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**Assessment of Food Demand/Supply Prospects and Related  
Strategies for Developing Member Countries of the ADB  
(An ADB-Supported IFPRI-IRRI Study)**

**Parts I and II**

**Projections of Food Production and Demand Balances  
for Developing Member Countries of the ADB to 2000**

**The International Food Policy Research Institute**

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**Projections of Food Production and Demand Balances  
in the ADB Developing Member Countries to the Year 2000**

**Introduction**

This portion of the overall study analyzes past food trends and assesses the food demand supply prospects of selected developing member countries (DMCs) of the ADB in 2000. Results of the trends analysis for foodgrains and other important food items in the region, and the foodgrains projections to 2000 in the 20 DMCs are presented here. Specifically, examination is made of the trends in the production and consumption of paddy rice, wheat, maize, other coarse grains, and pulses in these countries during the past two decades. Based on output and income trends, projections of country production and demand are made for each foodgrain item to obtain a scenario of the possible output-demand balances of these commodities by the end of the century. Analysis is made also of the consumption trends of meat, sugar, fats and oils, and fish. Some notes on methodology and the sources of data that are used for these projections are given in Appendix A of this report. The projection methodology for selected countries where trend-based projections required modification is discussed in Appendix B.

**Foodgrain Production in the DMCs**

Based on the 1976-80 estimates, the DMCs had an average annual production of 290 million metric tons of foodgrains in that period (Table 1). As may be expected of the production mix of countries in Asia, paddy rice formed the bulk of this output with nearly 190 million metric tons or  $\frac{2}{3}$  of the total.<sup>1/</sup> Wheat was a far second with

<sup>1/</sup> At a 65 percent recovery rate, rice production in milled terms was about 122 million metric tons.

15 percent while the coarse grains (maize and other cereals) accounted for another 15 percent. Pulses, the only noncereal item of the group, represented only 5 percent of the aggregate foodgrain output in the DMCs.

India produces about one-half of the foodgrains output of the DMCs; Indonesia comes next with about 10 percent. Bangladesh, Thailand and Pakistan contribute near equal shares which total 20 percent of production; thus, five out of the 20 DMCs account for 4/5 of food production in these countries. Other significant foodgrain producers are Burma and Vietnam with 4 percent each, and the Republic of Korea and the Philippines with 3 percent each.

Paddy rice production is reported for all DMCs except Singapore (which shows no output of any of the foodgrain items). It represents 90 percent or more of the national foodgrain output in 9 countries (Malaysia, Sri Lanka, Bangladesh, Taiwan, Burma, Vietnam, Kampuchea, Laos and Hong Kong) and between 80 and 90 percent in 2 others (Indonesia and Thailand). Among the DMCs, India accounts for almost 40 percent of paddy rice output, followed a far second by Indonesia with 14 percent.

Wheat, the second most important foodgrain of the DMCs, is reported in 8 countries, with India being the largest producer with 70 percent. Pakistan accounts for 21 percent while Afghanistan is a far third with 6 percent; India, Pakistan and Afghanistan jointly represent more than 95 percent of wheat production in the DMCs. Nationally, wheat is the predominant crop in Afghanistan (63 percent) and Pakistan (58 percent).

Maize, the major coarse grain, is generally grown in these countries, though not reported for Hong Kong and Singapore. India accounts for one-third of the DMC maize output while the Indonesia production represents 18 percent; the Philippines and Thailand contribute about 15 percent each to the total maize production of the group. The other coarse grains combined represent 9 percent of the total output of foodgrains in the DMCs, with about 90 percent of the crop coming from India alone. Within countries, these other cereals are relatively significant in India (16 percent), Republic of Korea (14 percent), Afghanistan (8 percent) and in Pakistan and Nepal (4 percent each).

About 85 percent of the production of pulses in the DMCs is from India where the crop provides a major source of protein in the population diet and represents 8 percent of the country's foodgrain production. Pakistan comes as a very far second in the level of pulses output with 5 percent of the total production of the crop in the DMCs. Within countries, however, the crop represents nearly 80 percent of the production of foodgrains in Papua New Guinea.

#### Trends of Foodgrain Production in the DMCs

Among the foodgrain items, wheat had the fastest output growth during 1961-80 with an average rate of increase of 6.3 percent a year (Table 2). With declines in pulses production in India, where most of the DMC crop is grown, the output growth of pulses for the group was almost stagnant at 0.1 percent annually. The growth of maize production in the DMCs was fairly rapid at 2.8 percent a year which was

significantly faster than the average annual rate of increase in rice production of 2.5 percent. Output of other cereals combined expanded at a slow 1.1 percent a year; as shown earlier, these crops appear to assume national significance in DMCs which have temperate areas. With the rapid growth of wheat output, a production growth rate of almost 3 percent a year during the past two decades was achieved by the cereals as a group.

Paddy rice output recorded impressively rapid expansion in Pakistan at more than 6 percent a year and in Indonesia at 5 percent a year. Fast growth in rice production also occurred in Sri Lanka, the Philippines and Malaysia at close to 4 percent a year; the Republic of Korea had a fairly rapid rate of increase in rice output of almost 3 percent a year. Except Laos, the Indochina countries showed either very slow growth or declining levels in the production of rice. In the case of wheat, very rapid increases in output occurred in Bangladesh, especially in the 1970s; the unusually high production growth rate of more than 10 percent a year in the country may be largely attributable to the still low base of its wheat output. The same may be said of the production in Nepal with its very rapid annual rate of increase of 7.5 percent. But the large absolute gains in DMC wheat output were really achieved by the major producers, India and Pakistan, where the growth rates were 7.3 percent and 5.7 percent, respectively. Both Burma and the Republic of Korea are relatively small wheat producers; but while Burma appears to pursue increased wheat production, as indicated by the 3.1 percent a year growth of the

crop in the country, the rapid decline of wheat production in the latter is a likely indication of country policy to rely more on wheat imports rather than grow the crop domestically.

The fast growth in demand for animal feed may have generated the rapid rates of increase in maize production of more than 5 percent a year in Taiwan, Thailand, Sri Lanka and the Philippines during 1961-80; in the case of Thailand, however, about 2/3 of maize output in the late 1970s was exported. Growth rates of maize production in India and Indonesia, which together account for more than half of DMC output, were relatively much slower at less than 2 percent annually. Pakistan achieved a fairly rapid rate of increase of more than 3 percent a year. Of concern is the maize production decline in Nepal where the crop represents a fifth of total foodgrain output in the country. In the case of the other coarse grains, production increases had been slow in India (1.2 percent) and negative in the Republic of Korea; these two countries account for 93 percent of the DMC output of these cereals. Very rapid increases in the production of other coarse grains occurred in Thailand and Vietnam (both more than 10 percent) but part of this stems from the still low level of coarse grain output in these countries.

The almost stagnant growth of the production of pulses in the DMCs is attributable to the output declines in Pakistan and, although slightly, India. These two countries, together with Bangladesh, where output growth was only 0.8 percent a year, represent more than 90 percent of the production of pulses in the DMCs. Output increases of

pulses were, however, rapid in Fiji, Sri Lanka, Thailand, Taiwan, the Republic of Korea and Indonesia which jointly contribute only about 5 percent of the DMC crop.

Taking the foodgrains as a group, average annual production growth rates of 4 percent or more were achieved in Indonesia, Pakistan the Philippines and Sri Lanka during 1961-80; the fastest production increase was in Pakistan at 4.3 percent a year. Average annual output growth rates of between 3 percent and 4 percent a year occurred in Malaysia, Papua New Guinea and Thailand while those for Burma, Fiji, India, Republic of Korea, and Laos were between 2 and 3 percent.

#### Contributors to DMC Foodgrain Production Growth

Among the foodgrain items, paddy rice was the largest contributor to the growth of production of these commodities in the DMCs between 1966-70 and 1976-80; it accounted for more than 60 percent of the total increment in foodgrain output of over 70 million metric tons during the period (Table 3). This can be expected since paddy rice is the most important basic staple of the region, representing about 2/3 of the DMC production of foodgrains in the earlier period. The most notable contributor to output growth, however, was wheat, which, as seen earlier, recorded the fastest rate of increase in production. Wheat's share of the overall growth in output was almost one-half the contribution of paddy rice although the relative proportion of wheat in the total production of foodgrains in the DMCs in 1966-70 was only 11 percent. The coarse grains, maize and other cereals, accounted for 8 percent of the production increment while the share of pulses was only 2 percent.

India accounted for more than half of the increase in DMC foodgrain output from the late 1960s to the late 1970s, with Indonesia a far second with 14 percent. Pakistan and Thailand had near equal contributions of 8 percent and 7 percent, respectively, of the output increment. These four countries together contributed over 4/5 of the growth of foodgrain production in the DMCs during the period. About 5 percent of the incremental output came from the Philippines and 4 percent each from Bangladesh and Burma. Compared to the relative foodgrain production shares of these countries during 1966-70, percentage contributions to the total DMC output increase were larger in India, Pakistan, the Philippines and, especially, Indonesia, about equal in Thailand and Burma, but much less in Bangladesh.

About 3/4 of the growth of foodgrain production in the DMCs during 1961-80 could be attributed to increases in crop yields and 1/4 to increases in harvest area. (Table 4). Improvement in crop yields contributed more than area expansion to production growth in paddy rice (70:30), wheat (57:61), and pulses (85:15); the slow increases in pulses output could be attributed wholly to the growth in yields as overall harvested area declined. The contribution of crop yield was less than that of area expansion only in the case of maize (39:61).

Among DMCs, growth in crop yields was the sole contributor to the increase of foodgrain output in 1961-80 in the Indochina countries, the Republic of Korea and Taiwan where harvested area of these crops declined during the period. Crop yield was the major contributor to output growth in Afghanistan, Burma, Indonesia, Pakistan and the Philippines. On the other hand, area expansion largely accounted for

the production growth of foodgrains in the Pacific Islands, Sri Lanka and Thailand, and was the sole source of output increases in Nepal which had decreases of yields in all foodgrain items. Near equal contributions of area expansion and crop yields to production growth occurred in Bangladesh and Malaysia.

#### Foodgrain Consumption in the DMCs

Annual foodgrain consumption of the DMCs rose from 227 million metric tons during 1966-70 to about 304 million metric tons during 1976-80, representing an increase of more than one-third between these periods. (Table 5). The biggest relative increase in the domestic utilization of these commodities was in wheat, which expanded by 62 percent, followed closely by maize with 56 percent. Paddy rice consumption went up by 30 percent while that of other cereals and pulses together rose by only 11 percent. Like in production, India accounts for about one-half of the total consumption of foodgrains of the DMCs; following far second and third are Indonesia and Bangladesh with 10 percent and 7 percent, respectively.

Consumption distribution among foodgrains. Based on 1976-80 averages, paddy rice and wheat respectively represent 61 percent and 18 percent of DMC foodgrain consumption (Table 6). Compared to their output shares during the period, these consumption shares were 4 percentage points below for paddy rice and 3 percentage points above for wheat. The indicated utilization shares for maize (7 percent), other cereals (9 percent), and pulses (5 percent) were about equal to the production shares of these commodities. Consumed wheat imports signi-

ificantly raised the consumption share of wheat and reduced that of rice relative to their output shares in half of the DMCs, especially in the Republic of Korea, Malaysia, Sri Lanka and Taiwan. Domestic use of wheat in the Pacific Islands and Sri Lanka, which are nonproducers of the commodity, accounted for 1/3 and 1/4 of total foodgrain utilization. In the Republic of Korea, Malaysia and Taiwan, the consumption share of wheat was 14 percent. These three countries also had high domestic utilization shares of maize, mostly imports, reaching a third of foodgrain consumption in Taiwan and about equalling those of wheat in the Republic of Korea and Malaysia. With most of its corn production for export, Thailand had a foodgrain consumption distribution dominated by paddy rice at 95 percent. The pattern of foodgrain consumption in Afghanistan, India and Nepal during the 1976-80 period closely followed the pattern of their foodgrain production. Hong Kong and Singapore (comprising "others") are mainly foodgrain consumers and their joint consumption distribution reflected the pattern of their import demand for these commodities.

Trends in foodgrain consumption. Total domestic utilization of foodgrain in the DMCs expanded at an average rate of 2.9 percent a year between 1966-70 and 1976-80 (Table 7). As indicated earlier, wheat consumption had the fastest growth with an average annual rate of increase of 5 percent; maize followed closely with 4.5 percent while rice had 2.7 percent. Growth in the use of other cereals and pulses in the DMCs had been very slow, their combined consumption increasing by only 1.1 percent a year between the late 1960s and the

late 1970s. Utilization of wheat increased by more than 10 percent a year in Indochina and Indonesia and by 7-10 percent a year in Bangladesh, Nepal, Taiwan and Thailand. Very rapid growth of maize consumption occurred in the Republic of Korea, the Pacific Islands, Sri Lanka, and again Taiwan and Thailand. The high growth rates of wheat and/or maize utilization in Indonesia, the Pacific Islands, Sri Lanka and Thailand were also on account of the still low levels of consumption of these commodities in those countries.

Taiwan exhibited the fastest growth in foodgrain use among the DMCs with more than 6 percent a year, due largely to rapid growth in maize and wheat consumption. The Pacific islands of Fiji and Papua New Guinea had a 5-percent annual growth in the utilization of foodgrains, which was mostly attributable to increases in the consumption of coarse grains and pulses. Foodgrain consumption had been rapid also in Indonesia and the Philippines, both recording average growth rates of 4.5 percent a year. Indonesia's paddy rice consumption expanded by nearly 5 percent annually while maize utilization in the Philippines averaged 6.5 percent. Like in Taiwan, the Republic of Korea's 4.3-percent growth rate in foodgrain consumption came from the fast growth in maize and wheat consumption which together accounted for about 30 percent of the country's total foodgrain utilization.

Distribution of foodgrain consumption among uses. Of the average yearly utilization of foodgrains in the DMCs during 1976-80, about 200 million metric tons or almost 2/3 was consumed directly for food, 31 million metric tons or 10 percent was used for animal feed and the

remaining 1/4 went to other uses (Tables 8 and 9). Use distribution of the wheat, paddy rice and pulses group, which accounted for 84 percent of total foodgrain utilization during the period, generally determined the overall pattern of foodgrain consumption, with 65 percent of these items used directly for food, 8 percent for feed and 27 percent for other uses.<sup>1/</sup> Rice and wheat bran were mostly accounted for by feed use while seeds and processing waste of paddy rice largely contributed to the amount under other uses. Food use still represents a significant portion of the consumption of maize and other cereals in the DMCs, accounting for 68 percent of the coarse grains utilized in 1976-80; only one-fifth of the coarse grain consumption during the period was reported for animal feed. With little reported waste from these foodgrain items, seeds accounted for much of the 12 percent that went to other uses.

Direct human consumption represented 3/4 or more of domestic foodgrain utilization in Afghanistan, the Pacific Islands and Pakistan, but accounted for less than half of utilization in Taiwan, Thailand, and Hong Kong and Singapore. Use for animal feed accounted for over 40 percent of foodgrain consumption in Taiwan and in Hong Kong and Singapore, about 1/4 in the Republic of Korea and Malaysia, and 15-16 percent in the Philippines and Thailand. Animal feed still

<sup>1/</sup> For pulses in particular, about 80 percent of DMC utilization of the commodity was directly for food, 9 percent for feed and 11 percent for other uses; only India, Pakistan and, to a very small extent, Bangladesh reported use of pulses for animal feed.

represents less than 10 percent of foodgrain utilization in about half of the DMCs.

Except in Indochina and Thailand, more than 60 percent of the paddy rice, wheat and pulses consumed in the DMCs was for direct use as food; food use of these commodities was 58 percent in Indochina and 49 percent in Thailand, two countries which showed other uses exceeding 1/3 of the consumption of these foodgrain items. The use of paddy rice and wheat for animal feed, mostly in the form of imported bran; was almost 30 percent of their total utilization in Hong Kong and Singapore; Malaysia and Thailand had 15-16 percent while the rest of the DMCs showed less than 10 percent. In the case of maize and other cereals, food use accounted for 70 percent or more of their domestic consumption in half of the DMCs, the highest being 86 percent in Sri Lanka. The use of maize and other cereals use directly as food represented 23 percent of total coarse grains consumption in Hong Kong and Singapore, 14 percent in Malaysia and only 5 percent in Taiwan. The relative share of feed use in the total consumption of coarse grains varied widely in the DMCs, ranging from 6 percent in Sri Lanka to 90 percent in Taiwan. Four other DMCs reflected feed use shares of less than 10 percent of coarse grain utilization--Bangladesh, Burma, India and Nepal; besides Taiwan, more than half of coarse grain consumption for animal feed was recorded for Malaysia (81 percent), Hong Kong and Singapore (70 percent) and the Republic of Korea (57 percent).

Trends of food and feed uses of foodgrains. As shown earlier, foodgrain consumption in the DMCs increased at an average annual rate

of 2.9 percent between 1966-70 and 1976-80. Food and feed uses of these commodities averaged annually by 2.8 percent and 4.7 percent, respectively (Table 10). Growth in the total utilization of wheat, paddy rice and pulses was 3.0 percent a year which was also the average yearly increase in the use of these items directly for food. The rate of increase in the use of wheat, paddy rice and pulses for feed was slightly higher at 3.3 percent but, as noted earlier, less than 10 percent of these commodities went to animal feed during the period. Consumption of maize and other cereals increased by 2.5 percent a year, their use for feed expanding a very rapid annual rate of almost 9 percent while food use increased by only 1.4 percent a year.

Foodgrain consumption for animal feed rose most rapidly between the late 1960s and the late 1970s in Taiwan, the Republic of Korea and the Pacific Islands where average annual rates of growth exceeded 10 percent; yearly increases in consumption for food use in these countries were 1.1 percent, 2.4 percent and 4.5 percent, respectively.<sup>1/</sup> Foodgrain use for animal feed expanded by almost 7 percent a year in Hong Kong and Singapore and by slightly over 6 percent in Malaysia. Indonesia and the Philippines exhibited fairly rapid increases in both food use (more than 4 percent a year) and feed use (nearly 6 percent a year). India and Pakistan recorded about equal yearly rates of growth in food and feed uses of foodgrains of about 2.6 percent and 4.0 percent, respectively. The increasing share of feed use in foodgrain uti-

<sup>1/</sup> The very high growth rates of feed use in the Pacific Islands may be largely attributed to the low base of the feed data for Fiji and Papua New Guinea.

lization can be expected as more than 60 percent of the DMCs, representing about 45 percent of the amount of foodgrains utilized for animal feed by the group, had annual growth rates in feed use exceeding 3 percent.

The fastest growth in the consumption of wheat, paddy rice and pulses, the major foodgrains for direct food use, occurred in Indonesia at 5 percent a year; increases of more than 4 percent annually were recorded also for the Pacific Islands and Pakistan and of more than 3.5 percent a year in the Republic of Korea and the Philippines. Slow growth of less than 2 percent a year in the consumption of these items occurred in Afghanistan, Bangladesh, Indochina, Hong Kong and Singapore, and Taiwan. In the case of maize and other cereals, the main foodgrain items for animal feed, very rapid growth in consumption averaging 10 percent or more a year was experienced in the Republic of Korea, the Pacific Islands, Taiwan and Thailand, while annual increases of 6-10 percent were shown by Burma, Malaysia, the Philippines, and Hong Kong and Singapore. As reflected by the consumption of wheat, rice and pulses, the low rates of growth in food use in Afghanistan, Bangladesh, Indochina and Nepal suggest declining per capita food availability in these countries but similar slow growth in the higher income countries of Hong Kong, Singapore and Taiwan would be indicative of changes in consumption patterns toward better quality food items. The latter appears to be confirmed by the rapid growth of feed use in these countries, as suggested by the consumption of coarse grains. Fast growth in demand for foodgrains for

use as food may be expected for Indonesia and Pakistan, and for use as both food and feed for the Republic of Korea, Malaysia, the Pacific Islands and the Philippines. The rapid growth of foodgrain demand for feed use in Taiwan and in Hong Kong and Singapore can be expected to continue or, more likely, accelerate.

#### Projected Surpluses and Deficits of Foodgrains in 2000

Table 11 summarized the projected surpluses and deficits for the DMCs in the year 2000<sup>1/</sup>. In this section some key results are briefly summarized.

The DMCs as a group show a projected deficit of over 40 million metric tons in 2000, with the largest deficits of about 18 million metric tons in paddy rice and 17 million metric tons in maize. There are smaller deficits in wheat (4.3 million metric tons) and pulses (4.8 million metric tons) and a surplus of 3.4 million metric tons in other cereals.

Most of the deficit in paddy rice is accounted for by India, Indochina, Bangladesh, and Indonesia. In India, the growth rate in production of 2.3 percent lags somewhat behind the growth in demand, despite the low projected growth in income. Indochina is difficult to assess due to lack of data and past dislocations in production. Using trend-based projections for yield and no growth in area rather than the trend negative growth production will be considerably lower than demand in 2000. Although Bangladesh is projected to improve upon its trend production growth record, production growth will still be lower than demand growth, due to the relatively rapid projected growth in

<sup>1/</sup> The projected surpluses and deficits given in Table 11 are based on modified trend-based projections of output and demand projections based on the trend growth of per capita incomes.

population. If Bangladesh succeeds in policies to reduce the population growth to government targets, about half the projected deficit could be eliminated. Indonesia is projected to experience increasing deficits due to a slowdown in production growth and continued strong growth in real income.<sup>1/</sup>

The main surplus countries are Pakistan and Thailand. Pakistan has increased production rapidly over the past two decades, and while we have projected a slowdown from the 6.3 percent trend growth, we still project a strong 4.4 percent annual rate of growth in production which will generate a large surplus by 2000. Thailand is projected to maintain an exportable surplus based on trend growth in production.

Indonesia and the Republic of Korea are projected to have largest deficits in wheat (about 4.3 million metric tons each), with Bangladesh, Indochina, Malaysia, the Philippines, Sri Lanka, and Taiwan all having deficits in excess of one million metric tons. With the exception of Bangladesh, there is essentially no wheat production in these countries. Bangladesh has experienced phenomenal growth in wheat production over the past several years, and while these rates cannot be maintained, we have projected continued rapid growth of 8.46 percent per year. This reduces but does not eliminate the deficits.

India and Pakistan are projected to have large exportable surpluses of wheat. Indian wheat production is projected to grow at 3.46 percent per year, about half the trend growth. This is sufficient to

<sup>1/</sup> The growth indications cited here for Indochina and Bangladesh are shown in Table 14 for output and Table 18 for population. (See also Appendix B for the projection methodology in individual countries.)

allow for large surpluses in 2000 due to the slow projected growth in per capita income. However, should India achieve per capita income growth rates nearer the average of the other DMCs (in the 2-3 percent range, rather than the trend 1.26 percent), the surplus in wheat would be largely eliminated. Pakistan is projected to show strong production growth of 4.4 percent per year (about three-fourths of the trend rate), which will generate a substantial surplus.

The deficit in maize is due almost entirely to Taiwan and Korea, where rapid growth in feed demand for maize will result in large deficits. Malaysia and the Philippines are projected to have deficits in excess of one million metric tons.<sup>1/</sup> Thailand is the only DMC with a significant projected exportable surplus, with projected production growth of 3.14 percent annually, providing a surplus of 5.61 million metric tons.

India is projected to produce over 90 percent of other cereals in the region, and production growth due to continued steady growth in yields, combined with the slow income growth is projected to provide an 8 million net surplus. Taiwan is projected to be the only major importer of other cereals.

India is the only large producer of pulses, and relatively slow growth in both area and yield are projected to result in a deficit of 3.9 million metric tons. Pakistan is projected to have a deficit of nearly one million metric tons, while Thailand is projected to have a surplus of 0.42 million metric tons.

<sup>1/</sup> See detailed country study in Executive Summary of the report.

Table 12 shows the projected levels of foodgrain production and, based on assumed "low" and "high" average annual growth rates of per capita incomes, of foodgrain demand in the DMCs by the year 2000.<sup>1/</sup> The resulting projections of foodgrain surpluses and deficits are presented in Table 13. Production shortfalls in total foodgrains are projected for the DMCs as a group under both of the assumed rates, ranging from 25 million metric tons to about 65 million metric tons for low and high income growth, respectively. Except in other cereals, for which surpluses are projected, the individual foodgrains show deficits for both income growth assumptions by the end of the century. Most of the projected deficits under the low income-growth case would be in paddy rice and maize whose indicated shortfalls are more than 12 million metric tons each; the deficit in wheat is projected at only less than half a million metric tons as significant surpluses are indicated for India and Pakistan.

With high income growth, the paddy rice deficit in the DMCs would more than double while that of maize would rise 1 1/2 times. Projected shortfalls in wheat and pulses would increase considerably because of their relatively higher income elasticities compared to the other foodgrains; the wheat deficit would expand to over 9 million metric tons and the shortfall in pulses, about 95 percent of which would be in India, would increase almost fourfold to more than 15 million metric tons.

<sup>1/</sup> See Tables 18 and Appendix A regarding the income growth assumptions used in the study.

Three DMCs (Burma, Pakistan and Thailand) are projected to be surplus countries in total foodgrains by the end of the century under both income growth assumptions. India would be in a surplus position by almost 14 million metric tons at low income growth but projected to be in deficit by more than 7 million metric tons at high income growth, mainly because of the shortfall in pulses. The projections for all other DMCs show deficits in total foodgrains under both low and high growth rates of income.

(Tables 14-17 present supporting data on the trend and modified projections of foodgrain production in the DMCs to the year 2000. One can note the countries and foodgrain crops for which trend-based projections of area and yields have been modified before output projections were matched with demand projections to obtain the projected foodgrain surpluses and deficits cited in the preceding discussions.)

#### Trends in the Consumption of Meat, Sugar, Fats and Oils, and Fish

Meat. Annual meat consumption in the DMCs during 1976-80 averaged 5.39 million metric tons (Table 19). The three major consumers of meat during the period were India with 14 percent, Indochina with 13 percent and the Philippines with 12 percent. Substantial quantities were also consumed in Pakistan (10 percent), Taiwan (9 percent), Thailand (8 percent), Hong Kong and Singapore (7 percent), and Indonesia (7 percent). Between 1961-65 and 1976-80, DMC meat consumption rose 1 1/2 times, representing an average annual growth rate of 2.6 percent.

Among the DMCs, growth of meat consumption between the early 1960s and the late 1970s was most rapid in Taiwan at nearly 10 percent a year, followed by the Republic of Korea with about 8 percent a year. The Pacific Islands of Fiji and Papua New Guinea also recorded a very rapid rate of increase in meat consumption of 6 percent annually.<sup>1/</sup> Fairly rapid annual growth rates of meat consumption were also indicated for Hong Kong and Singapore, Malaysia and Burma which had between 4 and 6 percent. Both Indochina and the Philippines showed increases averaging 3.5 percent a year. Very slow growth in meat consumption of less than 1 percent a year were reflected by Afghanistan and Bangladesh. It may be noted that, with but few exceptions, the DMCs with fast growth in meat consumption were also those with rapid increases in the consumption of foodgrains for animal feed.

Sugar. During 1978-80, average annual consumption of sugar in the DMCs amounted to nearly 26 million metric tons, of which 15 metric tons or nearly 60 percent was accounted for by India alone. Following far second and third were Pakistan and Indonesia with 12 percent and 7 percent, respectively. Sugar consumption in the DMCs expanded at an average yearly rate of 3.7 percent between 1966-68 and 1978-80.<sup>1/</sup> The Republic of Korea exhibited the fastest rate of increase in-sugar con-

<sup>1/</sup> As with foodgrains, the data on meat consumption in Fiji and Papua New Guinea have a low base.

<sup>2/</sup> For comparable data on the past and recent consumption of sugar, fats and oils, and fish, the observation periods used here are 1966-68 and 1978-80. Discussions make use of Tables 20 and 21.

sumption of more than 10 percent a year. Very rapid growth in the consumption of sugar also occurred in Taiwan (10 percent) and Thailand (8 percent). Sugar consumption growth rates of 5-6 percent were also recorded for Indonesia, Nepal, the Philippines and Malaysia. However, declines in sugar consumption between the two periods were observed in Bangladesh, Burma and in Hong Kong and Singapore.

Fats and Oils. The DMCs consumed an estimated 8 million metric tons of fats and oils a year during 1978-80. And as in the case of sugar, India had the major share, which represented about 53 percent of the total; Pakistan and Indonesia each accounted for about 11 percent. Growth in fats and oils consumption of the DMCs averaged a rapid 4.6 percent a year from 1966-68 to 1978-80, which raised the total consumption of these commodities 1.7 times between these periods. Annual consumption increases exceeding 10 percent were recorded by the Republic of Korea and the Pacific Islands. Rapid growth in fats and oils consumption averaging 6-8 percent a year also occurred in Taiwan, Indonesia and Pakistan. Both India and Malaysia had 4 percent annual growth rates. Very slow growth of less than 1 percent a year were observed for Bangladesh, Burma and Sri Lanka; declining consumption of fats and oils between the reference periods were indicated for the Indochina countries.

Fish.<sup>1/</sup> Based on available statistics of fish consumption in the DMCs, distribution among countries appears less skewed than those for

<sup>1/</sup> The limitations of the data on fish are well recognized, especially for countries whose food balance sheets are based on the "disappearance" concept. While the trend indications may be relied on for general directions, the absolute estimates should be treated with caution.

foodgrains, sugar and fats and oils. Although largest among the DMCs, India's consumption of fish during 1978-80 represented less than 1/5 of the total for the group. Indonesia was second with 14 percent, followed closely by the Philippines and the Republic of Korea with 12 percent and 10 percent, respectively. Countries with fish consumption shares of 5 percent or more of the DMC total include Bangladesh, Malaysia, Taiwan and Thailand. Data indicate that the DMCs consumed an average of about 10 million metric tons of fish annually during the 1978-80 period. Between 1966-68 and 1978-80, growth of fish consumption in the DMCs as a group averaged 3.2 percent. The most rapid growth in consumption occurred in the Republic of Korea at about 8 percent a year. Annual growth of fish consumption in Malaysia and Nepal were recorded at 7 percent and in Taiwan at 6 percent. Fish consumption between the reference periods appeared to have stayed relatively constant in Afghanistan and declined in both Bangladesh and Sri Lanka.

In summary, the consumption trends for meat, sugar, fats and oils, and fish in the DMCs suggest rapidly increasing demand for all these commodities in the fast growth economies of the Republic of Korea, Malaysia and Taiwan. Very rapid consumption growth rates were reached for all four commodities in the Republic of Korea, for meat, sugar and fats and oils in Taiwan, and for fish in Malaysia. For the rest of the four commodities in Taiwan and Malaysia, annual increases in consumption were 4-6 percent. Increases in demand for meat, sugar, fats and oils, and fish may be expected also in several of the other

DMCs where rapid consumption growth has occurred in one or more of these commodities. Rapid growth in consumption is reflected for fats and oils together with sugar in Indonesia, with fish in India and Pakistan, and with meat in Hong Kong and Singapore, for sugar and fish in Thailand, for sugar in the Philippines, and for meat in Burma.<sup>1/</sup>

1/ For this listing an average annual growth rate of 4 percent is termed as "rapid." Rapid growth rates are also observed for fish and sugar in Nepal and for meat and fats and oils in the Pacific Islands but the low levels of consumption in these countries tend to exaggerate percentage changes.

ADB Project

Table 1. Average Annual Foodgrain Production of ADB Developing Member Countries, 1976-80 Averages

(in thousand metric tons)

<u>Country</u>	<u>Paddy Rice</u>	<u>Wheat</u>	<u>Maize</u>	<u>Other a/ Cereals</u>	<u>Pulses</u>	<u>All Foodgrains</u>
1. Afghanistan	427	2,753	779	371	57	4,388
2. Bangladesh	19,211	504	2	55	237	20,009
3. Burma	10,609	68	82	53	314	11,125
4. India	73,866	31,335	6,102	23,488	11,642	146,433
5. Indochina <sup>b/</sup>	12,961	-	577	29	136	13,703
6. Indonesia	25,478	-	3,390	5	310	29,183
7. Korea, Rep. of	7,594	59	113	1,277	56	9,099
8. Malaysia	1,924	-	17	-	-	1,941
9. Nepal	2,302	403	707	158	47	3,617
10. Pacific Islands <sup>c/</sup>	26	-	5	5	23	59
11. Pakistan	4,612	9,391	844	700	739	16,287
12. Philippines	7,043	-	2,950	-	52	10,045
13. Sri Lanka	1,824	-	22	23	17	1,886
14. Taiwan	3,419	2	106	12	40	3,579
15. Thailand	16,055	-	2,718	225	272	19,270
16. Others <sup>d/</sup>	1	-	-	-	-	1
Total	187,353	44,515	18,416	26,401	13,940	290,625

a/ Including millet, sorghum, barley, oats or rye.

b/ Kampuchea, Laos and Vietnam.

c/ Fiji and Papua New Guinea.

d/ Hong Kong and Singapore.

Table 2. Average Annual Growth Rates of Foodgrain Production in ADB Developing Member Countries, 1961-80

Country	<u>Paddy Rice</u>	<u>Wheat</u>	<u>Maize</u>	<u>Other a/ Cereals</u>	<u>Pulses</u>	<u>All Foodgrains</u>
1. Afghanistan	1.55	1.61	0.56	-0.42	1.63	1.21
2. Bangladesh	1.66	*	-5.46	-0.41	0.75	1.79
3. Burma	2.20	3.99	2.60	0.56	1.93	2.19
4. India	2.32	7.27	1.85	1.19	-0.07	2.63
5. Indochina <sup>b/</sup>	0.14	--	0.78	*	1.06	0.20
6. Indonesia	4.98	-	1.30	**	3.38	4.41
7. Korea, Rep. of	2.91	-7.32	*	-0.26	5.14	2.27
8. Malaysia	3.80	-	3.95	-	-	3.80
9. Nepal	0.67	7.50	-1.17	1.04	-0.13	0.73
10. Pacific Islands <sup>c/</sup>	1.24	-	*	*	2.81	2.97
11. Pakistan	6.30	5.69	3.23	-0.55	-1.04	4.78
12. Philippines	3.81	-	5.70	-	2.42	4.31
13. Sri Lanka	3.99	-	5.90	-	8.86	4.00
14. Taiwan	1.39	**	7.77	1.85	5.46	1.49
15. Thailand	2.34	-	8.57	*	6.53	3.08
16. Others <sup>d/</sup>	**	-	-	-	-	**
Total	2.49	6.37	2.77	1.10	0.13	2.68

a/ Including millet, sorghum, barley, oats or rye.

b/ Kampuchea, Laos and Vietnam.

c/ Fiji and Papua New Guinea.

d/ Hong Kong and Singapore.

\*More than 10 percent. \*\*Less than -10 percent.

Table 3. Commodity and Country Contributions to Foodgrain Production Growth in the DMCs, 1966-70 to 1976-80

Commodity/Country	Production		Production Increase	
	1966-70 Average (000 MT)	1976-80 Average (000 MT)	(000)	(percent)
<b>By Commodity</b>				
Paddy Rice	144,786	187,353	42,567	61
Wheat	23,921	44,515	20,594	29
Maize	14,901	18,416	3,515	5
Other Cereals	24,321	26,401	2,080	3
Pulses	12,630	13,940	1,310	2
Total	220,559	290,625	70,066	100
<b>By Country</b>				
India	110,263	146,433	36,170	52
Indonesia	19,386	29,133	9,797	14
Pakistan	10,722	16,287	5,565	8
Thailand	14,557	19,270	4,713	7
Philippines	6,411	10,045	3,634	5
Bangladesh	16,975	20,009	3,034	4
Burma	8,149	11,125	2,976	6
Others	34,096	38,273	4,177	6
Total	220,559	290,625	70,066	100

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Table 4. Relative Contributions of Area Harvested and Yields per Hectare to Growth of Foodgrain Production in ADB Developing Member Countries, 1961-80

(percent)

Country	Paddy Rice		Wheat		Maize		Other Cereals <sup>a/</sup>		Pulses		All Foodgrain	
	Area	Yield	Area	Yield	Area	Yield	Area	Yield	Area	Yield	Area	Yield
1. Afghanistan	*	100	20	80	*	100	*	*	86	14	12	88
2. Bangladesh	49	51	57	43	*	100	*	*	100	*	51	49
3. Burma	12	88	54	46	*	100	100	*	84	16	19	81
4. India	30	70	47	53	79	21	*	100	*	100	19	81
5. Indochina <sup>b/</sup>	*	100	-	-	100	*	100	*	30	70	*	100
6. Indonesia	29	71	-	-	*	100	*	*	100	*	23	77
7. Korea, Rep. of	10	90	*	100	*	100	*	100	21	79	*	100
8. Malaysia	52	48	-	-	54	46	-	-	-	-	52	48
9. Nepal	100	*	100	*	100	*	100	*	100	*	100	*
10. Pacific Islands <sup>c/</sup>	73	27	-	-	76	24	81	19	91	9	85	15
11. Pakistan	42	58	31	69	60	40	*	100	*	*	24	76
12. Philippines	18	82	-	-	60	40	-	-	0.16	84	43	57
13. Sri Lanka	74	26	-	-	90	10	100	*	98	2	78	22
14. Taiwan	*	100	*	100	63	32	*	100	14	84	*	100
15. Thailand	61	39	-	-	100	*	100	*	100	*	77	23
16. Others <sup>d/</sup>	*	*	-	-	-	-	-	-	-	-	*	*
Total	30	70	43	57	61	39	*	100	15	85	25	75

- a/ Including millet, sorghum, barley, oats or rye.  
b/ Kampuchea, Laos, and Vietnam.  
c/ Fiji and Papua New Guinea.  
d/ Hong Kong and Singapore.  
\* Negative.

Table 5 . Distribution of the Total Domestic Utilization of Foodgrains  
Among Crops in the ADB Developing Member Countries, 1966-70 and 1976-80 Averages

(in thousand metric tons)

Country	1966-70 Average				1976-80 Average			
	Wheat	Paddy Rice	Maize	Other Cereals and Pulses	Wheat	Paddy Rice	Maize	Other Cereals and Pulses
Afghanistan	2,387	389	741	438	2,847	434	779	432
Bangladesh	764	17,021	6	386	1,675	19,891	2	328
Burma	60	7,016	52	251	75	9,699	73	344
India <sup>a/</sup>	20,372	54,953	5,564	31,318	32,425	72,832	6,301	34,864
Indochina <sup>a/</sup>	333	13,546	418	154	994	13,385	680	182
Indonesia	268	16,831	2,900	259	839	27,017	3,319	335
Korea, Rep. of	1,126	5,283	138	1,938	1,851	7,515	1,947	1,577
Malaysia	309	1,776	189	90	479	2,433	463	115
Nepal	198	1,825	801	197	405	2,225	704	204
Pacific Islands <sup>b/</sup>	52	66	3	24	77	106	10	44
Pakistan	6,384	2,481	719	1,479	10,376	3,661	846	1,486
Philippines	494	4,662	1,644	79	694	6,733	3,079	152
Sri Lanka	398	1,678	17	100	634	2,040	28	39
Taiwan	448	3,089	314	174	1,037	3,055	2,430	861
Thailand	44	11,250	89	137	110	14,038	366	233
Others <sup>c/</sup>	308	594	254	125	462	602	578	128
TOTAL	33,945	142,460	13,849	37,149	54,980	185,666	21,605	41,324

<sup>a/</sup> Kampuchea, Laos and Vietnam.

<sup>b/</sup> Fiji and Papua New Guinea

<sup>c/</sup> Hong Kong and Singapore.

Table 6 . Commodity Shares in the Total Domestic Utilization of Foodgrains in the ADB Developing Member Countries, 1976-80 Averages

Country	Wheat	Paddy Rice	Maize	Other Cereals	Pulses
	(percent)				
Afghanistan	63	10	17	9	1
Bangladesh	8	91	-	*	1
Burma	1	95	1	*	3
India	22	50	4	16	8
Indochina <sup>a/</sup>	7	88	4	*	1
Indonesia	3	86	10	*	1
Korea, Rep. of	14	58	15	12	1
Malaysia	14	70	13	2	1
Nepal	11	63	20	5	1
Pacific Islands <sup>b/</sup>	33	45	4	7	11
Pakistan	64	22	5	4	5
Philippines	7	63	29	1	*
Sri Lanka	23	74	1	1	1
Taiwan	14	41	33	11	1
Thailand	1	95	2	1	1
Others <sup>c/</sup>	26	34	33	6	1
TOTAL	18	61	7	9	5

<sup>a/</sup> Kampuchea, Laos and Vietnam.

<sup>b/</sup> Fiji and Papua New Guinea.

<sup>c/</sup> Hong Kong and Singapore.

\* Less than 0.5 percent.

Note: See also Table 5 .

Table 7. Average Annual Growth Rates of Total Domestic Utilization of Foodgrains by Crop in the ADB Developing Member Countries, 1966-70 to 1976-80

Country	All Foodgrains	Wheat	Rice	Maize	Other Cereals and Pulses
Afghanistan	1.3	1.8	1.1	0.5	-0.1
Bangladesh	1.9	8.2	1.6	**	-1.6
Burma	3.3	2.3	3.3	3.5	3.2
India	2.7	4.8	2.9	1.3	1.1
Indochina <sup>a/</sup>	0.5	*	-0.1	5.0	1.7
Indonesia	4.5	*	4.8	1.4	2.6
Korea, Rep. of	4.3	5.1	3.6	*	-2.0
Malaysia	4.0	4.5	3.2	9.4	2.5
Nepal	1.6	7.4	2.0	-1.3	0.4
Pacific Islands <sup>c/</sup>	5.0	4.0	4.9	*	6.2
Pakistan	4.0	5.0	4.0	1.6	0.0
Philippines	4.5	3.5	3.7	6.5	6.8
Sri Lanka	2.3	4.8	2.0	*	-9.0
Taiwan	6.3	8.8	-1.1	*	*
Thailand	2.5	9.6	2.2	*	5.5
Others <sup>d/</sup>	3.3	4.1	0.1	8.6	0.2
TOTAL	2.9	4.9	2.7	4.5	1.1

a/ Kampuchea, Laos and Vietnam.

b/ Fiji and Papua New Guinea.

c/ Hong Kong and Singapore.

\* More than 10 percent.

\*\* Less than -10 percent.

Note: See also Table 5.

Table 8 . Total Domestic Utilization of Foodgrains in the ADB Developing Member Countries, 1966-70 and 1976-80 Averages(continued)

(thousand metric tons)

Country	Total Use			Food		
	All Foodgrains	Wheat, Paddy Rice, and Pulses	Maize and Other Cereals	All Foodgrains	Wheat, Paddy Rice, and Pulses	Maize and Other Cereals
<u>1976-80 Average</u>						
Afghanistan	4,492	3,336	1,156	3,408	2,539	869
Bangladesh	21,896	21,803	93	13,518	13,475	43
Burma	10,191	10,065	126	6,339	6,241	98
India	146,422	116,956	29,466	99,586	76,373	23,213
Indochina <u>a/</u>	15,241	14,516	725	8,943	8,435	508
Indonesia	31,510	28,167	3,343	22,290	19,465	2,825
Korea, Rep. of	12,890	9,425	3,465	7,704	6,458	1,246
Malaysia	3,490	2,941	549	1,893	1,817	76
Nepal	3,538	2,677	861	2,309	1,692	617
Pacific Islands <u>b/</u>	237	210	27	190	177	13
Pakistan	16,369	14,831	1,538	12,228	11,136	1,092
Philippines	10,658	7,480	3,178	6,670	4,720	1,950
Sri Lanka	2,741	2,690	51	2,019	1,975	44
Taiwan	7,383	4,161	3,222	3,497	3,333	164
Thailand	14,747	14,256	491	7,095	6,933	162
Others <u>c/</u>	1,770	1,087	683	873	713	160
<b>TOTAL</b>	<b>303,575</b>	<b>254,601</b>	<b>48,974</b>	<b>198,562</b>	<b>165,482</b>	<b>33,080</b>

a/ Kampuchea, Laos and Vietnam.

b/ Fiji and Papua New Guinea.

c/ Hong Kong and Singapore.

Table 8. Total Domestic Utilization of Foodgrains in the ADB Developing Member Countries, 1966-70 and 1976-80 Averages(continued)

(thousand metric tons)

Country	Feed			Other Uses		
	All Foodgrains	Wheat, Paddy Rice, and Pulses	Maize and Other Cereals	All Foodgrains	Wheat, Paddy Rice, and Pulses	Maize and Other Cereals
<u>1976-80 Average</u>						
Afghanistan	489	293	194	504	93	597
Bangladesh	1,530	1,522	8	6,806	42	6,848
Burma	771	759	12	3,065	16	3,081
India	11,168	9,200	1,968	31,383	4,285	35,668
Indochina <u>a/</u>	1,294	1,132	162	4,949	55	5,004
Indonesia	2,110	1,785	325	6,917	193	7,110
Korea, Rep. of	2,846	862	1,984	2,105	235	2,340
Malaysia	931	487	444	637	29	666
Nepal	231	168	63	817	181	998
Pacific Islands <u>b/</u>	27	14	13	19	1	20
Pakistan	1,435	1,250	185	2,445	261	2,706
Philippines	1,633	667	966	2,093	262	2,355
Sri Lanka	146	143	3	572	4	576
Taiwan	3,017	112	2,905	716	153	869
Thailand	2,294	2,136	158	5,187	171	5,358
Others <u>c/</u>	792	313	479	61	44	105
<b>TOTAL</b>						

a/ Kampuchea, Laos and Vietnam

b/ Fiji and Papua New Guinea

c/ Hong Kong and Singapore.

Source of basic data: FAO, "Agricultural Supply Utilization Accounts Tape, 1981," Rome: 1982.

Table 8 . Total Domestic Utilization of Foodgrains in the ADB Developing Member Countries, 1966-70 and 1976-80 Averages

(thousand metric tons)

Country	Total Use			Food		
	All Foodgrains	Wheat, Paddy Rice, and Pulses	Maize and Other Cereals	All Foodgrains	Wheat, Paddy Rice, and Pulses	Maize and Other Cereals
<u>1966-70 Average</u>						
Afghanistan	3,955	2,827	1,128	2,972	2,143	829
Bangladesh	18,117	18,052	125	10,980	10,942	56
Burma	7,379	7,275	104	4,556	4,475	81
India	112,207	85,917	26,290	76,918	56,446	20,472
Indochina <u>a/</u>	14,451	13,999	452	9,342	8,024	318
Indonesia	20,258	17,328	2,930	14,402	11,942	2,460
Korea, Rep. of	8,485	6,442	2,043	6,060	4,470	1,590
Malaysia	2,364	2,116	248	1,361	1,310	51
Nepal	3,021	2,074	947	1,957	1,273	684
Pacific Islands <u>b/</u>	145	137	8	122	118	4
Pakistan	11,063	9,610	1,453	8,177	7,128	1,049
Philippines	6,879	5,191	1,688	4,388	3,366	1,022
Sri Lanka	2,193	2,155	38	1,658	1,625	33
Taiwan	4,025	3,585	440	3,124	3,075	49
Thailand	11,520	11,391	129	5,626	5,590	36
Others <u>b/</u>	1,281	923	358	744	683	61
<b>TOTAL</b>	<b>227,403</b>	<b>189,023</b>	<b>38,380</b>	<b>151,386</b>	<b>122,592</b>	<b>28,794</b>

a/ Kampuchea, Laos and Vietnam.

b/ Fiji and Papua New Guinea.

c/ Hong Kong and Singapore.

Table 8. Total Domestic Utilization of Foodgrains in the ADB Developing Member Countries, 1966-70 and 1976-80 Averages(continued)

(thousand metric tons)

Country	Feed			Other Uses		
	All Foodgrains	Wheat, Paddy Rice, and Pulses	Maize and Other Cereals	All Foodgrains	Wheat, Paddy Rice, and Pulses	Maize and Other Cereals
<u>1966-70 Average</u>						
Afghanistan	451	245	206	532	439	93
Bangladesh	1,263	1,253	10	5,934	5,875	59
Burma	507	501	6	2,316	2,299	7
India	8,600	6,844	1,756	26,689	22,627	4,062
Indochina <u>a/</u>	1,142	1,045	97	4,967	4,930	37
Indonesia	1,208	913	295	4,648	4,473	175
Korea, Rep. of	799	560	239	1,626	1,412	214
Malaysia	514	330	184	489	476	13
Nepal	194	126	68	870	675	195
Pacific Islands <u>b/</u>	7	3	4	16	16	*
Pakistan	971	805	166	1,915	1,677	238
Philippines	930	416	514	1,561	1,409	152
Sri Lanka	100	97	3	435	433	2
Taiwan	533	149	384	368	361	7
Thailand	1,774	1,713	61	4,120	4,088	32
Others <u>c/</u>	409	136	273	128	104	24
<b>TOTAL</b>	<b>19,402</b>	<b>15,136</b>	<b>4,266</b>	<b>56,615</b>	<b>51,295</b>	<b>5,320</b>

a/ Kampuchea, Laos and Vietnam.

b/ Fiji and Papua New Guinea.

c/ Hong Kong and Singapore.

\*Less than 500 metric tons.

**Table 9 . Relative Distribution of Foodgrains Among Items of Domestic Utilization in ADB Developing Member Countries, by Commodity Group, 1976-80 Averages**

(percent)

Country	All Foodgrains			Wheat, Paddy Rice and Pulses			Maize and Other Cereals		
	Food	Feed	Other Uses	Food	Feed	Other Uses	Food	Feed	Other Uses
Afghanistan	76	11	13	76	9	15	75	17	8
Bangladesh	62	7	31	62	7	31	46	9	45
Burma	62	8	30	62	8	30	78	9	13
India	68	8	24	65	8	27	79	7	14
Indochina <sup>a/</sup>	59	8	33	58	8	34	70	22	8
Indonesia	71	7	22	69	6	25	84	10	6
Korea, Rep. of	60	22	18	69	9	22	36	57	7
Malaysia	54	27	19	62	16	22	14	81	5
Nepal	65	7	28	63	6	31	72	7	21
Pacific Islands <sup>b/</sup>	80	11	9	84	7	9	48	48	4
Pakistan	75	9	16	75	8	17	71	12	17
Philippines	63	15	22	63	9	28	61	31	8
Sri Lanka	74	5	21	74	5	21	86	6	8
Taiwan	47	41	12	80	3	17	5	90	5
Thailand	48	16	36	49	15	36	33	32	35
Others <sup>c/</sup>	49	45	6	65	29	6	23	70	7
TOTAL	65	10	25	65	8	27	68	20	12

<sup>a/</sup> Kampuchea, Laos and Vietnam.

<sup>b/</sup> Fiji and Papua New Guinea.

<sup>c/</sup> Hong Kong and Singapore.

Note: See also Table 8 .

Table 10. Average Annual Growth Rates of Domestic Utilization of Foodgrains  
in ADC Developing Member Countries, 1966-70 to 1976-80

(percent)

Country	All Foodgrains			Wheat, Rice and Paises			Maize and Other Cereals		
	Total Use	Food	Feed	Total Use	Food	Feed	Total Use	Food	Feed
Afghanistan	1.3	1.4	0.8	1.7	1.7	1.8	0.2	0.5	-0.6
Bangladesh	1.9	2.1	1.9	1.9	2.1	2.0	-2.9	-2.6	-2.2
Burma	3.3	3.4	4.3	3.3	3.4	4.2	1.9	1.9	7.2
India	2.7	2.6	2.6	3.1	3.1	3.0	1.1	1.3	1.1
Indochina <sup>a/</sup>	0.5	0.7	1.3	0.4	0.5	0.8	4.8	4.8	5.3
Indonesia	4.5	4.5	5.7	5.0	5.0	6.9	1.3	1.4	1.0
Korea, Rep. of	4.3	2.4	*	3.9	3.7	4.4	5.4	-2.4	*
Malaysia	4.0	3.4	6.1	3.3	3.3	4.0	8.3	4.1	9.2
Nepal	1.6	1.7	1.8	2.6	2.9	2.9	-0.9	-1.0	-0.8
Pacific Islands <sup>b/</sup>	5.0	4.5	*	4.4	4.1	*	*	*	*
Pakistan	4.0	4.1	4.0	4.4	4.6	4.5	0.6	0.4	1.1
Philippines	4.5	4.3	5.8	3.7	3.4	4.8	6.5	6.7	6.5
Sri Lanka	2.3	2.0	3.9	2.2	2.0	4.0	3.0	2.9	0.0
Taiwan	6.3	1.1	*	1.5	0.8	-2.8	*	*	*
Thailand	2.5	2.3	2.6	2.3	2.2	2.2	*	*	10.0
Others <sup>c/</sup>	3.3	1.6	6.8	1.6	0.4	8.7	6.7	*	5.8
TOTAL	2.9	2.8	4.7	3.0	3.0	3.3	2.5	1.4	8.7

a/ Kampuchea, Laos and Vietnam.

b/ Fiji and Papua New Guinea.

c/ Hong Kong and Singapore.

\* More than 10 percent.

Note: See also Table 8 .

Table 11. Projections of Foodgrain Surpluses and Deficits in Developing Member Countries of the ADB to the Year 2000  
(million metric tons)

D/C	Paddy Rice			Wheat			Maize		
	Production	Demand <sup>a/</sup>	Surplus/ Deficit	Production	Demand <sup>a/</sup>	Surplus/ Deficit	Production	Demand <sup>a/</sup>	Surplus/ Deficit
Afghanistan	0.61	0.79	-0.18	3.87	4.84	-0.97	0.88*	1.35	-0.47
Bangladesh	31.14*	35.16	-4.02	2.27*	4.04	-1.77	e/	e/	e/
Burma	18.52	16.60	1.95	0.25*	0.12	0.13	0.32*	0.14	0.18
India	120.48	126.64	-6.16	72.43*	61.93	10.50	9.64	9.72	-0.08
Indochina <sup>b/</sup>	15.11*	21.36	-6.25	-	2.24	-2.24	0.66*	1.17	-0.51
Indonesia	48.45*	52.20	-3.75	-	4.33	-4.33	5.83*	5.50	0.33
Korea, Rep.	9.45*	10.85	-1.40	0.08*	4.31	-4.24	0.26*	8.35	-3.09
Malaysia	3.22*	4.12	-0.90	-	1.05	-1.05	0.04	1.31	-1.28
Nepal	3.39*	3.71	-0.32	0.96*	0.82	0.14	0.92*	1.09	-0.17
Pacific Is. <sup>c/</sup>	0.03	0.20	-0.17	-	0.15	-0.15	0.03*	0.03	0.01
Pakistan	12.94*	9.23	3.71	27.40*	22.59	4.81	1.74	1.73	0.02
Philippines	12.14**	12.29**	-0.15	-	1.57	-1.57	5.62**	7.08**	-1.46
Sri Lanka	3.80*	3.06	0.75	-	1.16	-1.16	0.06*	0.04	0.02
Taiwan	4.16*	6.29	-2.14	e/	1.35	-1.35	0.59*	10.38	-9.79
Thailand	26.47	24.85	1.61	-	0.28	-0.28	6.58*	0.97	5.61
Others <sup>d/</sup>	e/	0.59	-0.59	-	0.83	-0.33	-	1.03	-1.03
Total	309.91	327.94	-18.00	107.26	111.60	-4.34	33.17	49.88	-16.71

a/ Based on 1960-81 trend income growth.

b/ Kampuchea, Laos and Vietnam.

c/ Fiji and Papua New Guinea.

d/ Hong Kong and Singapore.

e/ Less than 0.005.

\* Modified from trend projections.

\*\* See detailed country study in Executive Summary, assessment of Food/Demand Supply Prospects and Related Strategies for Developing Member Countries of ADB, May 31, 1984.

Note: Parts may not add up to totals due to rounding.

Table 11. Projections of Foodgrain Surpluses and Deficits in Developing Member Countries of the ADB to the Year 2000  
(continued)

(million metric tons)

DMC	Other Cereals			Pulses			Total Foodgrains		
	Production	Demand <sup>a/</sup>	Surplus/ Deficit	Production	Demand <sup>a/</sup>	Surplus/ Deficit	Production	Demand <sup>a/</sup>	Surplus/ Deficit
Afghanistan	0.37	0.59	-0.22	0.03	0.10	-0.02	5.81	7.66	-1.86
Bangladesh	0.03*	0.15	-0.12	0.30	0.41	-0.11	33.74	39.75	-6.02
Burma	0.06*	0.09	-0.03	0.48	0.54	-0.06	19.63	17.49	2.14
India	42.12*	34.07	8.05	16.22*	20.08	-3.86	260.90	252.44	8.46
Indochina <sup>b/</sup>	0.20*	0.16	0.04	0.17	0.21	-0.04	16.14	25.14	-8.99
Indonesia	<u>e/</u>	0.04	-0.04	0.54*	0.62	-0.08	54.82	62.68	-7.87
Korea, Rep.	1.80 <sup>c/</sup>	1.88	-0.08	0.16	0.11	0.05	11.75	25.50	-13.75
Malaysia	-	0.17	-0.17	-	0.05	-0.05	3.26	6.71	-3.46
Nepal	0.17*	0.26	-0.09	0.05	0.08	-0.03	5.49	5.96	-0.47
Pacific Is. <sup>c/</sup>	0.02*	0.03	-0.01	0.04	0.05	<u>e/</u>	0.13	0.45	-0.33
Pakistan	0.63*	1.07	-0.44	0.69*	1.66	-0.96	43.40	36.27	7.13
Philippines	-	0.19	-0.19	0.07	0.09	-0.01	17.84	21.21	-3.37
Sri Lanka	0.03	0.04	-0.01	0.05*	0.02	0.02	3.94	4.31	-0.37
Taiwan	0.02	3.54	-3.52	0.19*	0.16	-0.06	4.87	21.72	-16.85
Thailand	0.63*	0.20	0.43	0.65*	0.23	0.42	34.32	26.54	7.79
Others <sup>d/</sup>	-	0.17	-0.17	-	0.03	-0.03	-	2.65	-2.65
Total	46.09	42.67	3.42	19.59	24.41	-4.82	516.02	556.65	-40.66

a/ Based on 1960-81 trends income growth.

b/ Kampuchea, Laos and Vietnam.

c/ Fiji and Papua New Guinea.

d/ Hong Kong and Singapore.

e/ Less than 0.005.

\* Modified from trend projections.

\*\* Results from IFPRI, "Projections of Rice and Corn Supply and Demand for the Philippines under Alternative Irrigation Investments," January 3, 1984.

Note: Parts may not add up to totals due to rounding.

Table 12. Projections of Foodgrain Production and of Foodgrain Demand at Low and High Income Growth <sup>a/</sup> in the DMCs, 2000  
(thousand metric tons)

DMC	Paddy Rice			Wheat			Maize		
	Production	Low Demand	High	Production	Low Demand	High	Production	Low Demand	High
Afghanistan	609	782	873	3,868	4,836	4,888	876	1,341	1,446
Bangladesh	31,141*	35,159	36,339	2,269*	4,038	4,302	2*	3	3
Burma	18,520*	16,485	16,762	250*	119	127	320*	135	138
India <sup>b/</sup>	120,482	123,738	129,744	72,430*	60,144	63,835	9,644	9,632	9,823
Indochina <sup>b/</sup>	15,111*	21,358	22,974	--	2,237	2,842	659*	1,168	1,300
Indonesia	48,450*	51,830	53,242	--	3,525	5,298	5,827	5,243	5,816
Korea, Rep. of	9,450*	10,748	10,849	78*	3,950	4,320	263*	7,289	8,354
Malaysia	3,220*	4,041	4,226	--	972	1,138	35*	1,161	1,489
Nepal	3,388*	3,709	3,924	963*	819	926	922*	1,093	1,119
Pacific Is. <sup>c/</sup>	30	196	211	--	138	158	33*	22	27
Pakistan	12,944*	8,774	9,712	27,399*	22,074	23,150	1,742	1,672	1,786
Philippines	12,140**	11,901	12,697	--	1,469	1,667	5,624**	6,756	7,425
Sri Lanka	3,804*	3,001	3,120	--	1,094	1,221	64*	40	42
Taiwan	4,155	5,732	6,292	1	1,153	1,354	589	8,143	10,376
Thailand <sup>d/</sup>	26,465	24,450	25,320	--	254	315	6,578*	932	1,005
Others <sup>e/</sup>	e/	624	587	--	781	832	--	977	1,028
Total	3 09,909	322,528	336,872	107,258	107,602	116,376	33,178	45,602	51,178

<sup>a/</sup> Low and high income growth rates are based on 75 percent and 125 percent respectively, of the 1961-80 trend GNP/capita in each country, with minimum and maximum levels of 0.5 and 6.0 percent a year

<sup>b/</sup> Kampuchea, Laos and Vietnam

<sup>c/</sup> Fiji and Papua New Guinea

<sup>d/</sup> Hong Kong and Singapore

<sup>e/</sup> Less than zero

\* Modified from trend projections

\*\* Results from IFPRI, "Projections of Rice and Corn Supply and Demand for the Philippines under Alternative Irrigation Investments," January 3, 1984.

Note: Parts may not sum to totals due to rounding.

Table 12. Projections of Foodgrain Production and of Foodgrain Demand at Low and High Income Growth <sup>a/</sup> in the DMCs, 2000

(thousand metric tons)

DMC	Other Cereals			Pulses			Total Foodgrains		
	Production	Demand Low	Demand High	Production	Demand Low	Demand High	Production	Demand Low	Demand High
Afghanistan	371	592	611	81	96	107	5,805	7,647	7,926
Bangladesh	30*	146	148	295	406	428	33,737	39,751	41,222
Burma	61*	94	95	477	522	551	19,628	17,355	17,673
India	42,120*	34,212	33,948	16,220*	19,340	30,938	260,896	247,065	268,290
Indochina <sup>b/</sup>	204*	163	199	168	209	230	16,142	25,135	27,545
Indonesia	2	39	50	536*	581	654	54,815	61,219	65,061
Korea, Rep. of	1,800*	1,882	1,878	161	102	107	11,752	23,972	25,508
Malaysia	--	160	185	--	50	56	3,255	6,385	7,094
Nepal	171*	261	272	48	76	85	5,492	5,958	6,326
Pacific Is. <sup>c/</sup>	20*	30	30	42	45	45	125	432	470
Pakistan	626*	1,089	1,056	691*	1,563	1,254	43,402	35,172	36,958
Philippines	--	192	194	72	86	86	17,835	20,405	22,070
Sri Lanka	28	34	36	48*	22	24	3,944	4,191	4,442
Taiwan	24	2,783	3,544	102*	140	156	4,871	17,951	21,723
Thailand	632*	192	213	648	215	244	34,323	26,044	27,097
Others <sup>d/</sup>	--	147	173	--	31	31	<u>e/</u>	2,559	2,651
Total	46,089	42,016	42,633	19,589	23,486	34,997	516,023	541,239	582,056

<sup>a/</sup> Low and high income growth rates are based on 75 percent and 125 percent respectively, of the 1961-80 trend GNP/capita in each country, with minimum and maximum levels of 0.5 and 6.0 percent a year

<sup>b/</sup> Kampuchea, Laos and Vietnam

<sup>c/</sup> Fiji and Papua New Guinea

<sup>d/</sup> Hong Kong and Singapore

<sup>e/</sup> Less than zero

\* Modified from trend projections

\*\* Results from IFPRI, "Projections of Rice and Corn Supply and Demand for the Philippines under Alternative Irrigation Investments," January 3, 1984.

Note: Parts may not sum to totals due to rounding.

Table 13.

• Projections of Foodgrain Surpluses or Deficits in DMCs to 2000 Based on Demand at High and Low Income Growth (million metric tons) a/

DMC	Paddy Rice		Wheat		Maize		Other Cereals		Pulses		Total Foodgrains	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Afghanistan	0.17	-0.26	-0.97	-1.02	-0.47	-0.57	-0.22	-0.24	-0.02	-0.03	-1.84	-2.12
Bangladesh	-4.02	-5.20	-1.77	-2.04	<u>e/</u>	<u>e/</u>	-0.12	-0.12	-0.11	-0.13	-6.01	-7.49
Burma	2.03	1.76	0.13	0.12	0.18	0.18	-0.03	-0.03	-0.05	-0.07	2.27	1.96
India	-3.26	-9.26	12.29	8.60	0.01	-0.18	7.91	8.17	-3.12	-14.72	13.83	-7.39
Indochina <sup>b/</sup>	-6.25	-7.86	-2.24	-2.84	-0.51	-0.64	0.04	0.01	-0.04	-0.06	-8.99	-11.40
Indonesia	-3.38	-4.79	-3.53	-5.30	0.58	0.01	-0.04	-0.05	-0.05	-0.12	-6.40	-10.25
Korea, Rep. of	-1.30	-1.40	-3.87	-4.24	-7.03	-8.09	-0.08	-0.08	0.06	0.05	-12.22	-13.76
Malaysia	-0.82	-1.01	-0.97	-1.14	-1.13	-1.45	-0.16	-0.19	-0.05	-0.06	-3.73	-3.84
Nepal	-0.32	-0.54	0.14	0.04	-0.17	-0.20	-0.09	-0.10	-0.03	-0.04	-0.47	-0.83
Pacific Is. <sup>c/</sup>	-0.17	-0.18	-0.14	-0.16	0.01	0.01	-0.01	-0.01	<u>e/</u>	<u>e/</u>	-0.31	-0.35
Pakistan	4.17	3.23	5.33	4.25	0.07	-0.04	-0.46	-0.43	-0.87	-0.56	8.23	6.44
Philippines	0.24	-0.56	-1.47	-1.67	-1.13	-1.80	-0.19	-0.19	-0.01	-0.01	-2.57	-4.23
Sri Lanka	0.80	0.68	-1.09	-1.22	0.02	0.02	-0.01	-0.01	0.03	0.02	-0.25	-0.50
Taiwan	-1.58	-2.14	-1.15	-1.35	-7.55	-9.79	-2.76	-3.52	-0.04	-0.06	-13.08	-16.85
Thailand	2.02	1.15	-0.25	-0.32	5.65	5.57	0.44	0.42	0.43	0.40	8.28	7.23
Others <sup>d/</sup>	-0.62	-0.59	-0.78	-0.83	-0.98	-1.03	-0.15	-0.17	-0.03	-0.03	-2.56	-2.65
Total	-12.62	-29.51	-0.34	-9.12	-12.43	-18.00	4.07	3.46	-3.90	-15.41	-25.22	-66.03

a/ Low and high income growth rates are based on 75 percent and 125 percent, respectively, of the 1961-80 trend GNP/capita in each country, with minimum and maximum levels of 0.5 and 6.0 percent a year

b/ Kampuchea, Laos and Vietnam

c/ Fiji and Papua New Guinea

d/ Hong Kong and Singapore

e/ Less than .005

Note: Calculated from the production and demand projections given in Table 13. Parts may not sum to total due to rounding.

Table 14.

Comparisons of Annual Growth Rates of the Trend and Modified Projections of Production,  
Area and Yield of Paddy Rice, Wheat and Maize in the DMC's Year 2000  
(Percent)

DMC	Paddy Rice Projections						Wheat Projections					
	Production	Trend Area	Yield	Production	Modified Area	Yield	Production	Trend Area	Yield	Production	Modified Area	Yield
Afghanistan	1.55	-0.10	1.64	1.55	0.00	1.55	1.61	0.32	1.29	*	*	*
Bangladesh	1.66	0.81	0.85	2.33	*	1.51	16.96	9.39	6.92	8.46	6.03	2.30
Burma	2.20	0.27	1.93	*	*	*	3.99	2.14	1.81	*	*	*
India	2.32	0.70	1.61	*	*	*	7.27	3.34	3.80	3.46	1.20	2.24
Indochina <sup>a/</sup>	0.14	-0.57	0.72	0.72	0.00	*	--	--	--	--	--	--
Indonesia	4.96	1.40	3.53	2.65	1.07	1.56	--	--	--	--	--	--
Korea, Rep. of	2.91	0.29	2.61	1.12	0.64	0.47	-7.32	-8.54	1.33	1.33	0.00	*
Malaysia	3.96	1.96	1.80	1.85	0.75	1.09	--	--	--	--	--	--
Nepal	0.67	0.39	-0.32	1.77	0.40	1.36	7.50	8.08	-0.54	3.75	2.12	1.60
Pacific Islands <sup>b/</sup>	1.24	0.90	0.34	*	*	*	--	--	--	--	--	--
Pakistan	6.30	2.63	3.58	4.44	2.22	2.20	5.69	1.73	3.90	4.40	1.50	2.86
Philippines	3.81	0.68	3.11	2.57	0.56	2.00	--	--	--	--	--	--
Sri Lanka	3.99	2.95	1.01	3.53	2.50	*	--	--	--	--	--	--
Taiwan	0.87	-0.43	1.31	*	*	*	-18.00	-19.31	1.62	1.62	0.00	*
Thailand	2.34	1.43	0.90	*	*	*	--	--	--	--	--	--
Others <sup>c/</sup>	-22.14	-0.57	-21.70	0.00	0.00	0.00	--	--	--	--	--	--
Total	2.86	.83	2.02	2.29	.79	1.50	7.00	3.05	3.83	3.77	1.28	2.46

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<sup>a/</sup> Kampuchea, Laos and Vietnam  
<sup>b/</sup> Fiji and Papua New Guinea  
<sup>c/</sup> Hong Kong and Singapore  
 \* Same as trend

Table 14.  
(continued)

-2-  
Comparisons of Annual Growth Rates of the Trend and Modified Projections of Production,  
Area and Yield of Paddy Rice, Wheat and Maize in the DAC's, Year 2000

	<u>Production</u>	<u>Maize Projections</u>		<u>Modified</u>		<u>Yield</u>
		<u>Trend</u> <u>Area</u>	<u>Yield</u>	<u>Production</u>	<u>Area</u>	
Afghanistan	.56	-0.42	0.98	*	0.00	0.56
Bangladesh	-5.46	-5.68	0.23	0.23	0.00	*
Burma	2.60	-1.01	3.64	*	0.00	2.60
India	1.85	1.45	0.40	*	*	*
Indochina <sup>a/</sup>	0.78	1.35	-0.56	1.35	*	0.00
Indonesia	1.30	-0.61	1.92	2.86	0.78	2.06
Korea, Rep. of	11.47	-0.44	11.96	3.20	0.00	3.20
Malaysia	3.95	2.10	1.81	3.38	1.51	1.84
Nepal	-1.17	0.29	-1.45	1.37	0.63	0.74
Pacific Islands <sup>b/</sup>	14.97	11.26	3.34	6.70	5.00	1.61
Pakistan	3.23	1.93	1.28	*	*	*
Philippines	5.70	3.37	2.25	2.84	0.83	1.99
Sri Lanka	5.89	5.31	.40	4.50	3.92	*
Taiwan	7.77	5.22	2.42	*	*	*
Thailand	8.57	-0.09	8.66	3.14	2.11	1.01
Others <sup>c/</sup>	--	--	--	--	--	--
Total	4.45	2.96	1.45	2.51	1.27	1.23

<sup>a/</sup> Kampuchea, Laos and Vietnam

<sup>b/</sup> Fiji and Papua New Guinea

<sup>c/</sup> Hong Kong and Singapore

\* Same as trend

Table 15. Trend Estimates of Production, Area Harvested and Yield per Hectare of Foodgrains in ADB Developing Member Countries, 1980<sup>a/</sup>

Country	Paddy Rice			Wheat			Maize			Other Cereals			Pulses			All Foodgrains		
	Production (000 MT)	Area (000 Ha)	Yield (MT/Ha)															
1. Afghanistan	448	208	2.15	2,810	2,376	1.18	783	463	1.69	371	351	1.06	59	36	1.63	4,471	3,434	1.30
2. Bangladesh	19,641	10,399	1.89	447	255	1.75	2	2	0.84	60	87	0.69	255	351	0.73	20,405	11,094	1.84
3. Burma	10,471	4,898	2.14	64	87	0.73	87	102	0.85	54	200	0.27	325	632	0.51	11,001	5,919	1.86
4. India <sup>b/</sup>	76,153	40,005	1.90	36,653	22,835	1.61	6,683	6,254	1.07	23,426	36,315	0.65	11,017	22,580	0.49	153,932	127,989	1.20
5. Indochina <sup>b/</sup>	13,091	7,052	1.86	-	-	-	504	436	1.15	40	37	1.07	136	243	0.56	13,771	7,768	1.77
6. Indonesia	28,692	9,079	3.16	-	-	-	3,317	2,537	1.28	2	3	0.62	339	678	0.50	32,350	12,357	2.62
7. Korea, Rep. of	7,571	1,233	6.14	59	24	2.50	140	35	4.04	1,381	535	2.58	59	63	0.94	9,210	1,890	4.33
8. Malaysia	2,233	792	2.82	-	-	-	13	10	1.78	-	-	-	-	-	-	2,252	802	2.81
9. Nepal	2,387	1,292	1.85	461	422	1.09	702	452	1.55	167	159	1.05	47	112	0.42	3,764	2,437	1.54
10. Pacific Islands <sup>c/</sup>	23	12	1.94	-	-	-	9	4	2.42	6	3	2.23	24	46	0.53	62	65	0.95
11. Pakistan	5,403	1,985	2.72	10,616	6,781	1.57	923	714	1.29	699	1,225	0.57	691	1,473	0.47	13,331	12,178	1.51
12. Philippines	7,345	3,514	2.09	-	-	-	3,215	3,364	0.95	-	-	-	45	61	0.73	10,605	6,959	1.52
13. Sri Lanka	1,901	797	2.38	-	-	-	27	31	0.84	22	37	0.60	17	28	0.63	1,967	893	2.20
14. Taiwan	3,496	731	4.78	1	•	2.51	132	43	3.07	17	7	2.37	35	23	1.53	3,681	804	4.58
15. Thailand	16,650	8,472	1.97	-	-	-	3,544	1,712	2.07	319	272	1.17	320	475	0.67	20,832	10,931	1.91
16. Others <sup>d/</sup>	1	•	1.79	-	-	-	-	-	-	-	-	-	-	-	-	1	•	1.79
TOTAL	195,506	90,469	2.16	51,111	32,780	1.56	20,036	16,239	1.24	26,285	39,231	0.67	13,369	26,801	0.49	306,635	205,520	1.49

a/ Based on 1961-80 data.

b/ Kampuchea, Laos and Vietnam.

c/ Fiji and Papua New Guinea.

d/ Hong Kong and Singapore (paddy rice data for Hong Kong).

• Less than 0.5.

Table 16. Trend-Based Projections of Production, Area Harvested, and Yield per Hectare of Foodgrains in ADB Developing Member Countries, Year 2000<sup>a/</sup>

Country	Paddy Rice			Wheat			Maize			Other Cereals			Pulses			All Foodgrains		
	Production (000 MT)	Area (000 Ha)	Yield (MT/Ha)															
1. Afghanistan	609	204	2.93	3,868	2,533	1.53	876	426	2.05	341	344	0.99	81	48	1.70	5,775	3,555	1.62
2. Bangladesh	27,326	12,212	2.24	10,267	1,535	6.69	1	1	0.88	56	84	0.66	295	407	0.72	37,945	14,239	2.66
3. Burma	16,180	5,168	3.13	137	132	1.05	146	84	1.74	61	263	0.23	477	869	0.55	17,002	6,516	2.61
4. India	120,482	46,009	2.62	149,221	44,056	3.39	9,644	8,338	1.16	29,653	31,849	0.93	10,859	21,828	0.50	319,870	152,090	2.10
5. Indochina <sup>b/</sup>	13,475	6,288	2.14	-	-	-	589	570	1.03	1,169	1,694	0.69	168	259	0.65	15,401	8,811	1.75
6. Indonesia	75,846	11,981	6.23	-	-	-	4,293	2,298	1.87	-	-	0.41	659	1,324	0.50	80,798	15,603	5.17
7. Korea, Rep of	13,432	1,306	10.29	13	4	3.26	1,225	32	38.65	1,311	260	5.04	161	77	2.09	16,141	1,679	9.61
8. Malaysia	4,706	1,167	4.03	-	-	-	40	16	2.55	-	-	-	-	-	-	4,746	1,133	4.01
9. Nepal	2,728	1,574	1.73	1,976	1,997	0.98	555	479	1.16	206	218	0.94	45	119	0.38	5,490	4,397	1.25
10. Pacific c/ Islands	30	14	2.08	-	-	-	143	32	4.67	56	16	3.53	42	77	0.55	276	139	1.99
11. Pakistan	18,342	3,334	5.50	32,117	9,552	3.36	1,742	1,045	1.67	626	929	0.67	561	1,330	0.42	53,388	16,190	3.30
12. Philippines	15,527	4,027	3.86	-	-	-	9,745	6,570	1.43	-	-	-	72	66	1.09	25,344	10,663	2.38
13. Sri Lanka	4,154	1,426	2.91	-	-	-	83	88	0.94	28	54	0.52	95	146	0.65	4,360	1,714	2.54
14. Taiwan	4,155	670	6.20	-	-	3.46	589	119	4.95	24	4	5.82	102	27	3.82	4,871	820	5.94
15. Thailand	26,465	11,246	2.35	-	-	-	18,344	9,019	2.03	3,348	8,859	0.38	1,134	3,059	0.37	49,291	32,183	1.53
16. Others <sup>d/</sup>	-	-	1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	343,547	106,626	3.22	197,483	59,819	3.30	43,020	29,117	1.65	36,879	44,574	0.83	14,751	29,636	0.50	640,698	269,772	2.37

<sup>a/</sup> Extrapolations of 1961-80 trends.

<sup>b/</sup> Kampuchea, Laos and Vietnam.

<sup>c/</sup> Fiji and Papua New Guinea.

<sup>d/</sup> Hong Kong and Singapore (paddy rice data for Hong Kong).

<sup>e/</sup> Less than 0.5.

Table 17. Modified Projections of Production, Area Harvested, and Yield per Hectare of Foodgrains in ADB Developing Member Countries, Year 2000 <sup>a/</sup>

DMC	Paddy Rice			Wheat			Maize		
	Production (000 MT)	Area (000 Ha)	Yield (MT/Ha)	Production (000 MT)	Area (000 Ha)	Yield (MT/Ha)	Production (000 MT)	Area (000 Ha)	Yield (MT/Ha)
Afghanistan	609	208	2.93	3,868	2,533	1.53	876	463	1.89
Bangladesh	31,141	12,212	2.55	2,269	822	2.76	2	2	0.88
Burma	18,520	5,168	3.42	250	155	1.64	320	173	1.85
India	120,482	46,009	2.62	72,430	28,970	2.50	9,644	8,338	1.16
Indochina <sup>b/</sup>	15,111	7,052	2.14	--	--	--	659	570	1.16
Indonesia	48,450	11,240	4.31	--	--	--	5,827	3,035	1.92
Korea, Rep. of	9,450	1,400	6.75	78	24	3.26	263	35	7.50
Malaysia	3,220	920	3.50	--	--	--	35	13	2.59
Nepal	3,388	1,400	2.42	963	642	1.50	922	512	1.80
Pacific Islands <sup>c/</sup>	30	14	2.08	--	--	--	33	11	3.10
Pakistan	12,944	3,082	4.20	27,399	9,133	3.00	1,742	1,045	1.67
Philippines	12,141	3,905	3.08	--	--	--	5,624	3,989	1.41
Sri Lanka	3,804	1,306	2.91	--	--	--	64	68	0.94
Taiwan	4,155	670	6.20	1	--	3.46	589	119	4.95
Thailand	26,465	11,246	2.35	--	--	--	6,578	2,600	2.53
Others <sup>d/</sup>	Neg.	Neg.	--	--	--	--	--	--	--
Total	309,910	106,072	2.92	107,259	42,276	2.54	33,178	20,973	1.58

a/ See notes on methodology and sources of data

b/ Kampuchea, Laos and Vietnam

c/ Fiji and Papua New Guinea

d/ Hong Kong and Singapore

Neg. = Negligible

Note: Parts may not add up to totals due to rounding

Table 17.  
(continued)

Modified Projections of Production, Area Harvested, and Yield per Hectare  
of Foodgrains in ADB Developing Member Countries, Year 2000

DNC	Other Cereals			Pulses			Total Foodgrains		
	Production (000 MT)	Area (000 Ha)	Yield (MT/Ha)	Production (000 MT)	Area (000 Ha)	Yield (MT/Ha)	Production (000 MT)	Area (000 Ha)	Yield (MT/Ha)
Afghanistan	371	351	1.06	81	48	1.70	5,800	3,603	1.61
Bangladesh	60	87	0.69	295	407	0.73	33,730	13,530	2.50
Burma	61	226	0.27	477	869	0.55	19,628	6,838	2.87
India	42,120	36,310	1.16	16,220	24,950	0.65	260,896	145,577	1.94
Indochina <sup>b/</sup>	204	189	1.07	168	259	0.65	16,142 <sup>n</sup>	8,070	2.00
Indonesia	2	3	0.62	536	1,324	0.40	54,815	15,602	3.51
Korea, Rep. of	1,850	400	4.50	161	77	2.09	11,752	1,936	6.07
Malaysia	--	--	--	--	--	--	3,255	933	3.49
Nepal	171	155	1.10	48	119	0.40	5,492	2,828	1.94
Pacific Islands <sup>c/</sup>	20	8	2.50	42	77	0.55	125	110	1.14
Pakistan	626	929	0.67	691	1,473	0.47	43,402	15,662	2.77
Philippines	--	--	--	72	66	1.09	17,838	7,953	2.24
Sri Lanka	28	54	0.52	48	74	0.65	3,944	1,502	2.63
Taiwan	24	4	6.00	102	27	3.78	4,971	820	5.94
Thailand	632	430	1.47	648	762	0.85	34,323	15,038	2.28
Others <sup>d/</sup>	--	--	--	--	--	--	Neg.	Neg.	--
Total	46,119	39,146	1.18	19,589	30,532	0.64	516,024	239,010	2.3

a/ See notes on methodology and sources of data

b/ Kampuchea, Laos and Vietnam

c/ Fiji and Papua New Guinea

d/ Hong Kong and Singapore

Neg. = Negligible

Note: Parts may not add up to totals due to rounding

Table 18. Population and GNP/Capita Data for Use in Demand Projections

Country	Population		Annual Growth Rate (percent)	Annual Growth Rate of GNP/Capita		
	1980 (thousands)	2000(Proj)		Trend a/ (percent)	Low b/ (percent)	High c/ (percent)
1. Afghanistan	22,038	36,654	2.58	0.56*	0.50	1.50
2. Bangladesh	88,705	153,331	2.77	0.50**	0.50	1.50
3. Burma	33,912	52,957	2.25	1.14	0.86	1.50
4. Fiji	619	764	1.06	3.48	2.61	4.35
5. Hong Kong	4,801	6,262	1.34	6.00**	4.50	6.00
6. India	676,611	1,010,854	2.03	1.26	0.95	1.58
7. Indonesia	143,032	208,695	1.91	3.89	2.92	4.86
8. Kampuchea	8,872	13,403	2.08	0.50*	0.50	1.50
9. Korea, Rep.	37,979	50,790	1.46	6.00**	4.50	6.00
10. Laos	3,721	5,725	2.18	0.50*	0.50	1.50
11. Malaysia	13,640	20,181	1.98	4.14	3.11	5.18
12. Nepal	14,256	22,432	2.29	0.50**	0.50	1.50
13. Pakistan	82,441	144,974	2.86	2.72	2.04	3.40
14. Papua New Guinea	3,082	4,986	2.43	2.41	1.81	3.01
15. Philippines	48,700	79,673	2.49	2.52	1.89	3.15
16. Singapore	2,427	3,095	1.22	6.00**	4.50	6.00
17. Sri Lanka	14,871	20,063	1.51	2.35	1.76	2.94
18. Taiwan	17,641	24,550	1.67	6.00**	4.50	6.00
19. Thailand	47,674	76,071	2.36	4.44	3.33	5.55
20. Vietnam	52,299	79,355	2.11	0.50*	0.50	1.50
Total	1,317,321	2,014,805	2.15	-	-	-

a/ Based on 1961-80 data.

b/ 25 percent below trend with minimum of 0.50.

c/ 25 percent above trend with minimum of 1.50 and maximum of 6.00.

\* No updated data; lifted from the global food gap analysis study which used the 1966-77 estimates.

\*\* Minimum or Maximum.

Table 19. Trends of Meat Consumption in the ADB Developing Member Countries, 1961-65 to 1976-80

Country	Annual Meat Consumption		Average Annual Growth Rate, 1961-65 to 1976-80 (percent)
	1961-65 Average (000 metric tons)	1976-80 Average (000 metric tons)	
Afghanistan	169.5	171.7	0.1
Bangladesh	203.8	220.7	0.7
Burma	106.7	172.7	4.1
India	630.2	729.5	1.2
Indochina <sup>a/</sup>	464.3	695.5	3.4
Indonesia	320.4	356.5	1.8
Korea, Rep. of	95.2	232.7	7.7
Malaysia	91.7	148.3	4.1
Nepal	50.4	63.5	1.9
Pacific Islands <sup>b/</sup>	30.8	63.0	6.1
Pakistan	379.2	543.4	3.0
Philippines	405.3	615.0	3.5
Sri Lanka	25.8	32.3	1.9
Taiwan	162.8	481.6	9.5
Thailand	312.4	431.0	2.7
Others <sup>c/</sup>	202.5	395.9	5.7
TOTAL	3,651.0	5,393.3	3.3

a/ Kampuchea, Laos and Vietnam.

b/ Fiji and Papua New Guinea.

c/ Hong Kong and Singapore.

Note: Meat here includes that of cattle, buffalo, sheep, goat, pig and poultry.

Source of basic data: FAO, "Agricultural Supply Utilization Accounts, Tape, 1981," Rome: 1982.

Table 20. Annual Domestic Utilization of Sugar, Fats and Oils and Fish in ADB Developing Countries, 1966-68 and 1978-80 Averages

(in thousand metric tons)

Country	1966-68 Average			1978-80 Average		
	Sugar	Fats and Oil	Fish	Sugar	Fats and Oil	Fish
Afghanistan	65.6	42.3	1.5	91.3	56.4	1.5
Bangladesh	775.3	191.4	836.4	709.7	194.9	630.9
Burma	228.4	173.4	325.9	184.5	193.1	479.9
India	10,066.0	2,606.5	1,243.1	14,925.5	4,234.2	1,976.4
Indochina <sup>a/</sup>	310.3	80.1	813.2	458.2	79.5	953.4
Indonesia	945.0	404.7	1,053.9	1,912.3	881.4	1,469.6
Korea, Rep. of	109.0	53.1	401.8	480.2	278.3	1,023.7
Malaysia	275.2	123.8	250.5	500.9	200.9	564.1
Nepal	17.8	44.9	1.9	34.2	54.3	4.2
Pacific Islands <sup>b/</sup>	63.2	12.8	53.8	91.4	85.0	56.5
Pakistan	2,062.2	421.0	84.4	3,044.3	898.9	145.8
Philippines	637.5	208.9	829.6	1,200.1	291.4	1,255.8
Sri Lanka	291.5	65.9	248.4	240.8	72.3	163.9
Taiwan	136.0	73.0	361.6	419.7	130.2	702.0
Thailand	402.3	91.3	353.1	1,055.7	137.3	562.5
Others <sup>c/</sup>	236.2	64.9	179.3	226.6	134.5	238.0
TOTAL	16,621.7	4,658.0	7,038.3	25,575.4	7,972.5	10,228.1

a/ Kampuchea, Laos and Vietnam.

b/ Fiji and Papua New Guinea.

c/ Hong Kong and Singapore.

Note: Data on sugar are for sugar cane and sugar beet in terms of raw sugar; conversion rates are 10 percent for cane and beet and 109 percent for refined sugar. Fats and oils include all processed vegetable and animal fats and oils; conversion rate of butter is 81 percent (fat content). Data on fish are in terms of whole fish.

Source of basic data: FAO, "Agricultural Utilization Accounts Tape, 1981," Rome: 1982.

Table 21. Average Annual Growth Rates of the Consumption of Sugar, Fats and Oils, and Fish in ADB Developing Member Countries, 1966-68 to 1978-80

(percent)

Country	Average Annual Growth Rate of Consumption		
	Sugar	Fats and Oils	Fish
Afghanistan	2.8	2.4	0.0
Bangladesh	-0.7	0.2	-2.3
Burma	-1.8	0.9	3.3
India	3.3	4.1	3.9
Indochina <sup>a/</sup>	3.3	-0.1	1.3
Indonesia	6.1	6.7	2.8
Korea, Rep. of	*	*	8.1
Malaysia	5.1	4.1	7.0
Nepal	5.6	1.6	6.8
Pacific Islands <sup>b/</sup>	3.1	*	0.4
Pakistan	3.3	6.5	4.7
Philippines	5.4	2.8	3.5
Sri Lanka	-1.6	0.8	-3.4
Taiwan	9.8	7.8	5.7
Thailand	8.4	3.4	4.0
Others <sup>c/</sup>	-0.3	6.3	2.4
TOTAL	3.7	4.6	3.2

<sup>a/</sup> Kampuchea, Laos and Vietnam.

<sup>b/</sup> Fiji and Papua New Guinea.

<sup>c/</sup> Hong Kong and Singapore.

\* More than 10 percent.

Note: See also Table 20.

## Appendix A

### Notes on Methodology and Data Sources

Analysis of foodgrain trends in the ADB developing member countries (DMCs) uses annual estimates of production during 1961-80 and of consumption during 1966-80. The observed trends in output form the basis of production projections to 1990 and 2000. Previous food-gap studies which employed similar trending procedures for Third World countries have shown that while aggregates of trend-based country projections of output provide useful indicators of the possible future food situation for country groups, the individual country projections should be treated with caution even when these are derived from pooled commodity data. Slight changes in production growth rates can result in large differences between the output projections for a country, especially if the base output is low, output increases are rapid and the projection period is relatively long. The problem is magnified when output projections are done for each commodity in a country. Accordingly, the trend-based projection of the production of each foodgrain item shown in Table 10 is viewed as a first approximation that serves as benchmark for analysis by country expertise.<sup>1/</sup>

In the absence of country-specific studies, modifications are made through changes in the projected levels and/or rates of increase in the area and yield components of production when these are viewed unattainable. The modified projections are presented in Table 11. In

<sup>1/</sup> Trend-based output projections use the exponential equation  $y=e^{bt}$  where Y represents production, b is the annual rate of change and t is the period in years.

the case of the Philippines the projections on the production and consumption of rice paddy and maize are drawn from the results of the country study.

Trend estimates of the use of foodgrains directly as food in 1980 serve as base for projecting future demand for human consumption in each DMC. Increases in demand due to population growth follow the projected population growth rates of DMCs under the medium-variant assumption. Changes in demand due to increases in income are projected first on the basis of the trend growth rate of GNP per capita during 1961-80; low and high income-growth projections of demand are also developed using 75 percent and 125 percent, respectively, of the trend growth rate of per capita income in each DMC.<sup>1/</sup> Calculations of changes in per capita foodgrain demand for human consumption generally make use of the available 5-year estimates of income elasticities until the year 2000. Projections of per capita demand for animal feed employ the income elasticity of demand for meat, representing livestock and poultry products, as a proxy for the income elasticity of demand for feed use. Allowances for seeds, waste and nonfood uses are based on 1976-80 indications from foodgrain consumption data of each DMC. Finally, price relationships are assumed to remain unchanged.

<sup>1/</sup> For purposes of this study, no corresponding changes are applied on the production side and thus it is assumed that income changes are independent of changes in foodgrain output. It is recognized that this assumption is not strictly valid; in countries where agriculture is the dominant sector, growth in agricultural output is an important determinant of income growth.

Data on foodgrain production and consumption, together with the estimates of income elasticity of demand for various commodities, are from FAO, Rome. Population estimates and projections are from the U.N. Population Division, as assessed in 1978, while the statistics on GNP in constant U.S. dollars are World Bank Estimates.

## Appendix B

### Modifications of Trend-Based Projections for Selected DMCs

#### INDONESIA

Due to the availability of more detailed data on rice in Indonesia, we are able to disaggregate the analysis and projections to a greater extent than for most other countries.

#### Paddy Rice

Area: The projections made here assume that the currently planned irrigation investment program through 1990 will be carried out, including completion of all construction started before the end of Repelita III, and a balanced Repelita IV program of investments, and that the program for 1990-2000 will add about 80% as much new physical area as in 1981-90, due to general slowing trend in investment. Projected areas for existing swampland/tidal are assumed to remain constant, while dryland area will decline slightly. Area harvested in existing wetland, rainfed and irrigated areas, which account for over 90% of production, follow a simple projection procedure. Cropping intensity on irrigated area increased from 1.37 to 1.42 between 1973 and 1981. It is assumed that this recent increase will be matched through 1990, with cropping intensity on existing land in Java increasing from 1.56 in 1981 to 1.61 in 1990, and to 1.68 in 2000; while the increase off-Java will be from 1.26 in 1981 to 1.32 in 1990 and to 1.40 in 2000. One-fourth of new physical area irrigated under the projected investment program is assumed to replace existing

rainfed area. This may understate actual displacement since historically nearly 40% of new irrigation displaces rainfed areas. The area harvested from existing wetland rainfed and irrigated area can then be computed as the (physical area irrigated times the irrigated cropping intensity) plus (physical rainfed area less physical area displaced by irrigation) times the rainfed cropping intensity. Cropping intensity on new areas irrigated is assumed to be 1.20 during 1981-90, reflecting start-up problems, but increasing to 1.32 in 1990-2000 as the investments mature.

Yield: In order to project yields on wetland (irrigated and rainfed) aggregate physical functions were first estimated for period 1972-1981. Data were compiled for Java and off-Java, and then pooled in the regressions in order to increase the degrees of freedom and observed variation in the variables. A number of functional forms were tested, with the best fit equation given in Table 1. Yield in wetland rice is estimated as a function of nitrogen use, the irrigated area harvested as a percentage of wetland area harvested, and the percentage of area harvested to modern varieties.

Utilizing this yield equation, together with projections of the independent variables, we can project wetland yields on Java and the other islands to 1990 and 2000. Table 3 summarizes the values of the relevant variables.

Fertilizer use on Java grew at the very rapid rate of 15% per year, 1972-81, as the use of modern varieties grew from 23% to 80%, and extremely favorable fertilizer/rice price ratios were instituted

and maintained. Nitrogen use in 1981 of 133 kg/ha may be very close to the current economic optimum, but we have assumed continued strong growth in nitrogen use on Java at 4% per year, 1981-90, and 2% per year 1990-2000, which results in more than a doubling of the average use 1979-81. We also project strong growth in fertilizer use off-Java, 10% per year through 1990, and 7.5% per year thereafter, which gives a fivefold increase from 1979-81 levels. Such a growth rate will require considerable improvement in the fertilizer distribution system off-Java, vigorous pursuit of intensification programs, and maintenance of the favorable price regime.

There is little room for further growth in percent area irrigated and percent of modern varieties, but we project continued growth as shown in Table 2.

Substituting the values from Table 2 into the yield function gives the projected yields for existing wetland rice areas. Dryland yields are assumed to decline slightly as some of the better dryland areas shift out of rice. Swampland rice areas are assumed to maintain constant yields. New area irrigated is assumed to attain 80% of existing wetland yields in 1990, and 90% in 2000. The resulting projections are summarized in Table 3.

Demand: Human consumption projections assume a population growth rate of 1.91% and per capita income growth rate of 3.89%. Estimates of the income elasticity of demand for rice in Indonesia range from .20 to .50. We have chosen a moderate value of .30 for 1980-90, declining to

.15 from 1990 to 2000, as incomes and the proportion of urban population increase.

Maize: Area harvested shows a negative trend 1961-80, as well as for the more recent 1970-80 period. It is unlikely that there will be further expansion on Java; any new expansion will come off-Java, where there was some growth (1.0% per year), 1970-80. We assume a comparable aggregate growth of 1.0% per year through 2000, from the 1979/80 average area as the base.

Yields grew at a 1.92% rate 1961-80, but much of the growth occurred 1970-80 with the generation of new disease resistant varieties and a near doubling of fertilizer use. We assume that the strong long-term growth rate of 1.92% can be maintained.

Other Cereals: Production of other cereals is negligible, with area harvested only 7000 ha in 1980, and the data indicating production of other cereals only since 1973 with near constant yields since then, so it is very difficult to make any judgments as to expected trends. We arbitrarily assume area will grow at 5% per year and yields at 2% per year.

Pulses: Area harvested grew at a rate of 3.4% 1961-70 and 2.1% 1970-80 with constant yields. We expect a continued slowdown in area growth, to 1.3% from the 1980 trend base, with 1.0% per year growth in yields.

MALAYSIA

Paddy Rice: Yields grew at an annual rate of 1.8% from 1961-80, but slowed to 1.5% during the last decade in this period (computed from 1969-70 average as the base to 1979-80 average as the final year). Virtually all the growth in yields occurred through 1974, and yields have stagnated since then. The main source of growth in overall average yield has been due to the increasing proportion of area planted to relatively high yield dry season irrigated paddy. This source of yield growth has slowed with the slowdown in irrigated area expansion. Use of modern varieties and intensity of fertilizer use are already high so additional gains from these sources are likely to come slowly. All of these factors point to a continued slowdown of yield growth in paddy rice. -We assume here that the growth rate will be 1.2% per year through 1990 (from the 1980 trend value as base year) declining to 0.9% per year 1990-2000.

Paddy area harvested grew at an annual rate of 1.96% 1961-1980, declining to 1.1% the last decade. The entire growth in area, 1961-80, was in dry season irrigated paddy, with wet season paddy area constant or declining throughout this period. Area harvested has been virtually constant since 1972 due to the slowdown in irrigation investment. Given the declining profitability of rice production relative to other sectors of the economy, it is doubtful that additional lands will come under cultivation except through expansion and intensification of irrigation. Current irrigation investment plans

through 1990 appear to permit a growth rate of approximately 1.0% per year through 1990. It is assumed that the growth in area will then decline to 0.5% per year.

Maize: Maize is a highly marginal crop in Malaysia, with less than 10,000 ha harvested in 1980. While area has trended upward through most of the period 1961-80, with an overall growth rate of 1.8%, there was substantial decline in area harvested since 1976. Since the base year average of 1967-70, the growth rate has been 1.6%. It is assumed that this rate will be maintained through the year 2000.

Yields have fluctuated widely around the trend growth rate of 1.81%. The tremendous variability in yields and marginal nature of production makes it difficult to project yields; here we simply assume that growth will continue at 1.81% per year from the 1980 trend value.

#### THAILAND

Paddy Rice: Thailand has experienced a growth in paddy production over the past 20 years of 2.34%, with relatively slow growth in yields of 0.90% and area expansion of 1.43% annually. The production growth rate appears sustainable through 2000, and we have used the trend-based projections.

Maize: Growth in maize area has been very fast, 10.8% 1961-1970, and 6.1% from 1969/70 to 1979/80. We expect maize area harvested to continue to grow but with comparable reductions in the rate of growth to that experienced in the last two decades. The assumed growth in area is therefore 3.4% 1980-1990, and 1.9% from 1990 to 2000.

After a yield growth of 2.5% per year 1961-70, yields actually

declined during the rapid area expansion of the 1970s. It should be possible for resumption of some yield growth as expansion of area slows. We assume a growth rate of 1.0% per year, which brings yields back to the 1970-71 levels.

Other Cereals: Area harvested of other cereals (primarily sorghum) grew from zero in 1960 to 275,000 ha in 1980, with most of this expansion in the last decade. The rapid growth rate from a very small base cannot be maintained; here we assume that the growth in area will be the same as for maize, 3.4% from 1980 to 1990 and 1.9%, 1990-2000.

Yields have been highly variable around a negative trend. It is assumed that yields will increase at about 1.0% per year from the 1979/80 base average, as expansion slows.

Pulses: After very rapid growth, area has been nearly constant 1971-80. Growth rate 1961-70 was 18.7%, declining to 7.0% 1969/70 - 1979/80. Assuming a comparable percentage decline in growth rate over the next two decades gives an annual rate of 2.62%. Yields declined during the rapid area growth period, stabilizing in recent years. We assume a 1.0% growth rate in yields.

#### BANGLADESH

Paddy Rice: Area grew at a rate of 0.84%, 1961-80, and we assume this rate can be maintained through 2000.

Although yield growth was only 0.81% 1961-80, the rate from 1970 to 1980 was 1.84%. Although this relatively rapid growth may be difficult to maintain, we believe a rate of 1.5% is attainable due to continued rapid expansion of tubewells and growth in fertilizer use.

Wheat: There has been phenomenal growth in wheat area (9.39%) and yields (6.92%), 1961-80, from very low bases in each case. Although these rates cannot be maintained, there appears to be potential area sufficient for a substantial increase in area, at 4% a year from the average base of 1979-80, or 6% from the 1980 trend value. Following the rapid increase in yields over the past 20 years, to levels substantially higher than in India and Pakistan, a slowdown in yield growth is anticipated. We assume that yields will grow from the 1980 trend value at the still strong rate of 2.3%, or one-third of the trend value. Even with the rapid growth in production, a deficit of 2,085,000 metric tons is projected for 2000.

Maize: Maize is a marginal and declining crop in Bangladesh. We project a continuation of trends leading to a virtual elimination of maize.

Other Cereals: Area harvested has declined at a rate of -0.18%, 1960-80, but at nearly -5.0% the past 10 year period. We assume that the decline will continue due in large part to displacement by wheat. We project a continued decline from the 1979-80 base at half the rate (2.5%) for the past 10 years. Yields have declined slightly, and are projected based on the long term trend.

Pulses: Area harvested showed a slight growth (0.76%) 1961-80, while yields were virtually constant. We assume continuation of these trends.

## NEPAL

Projection of the cereal grain production in the year 2070 is done by projecting area and yield rates for each foodgrain crop taking into account their trend growth rates combined with judgements and then the estimates of production were obtained by multiplying for each commodity, the projected area and estimated yield.

The estimations for hills and Tarai are done separately and then they are added to get the projection for Nepal.

In the hills it is recognized that a further addition to cultivated land would be almost negligible since land utilization seems to have reached the extensive margin already. However, some expansion in the cropped area is possible from increases in cropping intensity and irrigation facilities. It is also assumed that increase in crop productivities would be small. Though in the past there had been a declining trend in the productivities largely due to increases in new marginal land, brought under cultivation, it is expected that further increases in bringing new land under cultivation is slim, and that the developmental efforts will check this trend and possibly even reverse the trend. The extension services as well as production support service, i.e., supply of seeds, fertilizers, credits, have been poor. It is expected that these services would be improved and accelerate the adoption of improved technology and thereby bring about an increase in cereal grain production.

In the Tarai, however, it is assumed that some new land will be brought under cultivation through resettlement program by clearing some forests. Also it is expected that additional 260,000 hectares of land will be brought under new irrigation (surface as well as ground water irrigation) in between 1983 to 2000. Also all the Tarai districts would be covered under T & V extension program with the financial assistance from the World Bank. So it is expected that the negative trend in productivities will be reversed and production in Tarai will rise more due to increase in productivities than an expansion in cropped area. The past trend indicates that increase in production was largely due to expansion in cropped area.

In the past, area and production in maize crop had been declining. The recent introduction of winter maize crop is likely to change this trend. The new winter maize crop varieties are becoming popular among farmers very quickly. So the projected estimates have taken this development into account. Pulses are assumed to follow trends.

#### INDIA

Area: We utilize the projected trend estimate for 2000 of area under all cereals as a group, and the projected trend estimates of area for 2000 in the case of paddy and maize. We assume that there will be no further reduction in the area under other cereals compared to the trend estimate for 1980. The residual area was allotted to wheat (28.97 m/ha). This represents an increase in area under this crop of

6.14 m/ha which would be mostly in Eastern and Central India and also in Western India when the Narmada irrigation scheme becomes operational. With regard to pulses we assume an annual increase of 0.5 percent in the area over the projection period.

Yields per Hectare: We utilize the projected trend estimates for 2000 of yields of paddy and maize, and assume the yield of other cereals would be the same as that of maize. We found that the projected average yield of 3.39 mt/ha for wheat is too high, keeping in view that the yields in new areas to which wheat cultivation would be extended would be low. Hence we assumed an average yield of 2.5 mt/ha. In the case of pulses, we assume an average yield of 0.65 tons which represented a 33 percent increase over the trend estimate for 1980.

Production: Estimates for production were obtained by multiplying for each commodity, the projected area and estimated yield; the commodity-wise production estimates were aggregated to give the total production of cereals and foodgrains. These projections show a near balance between demand and supply of foodgrains in India in 2000. The estimated deficit in pulses is lower than the surplus in cereals.

Appendix B

Table 1. Yield response function, Java and other islands, 1972-81

Dependent Variable = YLD		
<u>Variable</u>	<u>Coefficient</u>	<u>t-Statistic</u>
CONSTANT	1,251.51*	2.29
NIT	8.61*	14.10
AREA	11.16**	1.80
HYV	9.59*	8.64

\* Coefficient significant at .01 level  
 \*\* Coefficient significant 15.08 level or better

Variable Definitions

YLD = average yield, irrigated and rainfed wetland (kg/ha)  
 NIT = nitrogen use (kg/ha)  
 HYV = area harvested to modern varieties as a percentage of total area harvested  
 AREA = irrigated area harvested as a percentage of rainfed and irrigated wetland area harvested

Table 2. Values of variables utilized in yield projections

<u>Variable</u>	<u>Actual 1981</u>		<u>1990 Projected</u>		<u>2000 Projected</u>	
	<u>Java</u>	<u>Other Islands</u>	<u>Java</u>	<u>Other Islands</u>	<u>Java</u>	<u>Other Islands</u>
NIT <sup>a/</sup> (kg/ha)	133	27	189	64	230	132
HYV (%)	80	80	90	90	95	95
AREA3 (%)	95	94	97	95	98	97

a/ See Table 2 for definitions of variables.

Appendix B

Table 3. Projected area, yield and production of rice in Indonesia, 1990

	Area (m. ha)			Yield (mt/ha)			Production (m. mt)		
	1981 <sup>a/</sup>	1990	2000	1981 <sup>a/</sup>	1990	2000	1981 <sup>a/</sup>	1990	2000
<b>Existing Area</b>									
<u>Wetland &amp; Irrigated</u>									
Java	4.78	4.86	5.04	4.20	4.82	5.24	20.90	23.43	26.41
Other Islands	2.94	3.00	3.18	3.41	3.73	4.38	10.04	11.19	13.93
Subtotal	<u>7.72</u>	<u>7.86</u>	<u>8.22</u>	<u>3.90</u>	<u>4.32</u>	<u>4.91</u>	<u>30.13</u>	<u>34.62</u>	<u>40.34</u>
<u>Dryland</u>									
Java	0.27	0.21	0.21	1.72	1.60	1.60	0.46	0.34	0.34
Other Islands	0.94	0.76	0.76	1.42	1.40	1.40	1.33	1.06	1.06
Subtotal	<u>1.21</u>	<u>0.97</u>	<u>0.97</u>	<u>1.48</u>	<u>1.44</u>	<u>1.44</u>	<u>1.78</u>	<u>1.40</u>	<u>1.40</u>
<u>Swampland</u>									
Java	-	-	-	-	-	-	-	-	-
Other Islands	0.45	0.45	0.45	1.90	1.90	2.10	0.86	0.85	0.95
Subtotal	<u>0.45</u>	<u>0.45</u>	<u>0.45</u>	<u>1.90</u>	<u>1.90</u>	<u>2.10</u>	<u>0.86</u>	<u>0.85</u>	<u>0.95</u>
Subtotal Existing	<u>3.38</u>	<u>9.28</u>	<u>9.64</u>	<u>3.50</u>	<u>4.04</u>		<u>32.63</u>	<u>36.88</u>	<u>42.69</u>
<b>New Area</b>									
<u>Irrigated</u>									
Java	-	0.22	0.44	-	3.36	4.72	-	0.85	2.08
Other Islands	-	0.34	0.68	-	2.98	3.94	-	1.01	2.55
Subtotal	-	<u>0.56</u>	<u>1.12</u>	-	<u>3.32</u>	<u>4.24</u>	-	<u>1.86</u>	<u>4.75</u>
<u>Swampland</u>									
Java	-	-	-	-	-	-	-	-	-
Other	-	0.24	0.48	-	1.90	2.10	-	0.46	1.01
Subtotal	-	<u>0.24</u>	<u>0.48</u>	-	<u>1.90</u>	<u>2.10</u>	-	<u>0.46</u>	<u>1.01</u>
Subtotal New	-	<u>0.80</u>	<u>1.60</u>	-	<u>2.53</u>	<u>2.10</u>	-	<u>2.32</u>	<u>5.76</u>
Total Java	5.05	5.29	5.69	4.07					
Total Other Islands	4.33	4.79	5.55	2.83					
Total Indonesia	<u>9.38</u>	<u>10.08</u>	<u>11.24</u>	<u>3.50</u>	<u>3.89</u>	<u>4.31</u>	<u>32.78</u>	<u>39.20</u>	<u>48.45</u>

<sup>a/</sup> Totals may not add because of rounding.

Appendix B

Table 4. Projection of Cereal Grain Production in the Hills and Tarai, Nepal, for Year 2000

	HILLS AND MOUNTAINS			TARAI		
	Area in Thousand Hectares	Yield per Hectare in Metric Tons	Production in Thousand Metric Tons	(000) ha.	Yield Rate M.T./Hectare	Production (000) M.T.
Paddy	260 (0.5)	2.5	650 (1.27)	1,140 (0.46)	2.40	2,736 (1.68)
Wheat (growth rates assumed)	208 (2.0)	1.5	312 (3.08)	434 (3.0)	1.5	651 (3.76)
Maize growth rates	352 (0.40)	1.8	634 (0.98)	160 (0.97)	1.8	288 (1.33)
Barley	20 (0.0)	1.0	20 (0.64)	7 (0.0)	1.0	7 (0.95)
Millet	108 (0.40)	1.15	124 (0.91)	20 (0.26)	1.0	20 (0.5)
Total Cereal	948 (0.73)	1.61	1,740 (1.40)	1,761 (1.02)	2.09*	3,767 (1.95)

\* Values in parentheses are annual growth rates for the period of 1980 to 2000.