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China:
Socialist Economic Development
(In Nine Volumes)
Annex C: Agricultural Development

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CURRENCY EQUIVALENTS

The Chinese currency is called Renminbi (RMB). It is denominated in yuan (Y). Each yuan is subdivided:

1 yuan = 10 jiao = 100 fen

Exchange rates used in this report are as follows:

1977  $1.00 = Y 1.828
1978  $1.00 = Y 1.661
1979  $1.00 = Y 1.541

WEIGHTS AND MEASURES

Chinese statistics are usually in metric units; in addition, mu and jin are often used:

1 mu = 0.1647 acres = 0.0667 hectares (ha)
1 jin = 0.5 kg

FISCAL YEAR

January 1 - December 31

TRANSLITERATION

The Pinyin system is used in this report.
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IBRD 15527R China: Hydrology and Water Conservancy Works
1. INTRODUCTION

1.01 The Chinese agricultural system provides sustenance to nearly one billion people and is the main source of livelihood for some 800 million agricultural workers and their dependents. On either count, the system is by some margin the largest in the world agricultural economy. Historically a leader in agricultural technology, Chinese agriculture is renowned for its intensive use of arable land based on extremely high man/land ratios. Thus, China’s agricultural sector accounts for less than 8% of the world’s arable land but provides enough food for about 22% of the world’s population. Among the developing countries, China accounts for more than 30% of the total farming population, roughly matching the combined totals for India, Indonesia and Brazil.

1.02 This chapter provides a general introduction to Chinese agriculture as a background for the more detailed description and analysis that follow. It comprises a brief account of the historical evolution up to the founding of the People’s Republic in 1949 (Section A), a description of the economic geography and major agricultural regions of China (Section B), and an international perspective on the current status of development and recent trends (Section C).

A. Historical Overview

1.03 Evidence from eastern China indicates the existence of an agriculture based on cereals dating from at least 7000 B.C. and an agriculture based on sustained field cropping from 1000-700 B.C. Thereafter, the gradual extension and development of agriculture were the essential underpinnings of a civilization whose artistic and scientific accomplishments span some three millennia of human history. The first recorded land tax dates from 594 B.C., and large quantities of land were being bought and sold by 400 B.C., by which time substantial works for irrigation, drainage and flood control had already been constructed.

1.04 There was further rapid development of agricultural technology between 800 and 1200 A.D., particularly in southern and eastern China. For lowland rice, sophisticated land preparation and transplanting techniques were introduced, and a considerable variety of improved seeds suited to local climatic and soil conditions was developed. During this period mechanical methods of lifting water, as well as improved gravity flow irrigation and flood control systems, became widely used. Thereafter, the historical records suggest that these technological advances were improved relatively little during the next several centuries. Rather, there was a progressive expansion in the arable area (including extensive cultivation of marginal areas for dryland farming), coupled with some intensification by means of double cropping and irrigation, with change dominated by demographic expansion. This
pattern persisted up to the end of the presocialist era in 1949, although the opening of China to Western influence and commerce brought about some changes, e.g. maize and groundnut cultivation in northern China, improved strains of cotton and tobacco, and market gardening to serve the growing industrial centers of eastern China. Agriculture in other parts of the world benefited from access to Chinese crops and technology, for example, soybeans, tea cultivation methods and sericulture.

1.05 By about 1750, the social structure of agriculture had evolved towards landlord-tenant systems (based on rental and sharecropping) and small-scale owner-cultivators. Within the limits of available technology, the extraordinary skills of the farmer and high standards of crop husbandry continued to sustain remarkably high levels of land productivity. Perhaps from as early as the seventeenth century, rice yields exceeded 2 tons per ha, which is about the current level for developing countries (excluding China). But extreme poverty - associated with a precarious balance of land and population, and with a sizeable group of landless and near landless peasantry - was characteristic of many areas of China. Quite minor aberrations in weather (flood, drought) could upset the food balance at a cost of millions of lives.1 Internal upheavals and international warfare in the twentieth century weakened the limited development of agricultural services and led to the widespread destruction or neglect of vital rural infrastructure. In the early 1930s, under the influence of the Great Depression, agricultural prices fell sharply, which led to distress sales of land and to tenant bankruptcies. Agricultural production recovered and reached new record levels in 1936; thereafter, the outbreak of war with Japan in 1937, followed by renewed civil war in 1947, prevented these levels from being surpassed until the mid-1950s.

B. The Economic Geography of Chinese Agriculture

1.06 Agriculture in a large part of China is severely limited by terrain and rainfall. Most of the country is too mountainous or too dry for crop farming, and considerable areas of some potential are remote from the main population centers and markets. A major determining feature is the huge

1 Writing in 1931, the historian R. H. Tawney described the situation as follows:

"There are districts in which the position of the rural population is that of a man standing permanently up to the neck in water, so that even a ripple is sufficient to drown him. The loss of life caused by the major disasters is less significant than the light which they throw on the conditions prevailing even in normal times over considerable regions." R. H. Tawney, "Land and Labor in China" (London, George Allen and Unwin Ltd., 1932).
mountainous land mass of western China, the Qinghai Xizang plateau, covering 2.2 million sq km at an average height exceeding 4,000 m. Most of the major rivers - the Huang He (Yellow), the Chang Jiang (Yangtze), and the Zhu Jiang (Pearl) - flow east and southeast from these mountains to form the densely settled valleys and flood plains of eastern China. If the country is roughly halved along longitude 103, over 90% of the population and about the same proportion of agricultural output are located in the eastern half.

1.07 Climate and topography together define a variety of agricultural regions, the major factors being soils, rainfall and the length of the growing season. Seven regions have been distinguished, but in a country of the size and diversity of China, several dozen separate zones would be needed to define accurately areas with similar agricultural production systems and potential. A further approximation is the alignment of these regions with provincial boundaries (to simplify interpretation). Map IBRD 15530R shows these regions; regional data are summarized in Table 1.1 (together with notes of some important definitions); main features are discussed in paras. 1.11-1.41 below.

1.08 The climatic variations over such a large and diverse land mass facilitate the cultivation of a wide variety of crops and provide some guarantee that a harvest failure due to weather will not affect more than a relatively small part of the total cropped area. Significant differences in farming systems occur in moving from north to south and from east to west. Starting in the north and moving southwards, the intensity of cultivation increases in four distinct stages: (a) single-crop, spring-grown temperate cereals in the northeast; (b) a winter wheat/summer crop cycle (three crops in two years) in the North China Plain; (c) double cropping with a summer rice crop in the Chang Jiang basin of central China; and (d) double (and occasional triple) cropping in the tropical southern coastal areas. Important changes over the past 30 years include the opening of much new land in the northeast (especially in Heilongjiang); extensive flood control and irrigation (including power irrigation); and the development of improved crop varieties, especially of dwarf and semidwarf fertilizer-responsive varieties of rice and cold-tolerant, quick-maturing wheats. Intensive farming systems are practiced in the North China Plain, the Chang Jiang basin, the upland basin of Sichuan and the southern coastal areas. In the northeast temperate zones, the opening of new land for agriculture (often through establishment of state farms) is accompanied by heavily mechanized farming on relatively large blocks of land. Close to half the arable area is irrigated (45 million ha, nearly triple the

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/1 The Manchurian Plains in the northeast form part of a different river system, with the Liao He flowing south into the Bo Hai and the Songhua Jiang flowing northeast into Soviet Asia after joining the Heilong.

/2 Nine agricultural economic regions have been distinguished by the Ministry of Agriculture.

/3 This includes areas totaling 35-40 million ha, which, because of their well-developed irrigation systems and good flood protection, the Chinese refer to as "high and stable yield" areas.
area in 1949). Moving southwards, grain yields increase sharply, with
extensively double- or triple-cropped land in some eastern and southern areas
producing four to five times as much as areas in the colder, drier northeast
and northwest. The population sustained by crop agriculture is greater in
the more favored areas, which have a much smaller arable area per farm
household.

1.09 China's range livestock (sheep, goats, cattle, camels) are found
largely on 200 million ha of grassland in the north and western border
regions. However, most animal production is accounted for by pigs and
poultry, which are reared in private plots under intensive systems and inte-
grated with crop production. Production is concentrated in regions with
denser populations and easy access to markets. China's pig population of
320 million head in 1979 is the largest in the world by a considerable
margin. Pigs are probably still the major source of cash income for the
peasant, continuing a tradition of great antiquity.

1.10 Agricultural incomes and living standards tend to vary according to
agricultural productivity and market proximity. Probably the most disadvan-
taged areas are the northern uplands, where temperature often limits cropping
to a single season, rainfall is sparse and unreliable, topography restricts
irrigation, and market access is made difficult by poor communications. These
conditions, which are typical of parts of Gansu, Ningxia, Shaanxi, Shanxi and
Henan, give rise to pockets of poverty in northern China roughly coterminous
with the loess plateau. Southern and western upland areas are also generally
poor, though the cropping possibilities are somewhat better; upland cash
crops, forestry and livestock have been developed here and are exploited to
some extent through household enterprise. Low-income areas are also found in
some of the lowlands, for example, the saline areas of the North China Plain
and flood prone areas of Anhui. The most favored areas include the northeast,
with its relatively low population density in relation to land resources, and
central and eastern China, where favorable land and climatic conditions allow
intensive cropping systems and good market access permits substantial rural
industrialization. Income derived from collective activities is generally
two or three times higher in the more favored areas than in the poorer areas;
income derived from household activities (which in the nation as a whole
accounts for about 30% of total peasant income) also tends to be higher in
the more favored zones.

The Northeast Region

1.11 This area, comprising the provinces of Heilongjiang, Jilin and
Liaoning, accounts for 7% of China's rural population (64 million in 1979)
and almost 10% of total gross agricultural output (measured in 1970 constant
prices). An area of late settlement (the first railway was not opened until
the twentieth century) and subsequently with strong development of industry
and urbanization, the population density in the rural areas is comparatively
low. The region still accounts for a substantial proportion of China's
potentially arable areas, including an estimated 8 million ha in Heilongjiang. About 12% of the arable area is irrigated. Agricultural output per head, some 30% above that for China as a whole, is higher than in any of the other six regions.

1.12 The region has the typical continental climate, with severe winters and hot summers. The frost-free period ranges from 140 days in the north to 180 days in the south. Mean annual precipitation varies sharply with location and averages about 600 mm per year. Soil quality is variable, but includes fertile loess soils in the west-central area and ribbons of alluvial soils along major river valleys, including black earths in the former swamp areas.

1.13 Spring wheat is the dominant crop in the north and west, while corn is important where precipitation is adequate (probably in less than 30% of the region). Millet is a transition crop between corn and wheat areas and soybeans are concentrated along the Songhua and Liao rivers. The region is China's major sugar beet area. Some sorghum (gaoliang) is produced, and rice cultivation has been pushing northward with the advent of high-yielding, short-season varieties. Single cropping predominates over most of the region. Grain production in the region, particularly in Heilongjiang, has grown more rapidly than in any other sizeable area in China, largely because of the area's relatively good soils and new land development. Crop yields are erratic, varying with moisture availability. In 1979 gross grain production was some 36 million tons, about 11% of the national total; almost 40% was sold to the state, close to twice the national average.

1.14 The cultivated areas are mainly in the rolling plains and valleys where extensive swamp drainage has taken place. After reclamation, sizeable areas are used as state farms, which average as much as 20,000 ha in Heilongjiang and account for about 15% of the region's total cultivated area. State farm lands are heavily mechanized - typically over 90% is tractor plowed and about 80% machine harvested; in Heilongjiang, average grain output per worker on state farms approaches 9 tons, compared to a per worker output of less than 1 ton nationally. Distributed collective income (DCI) in the communes was Y 114 per capita in 1979 (about $76 at the current exchange rate), the highest regional average in China; per capita income on the state farms was Y 255 in 1979.

The Border Provinces

1.15 This region, comprising Nei Monggol (Inner Mongolia), Ningxia, Gansu, Xinjiang, Xizang (Tibet) and Qinghai, forms a vast border periphery stretching north and west along China's land frontiers. With extensive arid and semi-arid areas and high mountains, population is sparse and agriculture is limited. Thus, although the region includes almost half of China's land area, the rural population (51 million) accounts for only 6% of the total and the region produces only 5% of total gross agricultural output. With important ethnic minority populations, Xinjiang, Xizang, Ningxia and Nei
Monggol are designated autonomous regions; Qinghai and Gansu also include sizeable minority groups. Gross agricultural output per capita was about 90% of the national average in 1979, and grain production (at about 315 kg per capita) was lower than in the other six regions and only some 80% of the national average. The per capita DCI was also below the national average at Y 77, but the aggregate conceals large differences within the region, with averages exceeding Y 100 in the western areas and falling to Y 57 in Gansu (which accounts for about one third of the region's population).

1.16 The climate is characterized by a long, cold winter (year round in the high mountains) and annual rainfall declines to less than 50 mm in the northern and western parts. Agriculture is dominated by semi-nomadic herding of sheep, goats and horses on the extensive rangelands. The region sustains some 95 million sheep and goats (52% of the national herd), including 60 million sheep, mostly reared for wool. Considerable efforts are in progress to develop the rangelands through improved pastures and breeding stock (including beef cattle), plus irrigation for winter sileage. Crop development is mainly limited to summer cropping of irrigated perimeters along the upper reaches of the Huang He and its tributaries, and of oasis-type irrigated areas in Xinjiang and sheltered valleys in Xizang and Qinghai. Much of this development is relatively high cost, but the authorities have given considerable emphasis to these border areas since the early 1950s, and, especially in Xinjiang, population growth has been considerably above the national average. Rainfed crop agriculture is largely limited to the southern part of Gansu and higher rainfall areas of Nei Monggol. Northeastern Nei Monggol is an important forestry area.

North China

1.17 In terms of gross production, population and grain output, this is the most important agricultural region in China. It includes five provinces (Shandong, Shanxi, Shaanxi, Hebei, Henan) and two municipalities (Beijing and Tianjin), has 27% of China's rural population (229 million in 1978), and accounts for a similar percentage of total production. The vast and densely populated North China flood plain, which forms the heartland of the region, is divided into northern and southern sections by the Huang He. To the west, the upland loess plateau of Shaanxi and Shanxi is in many respects a distinct subregion in which soil and climate have permitted an extensive, but risky, rainfed agriculture. The easy erodibility of these loess soils has created serious problems both within these two provinces and downstream on the plain where the Huang He deposits its heavy silt loads. The alluvial plains comprise mainly alkaline soils, often of immense depth and generally of moderate fertility. Along the coast of northern Shandong and in the Huang He delta, poor drainage is a serious problem and much effort is being put into corrective measures to reclaim or upgrade some 6 million ha of soils affected by salinity.

1.18 Annual precipitation is in the range of 600-800 mm (lower in the western plateau areas), but geographical and interyear variations are large.
Winters are severe (January temperatures average about -4°F, lower in the western areas) and summers are hot (July temperatures average 26-28°C).

1.19 Winter wheat is the dominant crop and is grown on about 30% of the total arable area. In the northwest, a typical rotation would be winter wheat planted during late September and harvested in June, followed by grain, sorghum or millet as a drought-resistant summer crop. On the plains, wheat predominates as the winter crop, while the summer crops may be millet and sorghum, corn and soybeans, and cotton, rice and sweet potatoes, depending on precipitation and soil quality. Cotton occupies about 10% of the cropped area in the southern plain and is particularly important along the Huang He. Groundnut is a major crop in Shandong, which is by some margin the most important center for this crop in China. The cropping index is about 140% for the region as a whole but is lower in upland Shanxi (110%).

1.20 The most rapid growth of grain production in the region has taken place along the coast and in the southeast; it has been achieved through improved water control, increased use of fertilizer and reclamation of saline soils. Much of the growth of grain production north of the Huang He has been associated with improved varieties of winter wheat. In the more arid northwestern part of the region, low, erratic rainfall and more limited irrigation prospects set definite limits to future yield and area increases. The region accounts for roughly half of total power irrigation development in China, most of which was developed in the 1960s and 1970s. Although several new irrigation schemes are nearing completion, limited groundwater may pose increasing problems for future development. About one half of the arable area is irrigated.

1.21 The average per capita DCI in the region's communes (¥ 79 in 1979) is slightly below the national average, despite substantially higher incomes in the rural periphery of Beijing, Tianjin and other major urban centers. This relatively low figure reflects the importance of extensive low-income areas, especially in Henan, where the average per capita DCI was only ¥ 63 in 1979, or 73% of the national average.

East China

1.22 This region, comprising the provinces of Anhui, Jiangsu and Zhejiang, and the municipality of Shanghai, is second only to the Northeast Region in terms of per capita income and to North China in aggregate agricultural output and grain production. With a rural population of 138 million in 1979, the region accounted for 20% of agricultural production and 60 million tons of grain. Since the region includes China's largest urban area (Shanghai), important markets also exist for the livestock and poultry, vegetables and fruits produced through small-scale enterprises, as well as for agricultural raw materials and commune-produced light industry components. Close to 30% of the nation's gross output from rural industry originates in this region - in per capita terms more than twice the average for the rest of China.
1.23 The Chang Jiang crosses the central part of the region and, along with its tributaries, provides much of the irrigation that permits intensive land use. The region is divided into three broad plains: the Jianghua Plain to the north of the Chang Jiang in Jiangsu, the Jiangnan Plain south of the river, and the great Chang Jiang delta. The plains are low-lying, with good alluvial or lake laid soils that are generally neutral or slightly acidic. Salinity is a problem in a narrow belt of coastline soils. Much of the arable land of the three plains has been used for rice cultivation for over 1,000 years.

1.24 Proximity to the East China Sea and the lack of topographic obstructions create a modified marine climate. Temperature extremes are avoided and the growing season is from 230 to 250 days. Precipitation along the Chang Jiang is about 1,000 mm, but declines towards the north; it is well distributed throughout the year, with abundant rainfall during the summer. The cropping index for the region as a whole exceeds 200%, and Zhejiang, with an index of 247%, has the highest cropping intensity of any province in China.

1.25 Rice is the dominant crop, but cotton, wheat, corn, sorghum and vegetables are also important. Most of the area is double cropped (wheat/rice) and in some locations a three-crop-in-two-year system is used. Production of three crops per year occurs in some locations but is declining in importance. The lower Chang Jiang Plain is one of China's most important cotton producing areas. Crop yields in the region significantly exceed national averages. Some 69% of the area was irrigated in 1979, the highest percentage for any region.

1.26 Grain production appears to have grown at about 3% p.a., with the slowest growth in Anhui, where moisture limitations and flooding are a severe handicap to increased production. Completion of the Jiangsu Water Control Project in 1977 and two large fertilizer plants (Nanjing and Anqing), together with planned renovation/enlargement of the Grand Canal, should provide the means for steady future increases in grain production in the region as a whole. Relatively high incomes in the region as a whole mask considerable differences between the highly developed lower Chang Jiang areas, centered around Shanghai, and the northern part of Jiangsu and Anhui, which are essentially part of the North China Plain in terms of settlement patterns, crops and income.

The South Central Region

1.27 This region, comprising the provinces of Hubei, Hunan and Jiangxi, is noted for grain production and freshwater fisheries, based on the extensive lakes that characterize the low-lying middle reaches of the Chang Jiang basin. The rural population of 119 million (16% of the national total) produced some

/1 Chinese data of cropped area include short maturation forage and green manure crops.
15% of gross agricultural output in 1979; total grain output was some 54 million tons - in per capita terms second only to the Northeast Region in production.

1.28 The region's topography is composed of plains broken by relatively low-lying hills. The Chang Jiang traverses the northern part and several smaller tributaries originate in the mountains to the south. The river systems include a number of rich alluvial plains and deltas, and regional soils vary widely depending on parent material, elevation and precipitation. Drainage is a serious problem in the lake areas, particularly in southern Hubei.

1.29 Precipitation in the region is variable, ranging from 700 to 1,500 mm per year and declining from southeast to northwest. The growing season ranges from 240 to 320 days. Summers are warm and humid (July average of 28°C) while winters are dry and comparatively mild (January average of 7°C). With favorable soils and moisture conditions, land is intensively cultivated; the region's cropping index of 225% is the highest regional average in China.

1.30 Rice is the most important crop of the region and is generally double cropped with wheat. Single-crop wheat is grown in some of the nonirrigated highlands of Hubei and cotton is grown in the drier parts of the province; occasionally the cotton is interplanted between rows of an early spring crop to allow triple cropping. Tea is an important upland crop in the southerly areas. Intensive aquaculture is practiced in the lakes and ponds.

1.31 Grain production appears to have grown by about 2.9% in recent years - a relatively high growth rate, which reflects a strong upward trend in Hubei. Grain production appears to be less variable than in any other region. With a large chemical fertilizer plant on-stream in northwest Hubei, and extensive irrigation projects under way along the Han river, grain production over the next several years should grow nearly as rapidly as in the recent past. There are also good prospects for diversified cropping (including fast growing timber species, orchard crops and further tea development) and animal husbandry (cattle) in the upland areas that are not suited to rice cultivation. The region enjoys a comparatively high income level: the DCI per capita was Y 96 in 1979.

South China

1.32 This region, comprising the provinces of Guangdong and Fujian and the autonomous region of Guangxi, lies mainly in the humid subtropics. It accounts for a little over 12% of China's rural population (105 million) and 10.6% of total agricultural output. The topography is mostly upland, with mountains, steep hills and dissected plateaus comprising over 80% of the land area. Agriculture is concentrated in the numerous river valleys and small flood plains, of which the largest, comprising about one million ha, is formed by the Zhu Jiang delta.
1.33 The climate is dominated by a well-developed monsoon. The growing season lasts nearly year round, with several stations reporting 350 frost-free days per annum. Precipitation ranges from 1,500 to over 2,000 mm, depending largely on topography, and is heavily concentrated during the April-September period. Typhoons are a problem at certain times of the year.

1.34 The most important soils from an agricultural viewpoint are the alluvial deposits along the river basins. These are of good texture and structure, and, with irrigation, are intensively used for rice and vegetables. Away from the rivers, the quality of soils deteriorates; many have been leached and eroded, and they contain little organic matter.

1.35 Rice is the dominant crop, occupying 60-65% of the cultivated area, but other important crops include sweet potatoes and corn. Most of the rice is double cropped over most of the plains area, sometimes with sweet potatoes, rapeseed or wheat grown during the dry season. The region is also the center for China's production of tropical crops, including sugarcane, pineapple, rubber and cocoa. The cropping index exceeds 200%, with some triple cropping in western Guangdong and on Hainan island. The annual rate of growth in grain production appears to have been 2.0-2.5%, with all of this increase coming from increased yields. In view of the limited areas with good soils, rough topography and the already intensive use of land, it may prove difficult to maintain recent growth rates in grain production, although the prospects for further growth of cash crops such as sugar and rubber appear to be good.

1.36 The average DCI per capita, at Y 80 in 1979, was slightly below the national average, but income from private agriculture may be relatively high in this region. There is considerable disparity between the prosperous lowland areas and the uplands, where poverty is extensive.

The Southwest Region

1.37 This region, comprising the provinces of Sichuan, Yunnan and Guizhou, is mostly mountainous uplands, with the significant exception of the large inland basin of the upper Chang Jiang, the so-called Red Basin of Sichuan, which comprises about 5 million ha of croplands. In 1979, the region included close to 17% of the nation's rural population (141 million) but produced only 12.6% of total gross agricultural output. With limited arable land and irrigation potential (cf. Table 1.1), its sown area per capita is the lowest regional figure. The region's DCI per capita, at Y 65 in 1979, was the lowest regional average; Guizhou, with a per capita income of only Y 46, was the poorest province in China.

1.38 The region's climate varies widely, reflecting the considerable differences in topography and elevation. In the mountainous areas, precipitation varies from 700 mm in the north to over 1,500 mm in the southerly exposures; at lower elevations the climate is subtropical, with rainfall concentrated in the summer months. Northwest Sichuan forms part of the Xizang massif where much colder temperatures and dry conditions prevail.
The Red Basin itself enjoys a remarkably mild climate and favorable rainfall (1,000-1,200 mm) because mountains to the north prevent the intrusion of cold, dry air from Mongolia, while the Yunnan plateau to the south is not high enough to impede the flow of the summer's tropical monsoonal air masses. The growing season in the Red Basin lasts from 260 to 340 days, slightly longer than in Yunnan and Guizhou.

1.39 Crop agriculture is dominated by the Red Basin, whose favorable climate, excellent soils and extensive irrigation combine to produce some of the most productive and intensively farmed land in China. Many crops are grown, with winter crops including wheat, rapeseed and barley, while summer crops are dominated by rice but include significant quantities of corn, cotton and sweet potatoes. Rice yields approach 6 tons per cropped ha in some parts, which is about equal to rates achieved in the most favorable growing areas of East and South China. Elsewhere in the region, the better alluvial soils are found in narrow strips along the stream beds, while upland soils are generally heavily leached and acidic. Crops are similar to those of the Red Basin, with rice as the dominant summer crop. The cropping index in the Red Basin area exceeds 200%, but in the region as a whole it is well below the rate achieved in other southern areas of China. Sichuan and Yunnan are noted for a well-developed pig industry. Stock numbers exceeded 64 million head at end 1979 (some 20% of the national herd), an average of 2.6 pigs per commune household.

1.40 Grain production in the region was some 46 million tons in 1979, an average of 327 kg per capita, which is significantly below the national average of 393 kg per head of rural population. Due to a reduction in cultivated hectarage in the Red Basin area and limited prospects for improved yields elsewhere, grain production has grown rather slowly over the past several years (though more rapidly under the 1977-79 period of reform, which has had a big impact in Sichuan). With further irrigation development in the Red Basin area, plus much improved fertilizer availability in recent years due to the opening of two large urea plants, future growth prospects are more favorable, especially if the conversion of prime farmland to industrial and residential uses can be checked.

1.41 Income differences are marked in the highly diversified conditions found in the region. Thus in the favored Red Basin areas, the per capita DCI approaches Y 90, to which must be added private income of Y 50-60. In the extensive uplands and mountains, the DCI is probably under Y 50 for many production teams.

C. An International Perspective of Chinese Agriculture

1.42 China's important contributions to the world agricultural economy are indicated by its large share in the production of several major commodities. China produces more than 10% of the world's annual output of rice, wheat, corn, sorghum, soybean, cotton, groundnuts, rapeseed, and tea, and
accounts for more than 25% of the world's tuber crops. With some 17% of world grain production in recent years, China's annual grain output of 269 million tons (average for 1977-79) is only fractionally below that of the USA (with an average production 279 million tons).\[1\] China is the world leader in rice production by a considerable margin with more than three times the annual output of India, the world's second largest producer. Among the developing countries, China is the most, or second most, important producer for many of the major annual crops. Tables 1.2 and 1.3 show details for some major crops in a comparative framework.

1.43 China's extensive rangelands support a large population of ruminant livestock, including the world's largest goat population (some 70 million stock), plus a sheep population (100 million) second only to Australia's. But the main emphasis is given to pigs, and with stock numbers exceeding 300 million head in recent years, China accounts for some 40% of the world pig population.

1.44 Table 1.2 indicates that crop yields in China in recent years are typically 30-70% above average world levels, considerably exceed the levels found in the developing countries (with soybean the only exception), but are generally some 30-50% below the levels found in the developed countries. Chinese crop yields generally compare favorably with those of other large producers; most exceptions, as Table 1.4 shows, are with reference to the USA and a few other developed countries.

1.45 With regard to cereals as a whole, only yields in the USA (with its massive corn crop comprising some two thirds of the country's grain production) and France significantly exceed the average 2.65 tons/ha yield now obtained in China. In certain respects, for example farm size and labor intensity, cereal agriculture in Western Europe is a better comparator than the USA; however, the considerable subsidies afforded to European crop agriculture permit high technical standards and crop inputs - a factor also true of rice cultivation in Japan.

Recent Trends in Agricultural Growth

1.46 Table 1.2, together with Table 1.3, also shows the growth of production for a variety of products. Estimates of trend growth in China are susceptible to considerable variation, depending on the choice of base years for the calculation. In particular, after 1958 a sharp decline in crop output occurred (for reasons discussed in Chapter 3), with recovery only by 1964. Thus growth from the 1950s to the late 1970s is considerably slower than growth from the 1960s. Two sets of estimates are shown in the tables, based on 1957 and 1970 data; detailed information for years prior to 1976 is only available for 1952, 1957, 1965 and 1970. For cereals, aggregate production in China has grown at about the same rate as elsewhere, clearly a

\[1\] These data are based on true grains; Chinese crop statistics often include tubers at grain equivalent weight and soybeans.
Table 1.2: PRODUCTION, YIELDS AND TREND GROWTH: SELECTED CROPS

<table>
<thead>
<tr>
<th></th>
<th>1977-79 Averages</th>
<th>Trend growth</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Production</td>
<td>Yields</td>
<td>Yield</td>
<td>Yield</td>
</tr>
<tr>
<td></td>
<td>million tons</td>
<td>tons/ha</td>
<td>% p.a.</td>
<td>-------</td>
</tr>
<tr>
<td>All Cereals /a</td>
<td></td>
<td></td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>China</td>
<td>269.1</td>
<td>2.65</td>
<td>2.4 (3.5)</td>
<td>2.8 (3.0)</td>
</tr>
<tr>
<td>Other countries</td>
<td>1,270</td>
<td>2.03</td>
<td>3.0</td>
<td>2.3</td>
</tr>
<tr>
<td>- Developed</td>
<td>807</td>
<td>2.62</td>
<td>3.0</td>
<td>2.7</td>
</tr>
<tr>
<td>- Developing</td>
<td>463</td>
<td>1.46</td>
<td>2.8</td>
<td>1.9</td>
</tr>
<tr>
<td>Rice (Paddy)</td>
<td></td>
<td></td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>China</td>
<td>136.4</td>
<td>3.95</td>
<td>2.2 (2.7)</td>
<td>1.8 (1.9)</td>
</tr>
<tr>
<td>Other countries</td>
<td>242</td>
<td>2.25</td>
<td>2.5</td>
<td>1.5</td>
</tr>
<tr>
<td>- Developed</td>
<td>27</td>
<td>5.94</td>
<td>1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>- Developing</td>
<td>215</td>
<td>2.10</td>
<td>2.5</td>
<td>1.7</td>
</tr>
<tr>
<td>Wheat</td>
<td></td>
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<td>---------</td>
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</tr>
<tr>
<td>China</td>
<td>52.5</td>
<td>1.82</td>
<td>3.9 (7.6)</td>
<td>3.6 (5.9)</td>
</tr>
<tr>
<td>Other countries</td>
<td>370</td>
<td>1.85</td>
<td>3.2</td>
<td>2.7</td>
</tr>
<tr>
<td>- Developed</td>
<td>279</td>
<td>2.08</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>- Developing</td>
<td>91</td>
<td>1.39</td>
<td>4.1</td>
<td>2.4</td>
</tr>
<tr>
<td>Corn</td>
<td></td>
<td></td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>China</td>
<td>55.1</td>
<td>2.76</td>
<td>4.6 (6.6)</td>
<td>3.1 (3.5)</td>
</tr>
<tr>
<td>Other countries</td>
<td>335</td>
<td>3.12</td>
<td>3.7</td>
<td>2.5</td>
</tr>
<tr>
<td>- Developed</td>
<td>255</td>
<td>5.09</td>
<td>4.0</td>
<td>3.2</td>
</tr>
<tr>
<td>- Developing</td>
<td>80</td>
<td>1.39</td>
<td>2.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Sorghum</td>
<td></td>
<td></td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>China</td>
<td>7.8</td>
<td>2.26</td>
<td>0.1 (-1.5)</td>
<td>3.3 (3.7)</td>
</tr>
<tr>
<td>Other countries</td>
<td>57</td>
<td>1.33</td>
<td>3.2</td>
<td>2.5</td>
</tr>
<tr>
<td>- Developed</td>
<td>22</td>
<td>3.37</td>
<td>2.7</td>
<td>1.5</td>
</tr>
<tr>
<td>- Developing</td>
<td>35</td>
<td>0.95</td>
<td>3.6</td>
<td>2.8</td>
</tr>
<tr>
<td>Soybean</td>
<td></td>
<td></td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>China</td>
<td>7.4</td>
<td>1.05</td>
<td>-1.5 (-2.1)</td>
<td>1.4 (-0.5)</td>
</tr>
<tr>
<td>Other countries</td>
<td>72</td>
<td>1.85</td>
<td>8.2</td>
<td>1.7</td>
</tr>
<tr>
<td>- Developed</td>
<td>55</td>
<td>2.02</td>
<td>6.9</td>
<td>1.8</td>
</tr>
<tr>
<td>- Developing</td>
<td>16</td>
<td>1.42</td>
<td>18.0/a</td>
<td>4.3</td>
</tr>
<tr>
<td>Cotton (Lint)</td>
<td></td>
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<td>-------</td>
</tr>
<tr>
<td>China</td>
<td>2.14</td>
<td>0.45</td>
<td>1.3 (-0.7)</td>
<td>2.2 (-0.2)</td>
</tr>
<tr>
<td>Other countries</td>
<td>11.5</td>
<td>0.41</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>- Developed</td>
<td>6.0</td>
<td>0.68</td>
<td>0.9</td>
<td>1.1</td>
</tr>
<tr>
<td>- Developing</td>
<td>5.6</td>
<td>0.28</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Groundnuts</td>
<td></td>
<td></td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>China</td>
<td>2.39</td>
<td>1.29</td>
<td>-0.3 (1.3)</td>
<td>1.2 (0.3)</td>
</tr>
<tr>
<td>Other countries</td>
<td>15.9</td>
<td>0.96</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>- Developed</td>
<td>2.2</td>
<td>2.42</td>
<td>3.4</td>
<td>3.9</td>
</tr>
<tr>
<td>- Developing</td>
<td>13.8</td>
<td>0.88</td>
<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Rapeseed</td>
<td></td>
<td></td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>China</td>
<td>1.81</td>
<td>0.71</td>
<td>3.5 (8.3)</td>
<td>3.0 (0.9)</td>
</tr>
<tr>
<td>Other countries</td>
<td>8.0</td>
<td>0.98</td>
<td>6.1</td>
<td>2.8</td>
</tr>
<tr>
<td>- Developed</td>
<td>5.7</td>
<td>1.48</td>
<td>9.0</td>
<td>0.4</td>
</tr>
<tr>
<td>- Developing</td>
<td>2.2</td>
<td>0.53</td>
<td>1.9</td>
<td>1.3</td>
</tr>
</tbody>
</table>

/a FAO definition, excluding soybeans and tubers.
/b Mainly Brazil and Argentina.

Sources: Official estimates for China; FAO estimates for other countries taken from FAO Production Yearbooks of 1979 and earlier years.

Note: For countries other than China, the trend comparison is between an average of 1977-79 and 1961-65 data. For China, the comparison is between data for 1977-79 and data for 1957, with the data in brackets showing a more recent trend, based on 1970 data.
### Table 1.3: OTHER OUTPUT INDICATORS

<table>
<thead>
<tr>
<th></th>
<th>1977-79 Average</th>
<th>Trend growth of production/livestock numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tea (‘000 tons)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>265.8</td>
<td>4.2 (8.7)</td>
</tr>
<tr>
<td>Other countries</td>
<td>1,498</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Sugarcane (million tons)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>20.1</td>
<td>3.2 (5.1)</td>
</tr>
<tr>
<td>Other countries</td>
<td>715</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Raw Silk (‘000 tons)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>23.8</td>
<td>6.1 (8.8)</td>
</tr>
<tr>
<td>Other countries</td>
<td>32.3</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Tuber Crops (million tons)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>149.8</td>
<td>2.7 (1.5)</td>
</tr>
<tr>
<td>Other countries</td>
<td>428</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Pigs (million head)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>304</td>
<td>3.6 (5.0)</td>
</tr>
<tr>
<td>Other countries</td>
<td>440</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Sheep (million head)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>98</td>
<td>3.0 (n.a.)</td>
</tr>
<tr>
<td>Other countries</td>
<td>973</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Goats (million head)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>74</td>
<td>2.4 (n.a.)</td>
</tr>
<tr>
<td>Other countries</td>
<td>563</td>
<td>3.7</td>
</tr>
<tr>
<td><strong>Cattle (million head)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>53</td>
<td>0.3 (n.a.)</td>
</tr>
<tr>
<td>Other countries</td>
<td>1,148</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Buffalo (million head)</strong></td>
<td></td>
<td></td>
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<tr>
<td>China</td>
<td>18</td>
<td>1.5 (n.a.)</td>
</tr>
<tr>
<td>Other countries</td>
<td>101</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Note: Sources and methods as for Table 1.2.
Table 1.4: SELECTED CROP YIELD COMPARISONS: CHINA AND HIGH-YIELD, LARGE-SCALE PRODUCERS
(1977-79 averages, tons/ha)

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>USA</th>
<th>Japan</th>
<th>Canada</th>
<th>France</th>
<th>USSR</th>
<th>Brazil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>3.95</td>
<td>6.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>1.82</td>
<td>2.16</td>
<td>4.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>2.76</td>
<td>6.29</td>
<td>5.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td>2.26</td>
<td>3.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soybean</td>
<td>1.05</td>
<td>2.07</td>
<td></td>
<td></td>
<td></td>
<td>1.45</td>
<td></td>
</tr>
<tr>
<td>Cotton (lint)</td>
<td>0.45</td>
<td>0.55</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundnuts</td>
<td>1.29</td>
<td>2.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapeseed</td>
<td>0.71</td>
<td></td>
<td>1.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: As for Table 1.2.

result of declining cropped area, since yields have risen faster. Fast growth in yields reflects in part the predominance in China of rice, wheat and corn, which together have accounted for over 90% of total cereal production in recent years. All three crops have benefited from the development of new fertilizer-responsive plant varieties, and the growth of wheat and corn yields in China, as in the world as a whole, has been particularly rapid. The comparison of production and yield increases also shows a growth in hectarage for these crops, especially for corn, in China accounting for about one third of the production increase (the corn area has increased by some 5 million ha since 1965).

1.47 A major difference between the experience of China and that of many other developing countries relates to the availability of new arable land, either from land development or increased multiple cropping (the latter usually due to irrigation). In China, probably since 1965, the reported cropped hectarage has been roughly constant following a substantial decline between 1957 and 1965. The main explanation is probably that new land available through irrigation or land development in the border areas was offset by losses to increased residential and industrial uses in the more highly developed zones, the latter frequently being double cropped land. In contrast, among the other developing countries (considered as a group) additional hectarage or an increase in the cropping intensity continues to make a significant (albeit declining) contribution to production growth, accounting for one third of the total increase in the case of cereals, for example.

/1 The sharp decline from 1957 to 1965 may also reflect some other factors that are discussed in Chapter 3.
1.48 Faced with an increasing food requirement (largely reflecting rapid growth of population), China has allocated land to permit a continuing strong growth of the major cereals. However, for other cereals such as millet and sorghum, and for other competing field crops, especially soybean, the cropped hectarage has declined considerably (for these three crops alone, by more than 13 million ha since 1957). In consequence, production growth of these secondary crops is generally below that experienced elsewhere, either in the developed or developing countries (and was actually negative for soybean). Competition with cereals for scarce arable land is also a partial explanation for China's comparatively weak performance in certain other field crops, notably cotton and groundnuts.

1.49 Crops that do not usually compete with foodgrains in land use, including tea, mulberry (for silk production) and tuberous rootcrops, show a strong growth performance in China relative to the rest of the world (in these instances, mainly comprising other developing countries). This is also generally true of livestock, especially of pigs. Meat production in China (dominated by pork) has increased rapidly in recent years, with higher feed-grain allocations and improved producer incentives. Thus meat production increased by about 16% p.a. in 1977-80, versus 3.4% p.a. in 1957-77.

The Resource Base for Agricultural Development

1.50 Intense and increasing pressure on a narrow arable land base is a major element in the interpretation of China's agricultural experience since 1949. Indeed, despite the country's vast area of about 9.6 million sq km, only about 10% (99.5 million ha) is arable land available for sustained cropping. Thus China has one of the world's highest man/arable land ratios, at roughly 10 persons per ha in terms of total population and about 8 persons per ha in terms of agricultural population. The ratio of agricultural population to arable land in India is less than half as high as in China; and in the USA in some respects the most similar large country in terms of climate patterns and variations - the equivalent ratio is 300 times less than in China.

1.51 Of necessity therefore, China's arable land is intensively farmed, typically with very high inputs of labor (and correspondingly high standards of crop husbandry), extensive use of chemical and organic fertilizers, and considerable development of irrigation and drainage to regulate water supply and extend multiple cropping possibilities. About 45% of China's arable land is irrigated (more than double the proportion for other developing countries taken together), i.e. roughly one quarter of the world's total

/1 Cattle are mainly raised for draft power in China rather than for meat, and the near stagnation of the cattle population reflects the substitution of mechanical power (tractors) over considerable areas of northern China. Buffalos have maintained their importance in the south, where conditions are much less suitable for mechanized field operations.
irrigated land. China's application of chemical fertilizer per arable ha now exceeds 125 kg, more than three times the average for other developing countries and approaching the average of developed countries; adding the vast annual applications of organic materials and manures would raise China's average to levels found almost nowhere else in the world. /1

1.52 Intensive land use, associated with organic manuring, irrigation and high labor availability, is of long standing in China. Nevertheless, much development is of recent origin (i.e., initiated during the period of the People's Republic) and reflects the substantial efforts made to promote agricultural growth. Only fragmentary and approximate indicators are available to illustrate these efforts in a comparative framework. Data relating to chemical fertilizer, irrigation and mechanization are shown in Table 1.5. They indicate a generally faster rate of increase in China than in other developing countries, especially for mechanization (where in all probability the data underestimate the differences because pedestrian tractors, of major importance in China, are excluded from the data base). For chemical fertilizer, the recent increase has been especially rapid, with application rates doubling from about 64 kg/ha in 1977 to 128 kg/ha in 1980.

Food Supplies and Population Growth

1.53 Food balance sheets and food consumption (measured by calories and protein intake) are not yet available for China. However, rough estimates of per capita food availability for some of the major items can be made, including foodgrains, vegetable oils, fruits, meat and fish products. The data for 1979 indicate a per capita gross calorie availability of about 2,400 and protein intake of about 60 gm, with about 92% of energy supplies coming from vegetable products. /2 Food availability has improved sharply, by about 15%, in the past two to three years; there was little improvement between 1957 and 1977. Corresponding data suggest that the average per capita food intake in China is generally comparable to, or above, that found in other low-income countries.

1.54 Two significant features characterize the food situation in China. First, a system of food security - based on nationwide state procurement, food rationing in the urban areas, and a well-developed crop production reporting system - assures that at least basic requirements are met in all localities and a measure of equity is maintained in local sharing arrangements. Second, this system has worked with only very modest additions to domestically

/1 In terms of cropped area, however, China's chemical fertilizer application rate would be reduced considerably in relation to that of the developing countries, as China's double- or triple-cropped area is relatively large (the aggregate cropping index is about 150%). This does not affect the growth rate comparison though, as the cropped area in China has been about constant (para. 1.47).

produced food supplies; net imports have probably never exceeded 5% of domestic production. In effect, surpluses are built up in favorable years, then used to maintain basic supplies during poor years. This is feasible both because of generally well-maintained and carefully controlled storage systems (though facilities are perhaps now becoming inadequate), and because the development of flood protection and irrigation facilities limits crop damage, even with exceptionally poor weather, to relatively small amounts, measured against nationwide production.

Table 1.5: COMPARATIVE INDICATORS OF RESOURCE INPUTS IN AGRICULTURE

<table>
<thead>
<tr>
<th></th>
<th>1978 levels</th>
<th>Recent trend increase % p.a.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical fertilizer (nutrient basis), kg per arable ha:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>90</td>
<td>(11)</td>
</tr>
<tr>
<td>Total other countries</td>
<td>70</td>
<td>6</td>
</tr>
<tr>
<td>- Developed</td>
<td>110</td>
<td>5</td>
</tr>
<tr>
<td>- Developing</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>Tractor mechanization, arable ha per tractor:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>180</td>
<td>(15)</td>
</tr>
<tr>
<td>Total other countries</td>
<td>65</td>
<td>3</td>
</tr>
<tr>
<td>- Developed</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>- Developing</td>
<td>270</td>
<td>7</td>
</tr>
<tr>
<td>Irrigated land, share in total arable land:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>45%</td>
<td>(3)</td>
</tr>
<tr>
<td>Total other countries</td>
<td>12%</td>
<td>2</td>
</tr>
<tr>
<td>- Developed</td>
<td>8%</td>
<td>2</td>
</tr>
<tr>
<td>- Developing</td>
<td>17%</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: For countries other than China, the trend increase is from an average of data for 1961-65 to 1978. For China the trend increase is based on estimates of 1965 data compared with 1978 data.

Sources: China, rough estimates based on data supplied to the mission; other countries, FAO data.
2. BASIC POLICIES AND THE INSTITUTIONAL FRAMEWORK

2.01 When the People's Republic was founded in 1949, the agricultural economy was suffering from severe dislocations associated with decades of warfare and civil disturbance. Destruction and deterioration of economic infrastructure were widespread; the institutional framework for production, marketing and technical services was in disarray. During the 1950s, despite limited capital and technical resources, major reconstruction and massive changes in the institutional framework were accomplished, which effected a radical transformation of the economic and social environment in both rural and urban areas. By the early 1960s, the Government had achieved its basic goal of establishing a society and economy functioning according to socialist principles, as well as an institutional framework that was maintained thereafter, with comparatively minor changes.

2.02 This chapter describes the major policies and institutions affecting agricultural development and summarizes their evolution since 1949. First the agrarian reforms of the 1950s and early 1960s are described, then the three-level commune system (Section B) and the state farm sector (Section C). Socialist marketing institutions and price policies are dealt with in Section D, which also includes a discussion of the rapidly expanding credit system. An outline of the complex and multi-layer structure of administration and functional responsibilities relating to agriculture is contained in Section E, together with a discussion of agricultural planning. The final section of the chapter deals with technical supporting services to agriculture, including research, extension and agricultural education.

A. Agrarian Reform

Land Reform

2.03 The first phase of agrarian reform, which focused mainly on the redistribution of agricultural land and political power, was completed by early 1953. The data in Table 2.1 provide a rough indication of the impact of the reform; both the pre- and post-reform data are based on sample surveys, almost certainly using different sampling procedures.\(^1\) Moreover, the

\(^1\) The 1930s data are based on the studies by J. L. Buck, "Land Utilization in China" (Nanking University, 1937). Post-reform data are derived from surveys carried out by the Central Statistical Bureau in 1954, as reported in Peter Schran, The Development of Chinese Agriculture, University of Illinois Press, 1969.
post-reform data include the formerly landless among the poor peasant beneficiary class, while the 1930s data exclude families that were landless at that time. Thus the average size of holding was reported at 4 acres for the 1930s, of which 2.85 acres were cultivated, and at 2.44 acres of cultivated land after land reform. The 15% difference in the cultivated area may be due to the population increase over 20 years, to sample error and bias, and to the inclusion of the landless in the later data.

Table 2.1: IMPACT OF LAND REFORM

<table>
<thead>
<tr>
<th></th>
<th>Distribution of households</th>
<th>Average extent of land (acres)</th>
<th>Distribution of households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-land reform</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>data of 1929-33</td>
<td>58.7</td>
<td>1.2</td>
<td>57.1</td>
</tr>
<tr>
<td>Small farmers</td>
<td>29.8</td>
<td>3.2</td>
<td>35.8</td>
</tr>
<tr>
<td>Medium farmers</td>
<td>7.7</td>
<td>6.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Landlords</td>
<td>3.6</td>
<td>30.0/b</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Landlords</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Others</td>
</tr>
<tr>
<td>Post-land reform</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>data of 1954</td>
<td>1.2</td>
<td>3.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Small farmers</td>
<td>57.1</td>
<td>Poor Peasants</td>
<td></td>
</tr>
<tr>
<td>Medium farmers</td>
<td>35.8</td>
<td>Middle Peasants</td>
<td></td>
</tr>
<tr>
<td>Large farmers</td>
<td>3.6</td>
<td>Rich Peasants</td>
<td></td>
</tr>
<tr>
<td>Landlords</td>
<td>2.6</td>
<td>Landlords</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.9</td>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>

/a Pre-reform data calculated in ownership equivalent units, on the assumption that rented cultivated land returned 50% to the landlord and 50% to the tenant. Pre-reform, each farm category rented land equivalent to 30-33% of owned land. After reform, renting on the part of poor and middle peasants was of marginal importance (less than 3%).

/b Owned land.

2.04 Taking the population increase into account, the situation of the poor and middle peasants in the immediate pre-reform period was almost surely worse than suggested by the 1930s data, so that the impact of the land reform was probably greater than the data in Table 2.1 indicate. In an economic sense, it seems clear that the reform's major effects - positive and negative - were largely felt at the top and the bottom of the pre-reform income classes, that is among the 5-10% of the population at the upper income levels and among the lowest 60%, who had most to gain (and who indeed gained most). In a social or political sense, the wealth and power base of the landlord/rich peasant class were totally destroyed by the reform, and with them the old leadership class in rural society. The class labels "landlord" and "rich peasant" as they were then applied have continued
to exert considerable influence in rural society; very few members of these classes, or their children, have subsequently taken up leadership roles in the rural society of modern China.

2.05 How this leadership was replaced is one of the most striking aspects of China's agrarian reform. A basic factor was the deliberate and very considerable efforts that were made to promote leadership from within the ranks of the poor peasantry, both before and during land reform. Operating under centrally provided guidelines, and with the help of special land reform teams brought in from the outside, the peasantry was organized into village committees and assemblies to carry through the reform. With the help of the cadres, the village itself carried out a census of landholdings and ownership, interpreted and imposed class labels, and expropriated and reallocated the assets of previous owners. Through this process, which often took six to nine months to complete, new peasant leaders could test and prove their abilities along various fronts: the capacity to organize and energize a community and to command the necessary respect among a peer group; the energy and judgment to persist in implementing a difficult program; and the intellectual capacity to grasp essential principles (such leaders were often illiterate). This also required a commitment to take up the considerable burdens of rural leadership without recompense and while maintaining a livelihood as a full-time farmer. The generation of new leadership created in part by the land reform movement has served China well during these first decades of development and social change. And a local leadership cadre that is drawn from the peasant class—but not drawn away from it—is an advantage that relatively few countries enjoy.

Agricultural Cooperatives

2.06 The land reform effected a major transfer of assets and income from the rich to the poor and, together with peace and stability, contributed to recovery and rapid growth of agricultural production in the early 1950s. But the initial land reform made little impression on what was probably a substantial cause of inefficiency, namely the fragmentation of cultivation across numerous tiny parcels of land—the result of centuries of inheritance, subdivision, and purchase and sale of small lots. Moreover, the assets to be redistributed included important quantities of tools, equipment and draft animals, whose efficient use was problematic at the level of the 2-3 acre holding of the newly enfranchised poor peasant. The land reform campaign was therefore quickly followed by vigorous attempts to promote agricultural cooperatives. Initially, these efforts focused on creating mutual aid teams, a concept that drew in part on a long-standing

/1 Here and in subsequent discussion of policy, the text mostly confines itself to economic considerations. In fact, politics and ideology were also major factors. For example, many leading Party members supported and promoted cooperative development from fear of a re-emergence of a rural propertied class (if private ownership of land were retained), rather than for economic reasons.
tradition among kinfolk in China (some village communities were made up almost entirely of blood relatives) and on experience gained in the first communist enclaves established in Jiangxi in the early 1930s, and later in Shaanxi.

2.07 Cooperation in the mutual aid team (generally made up of 5-15 households) varied from a simple exchange of labor to the common use of tools and draft animals, with rental payments to their owner-participants. In the more progressive areas, mutual aid teams evolved rapidly into formal Agricultural Producer Cooperatives (APCs), whose participants pooled their land resources and were paid according to work inputs and to land and tools contributed. By the mid-1950s, a very few cooperatives had reached the so-called Advanced Agricultural Producer Cooperative stage, under which land (together with major tools and draft animals) was pooled and became the property of the collective. The former owners were compensated by installment payments over three to five years. In advanced cooperatives, earnings were based exclusively on labor input under a workday system (with distributions made on the basis of an annual accounting) after deduction of input costs, taxes, reserve funds, etc. Individual households generally retained the use of or were allocated — a small private plot for vegetables and sideline activities, and they retained their small livestock, including pigs and poultry.

2.08 Progress in cooperative development is shown in Table 2.2. After a buildup of both the mutual aid teams and primary cooperatives before 1954, a considerable acceleration in the formation of the latter took place in 1955. This was followed by a radical transformation to advanced cooperative status in 1956, by which time virtually the entire agricultural sector was organized along socialist lines.

Table 2.2: DEVELOPMENT OF AGRICULTURAL COOPERATIVES, 1950-56

<table>
<thead>
<tr>
<th>Year</th>
<th>Total number of agricultural households</th>
<th>Households in mutual aid teams (millions)</th>
<th>Households in APCs (2)</th>
<th>Advanced as % of (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>105.70</td>
<td>11.31</td>
<td>-</td>
<td>10.7%</td>
</tr>
<tr>
<td>1951</td>
<td>109.38</td>
<td>21.00</td>
<td>-</td>
<td>19.2%</td>
</tr>
<tr>
<td>1952</td>
<td>113.55</td>
<td>45.36</td>
<td>0.06</td>
<td>40.0%</td>
</tr>
<tr>
<td>1953</td>
<td>116.23</td>
<td>45.64</td>
<td>0.27</td>
<td>39.5%</td>
</tr>
<tr>
<td>1954</td>
<td>117.40</td>
<td>68.48</td>
<td>2.29</td>
<td>60.3%</td>
</tr>
<tr>
<td>1955</td>
<td>119.12</td>
<td>60.39</td>
<td>16.88</td>
<td>64.9%</td>
</tr>
<tr>
<td>1956</td>
<td>122.36</td>
<td>-</td>
<td>10.41</td>
<td>96.3%</td>
</tr>
</tbody>
</table>

Source: State Statistical Bureau, Ten Great Years (Beijing, 1960).
2.09 The dramatic acceleration of the program in 1956 indicated by these data imply that close to 30% of all rural households, involving about 37 million families, shifted from post-land reform peasant proprietorship to joint production socialist agriculture in a single year – a manifestation of the authority of the leadership and the grassroots organization that had been built in the countryside in the brief period since 1949. The Advanced Agricultural Producer Cooperatives (as established by the end of 1956) incorporated the basic principles of group farming (pooling of land resources and joint ownership of major assets) and payment according to labor contribution that have remained the distinctive features of Chinese socialist agriculture in the countryside to the present day.

B. The People’s Commune

Development of the System

2.10 The progression through mutual aid team and simple cooperative to advanced cooperative was marked by a sizeable increase in the scale of organization. Allowing for considerable local variation, a typical mutual aid team might have 8-10 member families, a simple cooperative 20-25 member families, and an advanced cooperative 150-200 member families. The latter could thus embrace a large village or a collection of smaller settlements. Increasing the size of organization involved achieving a balance between conflicting considerations. On the one hand, farmer confidence and trust tended to favor smaller, highly localized groups, while on the other hand, exploitation of scale economies – especially for the acquisition and use of farm machinery and for land improvement works and other projects – argued for larger institutions. Moreover, a larger scale could also facilitate the development of rural services that necessarily depended on outside inputs and trained cadres, as well as on better linkage with higher political and administrative levels in government.

2.11 The latter arguments were adjudged sufficiently persuasive to launch another major initiative whereby, in 1958, some 740,000 advanced cooperatives were merged into 26,000 People’s Communes. With an average membership of about 5,000 households, the establishment of communes represented a 30-fold increase in the scale of organization. Although the initial

/1 Important factors were the geographic dispersion of population and arable land availability: typically, cooperatives were larger where population densities were higher, and smaller in resource poor areas with widely scattered populations.

/2 Again, with reference to an earlier footnote, the decision was vigorously debated by the Party leadership, with a sizeable group in favor of slower progression to advanced socialism.
outcome was in many respects a considerable disappointment, the experience provided a basis for subsequent reforms in the early 1960s, from which the commune emerged substantially in its present form.

2.12 Several factors—including external factors, such as the very bad weather for agriculture in 1960 and 1961—helped create the early difficulties encountered by the communes. Planning was sketchy, with the result that local cadres were ill equipped and ill prepared to handle their vastly expanded responsibilities. Administrative and accounting systems were worked out by trial and error, with a good deal of improvisation and confusion. Farmers too were poorly prepared for what was—or threatened to be—a quite drastic change from the small, neighborhood-based group farming approach. Under the early commune structure, an attempt was made to shift the distribution of surpluses from the small cooperative groups of farm families to the level of the entire commune. This greatly weakened the relationship between individual and team efforts and the income derived therefrom. This link was further weakened in areas where substantial funds were diverted to services such as free meals from communal kitchens, nurseries for children, health care and welfare. An additional production disincentive was the communes' active discouragement or elimination of private plots and the closing of local markets, through which farmers had sold or exchanged their sideline production. Finally, many of the "Great Leap" programs to promote rural industry based on the transformation of local materials (backyard blast furnaces, cement plants and the like) failed, so that a great deal of the peasants' labor input for capital construction yielded a poor return.

2.13 As the evidence of problems accumulated, the authorities effected a series of corrections, mostly in 1961 and 1962. These changes included the breakup of the original communes into units of a more manageable size (roughly tripling the total number from 24,000 to 74,000), with corresponding changes at lower echelons. They also involved the re-establishment of the small production team as the basic unit for farm planning and as the accounting unit for the distribution of collective income. Many commune services were scaled down or abolished, the right to cultivate private plots was restored, and rural markets were reopened. In sum, the system resulting from these adjustments was akin to the structure of the Advanced Agricultural Producer Cooperatives of the 1956-58 era, but with the addition of the commune itself as a higher level planning and coordinating body linked to the overall administrative structure. This revised system was codified in the Work Regulations for Rural People's Communes of 1962 (known as the 60 Articles), most of which are still in force today.

2.14 A subsequent period of consolidation and recovery was again checked by further upheaval associated initially with the Cultural Revolution, which began in 1966/67, and thereafter with continuing disturbance during what the authorities now describe as the "ten years of turmoil," which lasted until 1976. With "politics in command," economic criteria during this period
were accorded a secondary role in commune management. Local initiative was
discouraged in favor of strict adherence to central policy directives, though
these directives were frequently ill suited to local conditions. Equally
important, technical development, including manpower training and agricul-
tural research, was largely discontinued and technical criteria and advice
ignored in decision making. In the commune itself, private agriculture and
sideline activities, together with rural markets, were discouraged or
eliminated, and to some extent earnings became based on political criteria,
self-assessment and criticism sessions. As in the late 1950s, there were
renewed efforts to shift accounting and distribution from the level of the
production team to higher levels.

2.15 The results of these policies are examined in Chapter 3. Since
the late 1970s, a series of important reforms has restored the situation of
the early 1960s. In some respects recent reforms have gone well beyond
restoration in a major effort to raise living standards in the rural areas
and to increase the agricultural growth rate. The brief account of the
commune system that follows incorporates these recent changes. There is
still considerable local variation in the extent to which the new policies
have been adopted and some prospect of further change during what is still
regarded as a period of adjustment.

The Production Team

2.16 At the lowest level in the commune structure is the production
team, generally made up of 20-50 families (the national average is 34 fami-
lies) from one neighborhood or locality and often with strong family ties
among its members. At present, there are more than 5 million production
teams, comprising some 175 million peasant families or 807 million people.
Collective activities are mainly associated with the farming of a holding
that on average (with considerable local variation) includes some 15-20 ha
of arable land. Other collective activities include team "sidelines," which
encompass such activities as piggeries, orchards and herb gardens, apiculture
and the collection of wild products. Collective income may also be obtained
from team members' employment in brigade and commune enterprises (the latter
is described subsequently), and from temporary employment elsewhere, for
example in local towns or as construction gangs on infrastructure projects.
The team usually owns small tools and other equipment (possibly a pedestrian
tractor, threshers and irrigation pumps) and some storage facilities (for
grain and fertilizer). Larger machinery is obtained from the production
brigade, usually on a service fee basis. The collective activities of the
production team are managed by an elected team leader, who is supported by
other officials, including work point recorders, team accountants, store-
keepers, etc. These officials are all drawn from the team itself and con-
tinue to work as members of the team, though work points are also accumu-
lated for time spent on official business. In practice, many team leaders
have been in post for a considerable number of years.
2.17 The team is usually the basic production unit, with responsibility for farm planning and execution. Farm surpluses (after various deductions) accrue as income to the team and are distributed annually, though advances can be obtained at various times of the year. This income includes cash obtained by marketing the crop surplus and income in kind for household consumption. Gross output and the various deductions are processed through a set of team production and appropriation accounts. Of total gross output (sales plus retained production), costs of purchased inputs currently average about 32% (more in richer teams that hire machinery and utilize greater quantities of purchased inputs). Of the balance, some 50% is distributed as collective income to team members. The residual, about 18%, represents collective withholdings, including taxes, cash and grain reserves, and a small welfare fund. Cash and grain reserves are used, inter alia, as seed, feed and cash for working capital; emergency relief in case of natural disaster; and a fund for team investments and contributions to investments by brigades or the commune. Cash and grain available for fixed investments and improvements are quite limited, however, especially among the poorer teams, and labor contributions have been by far the most important resource for capital construction at the team level. The decisions on allocations are made by the team but are subject to any guidelines issued by the commune or the county, and, in more general terms, by the provincial or central government.

2.18 Distributed collective income (cash and grain) is allocated to individual household heads within the team according to household accumulations of work points and manure contributions to team agriculture from household animal husbandry (pigs), and through use of a basic per capita grain

/1 In a few cases, less than 5% of the total, the production brigade is the basic unit for production and accounting.

/2 Some indication of the evolution of these shares is provided by data collected by the mission for Hunan:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>(20)</td>
<td>25.4</td>
<td>30.4</td>
<td>33.2</td>
<td>31.9</td>
</tr>
<tr>
<td>Taxes</td>
<td>(9)</td>
<td>7.2</td>
<td>5.4</td>
<td>4.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Funds</td>
<td>(5)</td>
<td>8.2</td>
<td>5.9</td>
<td>9.4</td>
<td>8.7</td>
</tr>
<tr>
<td>Members</td>
<td>(66)</td>
<td>59.1</td>
<td>58.3</td>
<td>53.0</td>
<td>55.9</td>
</tr>
</tbody>
</table>

Total (100) 100.0 100.0 100.0 100.0
allocation.\(^1\) This allocation helps to ensure availability of basic necessities according to need, but is less important now than at some earlier times when egalitarian distribution was heavily favored. Nevertheless, in the poorest teams, providing basic necessities may still absorb virtually all team income, and in most teams two thirds of grain, or more, is distributed under the basic ration allocation.

2.19 Work points are based on criteria that conform to guidelines but allow some latitude for team decisions. Most work point systems appear to be based on time/rate assessments, with skill and other quality differentials. Many teams combine the basic system with task-related and piecework elements during certain seasons; a few base most activities on piecework systems. The assessments may be revised at periodic meetings of the team, for example, when a new crop is introduced into the farm plan or a new team-operated sideline enterprise is established, or in response to policy directives.

2.20 An aspect of considerable and increasing importance following the recent reforms is the use of contractual arrangements within the team itself. Various types of arrangements may be entered into. A commonly used approach is for a small group of workers within the team to make a contract involving, say, cash crop production, under which an output target and a work point and material input allocation are agreed with the team. The contract specifies how the proceeds from any above-target production will be shared between the group and the team, together with financial penalties for failure to meet the targets.\(^2\) This approach seems to be particularly popular in upland and agriculturally diverse areas, which have a pattern of mixed cropping on small and scattered arable areas. In some cases, contractual arrangements have been extended to include most agricultural activities, and the contract may be with individual households.\(^3\)

2.21 Work points can also be accumulated through participation in activities managed at the production, brigade, or commune level (or sometimes in state enterprises and urban employment), or through assistance on rural infrastructure or other improvement projects, the benefits from which do not accrue directly to the worker’s team. In these cases, the appropriate body (brigade, commune) will transfer the value of work done to the team’s account, with the work point accumulations of individual members set by the team. Here too, some evolution in the arrangements is apparent. In particular, for areas that have begun to specialize on a large scale in

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\(^1\) Distributed collective income as reported by the State Statistical Bureau (cf. Table 1.1) does not include manure payments. However, the payments for manure (possibly averaging as much as ¥ 7-8 per capita nationally) are made from collective resources and are part of the collective accounting system.

\(^2\) Sometimes called the "3 responsibilities - 1 reward" system.

\(^3\) A recent report suggests that contracts with individual households are now widely used in areas accounting for some 20% of China’s peasant households.
brigade- and commune-run enterprises, the tendency is now to pay cash wages to workers, with some supplementary payments being made to the workers' teams from enterprise profits.

2.22 Household accumulations of work points (plus credit for manure contributions) will usually suffice to finance the basic grain apportionment, plus providing supplementary grain and cash income. Where this is not the case, for example, if a household has few working members or illness has reduced the work input, debts may be accumulated with the team./1 Under special circumstances, for example, in households where elderly folk have no sons to provide for them, grants may be made from team welfare funds (public benefit funds)./2 Frequently though, a team will arrange for these families to do some light work so that grants are supplementary and limited in amount. Crop failure may reduce available food supplies below acceptable levels for teams, communes or whole localities. In these cases, relief grain is provided (usually on a loan basis) under the food security system managed by the Food Ministry (para. 2.41).

2.23 Once individual and household obligations for the team's collective activities are met, a good deal of the remaining time is devoted to the household plot and private sideline activities, including handicrafts and animal husbandry. These activities generate important supplements to distributed collective income, estimated at some 30% of total agricultural income at the national level,/3 and provide the main source of cash income in the peasant economy.

2.24 The household plots and private sidelines provide vegetables, eggs and some meat for household consumption, and, depending on market conditions

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/1 Deficit households may also pay for grain directly, from savings or proceeds from private agriculture and sideline activities; see paras. 2.23-2.25.

/2 The public benefit fund is replenished through a special category of collective withholdings on the team appropriation account, with maximum rates set at about 3% of distributed income. Other uses include subsidies for education fees or health charges for poor families and team expenses on special occasions.

/3 A 1979 commune income/expenditure survey (reported in the People's Daily of January 3, 1981) showed total per capita income at Y 160, of which some Y 102 was derived from the collective economy, Y 44 was household private income and Y 14 came from other sources, including remittances. These data compare with Y 83.4 obtained from commune accounts as per capita collective distributed income in 1979. Both the survey and the accounts data value income received in kind at 1978 prices. "Collective income" in the survey includes manure credits and cash wages, both of which are excluded from the accounts data. The survey data are thought to be upward biased, but probably not to any great extent.
and access, offer opportunities for cash earnings through sales at local markets and to state agencies. Under the 60 Articles of 1962, private plots were limited to 5-7% of a team’s arable land, although new, uncultivated land (which might be available in upland areas) could be opened on a private basis (to revert to collective use after 3-5 years), and private use of roadsides (e.g. for mulberry trees and bamboo) and designated fodder areas was also permitted. These arrangements still generally apply, but the limit is now 15% for private plots. Some provinces have also allowed households increased access to collective land on a temporary basis.\footnote{The survey data (para. 2.23) also report the average availability of private plots at 0.15 mu per capita (15 mu = 1 hectare). If the sample is representative, this implies that about 8% of total arable land (8 million ha) is in private plots. Privately managed land (including land available to households on a temporary basis) was similarly reported at 0.18 mu per capita, i.e. roughly 10% of all arable land.} It is also the practice in some areas for the private plot land to be managed collectively (especially where the land is used for grain production), with various sharing arrangements of the proceeds between the household and collectively organized labor (e.g. 60:40, 50:50, etc).

2.25 The range of household sideline activities, mostly undertaken by female members of the household, is large and includes such traditional craft skills as hat making, basket weaving, knitting, tailoring and pottery; the main restriction is that no extra household employment or hiring of labor is permitted. Many small, collectively managed enterprises also specialize in such activities.

The Production Brigade

2.26 This is the middle tier in the commune structure, coming between the team at the base and the commune administrative center. The brigade tends to encompass either one large village or several smaller ones, with considerable local and regional variation. In 1980, there were some 699,000 production brigades, with 7-8 teams per brigade on average, although some brigades involve as many as 12 teams and others as few as 3 teams. Basically, the brigade provides a coordinating mechanism for activities that require several teams to act together, for example, labor-intensive farmland construction and brigade-managed enterprises. The brigade may organize specialized teams, for example, a construction team that works on maintenance and farmland improvement or, if opportunities exist, on contract work (e.g. housing and office construction in nearby urban areas). The brigade is the location for basic social services, e.g. primary education and health posts manned by paramedics. The brigade is also the lowest level at which the Party is organized.

2.27 The brigade enterprise subsector has been growing rapidly in recent years and involves diverse activities, for example, brick works, oil presses, silk manufacturing concerns, repair stations for agricultural machinery,
orchards, tea farms, and other specialized agricultural and livestock enterprises. In the more prosperous areas, a brigade may handle as many as 15-20 such activities, and much recent investment has been generated through retained surpluses of the older brigade enterprises, rather than new direct savings from the accumulation funds of the teams. But the brigade enterprise subsector is scarcely developed in the more remote areas. In national terms there is an average of less than two enterprises per brigade, with average employment per enterprise of some 14 workers. Many enterprises close for one to two months during the year, at peak periods in the agricultural calendar.

Commune Services

2.28 Currently there are some 53,000 communes, roughly 25 per county (or "banner" in the autonomous regions), each serving an average of 12-13 production brigades. Thus the average population of a commune is some 15,000 people (but varying between 5,000 and 50,000), with arable land resources averaging about 1,800 ha. Management staff at this level are linked to higher level units at the county and provincial levels, and unlike brigade and production team officials, many receive salaries paid out of provincial budgets. In the more prosperous areas, the administrative center is usually located in a small rural township that offers a variety of higher level services—secondary education, a small hospital with professional medical care, tradesmen and craft specialist workers, transportation, credit and marketing facilities.

2.29 Staff at this level serve two major functions: the leadership and direction of commune activities as a whole, and the dissemination and monitoring of the impact of policies and program directives from higher authorities. As at lower and higher levels of administration, the Party structure works in tandem with the administrative structure, with the Party in overall command. Commune staff include: a commune manager or director; senior officials for finance, administration and civil affairs; and, typically, functional specialists for agriculture, water conservancy, industry and commerce, education and health, and military affairs. Senior staff form a commune management committee. Many higher level staff also double as commune Party officials, and the commune manager often also serves as the Party secretary. This system is now under review as part of the adjustment and reform process. It is possible in the future that commune production related management and technical staff will be strengthened, while administrative and political matters will increasingly be dealt with from the county level.

2.30 General administrative duties include the collection of taxes, maintaining public security, collecting data and writing official reports, registering births and deaths, and performing marriage ceremonies. Many local services are controlled from the commune level, including education,

/1 On average, each commune had roughly 20 state employees in 1979.
health, marketing and communications. Most communes operate a wired broadcast system. Programs received from provincial radio stations, supplemented with locally produced news, weather and entertainment, are broadcast through loudspeakers at brigade and team centers and can be picked up by many household radios. Marketing services coordinated by the commune include the activities of the state-run supply and distribution cooperatives and grain procurement services. The commune may enter into specific supply contracts with the cooperative supply agencies and with other entities (for example, to purchase manure from a local municipality or to sell cash crops to an industrial enterprise). The commune is also the base from which various agro-technical services operate, including extension and adaptive research.

2.31 In much the same way as the brigades, the communes promote and manage commune enterprises, which are on a bigger scale (averaging over 40 workers per enterprise in 1979) and include such activities as tractor service pools, chemical and cement plants, machine shops, canneries, paper manufacturing concerns, small-scale hydroelectric plants, and consumer goods industries. Commune-run enterprise is often linked with state or urban collective enterprise, with contracts for supplying components, making up textiles into piece goods and clothing, etc. In 1979, each commune had an average of six such enterprises, again with a considerable variation in the degree of development, depending on local factors.\(^1\) Workers in commune enterprises are typically paid a monthly wage and work on a year round basis. In general, production activities are mostly funded from commune sources, but there is increasing use of credit and some amount of grant finance, from the county and province, for such purposes as infrastructure improvements, flood control and irrigation work. Grant financing is particularly important in the poorer areas, where brigade and commune industry is, thus far, little developed and agricultural productivity is low.

C. State Farms

2.32 The state farm sector constitutes a small but significant element in the agricultural framework and is quite distinct from the People’s Commune. As the name suggests, the state farm is in many ways akin to state-owned industrial enterprise. In particular, its workers are wage-paid state

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\(^1\) Commune- and brigade-managed enterprises accounted for about one quarter of total commune gross output nationally. But over 50% originated in five eastern seaboard provinces, plus the rural suburbs of Beijing, Tianjin and Shanghai municipalities. In these areas, enterprises account for over 40% of output, versus under 20% in the rest of the country.
employees, and (until recently) any profits were returned to the state and investment capital allocated to the farm by the state. In practice, only in 1979 was a small profit reported from the state farms, although some farms were making profits in earlier years. This was probably due to the sizeable industrial subsector rather than to agriculture per se.

2.33 The first state farms were established in the 1950s, mostly as pioneer settlements in border areas, with ex-army personnel making up most of the labor force. A major expansion occurred between 1957 and 1965, when the cultivated area increased from about 1 million ha to over 3 million ha, and an additional 1 million ha has been added since 1970. State farms continue to be concentrated in border areas, and the element of land development and reclamation is still an important part of future development programs. In the 1970s, a good many of the urban school leavers that were sent to the countryside were assigned to work on state farms.

2.34 Currently, state farm lands comprise some 30 million ha, of which some 4.5 million ha are arable lands under cultivation - equivalent to 4.5% of the nation's total cultivated area. With 2,047 farms in operation, the average cultivated area is some 2,200 ha, rather more than the area available to the average commune, where the average population (workers and dependants) is three times as large. Over half of the cultivated area, some 2.4 million ha, is located in the northeast (mainly Heilongjiang) and is mostly used for large, machine-intensive grain and rootcrop farming; the average size of a state farm in Heilongjiang exceeds 20,000 ha. Xinjiang, in the extreme northwest, is another major base area, with about 1 million ha cultivated or an average of about 3,000 ha per farm. Other important areas include certain reclaimed coastal lands of Jiangsu and Hebei in northern China, and areas in the south where plantation rubber and sugarcane are the main crops. At present virtually all of China's natural rubber production comes from the state farm sector.

2.35 In recent years, management emphasis has begun to shift from pioneer settlement/land development towards increased productivity and profitability. This is linked to increasing the contribution of the state farms to marketed surplus (foodgrains and cash crops) for urban/industrial consumption. Currently about 35% of grain production from state farms is sold to the state, almost twice the marketing rate of the communes. It is planned to raise this to about 45% by 1985 and, with increased production, to increase total marketed grain from state farms by about 6 million tons. Another recent

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Under new arrangements, state farm profits will be retained for reinvestment up to 1985.
development has been a substantial expansion of state farm industrial enterprises: in 1979 these contributed some Y 3.3 billion to gross output, compared with Y 4.4 billion from farming activities.

2.36 Under the leadership of the Ministry of State Farms and Land Reclamation, the farms operate in a more or less self-contained fashion. On-farm services include health care, education and other social amenities, plus technical services and management by cadres trained in ministry-supervised colleges and secondary technical schools. Some 10.9 million workers and dependents are resident on state farms. The average per capita income, largely wage paid, was Y 255 in 1979, about three times the nationwide average for the communes. The farms are highly mechanized, with 85% of the cultivated area machine plowed, 50% machine harvested and 76% machine threshed. On the other hand, only 34% of the area is irrigated (versus about 48% for commune lands) and the "high and stable yield" area is estimated at only 8%. Reflecting in part the cold winters characteristic of the border areas, the aggregate cropping index is only 106%.

D. Marketing, Pricing and Credit in Agriculture

2.37 Together with agrarian reform and the establishment of producer cooperatives, the authorities also introduced socialist principles in pricing and marketing for agriculture during the 1950s. Price controls on major commodities were first used in 1949 as part of the effort to deal with the serious inflation of the period immediately prior to 1949. Thereafter the range and scope of private marketing was progressively restricted as official supply and marketing channels were developed. By the mid-1950s, schemes of unified or planned purchase were in operation. For the major crops - so-called "Category I" crops: grains, oilseeds, cotton and sugar - purchase and subsequent distribution were increasingly limited to state-managed procurement agencies, which used centrally determined prices. These agencies were also charged with collecting the agricultural tax, which was (and is) paid in kind, mainly as grain. A range of cash crops and livestock products was similarly designated as "Category II" crops, with production quotas sold to marketing cooperatives, and production in excess of the quotas sold in free markets and to the cooperatives. Prices for most of these crops were also set nationally, with some provincial variation. Finally, a residual category, consisting mostly of minor crops, vegetables and other products of household rather than collective enterprise, continued to be disposed of through rural markets at prices regulated either by the province or the county.

2.38 The marketing and pricing system established in the 1950s has been broadly maintained, although the importance and scope of rural and other free markets have varied over time with changing policies (described in Section B above). The two most important marketing agencies for agriculture, both
under state management, are the Ministry of Food, which procures and distributes grain and oilseed crops, and the All China Federation of Supply and Marketing Cooperatives (S & M Federation), a specialized agency that is also directly subordinate to the State Council. The S & M Federation purchases most cash crops, and it distributes some agricultural inputs and tools, as well as consumer goods, in the rural areas. Some products (including sugar, pigs for slaughter and rubber) are purchased by specialized branches of the Ministry of Commerce.

Grain Marketing

2.39 The Ministry of Food procures grain in large volumes (about 50 million tons p.a.), in recent years. These data are reported in husked grain; in terms of paddy they imply a total procurement of close to 60 million tons, or some 18-20% of total foodgrain output.\(^1\) Procurement is based on plan targets, with grain quotas assigned to production units a feature of the system since the mid-1950s, when they were based on assessments of land productivity and local foodgrain requirements. Quotas in most areas are fixed at levels that are well below the availability of grain surpluses (in some areas the quotas have not changed since the 1950s), so that quota purchases account for only about 45-55% of total grain procurement. In 1979, quota purchases amounted to about 25 million tons of grain, with the balance coming from tax grain (10 million tons) and above-quota purchases, the latter negotiated with the production teams on an annual basis. Purchases are made at two prices, depending on whether the transaction is a quota grain sale or an above-quota sale, for which there is a 50% price premium.\(^2\) Like quota purchases of grain, tax grain collections are also made on the basis of tax assessments that remain fixed for long periods of time. The tax burden, in relation to total agricultural output or grain output, is thus much lower than it was in the mid-1950s.\(^3\)

\(^1\) In very recent years another 10-12 million tons of grain (mainly wheat and corn) were imported, but these imports were partly offset by exports of 1-2 million tons of rice.

\(^2\) In 1979, some 3-4 million tons were also purchased by the Ministry of Food at so-called negotiated prices, which vary by locality and are set, in effect, by conditions in local free markets for grain (see para. 2.43). Negotiated prices are generally well above quota prices.

\(^3\) In 1979/80 (the grain marketing year runs from April to March), the agricultural tax collected in kind was about 10 million tons, equivalent to some ¥ 3.2 billion on the basis of average procurement prices. This excludes some 2.4 million tons of tax grain that was remitted in low-income areas, a practice likely to be followed in future years. Taxes on commune- and brigade-run enterprises (¥ 2.2 billion in 1979) seem likely to overtake agricultural taxes as a source of revenue in the next few years.
2.40 The Food Ministry is organized at central, provincial, prefecture and county levels throughout the country, with the basic unit in the countryside being a grain management station that serves one or more communes. The total staff at all levels exceeds 2 million workers, excluding seasonal workers. The ministry owns and operates substantial milling and storage capacity and some road transportation equipment, although most road transport is handled on a fee basis by local transportation companies of the Ministry of Transport.

2.41 The major emphasis in foodgrain policy has been to assure adequate supplies throughout the country at stable and uniform prices. In the urban areas, grain (and edible oil) is allocated via a rationing system. Grain rations vary with locality, being higher in the north than in the south. Thus, in the south, average per capita rations of processed grain are about 16 kg per month, with varying allowances by age and type of activity (e.g. mine workers 25 kg per month, office workers 13.5 kg per month, primary school age groups 12 kg per month). The edible oil ration is 1/4 kg per person per month, with an additional 1/10 kg sometimes available. In the rural areas, supplies are much more variable, depending mainly on an area's level of agricultural development and to some extent on the supply-demand balance in the province. In general, the authorities maintain a floor consumption level (unprocessed grain) of 200 kg per capita per annum in rice producing areas and 150 kg in other areas. After milling, these minima would be roughly equivalent to a ration of a little less than 12 kg per capita per month. Procured grain that is distributed in the rural areas is usually sold; such sales are primarily to meet the needs of specialized, nongrain (cash crop) areas, or they are made under special incentive arrangements (e.g. grain sold to producers of pigs sold to the state). Grain distributed in poor areas to meet basic requirements, essentially relief grain, is also usually sold, although it may be financed through loans that are often rolled over from year to year. Some relief is provided to individual households as grants through the social welfare system. Nationwide, the average grain distribution to commune members from collective sources was about 245 kg per capita in 1979, equivalent to roughly 200 kg in terms of processed grain, i.e. about 17 kg per capita per month. Adding state grain sales in rural areas, plus production of grain from private plots, raises the overall rural average to about 20 kg per month. The communes themselves retain about 20% of total grain output for seed, feed, industrial uses and general reserves, some of which is also used to supplement consumption directly.

/1 Free market purchases, at higher prices, can be used to supplement ration grain. Of total grain distributed through the state marketing system, about 75% is for urban areas, about 90% of which represents ration grain. Most of the grain redistributed in rural areas is absorbed under various incentive schemes and as ration grain in cash crop areas. In 1979, some 3 million tons was distributed as relief grain.
2.42 Consumer foodgrain prices have been maintained at stable levels, while procurement prices for producers have been substantially raised – including an increase of some 22% in 1979, when quota prices were increased by over 20% and the above-quota sales premium was increased from 30% to 50%./1 The increasing gap between purchase and selling prices involves the state in providing heavy subsidies to the Food Ministry. In aggregate, the subsidy for foodgrains is about Y 10 billion, i.e. Y 200 per ton procured and processed.

2.43 In 1978, restrictions were lifted on the sale of surplus grain in free markets at negotiated prices. It is estimated that some 5 million tons of grain now enter these markets, often grain of superior quality or of specialized types. The grain is usually sold at prices above (sometimes well above) the price of either procurement or ration grain. Some price regulation in these markets is effected by the local offices of the Food Ministry (Local Food Supply Company), which make purchases and sales from official stocks.

Input Supply, Cash Crops and Retail Trade

2.44 The responsibilities of the Food Ministry in the marketing and distribution of foodgrains and oilseeds are complemented by the work of the S & M Federation, a similarly large and complex organization. The S & M Federation has developed from what were originally small, locally based peasant marketing associations. The latter were first established in the 1940s in the then-liberated areas of northern China and later spread to other areas during the 1950s. State participation in ownership and management followed in 1958, effecting a transformation into what is today essentially a state trading corporation with elements of local autonomy.

2.45 Currently the S & M network comprises some 3.6 million workers, plus an additional 600,000 licensed agents who buy and sell on a commission basis. In the countryside, there are some 36,000 separately organized marketing cooperatives which, together with the licensed agents, form a nationwide commercial network. The "below county" or lower level cooperatives are expected to be financially self-sufficient and are permitted to retain 61% of their profits. The "county and above" levels serving the smaller towns and county seats return most of their profit to the state. In 1979, the total volume of retail sales exceeded Y 80 billion, including Y 14 billion of sales.

/1 In historical terms, consumer prices for foodgrains were increased by about 40% between 1952 and 1966, but have been held constant since then. Procurement prices were increased by about 115% between 1952 and 1980.
of agrochemicals, equipment and agricultural supplies to the collectives.\textsuperscript{1} The S & M Federation also purchases most of the economic crops produced in the countryside, including cotton, wool, jute and other fibers, silk cocoons, tobacco, fruits, processed vegetables and native products (medicinal herbs, spices, honey, etc.). The total value of purchases was close to Y 16 billion in 1979.\textsuperscript{2} Some technical services and other support are provided by the S & M Federation to encourage the further development of these crops.

2.46 Like the Food Ministry, the S & M Federation operates within a pricing framework that is governed by state policy and with purchase quotas for some of the leading crops. The policy has been to furnish necessities at stable prices, while agricultural inputs such as fertilizers have been supplied at progressively reduced prices and the prices for agricultural produce purchases have been increased (in particular, special price premia are now paid for above-quota sales of cotton). Many commodities are thus purchased or sold at nationally determined and near-uniform prices. Like the Food Ministry, the S & M Federation also receives special subsidies where the allowed distribution margins are too small to cover costs. Prices are locally determined (by the provincial or county authorities) for a range of other items, but the regional variation is also small in many cases. As a result of the recent reforms, many agricultural items now enter local markets or are sold at negotiated prices through contracts between the collective (commune, brigade or team) and outside bodies.

Agricultural Credit

2.47 Credit for agricultural development is largely the responsibility of the Agricultural Bank of China, although some credit funds for rural development are also provided by the People’s Bank and the Construction Bank. The Agricultural Bank was originally founded in 1955, but was subsequently merged with the People’s Bank of China until its reactivation as a separate institution in 1979. After vigorous expansion this year, when 60,000 new staff were hired and others transferred from the People’s Bank, the total staff is currently some 230,000. The bank is organized at the provincial,

\textsuperscript{1} Large equipment such as tractors is distributed by the Agricultural Machinery Supply Companies of the Agricultural Machinery Ministry.

\textsuperscript{2} Total agricultural and sideline produce purchases of the commercial departments (Food Ministry, S & M Federation, Ministry of Commerce, etc.) over a period of years were as follows (Y billion):

\begin{tabular}{cccccccc}
9.0 & 17.7 & 27.4 & 31.4 & 41.5 & 41.3 & 46.0 & 58.7 \\
\end{tabular}
prefecture and county levels and has some 22,000 branch offices. The work of the bank is complemented by some 59,000 local credit cooperatives, organized at the commune and brigade levels.

2.48 In conjunction with the central and local authorities, the bank exercises general responsibility for the planning and allocation of rural credit and for credit distribution. In addition to communes and state farms, various state agencies (such as the S & M Federation cooperatives and the agricultural machinery companies) can receive credit. The bank also promotes, and provides a vehicle for, rural savings as well as other banking services for individual and collective institutions. It supervises the work of the credit cooperatives and provides training both for their staff and for brigade- and commune-level accountants.

2.49 In 1979, the bank's loan portfolio was some Y 45 billion, with short-term credit (working capital loans to agricultural enterprises and agencies) accounting for Y 23 billion. The balance comprised production and term credit for the communes and state farms (Y 16.6 billion), plus a small element (financed by credit cooperatives) to individuals (Y 1.1 billion). Loans to communes and state farms are expected to be about 25 billion in 1980, increasing from Y 13 billion in 1978. Interest charges for production credit and working capital are 0.36% per month (4.32% p.a.), agricultural equipment loans are charged at the preferential rate of 2.16% p.a. and most other enterprise loans at 4.32% p.a. A small element in the portfolio is represented by relief loans at zero interest. Bad debts reportedly make up a small fraction of the portfolio (about 10% of loans to communes and brigades), though some loans are in effect rolled over from one year to the next when crops have been badly damaged because of adverse natural conditions. For term loans, the bank will finance up to 100% of equipment costs in some cases, but generally the borrowers will provide 30-40% of the funds themselves.

2.50 In general, the demand for credit at the local level appears to exceed the supply. In fact, the planned allocation to county and lower levels is essentially a rationing process, and the amount of funds available still depends largely on the local savings that can be generated, mostly through the credit cooperatives (para. 2.52). The bank is planning a major expansion in the 1980s and expects to double its loan portfolio by 1985.

2.51 The loan portfolio is financed by individual deposits (checking and savings accounts), which make up some Y 10 billion; checking accounts of collective enterprises and agencies (Y 22 billion); and government equity contributions channeled through the People's Bank of China. Private checking accounts accrue interest at 2.88% p.a. (collective sight accounts

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1 These data include loans made by and deposits of the rural credit cooperatives.
at 1.80%) and various term credit rates are offered, for example, 5.40% p.a. on one-year deposits. This rate became effective in April 1980 (3.90% p.a. was paid formerly); rate increases for loans are under review. The bank estimates that at present direct operating costs account for about 30% of its interest charges.

2.52 The local credit cooperative is an important part of the system and deals with a substantial fraction of the business at the commune level. Most credit cooperatives are self-financing and pay their own staff and administrative expenses, though some receive direct support from the bank. Production credit and small loans are dealt with by blending local savings and credit made available by the bank on a consolidated basis. In onlending bank funds, the credit cooperative receives a commission from the bank of Y 8 per Y 1,000. Thus the bank is directly involved in the credit operations (Y 10,000 or more) at the commune level, but not the smaller transactions - with substantial savings in operating costs. Management and supervision of the credit cooperatives extend to monthly inspection of the accounts and selection of the manager. Cash is returned to the bank on a daily basis.

E. Administration and Planning

Administration

2.53 The administrative framework for agricultural development is necessarily complex. It involves responsibilities for what is an extraordinarily large and multi-dimensional range of activities, which corresponds to the large and varied agricultural, economic and social environments of rural China. A general feature of the system is dual leadership, by which subordinate organizations and agencies are linked both to a parent ministry and to an appropriate level in local government, be it province, prefecture or county. On one side, this system provides for responsiveness to higher levels in policies and policy directives, and it ensures a degree of technical support and quality standards in professional work. On the other side, local planning and control of day-to-day activities and program implementation encourage a measure of local initiative and better coordination between the various branches. The importance of these aspects is underscored by the sheer size of the units involved: for example, the county has an average population of some 400,000 people; and the province in many instances has a population equal to that of a large country (15 provinces have populations in excess of 30 million, including Sichuan with close to 100 million, and Henan and Shandong, each with over 70 million).

2.54 The structures and functional responsibilities in agricultural work are broadly similar at the various levels in government, with increased subdivision and specialization at the higher levels. In the provinces and at
the center, the work of the key agricultural ministries (or departments at the provincial level) is coordinated by an agricultural commission, whose members are vice-ministers or department heads and other leading officials, and whose work is supported by a small secretariat. At the central level, the State Agricultural Commission deals directly with five ministries and two specialized agencies: the Ministries of Agriculture (which includes animal husbandry), Water Conservancy (flood control, major drainage and irrigation, small-scale hydropower development and domestic water supply), Forestry (separated from Agriculture in 1979), Agricultural Machinery, and State Farms and Land Reclamation; and the General Bureau of Aquatic Products and the Central Meteorological Bureau. In the provinces, some of the corresponding departments may be merged with the agriculture function, depending on the scope of local work. At the prefecture and county levels, staff are usually grouped under an agricultural office, with two or three specialized functional bureaus.

2.55 Other important agencies include those described in Section D above, which cover food, general marketing and agricultural credit, plus some of the industrial ministries responsible for the manufacture of agricultural materials and equipment, and others dealing with transportation, energy and public works. In many instances, the implementation of state-supported programs is carried out by specialized companies that are affiliated with the various ministries or departments and that sometimes work under contract (e.g. agricultural machinery companies, food supply companies, construction companies). Several such companies may be active in a province, some organized and managed at the provincial or county levels, others as national companies affiliated with the central ministries.

2.56 There is also a wide range of specialized research, training and design institutions, again typically attached to a parent ministry or department responsible for the work program, content of the training courses, etc., of the affiliated institution. For example, at the provincial level, the water conservancy department will usually have a research and design institute to carry out studies and engineering design work for water conservancy projects. Similarly, the agriculture department will supervise a network of agricultural research institutions, including a provincial academy of agricultural science and several subordinate institutes (the latter often specialize in particular crops or soil and land use problems), plus possibly 100 or more research stations at the prefecture or county level.

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/1 The important State Council biogas program is managed by the Ministry of Agriculture.

/2 Technical services in agriculture (research, training and extension) are described in more detail in Section F below.
Agricultural Planning

2.57 Detailed and comprehensive planning is undertaken at all levels of government and is a central feature of the Chinese socialist system. However, five-year plans have usually been interrupted or vitiated by institutional upheaval and major policy change, such as the Great Leap of the late 1950s and the Cultural Revolution. The past two to three years are described as a period of adjustment, experimentation, and reform with the introduction of a wide range of new policies designed to give new impetus to economic growth, modernization, and improved living standards. This period is now drawing to a close and greater stability is expected during the 1980s, when - effectively for the first time since the mid-1950s - development will again be based on five and ten-year plans. Currently, authorities at all levels are preparing these new plans, semidetailed for 1981-85, and in outline form for the ten years 1981-90.

2.58 Notwithstanding the difficulties of longer term planning, annual plans continue to be central to resource allocation, investment and production in agriculture. In particular, the allocation of critical inputs to the countryside (such as chemical fertilizer, diesel fuels, agricultural machinery and general credit) is based on the annual plan, with fairly limited scope for deviation once the plan targets are set. The national plan includes crop production targets, and capital construction fund and production input allocations, to the level of the county. Below county planning is done by the communes, brigades and production teams.

2.59 The state-managed marketing and supply system, the control of price setting and the tightly knit organizational structure of the commune (directly linked with higher administration) together constitute a powerful apparatus for agricultural planning. Such a broad array of instruments permits the use of various strategies and combinations of policy approaches. Indicative or indirect planning - which leans heavily on material incentives and pricing adjustments, and accords considerable discretionary power to lower level units - is at one end of the spectrum of policy approaches. At the other is physical planning or planning by directive, whereby detailed physical output and acreage targets are assigned from higher levels to the production units, which then determine investment and working capital allocations.\1\n
2.60 In several respects, the recent policy reforms mark a return to the practice of the 1950s, when indicative or indirect planning was more

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\1\ In general though, agriculture has been less tightly controlled than many other sectors. Surpluses have always been retained by the communes and capital accumulation has depended heavily on retentions plus the contributions of labor from the commune members. Private activities, while severely curtailed in some periods, have usually made a significant contribution to sectoral output and income.
generally used than during much of the subsequent period. These reforms are consolidated in a policy statement approved by the Fourth Plenary Session of the 11th Central Committee meeting of the Party, dated September 1979. The statement describes some 25 policy principles and recommends 8 key points in agricultural modernization strategy. The current approach encourages local initiative and a diversity of local plans, to make full use of agronomic potential and to develop specialization in line with local comparative advantage. Work incentives and subcontracting are also encouraged, and emphasis is given to the use of credit rather than state-furnished grants for capital construction and machinery acquisition. Output prices have been substantially increased and there is more differentiation to favor upgrading product quality. The private economy is being encouraged, as are commune and brigade-run enterprises; and the fixed obligations to furnish grain, oilseeds and cotton to meet quotas and for taxes have been reduced in relation to production levels. But there is still considerable local variation in the planning process as experimentation and adaptation continue, especially at the below county level. In some (probably most) areas, once arrangements to meet state plan objectives are made, the individual teams decide how best to use available resources and formulate their own plans in the light of their particular conditions. Under these conditions, the relative profitability of the various crops, market and investment opportunities become the most important factors in planning. Elsewhere, the team may still be largely influenced by what in effect are directives from higher authorities (brigade, commune, county, etc.) in determining crop hectarage targets, output and investment targets, etc., so that the scope for local decisions is much more circumscribed.

F. Technical Services and Training

2.61 China has a long history of agricultural improvements and attained comparatively high standards in crop husbandry at a very early stage of development. But in modern times, it was not until the republican era of the 1920s and 1930s that official support for service activities began to gain momentum. These early efforts, centered mostly in eastern and southern China, included research at a number of national institutes (mostly around Nanjing), research and training in some 25 national agricultural colleges (4 of which were run by missionaries), and training at about 20 provincial agricultural schools, including some technical institutes. An extension service was begun in 1929 (when a central body for extension was established and regulations promulgated) and was reported to be operating in some 14 provinces in 1946, serving some 485 counties, or about one quarter of the country. By 1949, some 6,000 students had graduated from the agricultural colleges (many of whom, however, did not work in agriculture), and another 8,000-10,000 graduates had received some college or other formal training in agriculture. Possibly as many as 1,000 graduates had pursued advanced studies abroad, some of whom largely made up the core group of high-level agricultural scientists and researchers.
2.62 Much of this early effort was disrupted and disorganized during the long period of civil warfare, and many high-level technicians fled to Taiwan with the Nationalist Government in 1949. The 1950s marked a substantial rebuilding phase that included building new facilities throughout the country, staff recruitment, training and expanded agricultural student enrollments, and new organizational structures. This work was reinforced in the late 1950s and early 1960s as experience in agricultural development began to indicate strongly the need for new productivity-augmenting technology in agriculture. But this expansion was severely checked and the trend reversed after 1966 due to the Cultural Revolution. Research and training activities continued at a low ebb through most of the 1970s. Virtually all colleges and schools stopped recruiting during 1966-70 and most were closed. After 1970, enrollments were made with scant regard for formal qualifications or aptitude. The course work during this period gave heavy emphasis to politics and ideology, and after completing their studies, most students returned to their communes. Similarly, many of the major research institutes were effectively closed and their senior staff dispersed in the countryside. Thus most basic or fundamental research work slowed or ceased, although a good deal of applied work and extension was undertaken in the countryside. This too was probably less effective than it might have been, given the prevailing policy climate during this period. Since 1977, the authorities have made considerable efforts to restore training and research activities, for instance through the re-establishment of competitive examinations as the basis for college entry and exposure to Western agricultural science and teaching through foreign training. However, much remains to be done in rebuilding and strengthening these institutions.

Agricultural Research and Extension

2.63 For most agricultural research work, the apex organization is the Chinese Academy of Agricultural Sciences (CAAS), a body subordinate to the Ministry of Agriculture, with responsibilities for a network of national research institutes, and for technical oversight and coordination of provincial programs. CAAS also organizes joint investigations on important national topics, arranges interchange of experience and summarizes research results. Currently there are some 31 national research institutes, 13 of which are located in Beijing and 18 in the provinces. These institutes focus mainly on applied research. Some are organized according to discipline, e.g. the Crop Breeding and Cultivation Institute and the Plant Protection Institute in Beijing, and others (especially for cash crops) by commodity, such as the Tea Institute of Zhejiang, and the Cotton Institute of Henan. Each province is served by a local research network and has a provincial academy of agriculture as the lead institution. These local networks are substantial and complex in

/1 Some basic research (in botany, entomology, soils and fertilizers, etc.) is undertaken in various institutions under the Academy of Science, which reports to the State Council.
the larger provinces. For example, in Sichuan, the provincial academy coordinates the work of 11 research institutes, mostly with crop-specific responsibilities (tea, cotton, rice, animal husbandry, aquaculture, etc.) but with some organized on a discipline basis. Below the provincial level are some 20 prefecture-level institutes and over 170 county-level establishments (almost one for each county), which have diverse programs of research, demonstration, and extension. In sparsely populated areas, several counties may be served by one such institute.

2.64 Research work at the national and provincial levels is also sponsored and coordinated on a considerable scale by other agriculture-related ministries or specialized agencies (including those responsible for forestry, fisheries, irrigation, agricultural machinery, and state farms), as well as such bodies as the S & M Federation. For example, the Ministry of Water Conservancy is associated with seven such institutes, including the Scientific Research Institute of Water Conservancy and Hydroelectric Power in Beijing, which has some 500 researchers. Similarly, most provinces have an institute of scientific studies for water conservancy, an institute for research on agricultural machinery, plus similar specialized facilities subordinate to other line departments. Nationwide there are some 1,300 large research institutes and facilities (above the prefecture level) that are in some way concerned with agriculture. Nevertheless, national statistics suggest that only about 8% of China's technical and scientific staff are employed in programs directly related to agricultural development.

2.65 The importance of close coordination and interaction between research work and extension activities was recognized early in China, beginning in the 1950s. The linkages were further reinforced, especially after the Cultural Revolution, giving rise to what is now described as a "seven-level" scientific network. The national, provincial and prefecture levels, the three higher steps, are concerned mostly with research, and the four lower levels (county, commune, brigade and team) deal mainly with the demonstration and popularization of new technologies and techniques, training and other extension-related activities. Most workers at the commune level and below are locally trained "peasant technicians" (some received low quality college training during the Cultural Revolution). They are organized from the county level into groups of three to five workers to carry out much of the field-level work; efforts are concentrated in designated "base points," usually at the team level, where experiments and demonstrations are conducted. During the 1950s and 1960s, an extensive network of agrotechnical stations was set up to undertake extension and training work, but since much extension was subsequently shifted to commune and within-commune levels, these centers are now mainly used for in-service training of local officials and cadres, and for short courses of farmer training and seminars./1

/1 The situation varies in each locality. In some areas, the agrotechnical centers manage demonstrations and extension work at the commune level, and in some areas the county-level research stations actually undertake fairly high-level research, rather than research application work.
The contribution of the research and extension networks to agricultural development is further discussed in Chapter 3. In general, the network is extensive but the numbers of qualified staff, especially at middle and senior levels, are severely limited, and adequate facilities and equipment are generally lacking. Due to the effects of the Cultural Revolution, there are few qualified scientists under the age of 45. Since China's programs have traditionally been strong in applied research and research relating to varietal improvement and agronomic practices for major food crops, more effort is now being given to strengthening basic research and to building up research in areas that were somewhat neglected in the past.

**Seed Production**

An effective system has been developed for producing seed especially for cereals. Breeder seeds from colleges, academies, counties or research stations are multiplied by county-managed specialized seed farms. The seed farms are responsible for purification, storage and testing of seeds. Stock seeds produced by these farms are sold to seed companies for the multiplication of certified seeds. Some communes also operate their own seed breeding and multiplication farms.

**Education and Training**

As noted above, the agricultural education system is still recovering from the long period of closure and anti-professional bias after the Cultural Revolution. Thus, the first graduates from the newly re-established college system will not be available before 1982, and a scheme of postgraduate education has only recently been formulated. Currently, there are critical shortages of staff at all levels. Responsibility for the management of agricultural education is vested in both the Ministry of Education and a parent functional department (e.g. agriculture, water conservancy, forestry, agricultural machinery, etc.). The Ministry of Agriculture is responsible for most of the facilities; seven national colleges are under the direct supervision of the Department of Agricultural Education (within the Ministry) and a further 38 institutions are supervised at the provincial level.

University education generally involves a four- or five-year degree course and is afforded to successful candidates of the college entrance examinations for secondary school leavers. Most of the tertiary-level institutions award (or will award) degrees in general agriculture, with various specializations among some 52 faculties. Some colleges are themselves specialized, for example the five colleges of animal health and veterinary practice and the technical schools for sericulture. Many of these establishments undertake substantial research programs. Some are long established; for example, the South China Agricultural College was founded in 1910.

/1 Including nine technical schools that offer three-year postsecondary study programs.
2.70 Over the 30-year period since 1949, some 210,000 students were graduated from this system. Total enrollment is currently about 45,000, plus 500 postgraduate students; the faculty staff exceeds 14,000, of which about 1,000 are full professors and assistant professors and a further 6,000 are lecturers. Within the plan period to 1985, it is expected that some 70,000 students will be graduated. Given the very large shortage of staff, they will be readily absorbed as agricultural professionals (teachers and research workers), and as administrators for various agricultural agencies.

2.71 Secondary-level technical education for agriculture is provided through a system of senior secondary schools. In principle, entrants are graduates from the lower secondary level, but in practice they include many older students who have failed the college entrance examination. Many of the graduates from these programs are assigned to positions (as extension workers, junior researchers and administrators) at the county or lower levels. Some 214 schools, supported by the Ministry of Agriculture, have an enrollment of 80,000 students and 9,000 teaching staff. The projected turnout from these schools is 180,000 graduates in the 1981-85 plan period (some 540,000 were graduated during the 30-year period 1949-79). Students at these schools (as well as college-level students) receive free tuition and most also obtain living allowances or accommodation.

2.72 Other ministries also supervise university and secondary-level specialist facilities in essentially similar ways; for example, the Ministry of State Farms and Land Reclamation has 5 college-level establishments and 22 technical secondary schools; the Ministry of Agricultural Machinery has 8 colleges and numerous technical schools. Nationwide, there are some 82 colleges or higher level training institutes and some 470 secondary technical schools that serve agriculture. Virtually all these institutions are also involved in giving short-term courses organized at various levels, mainly training and working seminars for staff and Party officials. The great majority, like the research establishments, lack sophisticated equipment (of types that are not widely manufactured in China, if at all), teaching aids and materials, as well as experienced, middle-level staff.

3. OUTPUT, PRODUCTIVITY AND EARNINGS IN AGRICULTURE SINCE 1952

3.01 The Communist Party came to power in 1949 committed to abolition of the power hierarchy of old China and with high hopes of substantially improving living standards among the masses, including the poor peasantry, by far the most numerous group among the underprivileged. As described in Chapter 2, a vigorous program of land reform was undertaken and a system of cooperative farming (built around the three-tier system of the People's Commune) was created. Redistribution of the land and abolition of land rents were one source of major improvements. This was coupled with the development
of a food security system, which was to ensure access to minimum food requirements regardless of ability to pay. Meanwhile access to primary education and health care was progressively improved. But the post-1949 successes themselves generated formidable challenges. The provision of adequate food supplies for all the people reinforced the critical dependence on arable land for cereal cropping. Peace, stability and food security encouraged a rapid growth of population and with it an ever increasing food requirement. The pursuit of industrial development posed additional demands on agriculture for raw materials and industrial crops; and industry was in competition with agriculture for investment resources and manpower for technical development.

3.02 This chapter describes how the various challenges were met, beginning with an overview of achievements. Section B places agricultural growth in an economy-wide perspective with reference to food requirements and supplies, other outputs and trade. Section C discusses the contribution of technical progress and input supply, including land and land improvement (flood control, irrigation and settlement), and examines questions of intersectoral linkage and investment allocation to agriculture. The impact of increasing the labor supply in agriculture and its relationship to output growth, real earnings and living standards in the rural areas are described in Section D.

A. Overview of Agricultural Achievements

3.03 The main highlights of agriculture’s performance and achievements can be summarized as a basis for the more detailed discussions that follow. There are perhaps three major achievements. First, Chinese agriculture has sustained (under conditions of virtual self-sufficiency) a population that accounts for about 22% of the world’s total with less than 8% of the world’s arable land. With some notable exceptions, such as in 1960 and 1961, supply of basic necessities has been maintained while the population increased by some 430 million in the 30-year period since 1949—an average rate of increase of 2.0% p.a. Provision of the basic necessities, together with the maintenance of a food security system to ensure their availability in times of local or national misfortune, has been a continuing policy preoccupation. No large developing country has done as well as China in this regard.

3.04 Second, while rural underemployment may exist, there is still little or no overt unemployment in rural China today, and the collective agricultural system continues to provide both work and income to a peasant population that increased by about 370 million since 1949. Yet best available data indicate that the total arable area increased by only 2% from 1949 to 1979 and the sown area (a better indicator of land availability, given China’s high multiple cropping index) increased by only 5% after 1952. With high population growth in the rural areas (2.0% p.a. from 1949), the man/land ratio sharply worsened. Indeed, the data imply that rural population per arable hectare rose from about 5:1 to 8.5:1 over the whole period.
3.05 A third achievement was the carrying out of the above while absorbing only a modest share of the nation's total investment resources—perhaps about 20% in more recent years, and certainly less than this in earlier years. In particular, agriculture has typically accounted for only 10–12% of the state capital construction budget \(^1\) (or roughly a quarter of the funds allocated for industrial development). In addition it is at least arguable (the data are too limited for a complete analysis) that agriculture contributed significantly to industrial development through unfavorable terms of trade, at least until the mid-1960s.

3.06 These achievements are well understood and appreciated in China. But appreciation is mixed with some disappointment about progress and a sense of missed opportunities with respect to past performance. Two aspects are particularly important. First, while agriculture supplied the economy with its basic food necessities, it did little more than this. Per capita consumption of major items appears to have been higher in 1957 than in 1952, but the following two decades were a period of little change. During these 20 years, agriculture was clearly only just providing for the basic food needs of the economy. As recently as 1972, for example, national per capita grain availability for consumption fell to only 85% of levels attained much earlier. Throughout the period it has been necessary to maintain strict rationing of such items as grains, oils, sugar and cotton cloth. A second point, though this is much more difficult to verify in statistical terms, is a high probability of little or no physical increase in the per worker net productivity of the agricultural labor force, at least through 1977. Indeed net output (value added at constant prices) per worker probably fell between 1957 and 1977.

3.07 Over the whole period, some overall increase in real consumption per agricultural worker was achieved—of the order of 1.7% p.a. But about half of this was due to improved terms of trade, whereby agricultural procurement prices were increased (particularly in the 1950s, early 1960s and late 1970s) while the prices of industrial products consumed in the rural areas were held constant or declined. Benefits from this mechanism, however, largely depend on the size of any surplus production of the peasant community available for sale to the state. Many poorer areas with a small surplus gained little benefit. Moreover, such areas were, in general, least affected by "green revolution" agricultural technology—improved seeds, irrigation and chemical fertilizer. Thus, the problem of regional income disparities is coupled with the more general problem of raising peasant household living standards.

\(^1\) This is the source of funds for large projects. Agriculture's share was actually smaller because hydropower and flood protection works for urban areas are also included in the agricultural investment data.
B. Agricultural Growth in an Economy-wide Perspective

Phases in Agricultural Development

3.08 An analysis that emphasizes the phases in China's agricultural development is appropriate in view of the significant effects on agriculture wrought by the rather abrupt changes in policy since the late 1950s. Such an approach is also dictated by data availability, since there are no continuous series yet available.

3.09 Data pertaining to the major phases are shown in Table 3.1, which disaggregates agricultural output into subcategories, some of which are based on mission estimates. A brief discussion of the various phases follows.

1 The Chinese statistical system distinguishes some five categories of agricultural output: crops, animal husbandry, fisheries, forestry and brigade-managed enterprises together with production team sideline activities. Most brigade enterprise and some team sidelines are not agricultural activities in the usual sense of the term, and it seems that many sidelines in the past have evolved to become brigade or commune managed enterprises. The category of brigade managed enterprise seems to have been recognized in the statistical system only after 1970 but grow rapidly thereafter. Team sidelines also include hunting and gathering activities, e.g. of medicinal herbs and natural forest products. In most of the subsequent analysis "agriculture" is defined to exclude brigade enterprises and sidelines. Where these are included, the term "agriculture plus sidelines" is used.

2 In general, data reporting systems improved steadily in the 1950s until 1957, but deteriorated subsequently during the Great Leap period when considerable exaggeration seems to have been common in lower level reporting units. After some recovery towards the mid-1960s, the system was virtually dismantled during the Cultural Revolution and many data were destroyed or not collected. The system continued at a low ebb through the early to mid-1970s, and estimates from these years should be treated with considerable reserve. Only in the past two years has a substantial reconstruction of the statistical reporting system been effected, and data for some important aggregates are still largely lacking.
Table 3.1: GROWTH RATES OF GROSS AGRICULTURAL OUTPUT, 1952-79

<table>
<thead>
<tr>
<th>Period</th>
<th>Foodgrain /a</th>
<th>Cotton &amp; oilseeds /a</th>
<th>Other crops /a</th>
<th>Animal husbandry &amp; fisheries</th>
<th>Brigade enterprise &amp; sidelines</th>
<th>Agriculture</th>
<th>Ag + sidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952-57</td>
<td>3.3</td>
<td>2.2</td>
<td>8.3</td>
<td>7.2</td>
<td>4.0</td>
<td>4.6</td>
<td>4.5</td>
</tr>
<tr>
<td>1957-65</td>
<td>nil</td>
<td>1.1</td>
<td>1.8</td>
<td>3.2</td>
<td>6.6</td>
<td>0.9</td>
<td>1.4</td>
</tr>
<tr>
<td>1965-77</td>
<td>3.1</td>
<td>1.8/b</td>
<td>0.1/3</td>
<td>2.4</td>
<td>3.4/b</td>
<td>10.5/12.5</td>
<td>8.9/8.1</td>
</tr>
<tr>
<td>1977-79</td>
<td>9.3</td>
<td>13.2</td>
<td>2.1</td>
<td>8.7</td>
<td>12.5</td>
<td>8.1</td>
<td>8.8</td>
</tr>
<tr>
<td>1952-79</td>
<td>2.6</td>
<td>1.7</td>
<td>3.3</td>
<td>4.4</td>
<td>8.3</td>
<td>3.0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

/a Derived from official estimates of crop output, as follows: average unit values at 1970 prices were obtained from data supplied to the mission for Sichuan province and applied to national physical output data for foodgrain crops, cotton and oilseeds. "Foodgrains" includes soybeans, pulses, and the grain equivalent (one fifth the wet weight) of tubers. It also includes the value of grain by-products. "Other crops" was derived as a residual: it is dominated by vegetables, fruit production, and various perennial crops. 1979 shares in aggregate agricultural output were: foodgrains, 58.9%; cotton and oilseeds, 7.1%; other crops, 12.7%; animal husbandry and fisheries, 17.9%; and forestry, 3.3%. Foodgrains, cotton and oilseeds accounted for 75.1% of gross output in 1952 and 66.0% in 1979.

/b 20-year growth rate, 1957-77.

Source: Assumptions described above and data supplied to the mission.
3.10 **First Plan Period, 1952-57.** The first task in agriculture following the establishment of the People's Republic was restoration and recuperation. Recovery was rapid and pre-war levels of agricultural production were attained by about 1952/53. Thereafter a phase of continuing development during the First Five-Year Plan period raised output to record levels. This was based largely on land development and irrigation (mostly through labor-intensive works), plus some more ambitious schemes of flood control, especially on the North China Plain. Much locally supported investment took the form of labor contributions, largely for various types of farmland construction - extensions to the arable area, land levelling, ditch and dike construction and road building. The general pattern was, in fact, not very different from that found elsewhere in the developing world of the 1950s, though the scale of effort - sometimes with individual works involving tens of thousands of peasants - was probably unique. Many of the centrally supported large schemes for irrigation, flood control and hydro-power were initiated with Soviet assistance in design and engineering, usually in association with river basin authorities (e.g. for the Huang He, Chang Jiang, Hai, etc.). Output data suggest that grain production increased some 25 million tons between 1952 and 1957, with 70% of this from additional paddy rice production. The expansion of 4 million ha in paddy rice area (equivalent to over 10 million tons of grain at 1952-57 average yields) was a major factor. The end of this phase of relatively rapid growth was in 1957/58.

3.11 **The Great Leap and Recovery, 1957-65.** A series of bad years in terms of weather and the disruptions of the attempted Great Leap Forward checked agricultural progress severely. Output does not seem to have recovered to 1957/58 levels until about 1964. The effects were particularly severe on foodgrains and other field crops. The worst year was 1960, when grain production fell below 150 million tons to about three quarters of the 1957 level of production. On the other hand, a major emphasis on the development of rural industry, while costly and wasteful in its early stages, resulted in a rapid growth of "sidelines." This feature has continued during subsequent phases. 

3.12 The difficulties experienced in 1959-61 prompted a wide-ranging review, which had important consequences for agricultural policy and investment strategy. Thereafter, until the late 1970s, agricultural development strategy followed an input-oriented approach, with increasing reliance on industrial products - chemical fertilizers, equipment and machinery - to spur agricultural output. State investment allocations to agriculture were substantially raised in the 1960s, along with higher allocations to branches of industry that produced agricultural inputs. By the mid- to late-1960s, China's burgeoning industrial sector was able to supply many items important

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/1 Sidelines accounted for 4.3% of "agriculture plus sidelines" in 1957; by 1979, including the new category of brigade enterprise, the proportion had risen to 15.1%.
for agricultural modernization, including pumps and engines for irrigation, threshing, small-scale hydropower and other purposes; tractors (in various sizes) and equipment for repair and maintenance facilities; and chemical fertilizer and plant protection materials. The prices of these industrial inputs were reduced considerably, by 30-50% in many cases, to stimulate their use. An Agricultural Bank was set up in 1963 to distribute large volumes of agricultural credit; and procurement prices were substantially raised in 1961/62, on average by close to 30%, partly to encourage higher collective savings for reinvestment. The initial stages of this policy coincided with the beginnings of a stream of new and improved high yield varieties from agricultural research, especially of rice and wheat. The steady expansion in use of "green revolution" technology in China marks a period of sustained progress in food production from about 1965.

3.13 The "Ten Years of Turmoil," 1966-76. Beginning in 1966/67 and lasting until 1976, the input orientation of agricultural development was further intensified as "physical directive" (para. 2.59) again became the dominant mode in agricultural planning. Thus prices of agricultural outputs and inputs changed relatively little over this decade. Agricultural credit became merely supportive of physical allocations of input supplies, which in turn reflected bureaucratic decisions about crop production, land use and cropping patterns. Agricultural policies became dominated by political slogans rather than economic considerations, and technical criteria (together with technician training) were neglected. Nevertheless, with provincial grain self-sufficiency and "grain first" as dominant themes in policy, foodgrain output appears to have grown at about 3% p.a. through the period 1965-77 (choice of these years is limited by data availability). This was accompanied by a renewed emphasis, beginning in the late 1960s, on rural industry and brigade- and commune-managed activities, which grew in excess of 10% p.a. In contrast, growth of cotton and oilseeds was virtually halted. Animal husbandry continued to show steady growth.

3.14 Overall agricultural growth at some 2.9% p.a. was supported by a substantial increase in use of modern inputs (agricultural machinery, irrigation power equipment and chemical fertilizer). There is, however, evidence of sharply rising unit costs of production, and farmer productivity and income were probably little increased. These matters are discussed below.

3.15 The Reform Period, 1977 and Beyond. Under new leadership, policy changes on a broad front have been made since 1977. These have involved improved producer incentives and a balance in local decision making that gives more weight to producers (production teams and brigades) in planning decisions. These changes, coupled with a further large increase in the supply of chemical fertilizer, reasonable weather in 1978 and exceptionally good weather

/1 The Agricultural Bank was merged into the People's Bank in 1966.
conditions in 1979, resulted in a major spurt in the growth of a broad array of agricultural outputs. Available data indicate that gross agricultural output grew by 8.5% p.a. over these two years and foodgrain production by 9.3%. Cash crop production (cotton, oilseeds) recovered sharply, and growth of animal husbandry (dominated by pork) was also rapid. Part of the large increase in agricultural output almost certainly represents catching up with underlying growth potential. Since the reforms themselves have not yet fully worked through the system, there may yet be scope for further output increases of this type. /1

Agriculture, Population Growth and Trade

3.16 In overall terms, perhaps the most striking impression from the various time series data of agricultural development is the dominant effect of the demographic factor in aggregate agricultural growth. Table 3.2 compares agricultural and population growth and gives the implied per capita increase of agricultural output over various periods. Except for the two most recent years, the per capita increase has clearly been very limited, and was negligible over the 1957-77 20-year period.

Table 3.2: GROWTH RATES: AGRICULTURAL PRODUCTION AND POPULATION, 1952-79

<table>
<thead>
<tr>
<th>Total</th>
<th>Agriculture /a population</th>
<th>Per capita increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(% p.a.)</td>
<td></td>
</tr>
<tr>
<td>1952-57</td>
<td>4.6</td>
<td>2.4</td>
</tr>
<tr>
<td>1957-77</td>
<td>2.1</td>
<td>1.9</td>
</tr>
<tr>
<td>1977-79</td>
<td>8.1</td>
<td>1.3</td>
</tr>
<tr>
<td>1952-79</td>
<td>3.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

/a Excludes brigade enterprise and sidelines (footnote /1, p. 50).

Sources: Data from Table 3.1 and population data supplied to the mission.

/1 Agricultural output in 1980 was checked by poor weather conditions, so that grain production (318.2 million tons) fell slightly in relation to the record of 1979 crop (332.1 million tons). Nevertheless, a surge in cash crop and meat production helped to raise gross output overall by 2.7%; so that average growth (agriculture plus sidelines) over the 3-year reform period was 6.7% p.a.
3.17 The limited improvement in the per capita availability of major food items is confirmed by the production data of Table 3.3. Trade data on a commodity basis are not systematically available for years earlier than 1977, although some estimates for trade in grains have been made. These estimates indicate negligible grain trade prior to 1957 and net imports accounting for about 2% of domestic consumption thereafter, adding about 11 kg to per capita availability in 1979. The increase in net grain imports in the most recent years probably reflect in large part the increased use of domestically produced grain for livestock feed in the rural areas. In terms of consumption shares, sugar and vegetable oils are the most significant imported supplements to domestic consumption, adding about 1.1 and 0.2 kg per capita respectively in 1979. (About one third of tea production is exported.)

3.18 Major agricultural outputs that are not food related include cotton and various fiber crops (silk, jute, etc.), plus wool, timber and forest products (natural oils and resins) and rubber. For cotton, the most important crop, per capita availability increased by about 25% from 1952 to 1965, but fell back sharply thereafter to about the 1952 level by 1977/78. Imports of raw cotton added about one quarter to domestic availability in 1979; and cotton is now a sizeable item in total commodity imports. China also imports some timber and rubber. In aggregate, imports and exports of nonfood agricultural materials were roughly balanced in 1979. /1 The share of all farm and sideline products in total commodity imports fell from 40% in 1957 to 23% in 1979.

3.19 Insufficient data were available to allow detailed analysis of trends in food availability, taking separate account of consumption levels and patterns in rural and urban areas. Some recently reported surveys of urban and commune households imply that the difference in nominal and (in all probability) real incomes between rural and urban areas is substantial. /2 It is likely, therefore, that urban per capita consumption standards are a good deal higher than those in rural areas. In one of the provinces visited by the mission, per capita meat consumption was reported to be twice as high in the urban areas as in the rural areas. Per capita grain availability among

/1 Including cotton yarn and filature silk as agricultural exports, but excluding cotton, wool and silk piece goods and fabrics and carpets.

/2 These surveys, conducted by the State Statistical Bureau, consisted of (a) a survey of 10,282 commune households in 23 provinces, municipalities and autonomous regions, reporting 1979 income and expenditure, and (b) a survey of 86,955 urban wage earners' families for the first quarter of 1980. Monthly per capita income among urban wage earners' families was Y 35.8, i.e. Y 429.6 p.a. The average per capita income among commune households in 1979 was reported as Y 160.2, i.e. 37% of the average for urban wage earners' families.
the noncommune population can be roughly estimated, with plausible assumptions, at the equivalent of about 400 kg (unmilled grain) p.a. The recent survey of commune households reported per capita grain consumption at some 257 kg (unmilled grain) — only two thirds as high. Similarly, urban meat consumption has been reported at 18 kg per capita per annum in 1980; with a national average availability of 12.3 kg, implied rural consumption would be about 10 kg.

| Table 3.3: FOOD PRODUCTION: KG PER CAPITA PER ANNUM, 1952-80 |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Grain, unmilled |                 |                 |                 |                 |                 |                 |                 |
| basis /a        | 234             | 248             | 215             | 232             | 239             | 274             | 260             |
| Meat /b         | 5.9             | 6.2             | n.a.            | n.a.            | 8.3             | 10.9            | 12.3            |
| Vegetables /c   | n.a.            | (79)            | n.a.            | (78)            | (94)            | (92)            | n.a.            |
| Oils            | 3.1             | 2.7             | 2.1             | 1.9             | 1.7             | 2.7             | 3.1             |
| Fish /d         | 2.9             | 4.7             | n.a.            | n.a.            | 5.0             | 4.4             | 4.6             |
| Fruit /e        | 4.3             | 5.6             | n.a.            | 4.1             | 6.0             | 7.2             | n.a.            |
| Sugar           | 0.8             | 1.3             | n.a.            | 1.8             | 2.6             | 2.6             |                 |
| Tea             | 0.1             | 0.2             | 0.1             | 0.2             | 0.3             | 0.3             | 0.3             |

/a Seed, feed, incremental reserves and industrial uses assumed to be 20% of gross production.
/b Pork, mutton and beef only.
/c Estimated from official data of sown area, with yields assumed at 20 tons/ha in 1957, increasing at 1.5% p.a. thereafter.
/d Gross weight of catch divided by population.
/e Gross production divided by population.

Sources: Estimated from data supplied to the mission by the State Statistical Bureau and the Ministry of Agriculture.

The assumptions used were as follows: with a commune population of 807 million and grain consumption per capita of 257 kg in 1979, total consumption would be some 207 million tons. Total production plus net imports would be about 342 million tons in 1979; seed, feed, reserves and industrial uses might account for about 70 million tons. Hence, grain availability for the noncommune population (164 million) was 65 million tons, i.e. about 400 kg per capita.
C. Investment in Agriculture: Land Improvement, Input Supply and Technology

Overview

3.20 Only limited data are available to describe the quantum of investment in agriculture since 1952 (Table 3.4). "Capital construction" covers state support for fixed capital formation in agriculture and is associated mainly with large-scale projects. These data also include what may be sizeable allocations to major hydropower schemes (which were a responsibility of the Ministry of Water Conservancy until 1979) and urban flood protection of limited direct relevance to agriculture. The separate "support to agriculture" category includes minor project expenditures (mainly from county and provincial budgets) and expenditures on agricultural services such as training, extension and research. The combined total indicates a rising level of state outlay, associated mainly with the increasing size of the overall budget. Taxes on agricultural output were roughly constant over the period from the early 1950s. At that time they accounted for a sizeable proportion (about 10%) of total sector value added but subsequently became much less onerous, though in recent years growing taxes on commune and brigade enterprise have begun to modify the declining tendency.

3.21 Two rough estimates of commune-financed accumulation (fixed and working capital) for 1965 and 1979 indicate a rising trend under this category of investment. These data include an accounting valuation of labor contributions, mainly for farmland capital construction (estimated officially at

/1 Projects with state support amounting to less than ¥ 20,000 (or $14,000) was the criterion in one province visited by the mission.

/2 With the prices of machinery, cement and steel tending to fall over time, little or no aggregate price increase is reflected in these trends.

/3 Taxes, accumulation and distribution to commune members showed the following pattern in one province visited:

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxes</td>
<td>11.3</td>
<td>15.2</td>
<td>9.8</td>
<td>7.8</td>
<td>6.7</td>
<td>5.2</td>
</tr>
<tr>
<td>Accumulation</td>
<td>6.3</td>
<td>13.9</td>
<td>11.0</td>
<td>8.4</td>
<td>14.0</td>
<td>12.8</td>
</tr>
<tr>
<td>Distribution</td>
<td>82.5</td>
<td>71.0</td>
<td>79.3</td>
<td>83.7</td>
<td>79.3</td>
<td>82.0</td>
</tr>
<tr>
<td>Total net income</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 3.4: ACCUMULATION AND STATE SUPPORT FOR AGRICULTURE, 1952-79
(Y billion)

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<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Capital construction funds</td>
<td>0.86</td>
<td>1.09</td>
<td>2.35</td>
<td>n.a.</td>
<td>3.72</td>
<td>5.68</td>
</tr>
<tr>
<td>Share of total</td>
<td>(7.8%)</td>
<td>(7.9%)</td>
<td>(13.7%)</td>
<td></td>
<td>(11.5%)</td>
<td>(12.1%)</td>
</tr>
<tr>
<td>2. Support for agriculture</td>
<td>n.a.</td>
<td>0.80</td>
<td>1.73</td>
<td>1.59</td>
<td>4.64</td>
<td>8.36</td>
</tr>
<tr>
<td>Of which:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water conservancy</td>
<td>0.46</td>
<td>0.89</td>
<td>2.08</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and animal husbandry</td>
<td>0.46</td>
<td>0.82</td>
<td>1.32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commune support</td>
<td>0.06</td>
<td>0.20</td>
<td>1.09</td>
<td>1.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.32</td>
<td>0.65</td>
<td>1.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Capital construction funds for agriculture-related heavy industry /b</td>
<td>0.15</td>
<td>[0.76]</td>
<td>[0.84]</td>
<td>[1.87]</td>
<td>[2.44]</td>
<td></td>
</tr>
<tr>
<td>4. Commune accumulation /c</td>
<td></td>
<td>6.5/d</td>
<td></td>
<td></td>
<td></td>
<td>19.5/d</td>
</tr>
<tr>
<td>N.B.:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Agricultural taxes</td>
<td>2.66</td>
<td>2.97</td>
<td></td>
<td>2.93</td>
<td>2.90</td>
<td></td>
</tr>
<tr>
<td>6. Commune and brigade enterprise taxes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.23</td>
</tr>
<tr>
<td>7. Terms of trade impact on agriculture /e</td>
<td>-5.2</td>
<td>-6.1</td>
<td>n.a.</td>
<td>0</td>
<td>9.9/f</td>
<td></td>
</tr>
</tbody>
</table>

/a Total expenditures on water conservancy were Y 2.23 billion (1965), Y 4.57 billion (1957-77 average), and Y 7.36 billion (1978-79 average).


/c Includes fixed and working capital, and covers agriculture, brigade and commune enterprise. After-tax commune and brigade enterprise reinvestment from profits (including support to agriculture) was about Y 5 billion in 1978/79.

/d Rough estimates based on an official estimate of the share of commune accumulation in total accumulation.

/e Data shown reflect the difference between state purchases of agricultural produce at 1970 prices and at current prices, assuming that all agricultural sales to the state are used to purchase industrial goods. This assumption may exaggerate the terms of trade effect, since some agricultural sales are subsequently repurchased within agriculture; on the other hand, some sales of agricultural produce to other sectors do not pass through the official marketing channels.


Sources: 1, 2, 4, 5, 6 - from official data supplied to the mission; 3 - from "The Relations Between Agriculture, Light Industry and Heavy Industry in China" by Yang Jiambai and Li Xuezeng, Social Sciences in China, No. 2, 1980.
20% of total commune-financed investment in the late 1970s). Self-financing is a much larger component in total financing than the combined total of state support, which illustrates the importance of self-reliance in agricultural development.

3.22 Financial flows associated with direct taxation on production, and state support of production, is only a part in a much larger framework of intersectoral resource flows. In China, from the early 1950s, the authorities established a pricing structure calculated to generate large profits for state industrial enterprise, the essential objective being to absorb resources surplus to basic consumer needs for capital accumulation. Subsequently, without fundamental modification in the basic objective, massive industrial development and increased productivity in state enterprise enabled an increasing resource flow for new industrial capital accumulation to be self-financed. In practice, though, profits were returned to the state budget before subsequent reinvestment in industry.

3.23 Physical indicators of a massive increase in the availability of irrigation and flood control facilities, rural electrification, machinery of various types and agrochemicals perhaps provide a clearer indication of the quantum of investment in agriculture than do the somewhat unsatisfactory financial data of Table 3.4. The aggregate data and growth trends described in Chapter 1 (Table 1.5) imply that the investments in agriculture have been large in the international context, comparing China with other developing countries. In effect, while agriculture has not been favored in Chinese investment planning (given its contribution to aggregate national income), the sheer size of total public investment outlays has ensured a substantial flow to agriculture, at least after the 1950s. In addition, the collective system in agriculture has mobilized substantial funds from what were and remain the very moderate incomes of the peasantry, as well as large contributions in labor.

3.24 Thus it is difficult to argue that investment in the past was, in some general sense, inadequate. But Chinese critics of past policies make several important points on this question. Investment priorities for agriculture were not always well selected, in part because technical and, particularly, economic criteria were largely ignored over long periods. The quantitative achievements mask considerable deficiencies, for example, the poor

/1 In practice, though, profits were returned to the state budget before subsequent reinvestment in industry.
quality of some chemical fertilizer and inappropriate types of agricultural machinery (see para. 3.36 below); some of the larger irrigation projects that require continuing subsidies to be viable (e.g. power subsidies for some high-lift pump irrigation systems); and some of the early flood control works that were implemented before proper study and have required substantial redesign later on. With limited incentives and heavy-handed directives from local officials, the potential of collective agriculture has not in the past been fully realized or well developed for want of an environment in which effective farm management could flourish. There was almost certainly a myriad of minor investments that could not be effectively scrutinized by local officials who themselves neither bore the consequences of failure nor enjoyed the fruits of success. A multitude of individually small, but collectively important, opportunities were lost for want of a local farm leadership able to seize and act upon its knowledge of the potential of the local environment.

**Land Development and Irrigation**

3.25 **Land Availability.** Intense and increasing pressure on a narrow arable land base is a major element in the interpretation of China's agricultural experience since 1949. Official estimates suggest that arable land availability, after increasing in the 1950s, fell thereafter to a level currently reported at 99.5 million ha (Table 3.5). A plausible explanation of post-1965 trends is that land losses (due to growing industrial, residential, infrastructure, hydropower and other requirements) in the already highly developed areas were large enough to offset the limited expansion that occurred in the border zones, primarily the northeast. All the populous provinces visited by the mission explained the decline in their arable land in this way. Land lost would frequently have been double cropped while land gained was mostly single cropped. But this explanation is much less plausible for the apparently large decline between 1957 and 1965./1 Among various explanations of this phenomenon are: (a) that following collectivization and the formation of the communes in 1958, labor was concentrated on the better arable lands and other land was converted to pasture or forestry uses; (b) that much land put under the plough in the 1950s could not in fact sustain continuous cropping and so fell into disuse for arable purposes; and (c) that the figure for arable land in 1957 is exaggerated, because at that time new

---

/1 Most increases in land availability were probably due to the development and reclamation work in state farms. Data reported by the Ministry of State Farms are as follows (in million ha):

<table>
<thead>
<tr>
<th>Year</th>
<th>Arable Area</th>
<th>Sown Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>1957</td>
<td>1.05</td>
<td>0.78</td>
</tr>
<tr>
<td>1965</td>
<td>3.33</td>
<td>2.64</td>
</tr>
<tr>
<td>1970</td>
<td>3.29</td>
<td>3.15</td>
</tr>
<tr>
<td>1979</td>
<td>4.36</td>
<td>4.51</td>
</tr>
</tbody>
</table>

The implied decrease in the sown area on commune and other cultivated land is therefore from about 156 million ha in 1957 to 140 million ha in 1965, increasing thereafter to 144 million ha in 1979.
land development was an important policy target. The steep increase in reported cropped area from 1952 to 1957 and subsequent decline in 1957-65 furnish strong support for the second and/or the third view.\footnote{1}

Table 3.5: ESTIMATES OF ARABLE AND SOWN AREA, 1949-79
(million ha)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Arable area</td>
<td>97.8</td>
<td>108</td>
<td>112</td>
<td>103.6</td>
<td>101.1</td>
<td>100</td>
<td>99.5</td>
</tr>
<tr>
<td>Sown area</td>
<td>n.a.</td>
<td>141</td>
<td>157</td>
<td>143</td>
<td>143.5</td>
<td>149</td>
<td>148.5</td>
</tr>
<tr>
<td>Cropping index</td>
<td>130</td>
<td>140</td>
<td>138</td>
<td>142</td>
<td>149</td>
<td>149</td>
<td>149</td>
</tr>
</tbody>
</table>

Source: Data provided by the Ministry of Agriculture.

3.26 Irrigation and Flood Control.\footnote{2} Extensive efforts to improve the land base, extend irrigation, drainage and flood prevention systems, and develop new lands were begun in the 1950s and were the main focus of rural investment during that decade. Huge projects for flood control drainage and gravity irrigation involved tens of thousands of peasant workers every dry season on the North China Plain and in other areas. Over the 30-year period, protection from flooding of the major rivers has been improved, in general, to afford protection against a 1 in 20-50 year flood occurrence; flood control standards for the majority of small rivers has also been raised. In total it is estimated by the Ministry of Water Conservancy that some 32 million ha of formerly flood-prone lands are now protected by dikes. The towns, industrial centers and other large settlements are now protected against floods of a 1 in 100-year frequency.

3.27 Over the 30 years since 1949 some 86,000 reservoirs were constructed, with a storage capacity estimated at about 400 billion cu m – close to 15% of the water runoff of the entire country. The large reservoirs are used for multiple purposes – flood protection, irrigation and hydropower.\footnote{3} State farm data show that of total new land developed between 1952 and 1979, some 16% was subsequently abandoned or put to other uses, including 7% for infrastructure, industrial and commercial purposes.

\footnote{1} See also Map IBRD 15527R: Hydrology and Water Conservancy Works.

\footnote{2} Hydropower was a responsibility of the Ministry of Water Conservancy until 1979; this ministry still deals with small hydropower plants (of 70 kW each, on average). Around 90,000 such plants had been constructed with a capacity of 6,340 MW at the end of 1979, or as much as 40% of total hydropower capacity in the country. The smaller plants (40 kW) are built by the communes themselves, on a loan basis. Some 1,000 such systems have been built in each of the last two years.
while medium-sized and small facilities are usually constructed for irrigation. Some 320 large reservoirs (those with a storage capacity exceeding 100 million cu m) have been built, plus some 2,200 of medium size (with a capacity of 10-100 million cu m) and more than 80,000 small facilities.\footnote{All but about 700 of the total are earthfill dams.} During the period, a capacity to undertake major works of a sophisticated type was developed. The largest reservoir is Danjiang Kan, on the Hanshui, a tributary of the Chang Jiang, with 20.8 billion cu m. A few large dams have a height exceeding 100 m, with a maximum of 146 m for the Liujiaxia dam, on the Huang He. These units will be surpassed by the 200 m high Three Gorges dam planned for the Chang Jiang, for which storage will exceed 70 billion cu m.

3.28 Total irrigation development is now estimated at some 45 million ha versus about 16 million ha in 1949. This represents some 45% of the total arable area, a proportion that contrasts with an estimated 17% for other developing countries. As much as 30 million ha are irrigated by pumping,\footnote{Data on irrigation power equipment, measured in HP units, are shown in Table 3.7. About half the pumps are now powered by electricity.} which reflects the very rapid development of groundwater reserves during the past 20 years. Some 11 million ha are irrigated by 2.1 million tubewells, 80% of them in northern China. The Chang Jiang basin is the largest irrigated catchment area, with 14.9 million ha. This can be compared with 7.4 million ha in the Huai basin, around 6 million ha in the Hai and 4.3 million ha in the Huang He catchment. Some 3 million ha are irrigated in the Sichuan basin area.

3.29 With major investments in water conservancy, China's grain production has become progressively less subject to year-to-year fluctuation due to weather. Negative deviation from one year to the next has probably not exceeded 7% of the total harvest since the disasters of the early 1960s. In 1980, for example, with serious floods and drought, aggregate grain production was within 5% of the record 1979 crop.

3.30 The enormous effort implied by the development of over 29 million ha since 1949 (about 1 million ha p.a.) would not have been possible without the massive involvement of the local populace organized by the collective institutions. The extensive participation of the rural population in construction and repair of facilities has often been described. Except for large dams built on major rivers or extensive dredging, almost all water conservancy work in China is done by hand, using wheelbarrows, small carts and often shoulder poles and baskets for transportation. Projects with tens of thousands of workers are common. On average, as many as 50-80 million participants are engaged on winter/spring construction campaigns, with a maximum of 110 million in 1973/74 when some 6 billion cu m of earth were reportedly moved.
3.31 The financial contribution of the communes and brigades is also of major importance. For the large schemes (generally larger than 20,000 ha or reservoirs larger than 100 million cu m) financing from the capital construction budget covers 100% of the costs of headworks, main and branch canals and structures. All tertiaries, structures, field ditches, land levelling, etc., are undertaken by the communes and brigades using local financing and labor. Medium and smaller schemes (700 ha to 20,000 ha) or reservoirs (10-100 million cu m) are also funded from the state capital construction budget, but labor payments are lower than for larger schemes. Funds needed for small schemes are usually raised by the communes themselves, but some material equipment costs are also partially subsidized by the state. State subsidies are larger in amount in poor areas. In aggregate, evaluated at standard wages, possibly 40% of all water conservancy work in China has been financed by the local communities (which also undertake subsequent maintenance and operation of tertiaries, field ditches, minor control structures, etc.). It was reported that state expenditure for water conservancy has amounted to some Y 77 billion ($52 billion) since 1949, i.e. close to Y 2.5 billion p.a., clearly the largest single element included under agricultural investment.

3.32 Problems in Land Development. Major problems in land development are erosion, siltation and salinity. Erosion control is mainly attempted by terracing and afforestation, but huge and sparsely populated areas, as well as adverse natural conditions, have limited the effectiveness of the work in the main problem area, the loess plateau of central north China. Reported failure rates are high in afforestation work, mainly because young trees need watering over several years before they are well established. Total replanted areas are often four or five times the size of the area in which trees are successfully established. In some areas serious erosion problems are caused by removal of the vegetative cover to meet fuelwood needs and feed. With continuing massive silting (an age-old problem of the Huang He) some of the newer reservoirs are filling at a rapid rate; the Sammenxia dam has lost about 5 billion cu m of storage capacity in this way. On the North China Plain, continuous silting also requires that the dike structures (for flood protection) be progressively raised, but drainage presents increasingly difficult problems in the neighboring areas as the river beds are elevated above the surrounding flood plains.

3.33 Poor drainage also contributes to the salinity problems that affect possibly 15% of the total irrigated area, i.e. some 7 million ha. Some secondary salinization seems to have occurred in the North China Plain as a result of the poorly designed water management systems developed during the

---

/1 Workers accumulate work points against the annual distribution and usually receive a supplementary grain ration as a daily allowance.

/2 These payments, once agreed between the local authorities and the participating communes and brigades, are paid over to the latter; workers actually accumulate work points plus additional ration grain.
late 1950s (associated with the Great Leap Forward). At that time irrigation was largely developed without drains, using the relatively salty (0.2-0.5 gm/liter) water of the Huang He. Drainage is also important in the northeast and northwest where substantial areas suitable for irrigation have saline soils. Vigorous efforts are now ongoing to tackle these problems.

**Manufactured Inputs**

3.34 Some perspective on the increased use of manufactured inputs in agriculture is provided by Tables 3.6 and 3.7, which show farm-level stocks of various types of machinery and the production of chemical fertilizer and plant protection chemicals. The acceleration in use over time implied by these data is particularly striking for some of the leading items such as tractors and nitrogenous fertilizer. Thus fully 50% of the 1980 stock of large tractors has been added since 1976 and over 50% in the case of small tractors. Similarly, the production of nitrogenous fertilizer in 1980 was more than twice what it was in 1976. Quite possibly, as much nitrogenous chemical fertilizer was made available over the four years 1977-80 as in the preceding 27 years since liberation. The recent increase is largely attributable to some 13 large capacity (each of 300,000 tons per year) urea plants, which were commissioned in the early 1970s and which are now reported to be working at, or near, their rated capacity. Most of these plants are located in southern China and serve the rice-growing areas./1

3.35 While the growth in use of manufactured inputs is quantitatively impressive, technology change on this scale and at this speed has given rise to several problems. The availability of nitrogen (N) has greatly increased relative to the other major nutrients, phosphorus (P) and potassium (K). Lacking an adequate local resource base for increasing the production of P and K fertilizers, and with limited imports, there is a considerable unsatisfied demand especially for phosphatic and, in some areas, potassic fertilizer. Studies based on soil analysis show that phosphate may now be the limiting factor in increasing crop yields in some of the more advanced areas of southern China, where use of chemical N is heavy. A second problem is the major use of low-grade ammonium bicarbonate, a fertilizer produced in small coal-based plants on a wide scale in China and still accounting for about half

/1 The use of organic manures is also reported to have increased, the latter associated particularly with the considerable growth of the pig population. Amounts of organic fertilizer available for crop production were estimated at some 1,209 million tons in 1957 and 1,572 million tons in 1965; the amount for 1979 probably exceeded 2,500 million tons. These data imply average application rates of about 25 tons per arable hectare. The usable nutrient content of this material is conjectural, but at 1% of the gross weight could be as high as 250 kg per ha still considerably greater than supplies from chemical fertilizer.
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</tr>
</thead>
<tbody>
<tr>
<td>Tractors (no.)</td>
<td>1,300</td>
<td>14,700</td>
<td>72,600</td>
<td>125,500</td>
<td>234,100</td>
<td>397,000</td>
<td>467,000</td>
<td>557,400</td>
<td>666,800</td>
<td>745,000</td>
</tr>
<tr>
<td>Of which:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owned by state farms</td>
<td>1,200</td>
<td>4,800</td>
<td>18,700</td>
<td>24,300</td>
<td>35,000</td>
<td>42,200</td>
<td>43,500</td>
<td>46,200</td>
<td>50,800</td>
<td>n.a.</td>
</tr>
<tr>
<td>Hand-tractors (no.)</td>
<td>n.a.</td>
<td>n.a.</td>
<td>39,600</td>
<td>78,800</td>
<td>302,200</td>
<td>825,000</td>
<td>1,090,000</td>
<td>1,373,000</td>
<td>1,671,000</td>
<td>1,874,000</td>
</tr>
<tr>
<td>Of which:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owned by state farms</td>
<td>n.a.</td>
<td>n.a.</td>
<td>5,900</td>
<td>n.a.</td>
<td>8,700</td>
<td>16,600</td>
<td>14,900</td>
<td>21,300</td>
<td>25,500</td>
<td>n.a.</td>
</tr>
<tr>
<td>Power-driven drainage and irrigation machines (mln HP)</td>
<td>0.1</td>
<td>0.6</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>60.0</td>
<td>65.6</td>
<td>71.2</td>
<td>74.6</td>
</tr>
<tr>
<td>Combine harvesters (no.)</td>
<td>300</td>
<td>1,800</td>
<td>6,700</td>
<td>8,000</td>
<td>9,200</td>
<td>14,200</td>
<td>15,700</td>
<td>19,000</td>
<td>23,000</td>
<td>n.a.</td>
</tr>
<tr>
<td>Of which:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owned by state farms</td>
<td>300</td>
<td>1,400</td>
<td>5,400</td>
<td>6,000</td>
<td>8,000</td>
<td>10,600</td>
<td>11,900</td>
<td>13,700</td>
<td>14,800</td>
<td>n.a.</td>
</tr>
<tr>
<td>Threilers (no. mln)</td>
<td>n.a.</td>
<td>n.a.</td>
<td>0.11</td>
<td>0.5</td>
<td>1.0</td>
<td>1.8</td>
<td>1.9</td>
<td>2.1</td>
<td>2.3</td>
<td>n.a.</td>
</tr>
<tr>
<td>Processing machines (no. mln)</td>
<td>n.a.</td>
<td>n.a.</td>
<td>0.2</td>
<td>0.9</td>
<td>1.7</td>
<td>2.4</td>
<td>2.5</td>
<td>2.7</td>
<td>2.9</td>
<td>n.a.</td>
</tr>
<tr>
<td>Paddy seeding machines (no.)</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>11,100</td>
<td>52,700</td>
<td>71,500</td>
<td>88,100</td>
<td>92,600</td>
<td>n.a.</td>
</tr>
<tr>
<td>Machine-plowed area (mln ha)</td>
<td>0.1</td>
<td>2.6</td>
<td>15.6</td>
<td>18.2</td>
<td>26.5</td>
<td>34.9</td>
<td>38.4</td>
<td>40.7</td>
<td>42.2</td>
<td>41.0</td>
</tr>
<tr>
<td>Of which:</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>In state farms</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>3.3</td>
<td>3.4</td>
<td>3.5</td>
<td>3.7</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Source: Data supplied to the mission by the Ministry of Agricultural Machinery and the State Statistical Bureau.
Table 3.7: PRODUCTION OF AGROCHEMICALS, 1952-80  
(million tons, gross weight)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>0.19</td>
<td>0.61</td>
<td>4.94</td>
<td>7.25</td>
<td>14.27</td>
<td>18.18</td>
<td>26.24</td>
<td>36.37</td>
<td>42.00</td>
<td></td>
</tr>
<tr>
<td>Urea</td>
<td>8.35</td>
<td>11.61</td>
<td>17.29</td>
<td>20.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonium bicarbonate</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphate</td>
<td>0.12</td>
<td>3.82</td>
<td>5.04</td>
<td>9.96</td>
<td>10.29</td>
<td>9.49</td>
<td>5.70</td>
<td>10.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>n.a.</td>
<td>0.00</td>
<td>0.02</td>
<td>0.03</td>
<td>0.04</td>
<td>0.08</td>
<td>0.08</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total /a</td>
<td>0.19</td>
<td>0.73</td>
<td>8.76</td>
<td>12.31</td>
<td>24.26</td>
<td>28.51</td>
<td>35.81</td>
<td>42.15</td>
<td>52.15</td>
<td>n.a.</td>
</tr>
<tr>
<td>Total (nutrient content)</td>
<td>0.04</td>
<td>0.15</td>
<td>n.a.</td>
<td>n.a.</td>
<td>7.24</td>
<td>8.69</td>
<td>10.65</td>
<td>12.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (kg per arable ha, nutrient content)</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>64</td>
<td>89</td>
<td>109</td>
<td>128</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (pesticides)</td>
<td>0.002</td>
<td>0.065</td>
<td>0.193</td>
<td>0.321</td>
<td>0.454</td>
<td>0.389</td>
<td>0.458</td>
<td>0.533</td>
<td>0.524</td>
<td>0.537</td>
</tr>
</tbody>
</table>

/a Considerable and increasing quantities of chemical fertilizer have also been imported, e.g. 1976 - 4.59 million tons, 1977 - 6.40 million tons, 1978 - 7.33 million tons, 1979 - 8.40 million tons.

Source: Data supplied to the mission by the Ministry of Agriculture and the State Statistical Bureau.
of total nitrogen output. Ammonium bicarbonate is highly volatile; as much as half the nutrient can be lost in transportation and in application, and so does not become available for plant growth./1 A third problem has been the tendency to encourage some farming communities to apply more chemical fertilizer than is warranted by the economic response application level. In the past, technicians tended to recommend usage rates calculated to maximize crop yields, and this inevitably leads to overapplication. Thus in some areas it was claimed that fertilizer use may fall in future, because under the new policies giving production teams more decision making powers, economic considerations are receiving greater attention in crop technology. Nevertheless, aggregate production and use continued to grow rapidly in 1980, by 15.7% compared with 1979.

3.36 Some problems with regard to agricultural machinery are essentially the same as those described for chemical fertilizer. In particular, much of the machinery available over the 1970s was of indifferent quality or inadequate design. Some was provided to communes on a grant basis. During most of the 1960s and 1970s when the authorities emphasized local self-sufficiency, numerous tractor plants and other equipment facilities were established; but those plants varied in quality, reflecting differences in locally available engineering skills and know-how of the work force. In some areas, production from these plants could more or less be forced onto sometimes unwilling commune purchasers, while in other areas (especially where local plants were turning out high quality products) machinery might be in short supply. With greater emphasis on the use of credit for machinery acquisition and more local level autonomy in purchasing decisions, production of tractors fell sharply in 1980: by 22% for medium and large tractors and 32% for pedestrian tractors.

3.37 A series of questions about mechanization in agriculture and its potential for displacing labor in the rural areas are now attracting considerable interest among Chinese scholars and agricultural planners. /2 Studies of the impact of tractor mechanization on crop yields and cropping intensities would be of particular interest. Its impact is probably important in areas where there is a special premium on rapid and timely land preparation and

/1 Efforts to reduce this problem are focused on (a) pelletizing the product at the manufacturing stage, and (b) advisory work to ensure application of bicarbonate as a basal dressing. Some of the more inefficient manufacturing plants have been closed and planned large-scale production of ammonia urea may reduce bicarbonate usage in the future.

/2 Such mechanization covers a considerably wider field than tractor mechanization alone. While aggregate indices of mechanization are still quite low for a number of field operations in China (sowing 10%, harvesting 3% and transplanting [rice] 1%), significant savings are associated, for example, with the wider use of mechanical threshers.
harvesting, for example in parts of north and northwestern China that have short and variable growing seasons. In eastern China, mechanization is stimulated by labor scarcity due to double and triple cropping in agriculture, plus a very substantial development of brigade and commune enterprise. Elsewhere, however, these effects of mechanization may have seemed unlikely to be of major importance, and in aggregate, more mechanization may have been undertaken than would be justified by economic considerations alone. This was almost certainly true during earlier periods when machinery was made available to production units on very attractive terms. Under collective agriculture, the consequences of excessive mechanization are economic rather than social, since labor displaced by machines is assigned to other tasks, albeit often of a low productivity. Its major impact is therefore on the costs of production.

3.38 Very possibly, however, the bulk of the more recent massive increases in the farm-level stock of tractors is in fact essentially an investment in transportation. In some areas, the use of tractors for haulage (associated with 0.5-1.0 ton capacity trailers) is reported to account for 80-90% of total tractor operating time. The area plowed per tractor also seems to have fallen drastically. Comparing the relevant rows of Table 3.7 (with four pedestrian tractors treated as equivalent to one medium-sized or large wheeled tractor), the apparent fall indicated is from about 190 ha in 1965 to about 60 ha by 1976 and to 34 ha by 1980. These data undoubtedly exaggerate the decline of plowed area per tractor because tractors were increasingly used in double-cropped areas of southern and eastern China, while land data relate to arable rather than to cropped area. Even so some considerable decline must have occurred. Estimates of traffic flow in rural areas are not available to gauge the changing aggregate requirement for short-haul, commune-based transportation. Much of the traffic associated with official purchases and deliveries of produce is undertaken by agency-owned vehicles or vehicles rented from local transportation companies. However, it

\[/1\] Much mechanization has been associated with tasks that are otherwise extremely demanding in terms of human labor, so that there is a quality of life dimension (as well as a production dimension) associated with certain types of labor displacement.

\[/2\] To take an extreme case, suppose each tractor in 1980 worked a full two plowing seasons versus only one in 1965; the 1980 plowed area would still (at 68 ha) be only about one third the 1965 area. Another possibility is that the data exaggerate the number of tractors actually available for use, due to the inclusion of tractors under repair or that have been scrapped. Some exaggeration of this kind is probably built into these estimates; one local estimate, for example, was that only 70% of tractors at the farm level were actually in use. However, the size of the recent increases in the tractor stock implies that the average age of vehicles could not have been increasing very rapidly, if at all. Hence this factor is unlikely to affect the general conclusion.
seems very likely that a considerable upsurge occurred in the late 1970s as incomes rose, rural markets were activated, and seasonal inputs such as chemical fertilizer became more widely available.

<table>
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</thead>
<tbody>
<tr>
<td>Equivalent tractor units (’000)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area mechanically plowed (million ha)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Average area plowed per tractor (ha)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

At the current stage of development, there are in fact few alternatives to the tractor (except the animal- or human-powered cart, also still much in evidence) for local haulage work. Trucks suitable for road transport of agricultural materials are expensive to purchase and operate for communes, and a light, high payload and fuel-efficient road vehicle has yet to be developed for local manufacture.\(^1\) Fuel pricing policy has also heavily favored tractor transportation: Tractors use diesel fuel, which is available at special subsidized rates for agricultural purposes (the rates have not been changed since 1965), while trucks use gasoline (which is sold at much higher prices), and are subject to heavy annual licensing fees.

**Agricultural Research and Extension**

The contribution of scientific work to the development of agriculture has been considerable, especially considering the low initial base and the need to build a system and train researchers with little effective outside help. Research has complemented irrigation development and the increased availability of chemical and organic fertilizer and the combination of research, fertilizer and irrigation has helped to make possible the large yield increases in cereal agriculture described in Chapter 1.

Research development seems to have focused mainly on rice and wheat, and results seem most striking for these two crops. However, indicated yields are relatively high for most other cereals and have also been increasing rapidly in the case of corn and sorghum. For rice particularly, China has pioneered a number of approaches in biological innovation. The first semi-dwarf improved rice was released in 1959, some seven years before the International Rice Research Institute released its IR8 variety. In the 1970s,

\(^1\) It is interesting that the 1980 report of Plan results describes a substantial rise in the farm-operated stock of trucks from 97,000 (1979) to 135,000 (1980) - close to a 40% increase in one year.
China was the first nation to develop and popularize a rice hybrid, and it has developed techniques for rapidly stabilizing the varietal characteristics in new plant material. About 5 million ha of riceland is now planted to hybrids. The development and popularization of early-maturing, semi-dwarf, high-yielding varieties in the late 1950s to mid-1960s and of hybrid rice in the 1970s have contributed significantly to increased rice production during the past 15 to 20 years. The rice varietal improvement program has stressed yield and early maturation as the main breeding objectives, but many of the popular varieties planted today are also resistant to important diseases like blast, bacterial leaf blight, and sheath blight, as well as brown planthopper and other insect pests.

3.42 Research has also contributed to the significant advances in wheat and corn production of recent years. The main breeding objectives for wheat are: (a) early maturation for use in multiple cropping; (b) semi-dwarf cultivars adapted to irrigation; and (c) resistance to major disease like scab. Most improved varieties planted today combine high yield with the above desirable characteristics. Irrigation has also been extended to more than 80% of the wheat area and is a major factor in accounting for the yield and production increases. To widen the genetic resources, spring wheat cultivars were introduced from abroad (including Mexico). The materials were used to develop varieties suitable for the South and Northeast. Most of the 5 million ha south of the Chang Jiang was planted to Chinese-Mexican crosses and another 2 million ha in the Northeast planted to Mexican or Chinese-Mexican crosses. In the better areas wheat yields of close to 6 tons/ha have been obtained. Spring wheat has also been successfully intercropped with corn and other crops. Chinese scientists have been experimenting with hybrid wheat, pollen culture and mutation genetics, none of which has yet proved successful, however. About 70% of China’s 20 million ha of corn is planted to hybrid varieties.

3.43 Apart from crop-specific research, China has done much pioneering work in other biological innovation, notably with the use of azolla and other green manures, in the development of biogas (and experiments to enrich the organic slurry for liquid fertilizer purposes), and in the use of forages and agricultural residues (rather than feedgrains), in livestock-fattening systems.

3.44 Good research work is ineffective unless the farming community has access to the results. In this regard, China’s seven-level interlinked research and extension network has been studied as a model that other countries might seek to follow. Indeed, the extraordinary rapidity with which research results are disseminated and applied by the farming community sets the Chinese experience off from that of many other countries. These features owe much to the extensive use of radio as a medium of extension advice. Thus far, the extension system seems to have been operated at an extraordinarily low cost, with a very high ratio of farmers to paid technicians. In Sichuan, for example, 1 or 2 extension staff stationed at the commune level serve an
average of 65 production teams and about 2,500 farm families; this ratio is much different from the 1:300-400 families aimed for by many other countries.

3.45 These very high ratios, however, in part reflect the acute shortage of agricultural technicians, following the closure of training facilities during the Cultural Revolution period (as described in Chapter 2). Given the wide range of nonadvisory services that agricultural technicians assist with (including the collection of agricultural statistics and other administrative tasks), the authorities are attempting to increase the numbers of technicians, as soon as is practicable, to some three or four per commune. With many extension workers now near or past normal retirement age, however, the build-up will take several years to accomplish. Meanwhile, agricultural technical workers (for either research or extension-related activities) will remain in critically short supply.

3.46 The problems of extension work due to the Cultural Revolution and the low priority given to technical work in the early 1970s were also experienced in agricultural research. The considerable pressures to conform to politically inspired technical doctrine and de-emphasis of basic research were very detrimental to effective work. Researchers during this period could not pursue one of their most important functions, which is the questioning and testing of prevailing conventional wisdom. In particular, insistence on the general application of experience specific to certain environments, such as the "Learn from Dazhai" campaigns, could not be questioned or the appropriateness of the policy investigated. Arising from past neglect and deterioration of facilities during this period, the limited local capacity for soil testing (as a basis for improved crop- and area-specific chemical fertilizer recommendations) is a continuing problem that has become more critical given the huge improvement in chemical fertilizer availability.

3.47 Chinese agricultural research has also suffered considerably from its relative isolation from the international research community over long periods of time, especially in regard to crops that were not of primary interest. Thus the technical contribution to improvements for many of the cash or industrial crops - sugar, tea, tobacco, cotton, etc. - does not seem impressive. Research on upland and dryland agriculture (including range livestock) has also been rather weak, although this has been a worldwide phenomenon until recently. Outside observers have also noted the need for improved coordination and communication between the various levels of research, especially given the considerable compartmentalization among the various subject- and crop-specific research institutions.

/1 Short-course farmer training has also been extensively used in China to avoid the need for paid permanent staff.
D. Labor, Productivity and Earnings in Agriculture

Labor Force Growth

3.48 China, with by far the largest agricultural labor force in the world, is also almost unique among the developing countries in its strong measures to limit urban expansion, despite a large emphasis on industrial development. Indeed, comparing data for 1952 and 1979, the proportion of urban to total population was constant at 13.3%, though this may partly be a statistical artifact, since, for example, commune townships are classed as rural.

3.49 The available data suggest that rural population growth was most rapid during the early period (2.6% p.a. in 1952-57) and slowed substantially during the 1970s, when population control policies were vigorously pursued. Data for the two most recent available years (1978 and 1979) suggest a growth rate of less than 1%, with some outflow to the urban areas, perhaps mainly associated with the return of urban school leavers sent to the countryside during earlier times. But apart from the migration factor, slower overall rural population growth can have little effect on the growth of population of working age for some time to come, since additions to the adult population will continue to reflect high birth rates of the middle and late 1960s.

3.50 As in most low-income countries, measurement of labor force and employment in rural areas of China presents formidable problems, since in practice almost the whole population works at various times of the year. (All age groups can accumulate household work points as claims against the annual distribution of the collective surplus.) State Statistical Bureau estimates for the commune labor force include as workers all females from age 16 to 55 and all males from age 16 to 60 who work for more than three months per year in collective work activities.

3.51 Official estimates of agricultural labor show an increase of about 2% p.a. over the whole period since 1952 - 2.3% in 1952-65 and 1.8% subsequently. These data include the relatively small work force of the state farms. The slower rate in the more recent period probably reflects the growing importance of nonagricultural activities since the middle 1970s. Thus, total employment in commune-managed enterprises, probably of minor importance before 1970, grew to 13.1 million in 1979.

Net Output and Labor Productivity

3.52 An appropriate measure of growth and productivity in agriculture, one that conforms with a national income measure of output, is net agricultural output or value added. In principle, this is obtained by deducting the various material costs of production, measured at constant prices, from gross output. In practice, at the present stage of development of China's statistical system, official estimates of neither the costs of purchased inputs (measured either in current or constant prices), nor value added at constant
prices, is available nationwide. Rough estimates can, however, be made with some plausibility. Methods are described in Annex A, paras. A.2-A.9. The estimated growth of net output, together with the growth of the agricultural labor force and implied productivity growth, is shown in Table 3.8.

Table 3.8: GROWTH RATES OF NET OUTPUT, LABOR FORCE AND PRODUCTIVITY IN AGRICULTURE, 1952-79 (% p.a.)

<table>
<thead>
<tr>
<th></th>
<th>Net output /a</th>
<th>Labor force</th>
<th>Net output per worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952-57</td>
<td>4.9</td>
<td>2.2</td>
<td>2.6</td>
</tr>
<tr>
<td>1957-77</td>
<td>1.6</td>
<td>2.1</td>
<td>-0.5</td>
</tr>
<tr>
<td>1977-79</td>
<td>9.4</td>
<td>1.0</td>
<td>8.3</td>
</tr>
<tr>
<td>1952-79</td>
<td>2.7</td>
<td>2.0</td>
<td>0.7</td>
</tr>
</tbody>
</table>

/a At 1970 prices, excluding brigade enterprise.

Sources: Mission estimates of net output, plus official labor data.

3.53 Aggregate net output increased a little more slowly than gross output (2.7% p.a. versus 3.0% p.a.) over the whole period, essentially because the output gains were not commensurate as large as the increases in costs associated with the use of modern inputs (despite considerable price reductions for the latter in the 1960s). The striking features of the table are the apparent deterioration during the period 1957-77 when the use of inputs was increasing rapidly, and the very rapid increase in net output during the reform period (1977-79), when weather conditions were also generally favorable.

3.54 Despite the impressive gains of the past two years, it is clear that the result of past population increases, scarce land and limited

Data were, however, collected for Hunan province for net agricultural output and production costs (excluding labor) at current prices. They show the following pattern:

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Net output</td>
<td>78.1</td>
<td>79.7</td>
<td>74.6</td>
<td>70.6</td>
<td>66.8</td>
<td>66.9</td>
</tr>
<tr>
<td>Production costs</td>
<td>21.9</td>
<td>20.3</td>
<td>25.4</td>
<td>29.4</td>
<td>33.2</td>
<td>33.1</td>
</tr>
</tbody>
</table>

100.0    100.0    100.0    100.0    100.0    100.0

A decline in production costs per unit of output has been reported at the national level from surveys of production team accounts for the period 1977-79.
alternatives to agricultural employment is a considerable element of labor surplus in many areas of the countryside. No detailed studies of this question were available to the mission, but the results of some recent surveys in Anhui and Sichuan of areas that had introduced household or group contracting procedures (para. 2.20) are instructive. Large increases in output, and hence income, from collective agriculture were obtained, while labor input (measured in labor days) was considerably reduced (by 20-30%) for major field operations because workers were remunerated according to results, rather than for work attendance. In these areas, household activities were also being vigorously encouraged and have provided expanding supplementary employment opportunities.

Earnings and Living Standards in Rural Areas

3.55 Direct evidence of trends in rural living standards, for example through repeated surveys of income and consumption, is not available in a form that allows adequately for changing prices. It seems likely, though, that the productivity trends just described provide a fair reflection of past change. These data are consistent, for example, with the evidence of aggregate food availability as described in Table 3.3, which shows a small increase overall, and virtually no change between 1957 and 1977./1

3.56 Two modifying factors of some importance are (a) terms of trade effects, due to increasing procurement prices for agricultural goods versus near static and declining prices for industrial goods sold in rural areas, and (b) the growing importance of brigade- and commune-managed enterprises as a nonagricultural income source./2 The second factor probably adds more to collective savings than to actual consumption, since most profits are retained for reinvestment and most enterprises - at least at the brigade level - pay work points rather than wages at the average work point values of the respective production teams. Thus such workers are not much better paid than their agricultural counterparts (although they usually receive some supplementary food allowances). To take an extreme case, if it is assumed that commune and brigade workers were paid an average 50% above agricultural workers, the net effect would be to increase 1977 and 1979 aggregate disposable rural incomes by about 4% and 5% respectively./3

/1 Furthermore, urban real per capita incomes reportedly increased 60% between 1964 and 1979, so that any rural gain in per capita food availability was presumably very small.

/2 Other factors that could also affect real consumption include changes in the allocation of production team net income between accumulation and taxes and distribution, and increased per capita net budgetary transfers to rural collective consumption, for education and health, for example. No information is available about these aspects; however, it is plausible that increasing savings offset reduced agricultural taxation, comparing the late 1950s with the late 1970s.

/3 Based on commune labor force estimates of 302.5 million in 1977 and 305.8 million in 1979, and commune and brigade enterprise workers of 23 million and 29 million for the respective years.
3.57 The "terms of trade" effect was described earlier in relation to investment (para. 3.22 and Table 3.4). The net effect of this change, comparing 1957 with 1977 and 1979, was probably substantial. The base of the calculation is shown as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Purchases of farm products</th>
<th>Price index</th>
<th>Price index of industrial goods sold in rural areas</th>
<th>Terms of Trade (1970=100)</th>
<th>Exchange value of farm products for industrial goods</th>
<th>Terms of trade effect</th>
<th>Net output of agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952</td>
<td>9.0</td>
<td>62.3</td>
<td>98.0</td>
<td>63.6</td>
<td>14.2</td>
<td>-5.2</td>
<td>49.8</td>
</tr>
<tr>
<td>1957</td>
<td>17.7</td>
<td>74.9</td>
<td>100.7</td>
<td>74.4</td>
<td>23.8</td>
<td>-6.1</td>
<td>63.3</td>
</tr>
<tr>
<td>1970</td>
<td>31.4</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>31.4</td>
<td>nil</td>
<td>77.7</td>
</tr>
<tr>
<td>1977</td>
<td>41.3</td>
<td>107.2</td>
<td>98.1</td>
<td>109.3</td>
<td>37.8</td>
<td>+3.5</td>
<td>86.4</td>
</tr>
<tr>
<td>1979</td>
<td>58.7</td>
<td>136.1</td>
<td>98.2</td>
<td>138.6</td>
<td>42.4</td>
<td>+16.3</td>
<td>103.4</td>
</tr>
</tbody>
</table>

/a Based on a limited list of consumer and producer goods sold in rural areas.

3.58 Before discussing these results, two important qualifications relating to the estimation procedure should be emphasized: (a) the calculation omits any terms of trade effect due to agricultural sales to other sectors outside the official marketing channels, and (b) that sales to the state agencies include goods that are subsequently resold in rural areas, but these transactions do not represent an opportunity for sector exchange of agricultural for industrial goods. Neither of these effects can be easily assessed in quantitative terms. The biases are in different directions, so that the net effect may be relatively small. In order of

/a For 1979, the State Statistical Bureau estimates sales by peasants to nonagricultural households at Y 4.75 billion; the Food Ministry estimates sales of grain in rural areas at about 25% of total procurement; at 1979 prices this is worth about Y 4 billion.
magnitude terms, the estimates imply that terms of trade changes may have roughly doubled the rate of increase of "agricultural real income" per worker over the whole period 1952-79 to allow consumption standards to rise at about 1.7% p.a. Of the improvement, however, more than 50% is concentrated in the two most recent years, 1977-79. Data comparing the growth rates of net output and real income (net output series corrected for terms of trade effects) are as follows:

<table>
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<tr>
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<tbody>
<tr>
<td>Net output per worker</td>
<td>2.6</td>
<td>-0.5</td>
<td>8.3</td>
<td>0.7</td>
</tr>
<tr>
<td>Net output per worker corrected for terms of trade effect</td>
<td>3.1</td>
<td>0.1</td>
<td>14.4</td>
<td>1.7</td>
</tr>
</tbody>
</table>

3.59 The recently reported data of 1978 and 1979 income-expenditure surveys confirm the suggestion of a very substantial rise in peasant income in recent years. The 1979 date show net income per capita at Y 160.2, an increase of 20% above the 1978 level (Y 133.6). Average distributed collective income (a much more restrictive concept, excluding private and wage income) was Y 74 in 1978 and Y 65 in 1977, an increase of 13.8%. These data are unlikely to be much influenced by price inflation; available price indices indicate little change from 1977 to 1978 and the 1978/79 data include income in kind valued at constant 1978 prices.

4. FUTURE PROSPECTS OF AGRICULTURAL DEVELOPMENT

4.01 Past performance in agricultural development, as described in Chapter 3, demonstrates the importance of policies and incentives for agriculture in China. Recent experience during the reform period of the late 1970s diverges markedly from that of the earlier 1970s and late 1960s; these experiences in turn are clearly differentiated from those of still earlier periods in the 1960s and 1950s. The blend of a collectivized agriculture and state management of the supporting framework of marketing institutions and sources of input supply is a powerful apparatus for the planned management of the sector. The policies and programs of the 1980s will continue to make a great deal of difference to agricultural development.
4.02 In several ways, the challenges facing agriculture in the 1980s echo similar themes from the past. The social reforms of the 1950s set a pattern of effective demand for agricultural produce that has been dominated thereafter by low-income, mass-market requirements for staples such as grain, vegetables, cooking oil and simple cotton clothing. Population will continue to grow and with it the demand for basic foods, mostly cereals, which occupy a dominant position in the Chinese diet and in crop agriculture. Security of food supplies will also need to be maintained. The reliance of light industry on agricultural raw materials is likely to grow. With a substantial majority of the 800 million peasants depending primarily on agriculture as their principal source of livelihood, ways must be sought to sustain and improve agricultural earnings and living standards. These objectives are to be met within a land constraint that promises to be just as severe in the future as in the past. Influencing the allocation of the land among its competing uses to match the changing patterns of national requirements is a challenge for the planners. Making the best use of the land’s potential is work for farmers and farm leaders, and improving this potential through technical change is the formidable task of the agricultural research and extension systems.

4.03 This chapter describes some of these ongoing efforts and various problems, with special reference to a technical perspective of agriculture’s development prospects and major food requirements (Section A), and to economy-wide planning estimates and general policies (Section B). Section C describes some policy issues of possible significance in the future development, together with a discussion of investment strategy and priorities.

A. A Technical Perspective of Prospects

4.04 Prospects of development in Chinese agriculture will continue to depend heavily on increased production of the grain crops, for three reasons: (a) grains still account for about 60% of the total gross output of agriculture and 80% of the sown area; (b) prospects for other field crops that compete with grain in land use are greatly influenced by the area that will be required for grains; and (c) the largest component of output outside the crop sector, pork production, also depends increasingly on feedgrain supplies. The review is mainly focused on grains, other field crops and animal husbandry.

4.05 Earlier sections have described how past development in crop production has depended largely on yield increases, given the near fixity of the arable and cropped areas since 1965. In the future, new policies to control more strictly the alienation of agricultural land for industrial and other purposes are to be applied, and additional development in the Northeast (mainly via state farm development programs) may add significantly to the arable land base in that region. On the other hand, much new infrastructure

\[1\] Excluding brigade enterprise.
development (e.g. for hydropower, road widening) is likely to be required and some loss of productive agricultural land is inevitable. On balance, it seems unlikely that sufficient new arable or cropped land could become available to alter significantly the reliance on crop yield increases for future production growth.

Foodgrain Production

4.06 Recent aggregate growth in foodgrain production /1 shows a rate of increase at about 3% p.a., due entirely to improved yields, with the area sown to grains declining slightly since 1970. The increase in yield over the 1970s was about 0.8 tons per sown ha, from a base of 2.0 tons per ha in 1970./2 Future prospects depend largely on further developments in crop technology, irrigation and fertilizer availability. A further factor, of some importance in the past, was a change in the cropping pattern so that more land was devoted to relatively high-yielding crops (e.g. rice and corn, with yields in the 3-4 ton range) and less to low-yielding crops (e.g. soybean and millet, with yields in the 1-2 ton range). It is unlikely that future changes in the cropping pattern would be so large, mainly because the area under low-yielding crops has already been considerably reduced and because protein-rich, but low-yielding soybean is now being encouraged.

4.07 The massive extension of pump irrigation in the Chang Jiang basin and North China Plain, and the widespread effects from greatly increased availability of chemical fertilizers, are other factors that served to raise crop yields in the recent past but are unlikely to help so much in the future. During the 1970s, the irrigated areas probably increased by about one million ha p.a., and chemical fertilizer availability (in terms of gross weight) must have at least quadrupled, mostly in higher quality, less volatile types. Plans for future irrigation developments (as discussed with the Ministry of Water Conservancy) suggest future targets for new development of 0.2-0.4 million ha p.a., much less than in the 1970s. No details of plans for chemical fertilizer were available, but clearly past rates of increase in supply cannot be sustained. Finally, agricultural research will continue to suffer from a lasting impact of the Cultural Revolution, with little prospect of increasing the numbers of qualified young researchers before the mid-1980s.

4.08 There are several factors, however, that improve the picture of future prospects. First, while the rate of new irrigation development is likely to decline, major efforts are planned to upgrade existing systems, through improved structures, water conservancy, and higher standards of flood and drought protection. Similarly, the quality of available fertilizers can be improved and increased use of phosphoric and potassic fertilizers (probably

/1 Including tubers at one fifth the wet weight and soybeans.

/2 Yields in 1980 averaged 2.73 tons/ha, but the crop year was seriously affected by poor weather. Yields in 1979, a good weather year, were 2.78 tons/ha.
involving increased reliance on imports) may have a substantial impact on yields in areas where use of chemical nitrogen is already high. Gains from rationalized distribution of fertilizer, based on local soil testing and fertilizer trials, may also be sizeable. The research programs can gain considerably from the availability of international experience and plant collections, especially, perhaps, for crops such as maize, sorghum, soybean and rootcrops, where past development in China has been more limited. Finally, an important plus factor is the emphasis that the Government is giving to agricultural development, both through incentives and policy development and through high priority to be given to research work. Chinese officials emphasize that while crop yields and technical standards are high in some parts of the country, much remains to be done in many low productivity areas. Insight into the importance of the recent policy changes is gained by considering their impact in Sichuan, one of the first provinces selected as an experimental area for subsequent reforms. In Sichuan, between 1976 and 1979, foodgrain production rose some 29% (to 32 million tons) and gross agricultural output by 34%; distributed income among commune members increased 49% over the same period.

4.09 With continuing major efforts, it seems plausible that aggregate foodgrain production might increase to about 410 million tons over the 1980s. Over the decade, this would imply a yield increase of about 0.7 tons/ha (with the sown area maintained at the 1980 level), so that average yields in 1990 would be about 3.5 tons/ha. Implications for food availability, taking into account population growth and other factors, are considered in paras. 4.15-4.20 below.

Oil-bearing Crops and Cotton

4.10 Oil-bearing crops and cotton together accounted for about 13 million ha in 1980; they are the major field crops that compete with grain in terms of land use./1 The considerable increases in production, yield and sown area reported in past three years for the oil-bearing crops,/2 together with continuing sizeable imports and still low levels of per capita oil availability, suggest a substantial future growth potential. Land availability is likely to be the major constraint. Yields of some major oil-bearing crops, such as groundnuts, are still quite low by international standards (about half US yields in this case), and groundnuts especially may develop further on the basis of specialization in high potential areas. A yield increase of 4% p.a. seems plausible for oil-bearing crops.

4.11 Prospects seem more difficult to assess for cotton, which occupied some 4.9 million ha in 1980. The planted area has recently recovered to 1965 levels and the 1980 crop (2.7 million tons lint) was a new record. With

/1 In contrast with international usage, soybeans in China are not included among the oil-bearing crops.

/2 From 5.6 to 8.0 million ha, 1977-80, with production increased from 4.0 to 7.7 million tons.
a 30% increase since 1977, current yields are about in line with international norms among developed country producers. Among these countries, cotton yields seem to have increased but little in recent years. On balance, yield growth at 2% to 3% p.a. for the 1980s might be feasible. A higher growth in production might be warranted, given likely increased demand (though synthetics are increasing in importance) and currently very sizeable imports.

Other Crops

4.12 Prospects seem generally favorable for production and yield increases for such crops as sugar and jute and for the permanent crops, such as mulberry (for sericulture), tea, rubber and fruits. In general, these crops either occupy relatively small areas of arable land (sugarcane and beet comprise less than a million ha) or, in the case of most permanent crops, occupy uplands not suited for grain. As noted earlier, several of the permanent crops have demonstrated high growth rates in the past, accompanied by some increase in the planted area; yields are still low by international standards (many stands are as yet immature). Relatively low yields in China, limited research efforts in the past and fuller use of local comparative advantage are also reasons for expecting fairly rapid growth (4-6% p.a.) among some of the lesser field crops. One important crop for which output data are lacking is vegetables, estimated to occupy some 3.23 million ha in 1979. For vegetables though, physical yield prospects are less important than the potential for substituting high for low value crops on the given land base. Demand and marketing facilities permitting, substantial productivity increase of this sort appears possible in the 1980s, given the dominance of low grade cruciferae (cabbage) in current vegetable production./1

4.13 With grain yields growing at 2.3% p.a., cotton and oilseeds yields at 3% p.a. and other nongrains at 5% p.a., the analysis suggests a growth rate for crop agriculture as a whole, based on current land use patterns, of about 2.4% p.a. for the 1980s. Whether these growth rates would materialize in fact will depend heavily on supporting services and investments for agriculture and the adequacy of price and other production incentives. These questions are discussed in Section C.

Other Agricultural Activities

4.14 Pork production accounts for about half the value of other agriculture and about three quarters of animal husbandry. Technology as such seems to present little problem in increasing pork supplies at a rapid rate./2

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/1 The average 1979 procurement price for vegetables, reported as only ¥ 0.09 per kg (i.e. less than 3 cents/lb), is indicative of the dominance among vegetables of low-value crops.

/2 The US pig industry produces some 7 million tons annually from a herd of 60 million; China’s current stock of over 300 million produced about 12 million tons in 1980.
China has an enormous stock of pigs, offtake rates (with a long fattening cycle, 8-10 months) are relatively low, and slaughter weights (except for officially procured pigs) are low. One major question though is the future availability of feedgrain or substitute concentrates in sufficient volume to support higher production. In the past, considerable emphasis was given to fodder-based feeding practice and probably little more than a quarter of hog feed was in the form of grain. Recent policies have encouraged the use of feedgrain, primarily through various incentives in official procurement, and the average procurement weight of pigs increased considerably, by about 10 kg over a two-year period (to about 86 kg). Aggregate meat production (over 90% pork) has increased by over 50% in the past three years, a response to higher procurement prices and more grain made available for use as pig feed. Incremental (unmilled) grain requirements for fattening are likely to be in the range of 3.3-4.4 kg of grain per kg of meat. While future growth depends largely on feedgrain availability, there is some scope for further development of other ration supplements such as cottonseed, rapeseed cake, soy cake, etc., much of which is now used as fertilizer. Breed improvement programs to upgrade the sometimes indifferent stock quality are also underway.

4.15 Poultry and inland fisheries are other important high-value protein sources whose production may similarly be constrained more by feedstuff availability than by technology. Although aquaculture production has risen at about 6% p.a. since 1976, this was not quite enough to offset an aggregate fall in total fish production, due to a decline in capture fishery production. Little information is available about poultry, although it is almost certainly second in importance to pork as a source of meat. Recently, several modern feed-intensive broiler factories have been established in the rural environs of large cities, fed largely on imported coarse grain. Prospects for other meat sources - beef, goat meat and lamb - are generally favorable, but base levels are very small compared with pork. For beef, the Government hopes to enlarge considerably the currently small herd, mainly through better utilization of the northern grasslands and southern uplands.

**Foodgrain Requirements**

4.16 Some of the options and problems in supply and demand management are illustrated by Table 4.1, which presents indicative figures for grain utilization under alternative assumptions. The 1980 base year estimate of production, at 325 million tons (116 million ha times a yield of 2.8 tons/ha) is above estimated at 1980 production (318 million tons) - the latter reflecting the particularly poor weather conditions in 1980. The estimate of direct consumption of grains by households is derived as a residual, after deduction of requirements for seed, feedgrain and industrial uses estimated as 20% of 1980 production, or 65 million tons. After allowing for these amounts, and net imports of 12 million tons, the grain available for direct consumption would be 272 million tons.

/1 For example, in Sichuan, pigs sold to the state at 65 kg liveweight or more give the seller the right to purchase 25 kg of unmilled grain at quota procurement prices.
Table 4.1: ILLUSTRATIONS OF SUPPLY-DEMAND BALANCE IN FOODGRAINS, 1990

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Domestic production</td>
<td>325</td>
<td>370</td>
<td>410</td>
<td>450</td>
</tr>
<tr>
<td>Net imports</td>
<td>12</td>
<td>26</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>337</td>
<td>396</td>
<td>422</td>
<td>450</td>
</tr>
<tr>
<td>Utilization</td>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Direct requirements</td>
<td>272</td>
<td>318</td>
<td>318</td>
<td>318</td>
</tr>
<tr>
<td>Seed feed and other uses</td>
<td>65</td>
<td>78</td>
<td>78</td>
<td>78</td>
</tr>
<tr>
<td>Total</td>
<td>337</td>
<td>396</td>
<td>396</td>
<td>396</td>
</tr>
<tr>
<td>Surplus</td>
<td>-</td>
<td>-</td>
<td>26</td>
<td>54</td>
</tr>
</tbody>
</table>

Source: Mission estimates, described in the text.

4.17 For the indicative estimates of 1990, direct consumption requirements are increased in line with population growth (1.25% p.a. according to projections explained in Annex B, paras. 3.09-3.12), and other demographic factors, including the changing age structure and the increasing body size of the population. In combination, these factors imply that to maintain 1980 consumption levels would require about a 17% increase in direct consumption, i.e. 1.6% p.a. The 1990 direct requirement for grain (at 1980 consumption standards) is thus 318 million tons. Other uses might similarly increase by about 20% over 1980 levels, in particular, with grain for feed increasing by about 8 million tons to maintain 1980 per capita meat consumption levels. The total requirement is thus estimated at 396 million tons.

4.18 The illustrations of 1990 foodgrain availability and utilization begin in column (a), with a hypothetical "worst case" situation that assumes 1990 production at 370 million tons (10% below the technical perspective estimate of 410 million tons). This scenario implies a return to the situation of the mid-1970s, with no scope for improving meat availability, and heavy pressure to reduce the areas planted to oilseeds and cash crops (cotton) in favor of grains. Just to maintain the 1980 per capita consumption levels would require a substantial increase in foodgrain imports. Under this
scenario, aggregate crop production might grow at about 2% p.a. With production heavily constrained by feed availability, the other large components of agriculture, livestock and fisheries, would probably average no more than 2.5% p.a. growth. Overall agricultural output growth would then be about 2.2% p.a.

4.19 Column (b) describes a situation with 1990 production at 410 million tons, and net imports of grain at 1980 levels. Production plus net imports at 422 million tons would allow a small improvement in per capita consumption. If half the surplus of 26 million tons was absorbed as increased direct consumption, the rate of increase per capita would be 0.4% p.a. If the balance was allocated to livestock feed, per capita meat availability could increase by 2.1% p.a. On the assumption that 1980 import levels are maintained, crop output growing at 2.8% p.a. (para. 4.13), plus livestock and fisheries at 4% p.a., suggests an aggregate growth rate of about 3% p.a.

4.20 The final illustration, 1990 (c), describes a "best case" situation, with grain production 10% above the 410 million tons estimate, i.e. 450 million tons. Imports could be eliminated, meat consumption could increase substantially, and average grain consumption per capita could be improved. Under this scenario, overall growth of agriculture might be about 3.6% p.a., i.e. roughly a 2% p.a. per capita increase.

4.21 The above discussion serves to underline the critical importance of rapid yield improvement and grain production increase for China's future agricultural development prospects. As illustrated, a 10% difference in the grain production projection for 1990, associated with a difference in yield growth in the range of 1.3% p.a. (the worst case) and 3.3% p.a. (the best case), would make a vast difference in the options available to policy makers for agricultural and rural development. Given the inherent uncertainties of such projections for agriculture, neither 1.3% p.a. nor 3.3% p.a. could be dismissed as totally improbable.

B. Objectives for Agricultural Development

4.22 Aggregate Consumption and Supply. As noted in Chapter 2, the Chinese authorities are currently preparing 5- and 10-year outline plans for the 1980s. Since agricultural output in very large part is directed towards household consumption requirements, the planned growth of household consumption is clearly a key parameter in determining overall demand prospects for the agricultural sector. In turn, growth of consumption itself will be shaped in part by supply prospects in agriculture, especially if, as seems likely, overall trade prospects would not allow for any substantial deterioration in the agricultural trade balance. This section illustrates some of the issues of supply and demand balance in agriculture from the perspective of the economy as a whole, taking into account the earlier discussion of technical constraints and grain utilization.
4.23 Aggregate real growth of net output in the economy as a whole is estimated at about 5.3% p.a. for 1957-79; accompanying this relatively high growth rate was a large increase in the share of accumulation in total net product (from 23.2% in 1957 to 31.1% in 1979). Real consumption outlays thus rose much more slowly than total outlays. A key objective of future strategy is to increase real consumption at considerably faster rates than in the past, with major implications for agriculture, which accounts over 60% of aggregate household consumption outlays. Moreover, with growth of population much slower than in the past, per capita consumption growth rather than population growth would dominate changes in the structure of aggregate consumption.

4.24 What are the implications for agricultural production of aggregate consumer expenditures rising faster than in the past, and what might follow from per capita expenditure increases much above the past rates of increase? Only very rough answers to these questions can be provided on the basis of the data currently available. As regards the aggregate increase, a target of, say, 5% p.a. growth in real consumption might require about a 3.5%-3.7% growth in agricultural production. The impact of increasing per capita expenditures on the pattern of agricultural production would be important. A considerably faster than average rate of consumption increase would probably be experienced for items with high expenditure elasticities, such as meats and fish, vegetable oils, sugar, textile products (cotton and wool), various sideline products and forestry products (for housing construction materials and furnishings). In sum, the suggestion from the demand side is that change in the commodity mix within agriculture would be needed to accommodate changes in the pattern of demand. In addition, a fast aggregate rate of agricultural growth will be required.

4.25 These projections can be compared with the various alternatives described in the earlier discussion of the technical perspective of future grain output. First, if grain output falters significantly (the 1990 "worst case" (a) of Table 4.1) so that no more than a 2.2% p.a. growth of agricultural output is realized, a 5% growth target for real consumption would almost surely prove infeasible and economy-wide growth prospects would be severely compromised. At the other extreme, with grain output of 450 million tons under the 1990 "best case" (c) scenario, aggregate growth in agriculture

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/1 See Main Report, Tables 3.4 and 3.10, for this and other parameters discussed in this paragraph.

/2 As discussed in para. 4.17, growth of about 1.6% p.a. would be needed to meet demand generated by the population increase when the effect of an aging population is included. Without consumption expenditure elasticity measures, it is difficult to predict the incremental agricultural requirements of higher per capita outlays. But given the high initial share of over 60% and some initial restrictions (rationing), a growth at 2% p.a. from increased per capita outlays seems reasonable.
corresponding to requirements would seem assured, and the sector would have
the flexibility to respond to changes in demand structure resulting from
higher per capita consumption levels. The intermediate and more likely case
is with agriculture growing at about 3% p.a., somewhat below consumption
needs. Management of aggregate demand would call for a careful balancing of
trade opportunities, rural and urban supplies, and, probably, continued
rationing of the most important items (grain, cotton and oilseeds).

Agricultural Output and Rural Income

4.26 Since farm households are both the producers and the major consumers
of farm products in the Chinese economy, prospective agricultural growth and
consumption growth are both closely linked to income growth in the rural
areas. Indeed, in a statistical sense, if income and consumption do not
increase rapidly in the rural areas, then attainment of a 5% p.a. growth in
aggregate consumption must rely on considerably more rapid growth among the
minority urban and industry-based population. Already the income differentials
between rural and urban areas are considerable, so that growth of rural
per capita consumption at least as fast as the national average would seem
desirable. But the threat of a widening gap between rural and urban incomes
is inherent in a situation where agricultural growth lags substantially behind
nonagricultural growth and rural/urban migration is restricted. The policy
options that would avoid, or at least minimize, the adverse impact of slow
agricultural growth on rural incomes include:

(a) permitting greater rural to urban migration than in the past,
especially by promoting urban employment opportunities in the
service sectors;

(b) maintaining rapid expansion of brigade and commune industry;

(c) improving productive employment opportunities in agriculture by
restraining the use of labor-replacing inputs and encouraging
labor-intensive techniques; and

(d) improving the agricultural terms of trade, possibly in conjunction
with heavier taxation of higher income segments of the rural popu-
lation.

4.27 All these options have both advantages and possible disadvantages.
Greater rural to urban migration, since the rural population is so much larger
than the urban population, could have no more than a small initial impact on
the total numbers in rural areas. But if concentrated on particular poor

/1 Currently, the commune population may account for about 75% of aggregate
consumption expenditure. Assuming growth at only 2% p.a. in this
category, consumption growth at 5% p.a. overall would require growth of
consumption among the noncommune population at over 11% p.a.
areas (a strategy which is more feasible in China than in other developing countries, since migration can be administratively controlled, and since the level of education among the rural poor is high), migration could have a comparatively large impact on rural poverty. On the other hand, urban industry is already generally overstaffed, and urban unemployment is already regarded as a problem. There is substantial scope for absorbing labor in services (with the possible exception of public administration), especially in collectives, which are receiving increased governmental support. But the extent to which this would be possible, and the institutional changes that would be needed, are matters which require further investigation. Urban infrastructure needs must also be considered: if all population growth over the next decade were to be absorbed by the cities, their population would double; the costs of providing the necessary additional housing, roads and social services would be huge (though it should of course be compared with the cost of other options).

4.28 Absorbing all increments to the labor force outside agriculture would require nonagricultural employment to grow in the 1980s at 5.5% p.a., compared with 4.0% p.a. during 1957-79. This is unlikely but not impossible, especially since much of the nonagricultural employment growth could occur (as in the past) in rural rather than urban areas. More generally, the role of brigade and commune enterprises in providing supplementary income in the 1980s will clearly be critical. In the mid to late 1970s, commune and brigade enterprises became "an engine of growth" in rural areas: their output growth averaged 18% p.a., and their share in rural net output and income rose from a very low level in 1970 to about 15% in 1979. If growth of these enterprises can be maintained at high rates, their contribution to future rural income growth could be significant. For example, the combination of 9% p.a. growth of enterprise income and 3% p.a. growth in agriculture would cause total rural income to grow at 4% p.a. But some of the factors that have stimulated past rapid growth of enterprise income may be less in evidence in the 1980s. One is favorable tax treatment (a three-year tax holiday, and low rates for certain types of enterprises). Another is a cost-price structure permitting substantial profit from transforming low-priced agricultural materials into high-priced industrial commodities. A third is limitation of investment opportunities in agriculture proper by the discouragement of specialization. Thus reforms in pricing, taxation and agricultural policy could all worsen prospects for rural enterprise development. Shortages of energy and industrial raw materials are also adversely affecting growth, and have led to the closure of inefficient enterprises. On the other hand, the vigorous development of manufactured exports should continue to stimulate rural enterprise development. Promotion of agricultural sidelines and specialized crop potential should likewise create many new local processing opportunities.

4.29 An important source of rural income growth in the past has been adjustment of the terms of trade in favor of agriculture — through both increased agricultural procurement prices and reduced prices of industrial goods sold in rural areas. To add one percentage point to rural income growth in the 1980s would require procurement prices to rise about 18% over the
decade (if the amount procured increased in line with gross output). By 1990, the resulting annual resource transfer would be about Y 14 billion—similar to that achieved by procurement price increases between 1970 and 1979. Improvements in the agricultural terms of trade, which are a way of transferring some of the faster growth of urban labor productivity to rural people, may be desirable not only on equity but also on efficiency grounds, since they could encourage faster growth of agricultural production. But they will be limited by the need both to keep urban real incomes growing (which will make consumer price rises difficult) and to avoid further strain on the budget (through larger subsidies). However, some of the cost of raising the relative prices of agricultural commodities could be financed through increased taxation of agricultural income or land in higher income areas.

4.30 Finally, it is important to increase the earning capacity of agricultural workers through appropriate choice of production techniques. For example, more careful attention should be given to the net profitability of various types of labor-displacing agricultural machinery—taking account of the value of the displaced labor in alternative activities (including leisure, more of which might be desirable in areas where working hours are currently very long). Better technology choices should also help to keep up the ratio of value added to gross output.

4.31 Though some poor areas will be among the biggest gainers, it is likely, as the Government recognizes, that the current agricultural policy of allowing each region to develop according to its comparative advantage will on balance tend to further widen regional income disparities. Commune and brigade industry growth, too, is likely to continue to be slowest in the poorest areas, whose financial resources are small, and which tend to be far from the best markets and sources of inputs. Even increased agricultural prices will do least for the poorest groups, whose marketed surpluses are small, and will actually harm those of the poor who are net purchasers of

/1 "We should advance in a series of waves instead of covering the whole area with scattered efforts. The financial and material resources for agricultural use should be managed in order of priority so that they can be fully and effectively utilized. Priority should be given to localities possessing the required conditions and greater efforts should be made in these localities. If the production in these localities rises markedly and peasant incomes increase rapidly, that is good and not bad, because it will produce a great demonstrative and encouraging effect in the whole country." (Decision of the CPP Central Committee on "Some Questions Concerning the Acceleration of Agricultural Development," published in Wen Hui-Bao, October 6, 1979, p.1.)
food. It is thus essential, as the Government also recognizes, \(^1\) to take special measures to attack rural poverty. But although a fund for backward areas was created in the 1980 budget, the amount involved (Y 500 million) was small, and a detailed antipoverty program has yet to be formulated. This question is further discussed in paras. 4.49-4.52 below.

C. Agricultural Policies and Programs

4.32 It is clear from the discussion thus far that well designed policies and programs have an important role through what is likely to prove a difficult and challenging period for agricultural development. The authorities have made significant reforms in agricultural policy and are giving considerable emphasis to improved performance in major agricultural programs. These efforts already seem to have had a considerable favorable impact on agriculture's performance, as discussed in Chapter 3. Considering the importance of the reforms, the diversity of conditions in Chinese agriculture, and the still short period since their introduction, longer term effects are also likely to be considerable and of particular benefit perhaps during the early to mid-1980s. This section considers issues of potential importance in future policy work and program development. The analysis is highly tentative since a great deal remains to be done in assembling relevant information and data as a basis for more thorough study of the policy reforms and their impact. At this stage, therefore, what follows is essentially series of observations and comments on the ongoing reform and adjustment process, and discussion of new problems that seem likely to arise as current changes in agriculture gather momentum. The concluding paragraphs summarize some important considerations in future investment strategy for the sector.

4.33 Systems of Reward and Work Incentives. Among the most important of the post-1977 reforms are efforts to strengthen the link between work done in agriculture and rewards pertaining thereto. The main features described more fully in Chapters 2 and 3, are:

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\(^1\) "Crop yields have been low and grain shortages have existed for a long time in some parts of North-West and South-West China and in remote mountainous areas, minority nationality regions and border areas. Consequently, the people there live in poverty. The slow development of production in these areas is not only an economic but also a political problem. The State Council will set up a special committee, composed of responsible comrades from departments concerned, to make overall plans and organize forces to support these areas materially and technically, and to help them lift themselves out of poverty by developing production. It is also necessary to help poor communes and brigades in other parts of the country to better their situation as soon as possible. Funds allocated by the state as aid for poor communes and brigades must be used for purposes of production and construction." (Same source as previous footnote.)
(a) restoration of and encouragement for household agricultural activities and individual enterprise, associated with the lifting of restrictions on public markets and widening the range of permissible commodities (including grain) in local trade, and in some areas with the allocation of additional land to households and wider access to collective lands for grazing, fodder, etc.;

(b) encouragement of larger allocations out of production team collective distributions according to work points and smaller allocations as assured per capita rations; and

(c) the creation of systems of subcontracting within collective agriculture itself, so that small groups or households gain additional income from production that is surplus to some agreed norm (but with penalties for failing to reach the norm).

4.34 The effects of such changes are pervasive and likely to be felt for some time after their initial implementation. While the full extent of the executed reforms is not known, the reform process is certainly incomplete. Some elements (such as the opening of markets) are now widely applied but others (changing work point systems and contracting) much less so. Recognizing the potential for considerable disturbance and perhaps some danger in such a major change, the authorities have deliberately adopted an approach that emphasizes experimentation, with some areas designated as testing grounds for various approaches. It follows that there may be considerable scope for further improvement as the results of these experiments and of the various local modifications are studied and evaluated. It is unlikely that any one system, for example of within-team contracting, would prove optimal in all situations. But some schemes will work better than others, and it is desirable that more effective schemes be substituted for those that are less effective. Subsequent efforts are of course conditional on thorough and detailed investigations of the initial experiments; practical economic and social research by Chinese scholars is important in this regard.

4.35 The sort of problems that such changes give rise to can also be illustrated. In one province selected for advanced experimentation, peasants were found to be working harder and faster in collective agriculture (facilitated by task-related payment systems) in part to make more time available for household activities, which were also, in general, being encouraged. For certain collective tasks, reported time savings per task were as much as 30% of the time taken under the old system. In this case, sizeable all-round gains in production and productivity seem to have been realized. In collective agriculture, median levels of output increased by 10-20%, for example. Yet this outcome is not inevitable, unless reforms in payment systems for collective agriculture proceed together with the encouragement of household activities. Households keep all the net rewards from any additional efforts they make in the latter activities, but in collective agriculture, only a part of such net reward is returned to the individual unless payment systems are well adjusted. Hence peasants may embrace opportunities for additional household
activity and income to the detriment of their collective work. Cases of this sort have also been reported in some parts of the country. These aspects are worth special attention in evaluative research.

4.36 **Diversification.** The authorities have given great emphasis to diversification of production in local agricultural planning. The objective is to pay greater attention to the local environment and its ecology, and at the same time to aim for more systematic exploitation (based on the areas' particular soil, topographic and even micro-climatic conditions) of what may be a myriad of small, but collectively important, sideline agricultural activities. Again, the full effects of these policies are likely to take several years to develop, since a good deal of the initial work relates to the new planting of various permanent crops (including tree crops) on hillsides and marginal arable lands. For upland agriculture, this approach is particularly apt and important, as these areas have, on the whole, gained least from modern technical development (improved cereal varieties, chemical fertilizer, machinery and irrigation are all largely addressed to lowland agriculture). The diversification approach also fits well with subcontracting and task-related reward systems, and it is indeed encouraged where these systems are promoted.

4.37 The main obstacle is the considerable dependence of diversification on transportation and marketing facilities. A wide variety of crops and other outputs calls for a correspondingly diversified marketing infrastructure (including packaging, distribution and storage), which must be available during what may be short but intensive harvesting periods. The ready availability of specialized input requirements, both seasonal and longer term, is also important. The marketing system is still somewhat deficient and considerable investment seems likely to be required. Diversified agriculture also typically relies mainly on road transportation. Considerable upgrading of roads (especially in the more difficult upland terrain), as well as the actual availability of transportation facilities, is rather critical.

4.38 **Specialization.** This is the other side of the coin vis-a-vis respect for the local environment and use of its potential. Where natural conditions favor particular types of crops – e.g., the sandy loams of parts of Shandong favor groundnut cultivation – the intention is to encourage specialization rather than to discourage it (as was sometimes done in the past in promoting local self-sufficiency). These effects already seem to have been important, as evidenced, for example, by the remarkable upsurge in oilseed production in Sichuan and other provinces, groundnut production in Shandong, and by the dramatic improvement in cotton yields. Further study of effects must await publication of detailed crop records in specific localities. Also, the long-term effects on certain permanent crops are still to be observed. As with diversification, the potential is to some extent limited by the availability of transportation (in this case including prospects of increased longhaul traffic, rail and waterway, as well as road transportation) and marketing services.
4.39 One policy concern, if not already important, may become so as specialization proceeds. Producers normally make production decisions according to the benefits and costs that they themselves realize. In China, because of internal price distortions, these are likely to differ from the costs and benefits evaluated from an economy-wide perspective. The problem is partly one of economy-wide uniformity in transportation tariffs in China and partly the appropriateness of the low prices (relative to world prices) currently charged for various major inputs, notably diesel fuel, used in agricultural transportation. This is a difficult problem that raises far-reaching issues. In the absence of market forces for adjusting prices and costs to reflect the real cost differentials, physical planning clearly has a continuing role in determining regional and local specialization patterns.

4.40 **Local Autonomy and Indirect Planning.** Given the continuing adjustments needed to realize the full benefits of the various reforms, the production team must be given a good deal of freedom in making decisions and implementing changes in the light of the specific local conditions. Local autonomy of this type is indeed being promoted as part of the reform program, though the degree of autonomy varies considerably by province and local area.

4.41 In encouraging local autonomy, an important question arises of how to reflect national or provincial priorities and requirements, especially in regard to annual crop production objectives, once the system of physical plan/crop targets is abandoned. This question is being extensively debated within China itself, but no clear policy determination seems to have emerged at this time. The most obvious substitute mechanism for old style planning is greater use of market forces and the price mechanism to convey the relevant signals to the production teams. Use of prices as a means of indirect planning is not new in China, and it is in keeping with the further objective of strengthening the role of economic principles in agricultural production.

4.42 But there may be disadvantages attached to the use of price adjustments for output planning. One problem already mentioned stems from the established system of unified, nationally determined procurement prices for strategic commodities (including some agricultural commodities), with little regional differentiation. Greater regional differentiation of prices is likely to be particularly important in a transitional period and at a time when the problem of transport costs is not yet resolved. For example, additional production in zone X is of little use when additional production is needed in zone Y; and a nationally uniform price adjustment could encourage production in zone X, since producers there would not incur the real costs of moving their production to a market. Thus uniform price adjustments could create rather than resolve inefficiencies. Consideration of this point

/1 Thus, some important provinces are only now announcing plans to relax old style planted area targets in agriculture. (Cotton area targets are still maintained as a matter of national policy.)
diminishes some of the apparent simplicities of indirect planning via price adjustments. And it reinforces a point made earlier, that it is difficult to reform one part of the system without simultaneously addressing problems in other parts.

4.43 While greater use of the price mechanism may face some problems in the current institutional setting of China, it is nonetheless a flexible and powerful instrument to align producer decisions with national priorities. Moreover, price changes can be introduced progressively, in a series of discrete, small adjustments. The Chinese producer is likely to be highly responsive to price changes, although thus far, with rather uniform and sometimes large adjustments, few opportunities have been available to measure response as such.\(^1\)

4.44 Weighing the pros and the cons of indirect planning based on price adjustments, it seems likely that the authorities will move into the 1980s with a pragmatic approach that combines continuing elements of direct planning with greater use of price adjustments than at earlier times. The collective system and the well-established hierarchy of planning controls, from the team upwards through county and provincial levels, facilitates such a mixed approach. For example, China can implement a two-tier price system, in ways that would prove more difficult in most countries. The system of "within-quota" prices for official purchases up to given quantities, and "above quota" prices for quantities in excess of quota purchases, is an example of this. The state can provide substantial incentives at the margin of production without paying the full cost of such incentives, as would be the case under a regime of uniform prices.

4.45 Field Management. The encouragement of local autonomy and initiative in production decisions under the reform program lends added emphasis to the management function, especially the role of production team leaders, and brigade and commune officials. Even at the lowest levels, responsibility is exercised for a farm unit that is not particularly small; with arable, largely irrigated, land of 10-15 ha, the average production team operates a farm that is slightly larger than that in France for example. In many respects, management functions have already greatly changed since the early 1950s. At that time, it was appropriate to give major emphasis to land consolidation and development, organizing the newly enfranchised peasant families and creating the system of collective farming that has since endured. But beginning in about the early 1960s, and increasingly thereafter, it became necessary to use the tools of modern agriculture (machinery of various types, new plant varieties, chemical fertilizer and insecticide), and to attempt to balance the costs and returns of using greater or lesser amounts of them. Under the system of direct planning, these management skills were perhaps

\(^1\) The upsurge in marketed hogs and eggs following the 1979 price increase is one instructive case, however.
never as important nor as well developed as they should have been, parti- 
cularly at the level of the production team itself. But these skills are 
clearly becoming of central importance in the 1980s, as returns must be 
increasingly sought from proper use of the available technologies and modern 
inputs; from relatively small variations in cropping patterns and sequences; 
and from a more careful evaluation of costs and returns in the use of inputs. 
The complexities of the management task are likely to grow as the stock of 
equipment and facilities in use is augmented and as brigade- and commune- 
managed enterprises play a greater role. The successes and failures of 
collective agriculture in the 1980s and 1990s will depend a good deal on the 
quality of management, as well as the linking of material rewards with effort.

4.46 One advantage of collective agriculture is that training one 
team-level manager serves the needs all the families in his production team. 
Management training in farming in most developing countries, which generally 
have individual rather than collective farming systems, usually poses near 
insuperable problems because of the numbers involved and the small size of the 
farm unit. Yet one of the most striking differences between the developing 
and the developed countries is that in the latter, few could now contemplate a 
career in farming without extensive professional training. The selection 
and training of managers for collective agriculture is an Important concern 
for the 1980s. Management training for the elected team leaders and brigade 
officials was not directly observed or discussed in detail by the mission. It 
would appear, however, that while efforts are being made (mainly at county and 
lower levels), in overall terms these are fairly limited. The adequacy of 
training in China's collective farm system seems worthy of close consideration 
and attention.

4.47 A question closely related to the management issue is the adequacy 
of the information/data processing system and the accounting framework as 
management tools. As outlined in Chapter 2, the system of production and 
distribution accounting is a vital component of collective agriculture, since 
in conjunction with work point recording it is the basis for distributing 
collective income and determining collective retentions, accumulation, etc. 
But judged on the basis of a few samples, team and higher stage accounts seem 
rather poorly designed to serve management purposes in farm planning and 
operations, especially since production cost accounting is little developed.

/1 Clearly this sort of training is not required at the team or even the 
commune level at this stage of development. On the other hand, this type 
of training is increasingly relevant and appropriate for some of the 
larger state farms, which, by any farming standards, are major enter-
prises. It could be an important element in ongoing efforts to improve 
the performance and efficiency of the state farm sector, especially since 
this sector's role in providing market supplies of grains and industrial 
crops is expected to expand in the 1980s.
4.48 Some experimentation and investigation may be warranted to see whether application of modern farm management practice, which is based on production economics and a modern data processing capability, might be helpful in collective agriculture. This too is an area where modern practice has evolved considerably in the past two to three decades. The technology itself, with the development of low-cost calculators and even micro-computers, is increasingly adapted to small-scale applications. Once established, production teams might “buy” such a service from a specialized unit established at the brigade or commune level at very little expense.

4.49 Regional Development and Poverty-Oriented Programs. Thus far most planning and programming of agricultural development has been done by, and was in relation to, the various administrative levels (national, provincial, county, commune, brigade, etc). Planning by sector of activity is the responsibility of the various ministries and agencies, which also operate at the different administrative levels, especially the higher levels. As described in Chapter 2, a good deal of effort goes into the annual plan, while five-year and other longer-term planning has not been very effective in the past.

4.50 For the 1980s, when policies are expected to be more stable and more time available for proposals to be properly worked out and progressively implemented, thought is being given to various types of longer term planning and how they might best be developed and applied. Much work of this type can appropriately be done at the subsectoral or ministerial level. To take but two important examples, a long-term program for the development of agricultural research activities would be a responsibility largely of the Ministry of Agriculture. Similarly, master water development plans for river basins fall under the Ministry of Water Conservancy. Other types of planning (especially regional planning) call for interministerial or interagency coordination and are in some ways more difficult to make effective. The authorities have already indicated a keen interest in regional planning, for instance by setting up a high level Commission of Natural Resource Survey and Agricultural Zone Planning. Also, they intend to concentrate special efforts in the development of “commodity base” areas, where resources and facilities will be coordinated to stimulate the production of high priority crops – grains, cotton, sugar, etc./1

4.51 This type of planning, too, could have importance in the 1980s as a means of addressing the difficult and diverse problems of the less advanced areas. For example, the loess plateau area poses especially difficult problems for development, with its limited natural resources, large though scattered rural population and with incomes among the lowest in China. In many years it requires special assistance from the State, involving relief

/1 Many of these areas are in the northeast and in the border provinces and are associated with the programs of the Ministry of State Farms and Land Reclamation.
contributions for food grains and other daily necessities. Agricultural prospects are also not very favorable given what appears to be very limited potential. Hence this area (and other, generally smaller, areas elsewhere in the country, such as the southern uplands and saline floodplains) might rapidly fall further behind the more dynamic and relatively prosperous zones, and the already large geographical differentials in income would further increase. Experience with problems of this type in other parts of the world indicates considerable merit in developing special approaches to the problems of such areas through a long-term regional development plan.

4.52 Efforts of this type can cater to the particular needs of any locality, with special fund appropriations and, equally important, the allocation of specialist skilled staff to assist with program implementation. Such a plan and accompanying program is usually important: (a) because the problems of such areas will usually call for actions and subprograms under various ministerial or agency jurisdictions that need special coordination mechanisms to work effectively; and (b) because the plan may call for some substantial initiatives that are beyond the resources of each of the local administrations acting separately, e.g. possibly a major research institute to focus attention on the particular farming systems of the problem area. In many instances, the type of plan and program called for will be of a long-term character, in outline form as long as 20-25 years. Such a perspective facilitates division of the work program into appropriate phases, with actions during any one phase calculated to lay the basis for, and to lead into, the next phase. Some special funds (¥500 million in 1980) are already earmarked for this type of special effort. Program design, as well as money, can make the critical difference in program effectiveness.

4.53 Planning for Local Development and Rural Industry. A second type of spatial planning that may also be increasingly important relates to the already fairly advanced rural areas, which perhaps have considerable potential for further development. In many of these areas, the development of rural enterprises at brigade, commune and county town levels has been a very important feature in recent development, generating large increases in output, employment, savings and wage incomes. A major transformation from rural/agricultural to a mixed industrial/agricultural economic base will have been completed in some of them over the next several years. Development of this type and on this scale raises several important policy issues. In many instances of similar kinds of transformation elsewhere in the world (typically unplanned transformations), powerful economies of agglomeration serve to focus and to reinforce development in and around a few growth poles. The factors at work include traffic routing and rail communications, power supplies, storage and ancillary facilities, skill development and upgrading opportunities for the work force, specialist facilities and repair trades. The interaction of these factors over time tends to result in the creation of secondary towns.

4.54 China seems thus far to have adopted a different course whereby each unit from the brigade level up has embarked on its own industrialization program using internally generated collective savings. The question is
whether significant benefits of the type described above, as well as those associated with the development of industry around rural growth centers, are being sacrificed under the present policy. And is there significant economic wastage, for example, in the duplication of facilities and in the competition for limited raw material resources and ancillary requirements (marketing, roads, material supplies and facilities) under the current policies? Or, on the other hand, are there significant savings - through avoidance of substantial outlays in urban infrastructure, transportation facilities, housing and amenities - under the current highly decentralized strategy that offset such costs? These sorts of questions are important given the current stage of development of rural industry. The answers probably require local level research; local spatial planning should be based on the findings of such research.

4.55 Agricultural Development and International Trade. The authorities are now making greater use of the potential of international trade in agriculture, both to ease critical bottlenecks and shortfalls in domestic production, and to seize favorable export market opportunities for specialty crops as well as more traditional export items. The recently developed system of contracting with supplier brigades, communes or even counties at negotiated prices (via the specialized import-export companies) appears a very appropriate initiative in this regard. During 1976-79, the annual average increase in volume terms for a range of the more important export items was more than 5% for frozen pork, 6-10% for rice, groundnut oil and kernels, and fruits, 11-15% for filature silk, soybeans and canned fruits, and 21-28% for tea and hides.

4.56 More generally, with a long seaboard and often congested internal transportation facilities, a rather significant trade in agricultural products is certainly justified on economic grounds - probably considerably more than the current volumes of trade indicate. Market knowledge and international trade contacts still appear to be at a development stage. The use of economic principles in seeking out profitable trade expansion is also still to be fully developed. These subjects merit special study. Comparison of trade quotations for imports and exports with domestic procurement prices and production costs (together with transport/marketing/distribution margins) would surely suggest how international specialization and comparative advantage can be further utilized in planning agricultural development in China. Such an approach has considerable merit in considering some of the larger questions (e.g. grain versus cotton and oilseed production) particularly since much of the agricultural land where these crops can be rather easily substituted for one another is, in fact, located in the eastern and northeastern seaboard provinces, which serve large urban markets and have good international as well as internal access.

4.57 China's agricultural trade continues to undergo rapid change. From late 1972 onward, both the scope and annual variability of agricultural imports increased. Grain imports rose sharply in 1973 and 1974, and the first significant purchases of soybeans and soybean oil came in 1973. Grain imports reached record levels in both 1978 and 1979, and soybeans and soybean oil
Imports were significant in 1977-79. China has recently become the world’s largest importer of cotton. Looking ahead, agricultural trade will be determined by a complex set of economic and policy variables. Demand growth will be influenced by income gains and the extent to which the authorities permit these to be translated into increased demand for meat. This, in turn, will add to the demand for grain. Demand for imported cotton, grains and soybeans may fluctuate more widely than in the past as marginal areas (such as the commodity bases of the northeast) are brought into production. All of these developments have important implications for global price variations in view of China’s relatively large purchases on world markets. To a significant extent, the volume and stability of future world trade in grains and fibers will be determined by the performance of China’s agricultural sector.

4.58 Investment Strategy in Agriculture. The Government’s stated intention is to treat agriculture (together with light industry) as a priority sector, so that unlike some other activities, planned investment may be expected to increase rather than to decrease. In the short term, the share of agriculture in the state capital construction budget (the source of financing for large schemes and investments) is scheduled to rise to 18% (1980-82) from 14% in 1979; “support to agriculture” (including small schemes, research, extension and other service costs) would increase from 6.3% in 1979 to 8% (1980-82) of total annual expenditures. Credit for agriculture is planned to double by 1985 from that in 1978. The recent large increases in brigade and commune enterprise outputs, and the increased profitability of collective agriculture (following the substantial 1979 increase in procurement prices) should also result in increased cash for investment from local sources.

4.59 Based on discussion and mission observations in the field, three general comments are offered. First, the increased emphasis on agricultural credit to complement local savings is entirely in keeping with the general thrust of the recent reforms, which is to emphasize increased local autonomy and decision-making powers. There is a strong presumption, based on worldwide experience, that decisions involving credit which is to be repaid at positive real interest rates will be carefully considered and generally prudent. It seems particularly appropriate that modern production inputs be financed largely via the credit system, to allow fully for the local appraisal of returns and costs. Other important activities that can be further developed and stimulated through credit include the small hydropower and biogas digester programs. These are likely to expand considerably in an effort to conserve fossil fuel sources and to meet growing demands for power and fertilizer in the countryside. Moreover, the efforts and attention of senior local officials can then be better concentrated on any major term investments that are proposed (for example in brigade enterprise), as well as on activities

/1 Some of these objectives may be affected by the further adjustments and measures currently being taken to reduce the budget deficit.
that would continue to fall outside the credit network (such as major irrigation development, flood control and roads). By virtue of well developed collective institutions, including the local credit associations, as well as collective agriculture, the Agricultural Bank could become a relatively low cost credit delivery mechanism. The bank itself, in terms of staffing and institutional development, may well merit some priority as a channel for larger financial flows to Chinese agriculture.

4.60 A second general observation is related to the large class of investments in agriculture that will continue to fall mainly outside the credit network, including much large scheme expenditure, which comes out of the capital construction budget. The historically important programs in water conservancy, agricultural machinery, chemical fertilizer supply and reclamation will all warrant continuing substantial efforts in the 1980s. Local transportation improvements (through road construction and upgrading) and marketing infrastructure are additional areas where perhaps more effort and investment will be required than in some past periods. Despite substantial achievements, there is evidence of considerable waste associated with duplication of facilities at the local level and schemes that, however well they function in technical terms, continue to rely on some specially favorable financial arrangement to be financially viable. (A good example may be the low pricing of power used by some high lift pump irrigation systems.) There is a strong case for more systematic review of the prospective costs and benefits (measured in appropriate economic magnitudes), at least for the major schemes, before final approval is given. The techniques of "cost-benefit analysis" are now fairly well developed and they can be applied to virtually any type of project whose main purpose is to generate economic returns. A capability to carry out analysis of this type should be developed in China as a priority.

4.61 A third point is concern about the capacity to quickly augment the supply of trained manpower that is needed for the new and perhaps more challenging programs in agriculture now being contemplated. No new graduates in agricultural science, for example, will become available before 1982, and postgraduate programs are only now getting under way after a long hiatus. The problem of cadres in leading positions who are well past normal retirement age is a cause for considerable concern in China. But there are few middle level trained professionals to take their places. How serious this problem may become as a constraint to effective development planning is difficult to assess, but the shortages are severe. The capacity to implement the various programs must be a factor in their design (including decisions about the use of sophisticated technology, of types new to China) and in the decision to go ahead with, or to defer, any given proposal. Carefully selected foreign technical assistance can also be helpful. Meanwhile, extraordinary efforts to alleviate the manpower shortage should be encouraged through agricultural training and related programs.