256.21	6.53
1995-96	24.81	172.85	6.97	18.86	183.14	9.71	39.43	297.20	7.54
1996-97	18.24	118.80	6.51	23.00	233.64	10.16	42.77	318.50	7.45
1997-98	27.99	134.17	4.79	21.02	205.37	9.77	44.80	334.65	7.47
1998-99	28.22	199.81	7.08	22.64	225.24	9.95	44.50	331.38	7.45
1999-2000	27.32	184.46	6.75	24.07	241.33	10.03	45.36	330.66	7.29
2000-01	22.95	179.91	7.84	23.78	246.13	10.35	44.31	319.84	7.22
2001-02	35.11	286.88	8.17	23.78	255.32	10.74	43.18	309.27	7.16
Growth rate (percent)	10.62	6.28	-4.35	0.17	2.86	2.69	2.44	2.12	-0.31

... To be continued

Table 4. Continuation

Year/Growth Rate	Chili			Tomato			All Vegetables		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1987-88	21.76	39	1.79	4.53	46.96	10.37	178.22	1,776.87	9.97
1988-89	21.76	37	1.70	5.73	70.30	12.27	196.80	1,994.15	10.13
1989-90	9.12	15	1.64	13.68	200.55	14.66	271.44	2,855.19	10.52
1990-91	11.84	21	1.77	12.95	171.85	13.27	280.36	3,004.50	10.72
1991-92	14.56	17	1.17	8.44	183.47	21.74	309.70	3,167.45	10.23
1992-93	21.44	35	1.63	7.36	142.00	19.29	325.72	2,814.87	8.64
1993-94	21.60	32	1.48	7.36	157.00	21.33	280.86	2,719.99	9.68
1994-95	21.76	32	1.47	8.32	178.00	21.39	353.39	3,381.65	9.57
1995-96	22.08	32	1.45	8.00	203.00	25.38	382.04	3,314.95	8.68
1996-97	22.24	33	1.48	7.04	188.00	26.70	323.61	3,068.07	9.48
1997-98	22.08	33	1.49	8.80	165.00	18.75	358.89	3,452.47	9.62
1998-99	23.04	38	1.65	9.28	200.00	21.55	369.16	3,453.88	9.36
1999-2000	23.20	40	1.72	9.44	219.00	23.20	395.57	3,805.29	9.62
2000-01	22.56	37	1.64	9.44	224.00	23.73	-	-	-
2001-02	23.20	37	1.59	10.08	246.00	24.40	-	-	-
Growth rate (percent)	3.34	3.14	-0.20	1.98	7.18	5.20	5.48	4.62	-0.86

Source: OAE, various issues.

Table 5. Growth Rate of Selected Fruit Area, Production and Yield during 1992-2001

(Unit: Percent)

Fruit Type	Area	Production	Yield
Longan	9.37	3.69	-5.68
Durian	2.70	-0.86	-3.56
Mango	15.10	0.87	-14.24
Mangosteen	9.46	6.99	-2.47
Rambutan	2.91	0.13	-2.77
Lychee	3.32	-9.01	-12.32
Banana*	-1.52	0.99	2.51
Pineapple	-0.42	-1.37	-0.06

Source: Estimated from Table 3 of the country paper of Thailand-2.
Note: * The estimates are for years 1997-2001.

Table 6. Production of Swine and Broiler in Thailand, 1992-99

(Unit: Million head)

Year/Growth Rate	Swine	Broiler
1992	8.34	725.64
1993	8.73	710.61
1994	9.85	646.54
1995	9.02	664.29
1996	9.46	705.00
1997	11.42	764.88
1998	10.01	828.53
1999	10.50	855.22
Growth rate (percent)	3.32	2.95

Source: OAE, various issues during 1992-99.

Table 7. Shrimp Production in Thailand, 1988-97

Year	Total Shrimp Area (000 ha)	Total Shrimp Production (000 mt)	Black Tiger Shrimp Production (000 mt)	Black Tiger as Percent of Total (percent)
1988	68	56	41	73.2
1989	77	93	81	87.1
1990	67	118	108	91.5
1991	76	162	155	95.7
1992	74	185	179	96.8
1993	73	226	220	97.3
1994	74	263	259	98.5
1995	76	260	256	98.5
1996	74	240	235	97.9
1997	74	228	224	98.2
Growth rate (%)	0.64	15.08	17.45	2.38

Source: Official files from Department of Fisheries.

Table 8. Annual Growth in GDP, Exports and the Share of Agricultural and Non-Agricultural Products during 1989-99

Year	Growth in GDP (percent per annum)	Export Earnings				Production as Percent of GDP	
		Agricultural Products		Non-agricultural Products		Agricultural Products	Non-agricultural Products
		Amount (฿ million)	Percent	Amount (฿ million)	Percent		
1989	12.2	230,537	44.8	284,193	55.2	15.1	84.9
1990	11.6	224,168	38.1	363,989	61.9	12.7	87.3
1991	8.1	256,036	35.4	467,076	64.6	12.6	87.4
1992	8.1	284,980	34.6	539,377	65.4	12.3	87.7
1993	8.6	279,651	29.8	659,460	70.2	10.6	89.4
1994	9.0	336,141	29.6	799,372	70.4	10.8	89.2
1995	8.9	407,037	29.0	996,910	71.0	11.2	88.8
1996	5.9	412,490	29.3	995,958	70.7	11.1	88.7
1997	-1.4	484,847	26.9	1,315,985	73.1	11.2	88.8
1998	-10.8	585,687	26.1	1,656,856	73.9	12.7	87.3
1999*	4.2	550,116	24.9	1,659,342	75.1	11.2	88.8

Sources: National Bank of Thailand, various issues (January 1989-December 1999); and OAE, various issues (1994, 1996 and 2000).
Note: * Projected.

Despite the increase of export earnings from the agriculture sector, its relative share in total export earnings has decreased overtime. As growth in the non-agriculture sector was higher than the agriculture sector, therefore, the share of the former steadily increased both in the GDP and export earnings (Table 7).

KEEPING COMPETITIVENESS OF THAI AGRICULTURE

Past Policies

Some government policies towards agriculture, particularly for rice, have been of penalizing in nature. Three different measures were imposed on rice export, i.e., the rice premium, an export duty and a requirement that exporters must sell a proportion of their rice exports to the government at below-market price. This led to depressed domestic prices of rice, sometimes as much as 50 percent below the world prices.

A similar heavy burden was placed on rubber exports through a variable export tax, which sometimes rose to 25 percent of the world price. Corn was subjected to different sort of intervention aimed at ensuring supplies for the Japanese and Taiwanese markets, cassava export was freely allowed to produce, and sugarcane was protected to promote domestic sugar industry (Siamwalla, *et al*.. 1991). Therefore, during the 1970s, growth in the agriculture sector was partly due to crop diversification to new exportable crop such as sugarcane and tapioca, which showed spectacular growth of about 20 and 30 percent, respectively. Hence, during the 1980s, four food crops, namely; rice, corn, sugarcane and cassava emerged as important crops in terms of planted area and value of output produced.

On 28 December 1993, the Thai Government decided to carry out an agricultural diversification program, aiming to reduce the production of rice and other traditional crops in favor of increased production of soybean, livestock, fruits and other farm products. It was recommended that rice area should be decreased by 160 thousand ha (or one million *rais*) and the area of tapioca, coffee and chili be cut by 75.5 thousand ha over 1994-96. To implement the program, subsidized credits and inputs were provided for the replacement crops and livestock products (Yao, 1997).

However, these targets were not achieved. The rice area at best remained almost stagnant, if not increased. This was due to institutional bias towards rice production. The research and extension systems have been geared towards rice production. There were not enough research and development funds for the fruits, vegetables, and minor crop. Marketing infrastructure was also best serve the rice crop and other major crops. Therefore, farmers did not have alternatives economically viable options to replace rice with other crops.

Future Policies

Although agricultural diversification was unintentionally introduced in the Thai agrarian economy during the First National Economic and Social Development Plan of 1961-66, but its present nature is quite different. Now Thailand is member of WTO and the rules and regulations on world trade have great impact on future agricultural production. Agricultural diversification is also desired to sustain competitiveness in the domestic and international markets.

In order to adjust to the changing economic situation, Thai Ministry of Agriculture and Cooperative has implemented policies and strategies for development of agricultural products and increase income of farmers. There are two strategies that are expected to contribute to a great extent in agriculture diversification. These are:

1. continuation of agricultural diversification program initiated during 1993. Great success has been achieved in terms of increase in area under various fruits. However, the yield per ha of many fruits is much below the potential.
2. in order to improve yield per ha, a separate strategy has been adopted. Under this strategy, government is intended to support the effort for supplying seed/planting material of improved varieties of new crops and fruits along with extending necessary technical help from the Department of Agricultural Extension.

In addition, some institutional changes have been suggested in the Eighth National Economic and Social Development Plan (1997-2001) for the overall development of agriculture sector. The general policy

objective of this plan is to promote competitiveness of Thai agricultural exports in the world market. In this period, a strategic plan is designed to develop the production and marketing of 12 major agricultural commodities, i.e., rice, maize, cassava, rubber, sugarcane, coffee, palm oil, longan, pineapple, durain, orchid and black tiger shrimps. Three main strategies of the plan are as follows (OAE, 1999).

1. ***Production Control Strategies***

This strategy is to increasing production efficiency by reducing per unit production cost, improving quality to meet with the standard of market demand, adjusting production quantity to avoid excess demand and excess supply in some period, and enforcing the policy of acreage control for certain commodities.

2. ***Processing Strategies***

The main objective of this strategy is to improve both the quality and quantity of primary agricultural products in order to support the processing industry. Under this, research and development of appropriate production technologies are supported, quality standards are defined in accordance with the international standards for health and environment, major processed agricultural products are promoted, and industrial areas for agro-industry are specified.

3. ***Marketing Strategies***

This strategy includes maintaining stability of price of primary agricultural product in domestic markets along with export promotion, improvement in marketing efficiency on domestic and international fronts.

SUMMARY

We can conclude from the above discussion that government policies and programs strive to promote agricultural diversification in Thailand based on promising products or products with higher comparative advantage in the international market. The data presented in this paper have indicated that government efforts are bearing fruits.

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14. THAILAND (2)

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INTRODUCTION

Role of the Agriculture Sector in Thai Economy

From the Third National Economic and Social Development Plan (1972-76) to the Seventh plan (1992-96), the agricultural production structure of Thailand has greatly changed. The proportion of the GDP from agriculture in relation to the whole economy has continuously declined (Table 1). Despite the declined shares of agriculture in various development parameters, substantial proportions of country's population (61.8 percent) and labor force (58.9 percent) are still engaged in the agriculture sector (Table 2).

Table 1. Shares of the Agriculture Sector and Its Sub-sectors in GDP (at constant factor prices of 1988)

(Unit: Percent)

Item	5th Plan (1982-86)	6th Plan (1987-91)	7th Plan (1992-96)
Agriculture Sector:	19.01	14.88	11.42
Crops	12.00	9.20	6.67
Livestock	1.80	1.58	1.17
Fisheries	1.84	1.59	1.75
Forestry	1.02	0.50	0.18
Services and primary processing	2.35	1.95	1.67
Non-agriculture Sector:	80.99	85.12	88.58
Industry:	23.24	26.98	31.33
Agro-industry	13.86	14.77	12.61
Other industry	9.38	12.21	18.72
Others	57.75	58.14	57.25
Total GDP	100.00	100.00	100.00

Source: Office of Agricultural Economics (OAE), 2000.

Table 2. Sector Share in Population and Labor Force in Thailand

(Unit: Percent)

Item		3rd Plan (1972-76)	4th Plan (1977-81)	5th Plan (1982-86)	6th Plan (1987-91)	7th Plan (1992-96)
Population:	Agriculture	71.0	67.5	64.5	63.1	61.8
	Non-agriculture	29.0	34.5	35.3	36.9	38.2
Labor Force:	Agriculture	67.8	64.5	61.9	60.3	58.9
	Non-agriculture	32.2	35.5	38.1	39.7	41.1

Source: OAE, 2000.

The growth in non-agriculture sector remained higher than the growth in the agriculture sector. This, along with relatively slow absorption of labor force in the non-agriculture sector, has caused disparity of income between the agriculture and non-agriculture sectors. It is likely that these trends will continue, and

Thailand will transfer itself from an agricultural country to an industrial country. It is also expected that the transfer of population and labor force from the agriculture and non-agriculture sectors will accelerate.

Agricultural Production Structure

The agriculture sector has six sub-sectors. These are:

i) crop;
ii) livestock;
iii) fisheries;
iv) forestry;
v) services; and
vi) primary processing.

Crop is the most important sub-sector contributing more than 50 percent of the production value of agriculture. The crop sub-sector is continuously diversifying. For instance, from producing only rice and a few other upland crops it is now diversified into many kinds of annual crops which give higher returns to farmers, and perennials especially those that bear fruits for long-term income.

Production of the livestock and fisheries has also expanded especially in poultry, dairy, beef cattle and aquacultures. The economic importance of forestry has declined due to deforestation. The services and primary processing industries expanded due to generally a better economic situation in the country, creating diversity in services and consumption of agricultural products.

OPPORTUNITIES AND CONSTRAINTS OF THE AGRICULTURE SECTOR

Development Opportunities

Great opportunities exist to improve agricultural production in Thailand. These are in the following areas.

1. ***Technology***

In Thailand, still old technologies are applied in the production of most agricultural crops, especially in using home-produced seed and manure. The investment per unit of land is low. Moreover, most production depends upon rainfall to meet water requirements of different crops. These factors cause inefficiency in production, reflecting in low per ha yields of most crops. If these constraints are removed by using improved technology, the efficiency of agricultural production will greatly increase.

2. ***Trade***

Agricultural production in Thailand is in a better position to compete on international market, as it receives low level of government support when compared to the competing countries. Many agricultural products have comparative advantage over the products of competing countries. However, international markets are restricted for Thai products through different trade and non-trade barriers. Therefore, opening agricultural markets and reducing the export taxes in developed countries will help to expand the production of these commodities, and will increase farmers' income. Markets access can be improved through trade agreements of World Trade Organization (WTO) and Asian Free Trade Area (AFTA).

The phyto-sanitary requirements of importing countries have created additional barriers to sell Thai products abroad. Thailand still has limited facility and infrastructure in this area.

3. ***Farmers' Skill and Environment***

Thailand has about 60 percent of all the labor force working in the agricultural sector (Table 2). The labor has ability to learn and receive new technology. This is evident from the shift of growing rice and vegetables for domestic consumption to growing vegetables, cut-flowers and ornamental plants, fruit tree, milk and fish for export. These activities require improved skills and Thai farmers are able to perform them well. Also, Thailand faces only few natural disasters compared to other neighboring countries such as Philippines enabling Thai farmers to supply agricultural production more regularly.

Constraints of Agricultural Development

Despite these opportunities, there are various constraints facing to the agriculture sector. These are as follows:

1. ***Declining Land Used for Agriculture***

When the economy expands at a high rate, agricultural land is transferred from low-return agricultural products to high-return uses, especially for residence, industry, tourism and recreation. Part of the land transferred is fertile irrigated land. This adversely affects agricultural production.

2. ***Unsuitable Land in Agriculture***

About 35 percent of the total land in Thailand is unsuitable for agriculture resulting in low efficiency in production. At present, Ministry of Agriculture and Cooperatives is undertaking a plan to diversify the production of rice, cassava, pineapple, coffee, pepper, coconut and oil palm planted on unsuitable land and divert these lands to other uses more suitable for the land condition.

3. ***Small Landholdings***

Most farmers in Thailand are small and scattered. Therefore, it is difficult to organize them in cooperatives. This reduces their bargaining power and access to market information and facilities. They have no storing facility for farm products, which forces them to sell their crops immediately after the harvest, usually at low prices.

To meet the challenges of free trade, the Ministry of Agriculture and Cooperatives set the agricultural development plan keeping in mind these challenges and the consequences of alternative development strategies on natural resources and the environment. This can be clearly seen in the Eighth National Economic and Social Development Plan. The main focus of the Ministry is to restructure the production activities which suit land condition, unit farmers to form cooperatives, and support agricultural production and marketing through farmers' institution.

DIVERSIFICATION WITH HORTICULTURAL CROPS

Thailand produces a wide range of fruits many of them are well recognized for their taste and quality in the international market. Out of these, 33 fruits species have been identified as commercially important by the Department of Agricultural Extension and the rest are considered as the minor fruits with less important role. Thai fruits may be categorized into two groups:

i) The fruits with high marketable potential both in domestic and overseas markets. This group comprises of durian, longan, mangosteen, pomelo, pineapple, mango, rambutan, papaya, lychee and tangerine. Durian and longan are named as the Thai champion products by the Ministry of Agriculture and Cooperatives.

ii) The fruits mainly produced to meet the domestic demand. This group contains many species of fruits such as santol, rose apple, sugar apple, jujube, marian plum, guava, longkong, langsat, young coconut, tamarind, sala, jack fruit, lime, grape and banana.

The annual growth in cultivated area of major economic fruits during the Seventh Plan period (1992-96) ranged between 1.3 percent for rambutan and 25.8 percent for mango. The growth in production varied from -4.0 percent in pineapple to 14.2 percent in longan during this period. Longan had the highest expansion of production followed by mangosteen, durian, and rambutan. The growth rates in cultivated area during the Eighth Plan have substantially decreased for all these fruits, except for rambutan and pineapple. However, growth in production has increased in all fruits, except durian, rambutan and mungsteen (Table 3).

Export potential for Thai fruits and products may be judged by the overall quantity of fruits exported to the world market. In 2000, Thailand exported approximately 1.145 million mt of fruits worth of ฿28.0 billion (approximately US$701 million). The top three fresh fruit export earners were longan, durian and lychee. The top three frozen fruits exported are durian, longan and pineapple. Canned pineapple contributed more than 80percent of quantity of all fruit products exported and 50 percent of fruit export earnings. Besides pineapple, canned longan, lychee, rambutan and mango have shown an impressive growth in the processing industry. In dried fruit category, longan is a top export earner (Table 4-5).

Table 3. Harvested Area and Production of Major Fruits in Thailand, 1992-2001

(Unit: Area = 000 ha; production = 000 mt; and yield = mt/ha)

Year	Longan			Durian			Mango			Rambutan		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1992	23.7	145.0	6.1	76.5	711.4	9.3	83.4	1,112.0	13.3	58.6	607.6	10.4
1993	27.5	92.7	3.4	97.8	749.3	7.7	87.0	1,232.9	14.2	58.7	616.5	10.5
1994	30.7	193.1	6.3	82.7	772.7	9.3	190.0	1,260.0	6.6	59.4	608.2	10.2
1995	34.8	143.6	4.1	93.1	849.9	9.1	201.3	1,207.6	6.0	59.7	643.1	10.8
1996	38.4	236.4	6.2	97.8	917.7	9.4	199.5	1,201.9	6.0	61.9	643.0	10.4
Growth rate (percent)	12.0	14.2	2.2	4.4	6.4	1.9	25.8	1.4	-24.4	1.3	1.6	0.3
1997	41.4	286.0	6.9	98.6	916.0	9.3	226.9	1,216.4	5.4	64.2	726.0	11.3
1998	44.0	33.8	0.8	99.2	463.9	4.7	219.6	994.7	4.5	66.9	643.0	9.6
1999	47.2	142.5	3.0	101.6	780.9	7.7	244.7	1,461.7	6.0	69.1	601.0	8.7
2000	53.0	358.4	6.8	103.6	648.9	6.3	-	-	-	72.2	618.0	8.6
2001	57.3	187.0	3.3	104.7	826.4	7.9	-	-	-	74.9	617.0	8.2
Growth rate (percent)	8.2	-5.1	-6.9	1.6	1.3	-0.3	3.8	9.2	5.4	3.9	-3.6	-7.5

Year	Mangosteen			Lychee			Banana			Pineapple		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1992	13.1	90.9	6.9	8.3	46.2	5.6	-	-	-	89.8	2,180	24.3
1993	14.8	100.3	6.8	9.2	45.0	4.9	-	-	-	99.8	2,589	25.9
1994	16.5	110.2	6.7	10.1	46.8	4.6	-	-	-	99.4	2,370	23.8
1995	16.4	128.3	7.8	10.3	42.8	4.2	-	-	-	90.6	2,088	23.0
1996	20.0	142.7	7.1	11.4	48.0	4.2	-	-	-	83.4	1,987	23.8
Growth rate (percent)	9.5	11.5	2.0	7.5	0.3	-7.2	-	-	-	-2.5	-4.0	-1.6
1997	23.8	181.7	7.6	11.5	37.6	3.3	9.0	146.4	16.3	84.6	2,083	24.6
1998	26.4	159.9	6.1	11.5	2.9	0.3	10.3	168.9	16.4	81.9	1,786	21.8
1999	27.2	168.3	6.2	11.8	21.8	1.8	9.1	159.6	17.5	97.1	2,372	24.4
2000	30.2	162.8	5.4	10.9	36.6	3.4	10.0	174.4	17.4	97.8	2,248	23.0
2001	30.0	160.6	5.4	11.8	40.1	3.4	8.4	151.4	18.0	88.3	1,979	22.4
Growth rate (percent)	3.7	-2.3	-6.0	-0.02	26.6	26.7	-1.5	1.0	2.5	2.6	-1.3	-1.3

Source: OAE, various issues during 1992-2001.

Table 4. Export Volume and Value of Fruits and Products in Thailand, 1992-2000

Item/Year		Fresh	Dried	Frozen	Products					Total
					Canned	Non-canned	Preserve with Sugar	Juice	Sub-total	
Volume (000 mt)	1992	74.4	18.5	11.0	539.1	-	28.5	100.8	668.4	772.3
	1993	93.1	16.0	7.9	545.4	-	31.4	137.7	714.5	831.5
	1994	115.6	22.5	9.9	815.9	8.2	26.1	252.8	1,103.0	1,251.0
	1995	136.6	15.2	9.7	437.5	176.7	27.5	137.8	779.5	941.0
	1996	172.9	38.0	9.0	309.8	52.3	18.0	99.1	479.2	699.1
	1997	219.9	56.9	13.0	342.7	83.0	27.2	104.3	557.2	847.0
	1998	141.8	24.8	15.2	288.2	59.0	29.4	106.7	483.3	665.1
	1999	224.8	15.8	27.3	529.7	85.6	25.5	150.5	791.3	1,059.2
	2000	257.3	82.3	40.0	478.6	94.5	25.4	167.1	765.6	1,145.2
Growth rate (percent)		14.1	12.4	16.7	-1.0	21.4	-1.4	0.5	-2.0	1.4
Value (฿ million)	1992	1,158.9	277.3	454.5	9,677.7	-	1,077.5	2,545.6	13,300.8	15,191.5
	1993	1,418.7	249.0	337.3	8,469.2	-	1,222.7	2,646.5	12,338.4	14,343.4
	1994	2,062.0	442.6	413.3	9,013.7	149.9	1,171.9	2,601.5	12,937.0	15,854.9
	1995	2,792.9	350.3	407.3	7,429.6	4,024.9	1,273.8	3,179.4	15,907.7	19,458.2
	1996	3,336.0	1,011.0	398.0	6,455.0	1,469.0	875.0	3,137.0	11,936.0	16,681.0
	1997	4,739.0	2,477.0	650.0	8,404.0	1,484.0	1,579.0	3,254.0	14,721.0	22,587.0
	1998	3,268.0	449.0	810.0	8,697.0	2,140.0	1,941.0	3,571.0	16,349.0	20,876.0
	1999	4,735.0	724.0	875.0	13,546.0	2,831.0	1,578.0	5,064.0	23,019.0	29,353.0
	2000	5,198.0	2,891.0	1,245.0	9,774.0	3,150.0	1,351.0	4,393.0	18,668.0	28,002.0
Growth rate (percent)		18.4	24.3	14.5	2.5	31.5	4.8	8.0	6.0	8.8

Source: Department of Customs, various issues during 1992-2000.
Note: US$1.00 = ฿41.36 during 1998.

Table 5. Export Volume and Value of Major Fresh Fruits in Thailand

(Unit: Volume = million mt; and value = ฿ million)

Year	Longan		Durian		Mango		Mangosteen		Rambutan		Lychee	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
1992	21.8	725	17.5	451	10.7	178	1.8	80	6.5	168	11.2	410
1993	30.7	842	21.2	554	7.6	128	3.2	75	6.9	195	9.5	328
1994	46.1	1,383	30.2	739	9.7	185	1.5	70	11.7	309	6.8	244
1995	46.1	1,502	52.3	1,205	9.6	178	3.8	111	12.1	392	12.0	415
1996	104.3	2,954	71.3	1,484	15.2	295	2.9	96	19.9	684	25.7	807
Growth rate (percent)	35.4	33.9	37.1	31.6	9.3	13.4	11.0	7.8	27.9	35.1	18.8	15.9
1997	135.9	5,030	78.5	1,736	14.5	331	3.2	99	17.5	609	26.7	953
1998	8.6	527	96.9	2,069	15.7	407	2.7	67	15.8	574	6.8	365
1999	60.3	2,097	132.9	2,727	16.8	370	5.3	130	15.6	479	25.4	948
2000	170.5	5,051	112.3	2,330	15.4	385	13.1	283	14.5	446	21.5	692
Growth rate (percent)	26.3	135.9	13.9	11.6	2.3	3.6	48.5	38.1	-5.7	-11.7	6.7	-0.1

Source: Department of Customs, various issues during 1992-2000.

STRATEGIES FOR DIVERSIFICATION WITH HORTICULTURE CROPS

Even though Thailand is one of the world's major producers of fruits for export, both fresh and processed products, strong international competition causes difficulties in trading Thai fruit products in the world markets. To strengthen the national agricultural policy, the government has established a plan for future fruit development, of which the major guidelines are as follows:

a) Development of new and superior fruit varieties suitable for local consumption, processing industry and export markets.
b) Strengthening the support in research and development (R&D) programs which emphasize on:
   * collection and conservation of germ plasm to minimize genetic erosion in fruit crops.
   * introduction of improved orchard management to reduce production costs, focusing on the improvement of cultural practices and soil and water management.
   * popularization of the integrated pest management programs to reduce pesticide use and to avoid detrimental effects on consumers, growers and environment.
   * use of rootstocks grafted with disease-free planting material to increase productivity and longevity of fruit trees.
   * designing effective harvest and grading devices to increase quality and decrease production costs of fruit crops with high export potential.
   * development of post-harvest technology to prolonging storage life, and improve handling and packaging for overseas markets.
   * investigation of sophisticated techniques for processing and development of attractive value-added products to meet the demand of both local and international markets.
c) Implementation of quality and standard regulations related to sanitary and phyto-sanitary measures (SPS) and the hazard analysis critical control point (HACCP) system for fruit crops with high potential for export.
d) Support of the existing farm cooperatives and establishment and promotion of new groups at district and provincial levels with the aimed of:
   * exchanging experiences; and
   * becoming group centers as a bargaining power and seeking financial support from other sources at low interest rates.
e) Encouragements of agro-industry enterprises to resolve the oversupply of fruit production, increase the value of fruit products, and help boosting the export potential.
f) Development of so-called "one-stop" service policy by the Thai Government in order to facilitate more efficient marketing and export services.

STRATEGIES TO IMPROVE COMPETITIVENESS

Special Project

In order to make farm products more competitive, a five-year project has been launched with the financial assistance from Asian Development Bank. Agricultural products will be classified into three categories, each with specific production and marketing plans. These groups are:

1. export commodities: rice, cassava, rubber, coffee, vegetables, fresh fruits (longan and durian), livestock, poultry and prawns.
2. domestically consumed commodities: maize, oil palm, onion and garlic.
3. import-substituting commodities: soybean, fishmeal, and cotton.

The strategies will be implemented in short, medium and long terms. The principle goal is to meet local demand and earn revenue from exports. The project focuses on curbing oversupplies, reducing production costs, and improving production efficiency. These will be achieved through the following four operational plans:

i) Defining crop zoning to control supply and quality of agricultural productions;
ii) Registration of farms to keep the record of farming areas of each agricultural product and to implement market intervention programs effectively;
iii) Emphasizing R&D to provide high-yielding seeds in order to promote the non-genetically modified organisms (GMOs) varieties, develop new appropriate technology and knowledge to overcome pre- and post-harvest constraints; and
iv) Setting up the production and quality plans for various agricultural products to meet market demand.

Other strategies for restructuring production and marketing systems are:

* to develop farm products quality and improve their delivering system to local and international markets in more quick and efficient ways.
* to promote the production of agro-industrial goods and farm product processing industry.
* to set up a center for developing technology and to promote agriculture professions.
* to locate the agricultural product export zones with attractive privileges.

Agriculture and New Technologies

Agricultural competitiveness go hand in hand with the adoption of appropriate new technologies. The new management and biotechnologies provide powerful tools for sustainable agricultural development and maintain market shares in the world market. The concern for safety foods brings about the urgent need to develop comprehensive national strategies and adequate regulatory framework on the issue. The effect on human and animal health, and environment as a result from GMOs or any other substances should be assessed on scientific basis to ensure consumers' safety, protect the environment, and overcome trade barriers.

SUCCESSFUL EXAMPLE: LONGAN AND DURIAN

Longan and durian are chosen as agricultural product champions in Thailand according to their high potential in both production and export. Thai longan and durian have become popular fruits among high-income consumers all over the world due to their high quality and unique taste.

Thailand has an advantage in producing longan and durian due to proper weather. Highly experienced farmers produce good variety of Thai longan and durian by using modern agricultural production technology. These make Thai longan and durian the best in the world market with high potential to increase their markets share.

The application of the agricultural restructuring program increased the harvested area of longan from 23.6 thousand ha in 1992 to 57.3 thousand ha in 2001 and the production from 145.0 to 186.8 thousand mt in the respective period. In the corresponding period, the harvested area of durian increased from 76.5 to 104.7 thousand ha and production from 711.4 to 826.4 thousand t (Table 3).

To strengthen the competitiveness of Thai longan and durian in the international market the government has set up the strategies to support the development of longan and durian production and to increase the competitiveness in cooperation with the private sector. The strategies are as follows:

Production Strategies

Although Thailand has an advantage in producing longan and durian compared to other major producing countries, such as the People's Republic of China, Vietnam and Taiwan, many problems still exist. The fluctuation of product prices and expensive inputs would normally raise the cost of production, besides lack of harvesting labor, marketing information and knowledge especially about the quality standard of the product. These need to be solved through the following strategies:

* Transferring the appropriate technology for "Good Agricultural Practice (GAP)" from planting to harvesting, including, pre- and post-harvest processes to all longan and durian planters.
* Zoning the longan and durian production areas to promote the production only in the suitable area through the incentive measures.

* Supporting R&D studies to evolve new varieties (high-yielding, good quality, disease- and pest-resistance) aiming to increase the productivity.

Processing Strategies

* Establishing an export standard of processed longan and durian.
* Transferring of technologies to farmers in the target groups to standardize the processed longan and durian products.
* Supporting R&D for new processed longan and durian products with high standard to compete in the world market.
* Registering and certifying the longan-drying factories aiming to promote product standardization.

Marketing Strategies

* Supporting the trade of standardized longan and durian by encouraging longan and durian farmers to improve longan and durian quality, which will improve market acceptance and stabilize longan and durian price both in domestic and overseas markets.
* Supporting an infrastructure investment, cold storage, etc. to facilitate market during the harvesting of oversupplied season and also to stabilize price of longan and durian at the same time.
* Supporting the promotion campaign and introducing longan and durian and their products to the market both local and overseas through the cooperation of government and private agencies.
* Supporting and encouraging the longan and durian exporter to do their business under the registered brand names to ensure and guarantee the product quality.
* Establishing one-stop export service center to support and facilitate the export of longan and durian in the major longan and durian production zones.
* Implementing the strategy of "Ally Trade" to initiate the good relationship and reliability among longan and durian farmers, exporters and importers.
* Searching for new export markets, increasing shares in the traditional market and negotiating to reduce trade barriers.
* Promoting the competitiveness by means of marketing information of both exporting and importing countries in order to know the demand, supply and related import regulations and requirement of longan and durian.

SUMMARY

From the Third National Economic and Social Development Plan (1972-76) to the Seventh plan (1992-96), the contribution of the agriculture sector in GDP has a tendency to decline, while the proportion of the labor force in the agriculture sector is still high. This has caused disparity of income between the agriculture and non-agriculture sectors. Thailand will continue moving in this direction, and is likely to change itself from an agricultural country to the newly industrial country in the near future.

Crops is the most important branch of agricultural production taking into account more than 50 percent of the total production value. Farmers in Thailand are not enthusiastic in organizing themselves into cooperatives and still use traditional technologies, and depend on rainfed lands for farming. These factors cause inefficient production. Besides, a large part of the land is unsuitable for agriculture, and the land for agricultural use has a tendency to decline.

In view of these constraints of agricultural development, the government has to restructure the agricultural production from producing only rice and a few other crops to growing plants that have higher returns and planting perennials, especially those that bear fruits. Production of the livestock and fisheries branches, especially of poultry, dairy, beef cattle and aquaculture has also expanded.

The rules and regulations of the international free trade system under the WTO and AFTA agreements now bind every country to open its market. However, developed countries are limiting trade with developing countries by setting a higher standard for imported agricultural products as well using the non-trade barriers.

The strategies to make agricultural products more competitive focus on curbing oversupplies, reducing production cost, and improving production efficiency and quality. To implement these strategies the

operation plans include zoning of crop production, registration of farms, emphasis on R&D, and setting up plans for agricultural product quantity and quality.

For the future prospects of agricultural diversification and restructuring, Thailand is moving toward the industry-based agriculture and export higher value-added agricultural products rather than exporting raw materials only. Comprehensive national strategies and adequate regulatory framework to ensure safety foods need to be developed to assure consumers' safety and facilitate trade.

Thailand is one of the world major leaders of tropical fruit producing countries for export, both fresh and processed products. Longan and durian, that have been chosen as leading products because of their high potential both in production and export. To strengthen the competitiveness of Thai longan and durian in the international market, the government has to set up the strategies in the Ninth Development Plan (2001-05) to support the development of longan and durian production, marketing and processing with emphasis on: (1) transferring appropriate technology to farmers and processors; (2) zoning the longan and durian production area; (3) registering the farmers and certifying the factories to promote product standardization; (4) establishing an export center as one-stop service center; and (5) searching for new export markets, increasing shares in the traditional market and also negotiating with importing countries to reduce trade barriers.

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15. VIETNAM

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SOCIOECONOMIC CHARACTERISTICS OF HANOI

Hanoi, Capital of Vietnam, is the center of political, economical and cultural activities of the country. Every year, about one million people consisted of foreigners and those from other provinces, visit Hanoi for business, tourism, study and other purposes. The Hanoi province is spread over about 921 km^2. The capital is divided into 12 districts, of which seven are urban and five are peri-urban. The rural districts occupy more than 90 percent of the province area.

The Hanoi consists of seven urban districts; namely, Hoan Kiem, Ba Dinh, Hai Ba Trung, Dong Da, Thanh Xuan, Cau Giay and Tay Ho whereas rural Hanoi is comprised of five districts; namely, Tu Liem, Thanh Tri, Gia Lam, Dong Anh and Soc Son. The total population of the capital is 2.8 million in 2001, of which 2.5 million people live in seven urban districts and 1.3 million people live in rural districts of Hanoi. It is projected that the population of Hanoi province will reach 3.6.million by 2010 of which 63 percent will live in urban area. This implies that peri-urban agriculture of Hanoi has great responsibility to fulfill increasing food demands in the future.

The agricultural land of Hanoi is consisted of 44.6 thousand ha. The population density in 2001 in urban and rural areas was 16,648 and 1,520 people per km^2, respectively. The agricultural land per person in rural area is estimated as 322 m^2. Due to rapid development in various sectors of urban Hanoi, a rapid urbanization is expected in near future, which will lead to further decline in the availability of agricultural land for farming purposes (Table 1).

Table 1. Trend in Reduction of Agricultural Land

Year	Agricultural Land Left Unproductive (ha)	Agricultural Land No Longer Productive (percent of total land)
2000	6,300	14.3
2005	9,100	20.7
2010	11,600	26.4
2020	15,000	34.2

Source: Hanoi Agricultural Extension Center (HAEC), 2000.

Hanoi's agriculture is presently supplying a substantial proportion of Hanoi city's food demand, especially of vegetables, fruits, fish, meat, and eggs and milk. Substantial change in the food demand patterns can be expected in view of the socioeconomic development in urban Hanoi. The demand for livestock and horticultural products will expand more rapidly as compared with cereals. This implies that the future agriculture in Hanoi area will increasingly be diversified. Moreover, the health and environmental concerns will dominate in the city and peri-urban planning and development. In view of these future challenges, the question arises what could be done to transform Hanoi agriculture in line with the new world economic order. An attempt is made in this paper to make a critical review of the developments in the Hanoi agriculture.

AGRICULTURAL POLICIES

During the late 1980s, Vietnam Government renewed its economic policies to enhance economic development of the whole economy in general and the agriculture sector in particular. Following policies were revised.

Farmers' Right of Land Use

Land Law named as "Law on Agricultural Land Use Tax" was issued in July 1993, and it was implemented in January 1994. This Law confers five main rights to the farmers which are land-use change, transfers, lease, heritage, and collateral. Under this Law, land was allocated to the household on long-term basis as follows: 20 years for annual crops; 50 years in case of multi-year crops; and seventy years for multi-year crops in government approved projects. Until 1998, more than 70 percent of farm households received "land use certificates" covering 67 and 60 percent of agricultural and forestry lands, respectively (UNDP, 2001).

Development of Agricultural Infrastructure

The Government of Vietnam has mobilized all possible resources towards the development of rural areas, the buildup and upgradation of irrigation, transport, and communication infrastructure, and better protection of health and environment. As a result, during the 1990s, irrigated area has increased by 1.4 million ha. The investment in agriculture is increasing at commendable rate.

Strengthening Agricultural Extension

The agricultural extension has important role in rapid transfer of promising production technologies to farmers' fields. In order to strengthen the nationwide agricultural extension system, local extension centers have been established in 61 provinces and cities. In many provinces, their branches have reached to the districts, villages and commune levels. Veterinary and plant protection centers have been established in parallel at the district level (UNDP, 2001).

Development of Rural Credit Network

Since 1993, the Agricultural and Rural Development Bank has rapidly expanded its operations not only in terms of the number of beneficiary farmers but also the value of credit advanced. Rural credit grew annually by 24-27 percent. By the end of 1997, total loans outstanding in rural areas amounted to VND (Vietnam dong) 36 trillion (UNDP, 2001).

Liberalization of Trade Policies

Under this policy, the domestic markets are deregulated and the trading activities are gradually integrated with the rest of the world economy. The so-called "market barriers" have been lifted. The goods were allowed to circulate freely in domestic markets. In general, market forces are allowed to determine prices and one-price market mechanism operate across-the-board in a single domestic market. On international trade front, except for a few products banned for security, health, cultural or moral reasons, import and export of goods have been taken place freely. Taxes imposed on the import of agricultural raw materials and agricultural exports have been minimized to the extent of zero in certain cases.

AGRICULTURE IN HANOI

Crops Grown

The total area under crops has decreased from 89 thousand ha in 1991 to 85.4 thousand ha in 2001, mainly because some of the area has fallen to construction and other development infrastructure in and around the city. The rate of decline in crop area is expected to be faster in the future as depicted in Table 1. However, it looks that the decline mainly came from sweet potato and autumn rice, while area under high-value crops such as fruits and vegetables continued to rise. The controlled urbanization policy followed by the government may the reason to block the most fertile land to fall under urbanization. There is a great lesson to be learned by other countries where most fertile land under high-value crops in and around the city falls in first pray to urbanization.

Rice is the major crop in Hanoi province occupying more than 50 percent of the gross sown area. However, the area under cereals including sweet potato and corn is either declining or stagnant. On the other hand, the importance of vegetables, fruits, and flowers in the cropping system has significantly increased during the 1990s. For example, the flower area increased eight times, fruit area about doubled, while vegetable area increased by 50 percent during 1991-2001. The area under groundnut and soybean in Hanoi province also showed a significant improvement (Table 2).

Table 2. Area and Production of Major Crops Grown in Hanoi during 1991 and 2001
(Unit: Area = 000 ha; production = 000 mt; and yield = mt/ha)

Crop	1991			2001		
	Area	Production	Yield	Area	Production	Yield
Rice: Spring rice	25.30	331.43	13.1	26.83	91.78	3.42
Autumn rice	30.40	1,018.40	33.5	25.52	102.17	4.00
Sub-total	55.70	1,349.83	24.2	52.35	193.95	3.70
Corn	10.30	210.12	20.4	10.31	28.37	2.75
Sweet potato	5.50	325.05	59.1	4.10	27.08	6.60
Groundnut	2.40	16.08	6.7	3.70	4.29	1.16
Soybean	1.20	10.56	8.8	2.30	23.9	10.39
Vegetable	5.10	784.38	153.8	7.57	135.59	17.91
Fruit*	1.80	n.a.	n.a.	3.33	33.56	10.08
Flower	0.07	n.a.	n.a.	0.56	n.a.	n.a.
Others	6.93	n.a.	n.a.	1.59	n.a.	n.a.
Total	89.00	n.a.	n.a.	85.81	n.a.	n.a.

Sources: For 1991, General Statistics Office (GSO), 1996; and for 2001, Hanoi Statistics Office (HSO), 2002.

Note: * The fruit area includes both harvestable and non-harvestable area.

The production of high-value crops not only increased due to the expansion in their area, but also due to the improvement in their yield. While the first came through appropriate incentives for the urban and peri-urban agriculture, while the second was achieved through an active research programs in the high-value crops. The concerned national organization in collaboration with the concerned international research institutes released many new yielding varieties of fruits, vegetables, soybean, and groundnut in the Hanoi area. This was coupled with the demonstration of appropriate management technologies and training of the farmers for adoption of these technologies in the urban and peri-urban areas.

Vegetable Production

Vegetables are grown on a total of 7.6 thousand ha in the Hanoi province, which occupy about 9 percent of the gross sown area under all crops in the city. This produces about 135.6 thousand mt of vegetables. The major vegetables produced are *kangkong* and other leafy vegetables (Table 3).

Table 3. Individual Vegetable Area, Production and Yield in Hanoi, 2001
(Unit: Area = ha; production = mt; and yield = mt/ha)

Kind of Crop	Sown Area	Production	Yield
Kangkong	1,669	50,145	30.0
Head cabbage	527	10,617	20.1
Other leafy vegetables	1,697	23,963	14.1
Kohlrabi	521	8,587	16.5
Tomato	371	6,867	18.5
Onion and garlic	305	4,933	16.2
Cucurbits	409	8,444	20.6
Other vegetables	2,074	22,037	10.6
Total	7,573	135,593	17.9

Source: HSO, 2001.

1. ***Supply and Demand Gap of Vegetables***

The production within the city gives per capita annual availability of vegetables at about 48.2 kg. Household consumption surveys conducted by the Research Institute for Fruits and Vegetables and GSO of Hanoi suggests per capita annual consumption of vegetables in Hanoi province at 98 kg. This leaves the city with a deficit of about 50 kg per capita per annum, or about 140 thousand mt total annual deficit. In other words, more than one-half of the total vegetable demand of the city is imported from outside the Hanoi province. This implies that about 40 trucks each loaded with 10 mt of vegetable have to enter in the city coming from other provinces every day. It is worth mentioning here that this is annual deficit in vegetable supplies from the urban and peri-urban sources of Hanoi province. There may be variation in the deficit depending upon the seasonal supplies from the urban and peri-urban sources in the city, as the production varies across season. Moreover, with the increasing population and income, this deficit may grow unless scientific high-productive and low-cost innovations are introduced in the cultivation of vegetable production.

2. ***Diversity in Vegetable Production***

In Hanoi, there is a big diversity in vegetable species with superior vegetables such as cauliflower, broccoli, sweet pepper, baby corn, baby cucumber, etc. grown on 20 percent of the vegetable area. Cabbage, tomato, kohlrabi, beans, pea, and local spices are grown on 50 percent, and remaining 30 percent of vegetable area is under other cucurbitaceae crops. Many new vegetables are introduced into the existing system for more nutrition and high income. These include carrot, onion, lettuce and asparagus.

3. ***Off-season Vegetable Production***

In north Vietnam, vegetable harvesting is concentrated in January and February, while April-July is off-season. As a result, vegetable prices are highest during April-July (Thuy, *et al*. 2002). Hence, increased supply of vegetables during the off-season can reduce their shortage during this period as well as enhance farmers' income. A partial analysis of the off-season vegetable production clearly shows that it is highly profitable to grow off-season vegetables (Table 4).

Table 4. Economics of Vegetable Production in the Off-season

Vegetable	Spending (VND 000/ha)	Yield (mt/ha)	Selling Price (VND 000/kg)	Income (VND 000/ha)	Benefit (VND 000/ha)
Snap bean	16,025	16.2	2.0	32,400	16,375
Yard-long bean	18,319	18.9	2.5	47,250	28,932
Leaf mustard	14,080	12.0	2.5	30,375	16,295

Source: HAEC, 2000.
Note: US$1.00 = VND14,000 during 2000.

Flower Production

Before the 1990s, flower cultivation in Hanoi was restricted to local varieties with monotonous color. Since the beginning of the 1990s, new flower varieties of different colors have been imported from other countries and now successfully grown in many parts of Hanoi. New varieties of rose from France, Holland, China are planted in Tu Liem, Thanh Tri, and Dong Anh districts. Chrysanthemum varieties from Singapore, China, Holland and Japan and Carnation varieties form France, Holland and China are now commonly cultivated in Tu Liem district of Hanoi.

Fruit Production

In Hanoi, local fruit species are famous for high quality. These varieties include, Xuan Dinh sapodilla, Phu Dien pomelo, Canh orange, Gia Lam carambola. These local fruit species have been encouraged to grow in the planned areas such as knoll-hilly zone in Soc Son, Tu Liem, Dong Anh and Gia Lam districts. Planting fruit tree gets high income.

Cultivated area of fruit tree has increased during 1990-2000 (Table 2). During 2001, per capita annual availability of fruits from urban and peri-urban production is about 12 kg. The household consumption survey suggest per capita annual consumption of fruits at 15 kg. This produces a deficit of 8 kg per capita per annum, or 8.4 thousand mt, implying that the city is able to produce about 75 percent of its requirements.

IMPROVING HANOI AGRICULTURE

The above-described government policies in the preceding section are applicable generally to the agriculture sector of Vietnam. In the following section, the efforts to increase production and income of Hanoi farmers are briefly discussed.

Cropping System

Each district of Hanoi differs by soil type, terrain, geography, and socioeconomic conditions. Therefore, cropping system in each district designed is based on these conditions with the aim to maximize yield and efficiency of resources engaged in agricultural production. For instance, Soc Son district has the highest terrain. In addition to agricultural lands, it has hilly area in the northwest, which is suitable for growing fruits. Therefore, instead of cultivating food crops like rice and corn, nowadays farmers also plant fruits, beans, soybean, and peanut in these areas.

Agricultural area in the southeast of Thanh Tri district is lowland. The rice-rice system giving a net income of VND10.5 million per ha is changing to rice-fish generating a net income of VND22.5 million per ha.

In many other places of Hanoi, the cropping pattern in the rice growing areas with low income have been changing to other crops such as high-value fruits and vegetables, flowers, hybrid corn, and other plant species.

New Varieties and Technologies

In view of enormous population pressure per unit of agricultural land, the intensity of the Hanoi peri-urban agriculture is increasing overtime. The farmers are using new high-yielding varieties and cultivate the crops of high economic value using more progressive production technologies.

Safe Vegetable Production

The term safe vegetable production is generally used for the production of vegetables without using pesticides. The daily consumption of vegetables in Hanoi is about 471 mt and 70 percent of this demand is fulfilled by peri-urban Hanoi (De Bon, and Thi, 2000). In peri-urban Hanoi, these vegetables are produced under highly intensive cropping system by excess use of pesticides. Various studies conducted during 1992-97 show the presence of excessive amounts of nitrate contents (Table 5), pesticide residues, heavy metal contents and biological pathogen agents (Thi, 2000). A study found the pesticide residues on 25 percent fruits and vegetables sampled, whereas the presence was above the maximum level allowed (MLA) by the Ministry of Health on 5 percent fruits and vegetables. The highest level of pesticide residues was found on long beans, Chinese spinach, grapes, kohlrabi and tomatoes (Quang, 1999).

Table 5. Nitrate Contents in Vegetable in Some Vegetable Production Areas

(Unit: mg/kg fresh)

Vegetable	NO_3^- Contents			
	Threshold	Gia Lam	Tu Liem	Thanh Tri
Cabbage	500	1,870	2,130	1,660
Leaf mustard	500	2,240	1,870	1,787
Tomato	150	120	88	76

Source: Xuan, *et al*., 1996.

In order to reduce the health risks due to the consumption of polluted vegetables, Hanoi People's Committee in collaboration with different agencies initiated programs to promote the production of safe and clean vegetables. The results from the safe vegetable production demonstrations conducted at HAEC suggest that reasonably high yields can be obtained if vegetables are produced without using chemicals (Table 6).

Table 6. Result of Safe Vegetable Production Demonstration in Hanoi

Year	Commune and District	Area (ha)	Vegetables	Yield (mt/ha)
1995	Van Noi–Dong Anh Yen My–Thanh Tri Dong Du–Gia Lam	15	Asparagus	1.0
			Baby corn	1.2
			Baby cucumber	7.0
			Mini tomato	6.5
1996	Van Noi–Dong Anh Dong Du–Gia Lam Yen My–Thanh Tri Yen Noi–Tu Liem	30	Tomato	25.0
			Cabbage	30.0
			Cauliflower	20.0
			Baby cucumber	6.4
			Mini tomato	7.0
			Leaf mustard	13.0
			Baby corn	1.2
1997	Van Noi–Dong Anh Dong Du–Gia Lam Yen My–Thanh Tri	20	Kohlrabi	13.0
			Cabbage	33.0
			Leaf mustard	14.0
			Baby cucumber	7.5
			Tomato	27.5
			Cauliflower	20.0
			Sweet pepper	13.0
1998	Van Duc–Gia Lam	10	Cabbage	32.0
			Dark purple-rub	15.0
			Snap bean	15.0
			Tomato	27.0
1999	Dong Xuan–Soc Son Le Phap–Dong Anh Dong Du–Gia Lam Duyen Ha–Thanh Tri	43	Baby cucumber	7.6
			Baby corn	1.5
			Tomato	28.0
			Cauliflower	20.0
			Snap bean	27.8
			Cabbage	30.0
			Leaf mustard	12.0
			Dark purple-rub	14.0
2000	Van Noi–Dong Anh	10	Snap bean	18.0
			Leaf mustard	12.0
			Tomato	25.0

Source: HAEC, 2000.

Moreover, safe vegetables enjoy higher prices than conventionally produced vegetables (Table 7). As a consequence, farmers became interested in producing safe vegetables, and their area has tripled just during three years of 1996-99* (Table 8).

Balanced Application of Fertilizer

Inorganic fertilizer along with farm manure use on vegetables is quite high in Hanoi agriculture (Table 9). Use of improperly decomposed manure and imbalance dose of chemical fertilizers not only causes low plant yield but also high accumulation of NO_3^- in the soils (Table 10), incidence of harmful microbial content, and chemical residue on vegetables above the allowable limits. This not only affects both consumers and producers health, but also pollute the environment.

* However, from the farmers' point of view, the yield per ha of safe vegetables is about 20 percent. As the appearance of safe vegetables is less attractive, it is difficult to sell safe vegetables at higher price without any certified labeling (Thi, 2000).

Table 7. Average Price of Selected Safe Vegetables in Hanoi during 1998

(Unit: VND/kg)

Vegetable	Safe Vegetable		Normal Vegetable Selling	Change in Normal Vegetable Price (percent)
	Buying Price	Selling Price		
Kangkong	1,500	3,000	800	375
Common cabbage	1,000	2,500	500	500
Chinese cabbage	2,000	4,000	1,000	400
Pakchoi	2,500	5,000	1,500	333
Lettuce	3,000	5,000	2,000	250
Tomato	2,000	5,000	800	625
Bean	2,500	5,000	2,000	250
Cucumber	2,000	4,000	1,000	400

Source: Census data of Agricultural Economical Institute Report in National Workshop on Safe and Year-round Vegetable Production in Peri-urban Areas held in December 1999 in Hanoi.

Table 8. Cultivated Area and Production of Safety Vegetable Produced in Hanoi Peri-urban Areas during 1996-2001

Items	1996	1997	1998	1999	2000	2001
Sown area (ha)	400	591	1,440	1,785	1,947	2,250
Safe vegetables area as percent of total area	5.3	7.6	17.5	22	24	30
Average yield (mt/ha)	12.0	13.5	14.0	13.0	15.3	16.7
Total production (mt)	4,800	7,978	20,160	23,205	29,789	37,575

Source: Hanoi Agricultural and Rural Development Department (HARDD), 2002.

Table 9. Survey Result of Fertilizer Use in Hanoi

Commune and District/ Crop Rotation	Crops	N (kg)	P_2O_5 (kg)	K_2O (kg)	Peat Manure (kg)	N. Soil (mt)	FYM* (mt)	Other
Lien Mac, Tu Liem								
Rice-rice	Summer	120	80	30	550	0	7	Straw
	Autumn	80	50	30	300	0	5	
Rice-rice-vegetable (one crop)	Summer	100	70	30	550	0	7	Stem
	Autumn	70	50	30	300	0	5	
	Winter	180	90	60	550	6	12	
Vegetable (one crop)		150	60	30	800	10	15	
Flower		200	80	40	600	12	20	Stem, leaf
Van Noi, Dong Anh								
Rice-rice	Summer	80	90	60	0	0	8	Stem, leaf
	Autumn	70	60	40	550	0	6	
Rice-rice-one upland crop	Summer	80	80	60	0	0	8	Stem, leaf
	Autumn	70	60	40	550	0	6	
	Winter	150	80	70	550	7	10	
Vegetable (one crop)		150	80	70	600	10	15	Stem, leaf

Source: Xuan, *et al*., 1996.

* FYM = Farm yard manure.

Table 10. Effect of Balanced Fertilizer Application on Vegetable Yield and NO_3^- Contents

Vegetable Site	Fertilizers (kg/ha)				Yield (mt/ha)	NO_3^- (mg/kg fresh)
	Farm Manure (mt/ha)	N	P_2O_5	K_2O		
Cabbage						
1	10-12*	260-280	70-90	50-60	41.2	984
1	15	200	80	100	40.8	368
2	15-17*	220-240	60-70	30-50	36.5	1,025
2	15	200	80	100	41.8	420
3	16-18*	220-240	45-60	0	34.8	940
3	15	200	80	100	42.6	342
Tomato						
1	14-16*	180-200	45-60	50-60	39.5	52
1	15	150	80	90	43.2	65
2	13-16*	160-180	70-80	0	36.6	48
2	15	150	80	90	40.8	30
3	16-18*	180-200	0	0	32.7	68
3	15	150	80	90	45.4	46

Source: Xuan and Lan, 1997.
Note: * Farmer application level.

Results from demonstrations fields suggest that rational use of fertilizer and manure can given generally higher plant yield and also safe vegetable products (Table 10). The demonstration plot with a multiple crop index of 2.2, balanced fertilizer application, changed cropping system, and new varieties produced an average income of VND21 million per ha in 1993, VND23 million per ha in 1996, VND24.8 million per ha in 1997 and VND26.4 million per ha in 1999.

Processing of Agricultural Products

Processing of agricultural products is an important part of the production-marketing cycle. It enhances the value of agricultural production. The government has completed agricultural product processing models in Gia Lam in 1997, Thanh Tri in 1998, and Soc Son in 2000. The results of vegetable processing models on baby corn, baby cucumber, and pepper show that vegetable processing utilizes leisure labor, enhances economic value of vegetables, and increases income per ha (Table 11), thereby improves competitiveness of vegetable production.

Table 11. Economics of Vegetable Production for Processing (calculated for 1 mt of fresh vegetable)

Vegetable Type	Buying Price (VND/mt)	Production Cost (VND/can)	Selling Price (VND/can)	Number of Cans	Profit (VND/mt)
Baby corn	12,944,179	6,820	7,500	1,889	1,284,520
Baby cucumber	8,847,272	4,700	5,500	1,889	1,511,200
Pepper	6,399,647	2,000	2,500	3,090	1,545,000

Source: HAEC, 2000.

Improving Technical Knowledge of the Farmers

To improve the knowledge of farmer, HARDD adopted three training methods:

a) Farmers' training about using new technologies and varieties. About 80,000 farmers are trained in Hanoi every year;
b) Information dissemination on radio and television; and

c) Arranging demonstration plots at farmer fields and arranging farmer meetings at these plots for demonstrating new vegetables, flower, safe vegetable production model, rice varieties model, hybrid rice, corn variety production, changing of cropping system model, etc.

These knowledge enhancement campaigns produced following encouraging results as follows:

1. Food production including paddy increased at 5.5 percent per annum during 1996-99.
2. Area of winter crops increased from 35.2 percent in 1996 to 45.3 percent in 1999.
3. Area under vegetables increased at the annual rate of 7.3 percent and production at 9.3 percent. Superior and off-season vegetables occupy 40-45 percent of total vegetable area, and peri-urban Hanoi covers more than 80 percent of total fresh vegetable supply to the city.
4. The Hanoi People's Committee has paid attention to invest on development of safe vegetable production and now more than 37 thousand mt of safe vegetables are produced in the city.
5. Total value of agricultural production has increased from VND700 billion in 1996 to VND820 billion in 1999. The living standards of Hanoi farmers are also gradually improving.

SUGGESTIONS FOR INCREASING AGRICULTURAL DIVERSITY IN HANOI

Increasing urbanization is a great challenge to many developing countries. Under the scenario of constantly increasing population, declining available agricultural land, and rising environmental and safe food concerns, the Hanoi's agricultural development should be aimed at:

1. enhancing the productivity of the agriculture sector particularly of livestock products and horticultural food crops.
2. strengthening breeding efforts to evolve crop varieties, which are better responsive to fertilizer and highly resistant to pests and diseases.
3. developing the low cost improved technologies for harvest and post-harvest operations in order to safe shipment of agricultural products to consumers with minimum damage to the quality.
4. streamlining the strict rules and regulations for issuing of license to pesticide dealers.

Some policy guidelines are hereby proposed in order to fulfill the above objectives.

1. The priorities of agricultural research and extension systems should be fully oriented towards future challenges of Hanoi agriculture.
2. There should be regular programs for training farmers about managing more diversified cropping system. Their knowledge about methods of producing safe food crops should be enhanced on regular basis using various methods such as organizing demonstration plots, and using mass media.
3. The farming community should also be trained in improved methods of crop harvesting, its post-harvest handling, sorting and grading. This will not only help in getting due reward of farmers efforts but also help channelizing the product to the desired stakeholders (i.e., to consumers or further processing).
4. In view of decreasing average farm size, cooperative farming should be promoted in peri-urban areas of Hanoi.
5. Extending credit facilities to the farmers for various long-term developments at the farm level such as land leveling, improvements in water management, etc.
6. Necessary infrastructure and support services should be provided to the farmers by extending appropriate incentives to various agencies involved.

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Part IV. APPENDICES
List of Participants, Resource Speakers, and Secretariat / Program of Activities

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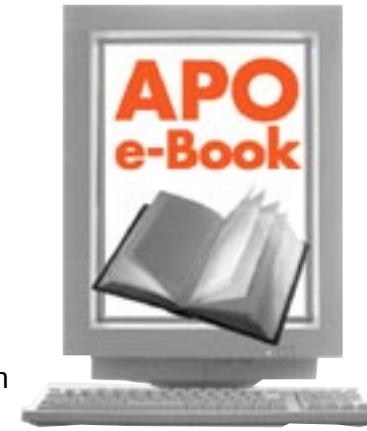
Edited by Dr. Mubarik Ali, Agriculture Economist/Head of the Socioeconomic Unit and Economic and Nutrition Project, Asian Vegetable Research and Development Center, Republic of China



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2. PROGRAM OF ACTIVITIES

(16-23 May 2001)

Date/Time	Activity
Wed., 16 May	
Forenoon	Opening Ceremony Presentation and Discussion on Topic I: *Globalization and International Competitiveness: Concepts and Policy Implications for Agriculture* by Dr. Luc De Wulf
Afternoon	Presentation and Discussion on Topic II: *Diversification of Agriculture in More Competitive Environment* by Dr. Pramod K. Joshi Presentation and Discussion on Topic III: *Agricultural Diversification in Japan* by Dr. Mitsugi Kamiya
Thurs., 17 May	
Forenoon	Presentation and Discussion on Topic IV: *Diversification with Vegetables to Improve Competitiveness in Asia* by Dr. Mubarik Ali Presentation of Country Reports by Participants
Afternoon	Presentation of Country Reports by Participants
Fri., 18 May	
Forenoon	Presentation of Country Reports by Participants
Afternoon	Presentation of Country Reports by Participants
Sat., 19 May	
Forenoon	Workshop
Afternoon	Free Time
Sun., 20 May	
Forenoon	Free Time
Afternoon	Leave Tokyo for Yonezawa, Yamagata Prefecture
Mon., 21 May	
Forenoon	Visit JA Yamagata Okitama (agricultural cooperative)
Afternoon	Visit farm house (producing cherry) and Union of Vegetable Production
Tues., 22 May	
Forenoon	Visit orchard, JA Yamagata Okitama
Afternoon	Visit Zao Rakuno Center (dairy farming)
Wed., 23 May	
Forenoon	Summing-up Session Closing Session