4.1 Introduction

Economic growth is typically accompanied by declining shares of agriculture in total value added and employment. This pattern of structural change aptly depicts Asia’s development over the past 50 years (Table 4.1). Yet the decreasing share of agriculture in gross domestic product (GDP) masks its importance.\(^1\) As the region’s economies transformed, agriculture played an important role in supplying food and surplus labor, providing inputs to other sectors, and creating new market demand for industrial goods and services. Asia’s experience shows that a productive agriculture and dynamic rural economy is a key factor for countries that have undergone successful structural change and inclusive development.

This chapter presents a historical overview of how agriculture and rural economies have transformed as an integral part of Asia’s overall economic transformation. Over 50 years ago, Asia’s agrarian economies elicited pessimism. Many believed Asian nations would suffer from food shortages (and famines in the worst cases) because of explosive population growth, stagnant grain yields, and the

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near-exhaustion of farmland. In addition, agriculture was seen as an inferior partner in overall development—a sector deemed unprofitable for investment but from which resources had to be extracted for financing industrialization.

Land reform (introduced in many countries, especially in East Asia) distributed land to small farmers, increased incentives, and contributed to increased productivity. The Green Revolution began in the late 1960s with increased investment in irrigation, improved seed varieties, and modern inputs such as chemical fertilizers and pesticides. It fundamentally altered the perception of agriculture. It helped Asia’s farmers substantially increase yields of rice, wheat, and other cereal crops, and allayed fears of widespread food insecurity.

Following the Green Revolution, mechanization, such as the increased use of tractors and harvesters, contributed to agriculture’s structural change. As economies continued to grow, other changes occurred in rural Asia. First, farm production diversified beyond food grains, responding to rising incomes and changing consumption patterns. Livestock, fruit, and vegetable production outpaced that of cereals. The diversity of diets has been most notable since the 1990s as consumption of rice—Asia’s traditional food staple—started to fall among middle-income and increasingly urban populations. Second, market reforms and trade openness since the 1980s have increasingly commercialized agriculture with greater private sector involvement. Supported by new infrastructure and communications, food systems that linked production, processing, marketing, and distribution became more integrated. Third, rural nonfarm economies expanded beyond agriculture or small-scale industry and commerce. In particular, the rapid growth of small towns and secondary cities forged closer ties between rural and urban economies. The expanding nonfarm economy helped absorb labor released from farming and improved labor productivity.

The story of agricultural and rural transformation policy centers on food, employment, and income. This chapter discusses how institutional and policy changes—including land reform, market liberalization, and public investment—have facilitated the process. As the scope and speed of change differ across Asia, the chapter will highlight country experience in transforming traditional agriculture, which grew to become Asia’s region-wide strategic imperative. Indeed, one of the initial priorities of the Asian Development Bank (ADB) was agriculture—symbolized by the grain husks in its logo.
Table 4.1: Macroeconomic Indicators in Agriculture, Selected Economies, 1970–2018

<table>
<thead>
<tr>
<th>Subregion/Economies</th>
<th>Agriculture Share to GDP (3-Year Average)</th>
<th>Agriculture Share to Employment (3-Year Average)</th>
<th>Annual Growth Rate of Agricultural GDP</th>
<th>Annual Growth Rate of GDP</th>
<th>Annual Growth Rate, Agriculture Value Added per Worker</th>
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<td>...</td>
<td>49.0 45.2</td>
<td>(0.2) 4.3 0.4</td>
</tr>
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<td>...</td>
<td>36.7 16.1</td>
<td>... 0.9</td>
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<tr>
<td>Uzbekistan</td>
<td>...</td>
<td>30.2 33.6</td>
<td>...</td>
<td>38.3 33.6</td>
<td>3.2 4.0</td>
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<tr>
<td>East Asia</td>
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<td>...</td>
<td>47.2 29.1</td>
<td>2.9 3.3</td>
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<tr>
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<tr>
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<tr>
<td>Taipei, China</td>
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<td>7.9 4.1</td>
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<td>9.7 4.7 0.8</td>
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<tr>
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<td>64.5 38.7</td>
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</tr>
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<td>65.2 41.7</td>
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<tr>
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<td>4.3 6.3</td>
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<td>5.9 4.2</td>
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</tr>
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<td>38.3 26.7</td>
<td>2.4 2.7</td>
<td>4.2 5.3</td>
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Table 4.1 continued

<table>
<thead>
<tr>
<th>Subregion/Economies</th>
<th>Agriculture Share to GDP (3-Year Average) (%)</th>
<th>Agriculture Share to Employment (3-Year Average) (%)</th>
<th>Annual Growth Rate of Agricultural GDP (%)</th>
<th>Annual Growth Rate of GDP (%)</th>
<th>Annual Growth Rate, Agriculture Value Added per Worker (%)</th>
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</thead>
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<td>18.9</td>
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<tr>
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<td>8.4</td>
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<td>50.8</td>
</tr>
<tr>
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<tr>
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</table>

... = data not available, ( ) = negative, GDP = gross domestic product, Lao PDR = Lao People’s Democratic Republic, PRC = People’s Republic of China.

This chapter has the following sections. Section 4.2 reviews Asia’s food problems in the 1950s, giving the historical context for transformation forces that unfolded subsequently. It is followed by section 4.3 with an overview of land reform experience across Asia. Section 4.4 describes how the Green Revolution started and highlights the impacts of the technology-led transformation on solving Asia’s food problem. Key policy and institutional changes needed to sustain the Green Revolution momentum are discussed in section 4.5. Section 4.6 presents continuing transformations of food systems including changes in consumption patterns, production diversification, agricultural trade, and agribusinesses and supply chains. Section 4.7 discusses how transformations are extended to rural nonfarm economies, to foster rural–urban integration. Finally, section 4.8 discusses, among other things, key priorities for advancing agricultural modernization and rural development including food security, food safety, and well-functioning agricultural markets.

4.2 Asia’s food problems in the 1950s

In the immediate years after World War II, many developing countries won independence. Leaders saw an opportunity to establish a more stable, more productive, and economically independent modern state. Developing large-scale industry was one way to express economic independence. Many countries initially tried to promote industry—especially heavy industry—and quickly recognized they had to pay greater attention to agriculture.2

Indeed, the prevailing reality of Asia’s predominantly agrarian economies was stark. When assessing the progress of developing Asia’s postwar industrial development in 1958, the United Nations (UN) Economic Commission for Asia and the Far East (ECAFE) said “agricultural expansion in a number of the countries in the region has hardly materialized to the extent anticipated ... Per capita food production in the region is not yet restored even to prewar levels ...”3 In many Asian countries, agriculture continued to be weak and

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2 During the colonial era, the production of export-oriented tropical commodities, such as tea, rubber, and palm oil, came from large plantations. By the 1950s, most became smallholder production systems. Since then, there has been a resurgence of investment in plantation agriculture in some Southeast Asian countries such as Cambodia, the Lao People’s Democratic Republic, and Myanmar (Byerlee, D. 2014. The Fall and Rise Again of Plantations in Tropical Asia: History Repeated? Land. 3 (3). pp. 574–597).

vulnerable. Many had to rely on food aid and imports to meet growing demand. Five years later, in its 1964 annual survey, ECAFE said “the net import into the developing ECAFE region increased by 41% from 4.2 million tons in 1951/52–1953/54 to 5.9 million tons in 1960/61–1962/63.” Without an increase in production, ECAFE estimated net import of cereals in 1970 might have to triple from the early 1960s level. During 1963 and 1964, cyclical food shortages and speculation precipitated food crises in a few countries. This again drew government attention to the severe problem of food supply.

“Getting Agriculture Moving” became a new strategic priority in Asia. There were just a few examples of how to do so. In the late 19th century, Japan showed how productive agriculture could power economic growth by introducing new technology, extension services, and better education, and developing transportation networks and logistics services. Taipei, China’s experience since the early 1950s was a more recent example of how active support for agriculture facilitated overall economic development. Difficult policies such as land reform were swiftly implemented, large investments were made to rehabilitate irrigation systems and develop rural infrastructure, and rural cooperatives were established to assist smallholders by supporting agricultural marketing and input supply. Combined, these measures led to a surge in domestic agricultural production in Taipei, China, which grew by 4.4% annually between 1954 and 1967—the fastest in Asia.

The experience of Japan and Taipei, China showed that Asia’s sluggish agriculture in the 1950s and early 1960s was due to a failure to invest in rural development. There were also deep-seated misconceptions about peasant behavior: individual farmers were often regarded as tradition-bound and unresponsive to markets. T. W. Schultz countered these in *Transforming Traditional Agriculture* (1964).

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He observed that the “rational peasant” was poor but efficient, operating at minimum cost within the limits of existing technology. The basic challenge of rural development was to open new opportunities through research and technological advances. At the same time, education could increase the capacity of farmers to skillfully adopt innovation. Economic incentives would speed the process by making increased production more profitable and offsetting the high risks associated with new methods.

Therefore, transforming traditional agriculture was foremost about changing Asian policy makers’ mind-set about agriculture. This point was forcefully made in the 1969 Asian Agricultural Survey, ADB’s first regional study after it was established in 1966, with professors T. W. Schultz and Kazushi Ohkawa co-chairing the Survey Advisory Committee.

The survey had a clear optimistic vision. Transforming traditional agriculture required modern farming technology and removing the institutional and infrastructural constraints to farmers adopting new technology. When modern technology was effectively introduced, the survey envisioned “large parts of agriculture in this region will become profitable, the supply price of farm food products will begin to recede, producing for consumers generally a real consumer surplus, and it will shift the comparative advantage back in favor of this region.”

4.3 Land reform: experiences and lessons

Among development alternatives, rural institutional reform became the dominant theme in agriculture and in supporting overall development. Land reform was an important element. Many economies in Asia had begun land reform programs as early as the late 1940s; “land to tillers” was a popular agenda. Since then, land reform has had two distinct phases: the first was from the late 1940s to 1970s; the second during the 1980s and 1990s. The first wave was in Japan; the Republic of Korea (ROK); Taipei, China; and newly independent economies. The second occurred in transitional economies that were decollectivizing agriculture. While distinct, both had similar economic justification—farmers without permanent title in the land they farmed or oppressed by heavy rents would not have any incentive to invest

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labor and capital for expanding farm output. Land reform had multiple goals on top of economic goals. It had a redistributive focus to address asset inequality. And politically, redistributing land from landowners to tenants and landless laborers helped establish more egalitarian societies, which promoted social and political stability for development and prepared better educated workers for industry.

After World War II, land reform in Japan; the ROK; and Taipei, China was carried out over the short span of 5 to 10 years. Special circumstances made land reform in the three economies swift. Japan's reforms were directed by United States (US) occupation forces, although even before the war, its Ministry of Agriculture drafted a comprehensive land reform plan—used as the basis for the reform program under US occupation. The Democratic People’s Republic of Korea began land reform immediately after independence from Japan, and the ROK introduced its farming land reform law in 1949 to compete against communist influence. In Taipei, China, reform was enforced by the Nationalist government which had just left the mainland. It was implemented more thoroughly because there was limited interference from indigenous landed interests.

The three northeast Asian economies (Japan; the ROK; and Taipei, China) initially implemented reforms to improve rental terms for tenant farmers. But the emphasis soon shifted to redistribute lands from large landowners to tenants and laborers, with redistribution done below market prices. Also, in all three economies, there was a 3-hectare limit for farms. A critical implementation mechanism was the creation of land committees with tenants and owner–farmers outnumbering landowners. In Japan, 33% of arable land was redistributed to some 61% of rural households. In the ROK, 27% of arable land was redistributed to 46% of rural households. Similarly, 27% of arable land was redistributed to 63% of rural households in Taipei, China. Studies found that land reform in the three economies improved welfare and increased agricultural productivity.

Elsewhere in Asia, land reform progressed slowly with mixed outcomes. In the Philippines, land reform programs started in the 1940s. But they were ineffective until 1972, when the 1963 Agricultural Land Reform Code was vigorously implemented under a newly created Department of Agrarian Reform. The individual landholding ceiling was 7 hectares and applied only to farms producing rice and maize. It exempted sugarcane and other plantations, and applied only to tenanted areas. To evade the law, landowners registered land under family member names and evicted tenants, preventing their access to land and forcing them to work as agricultural laborers. Even after 4 decades of land reform legislation, just 10.8% of arable land had been transferred to former tenants by 1985. Over the years, land reform codes have become more complicated and implementation arrangements more complex. Still, officially, land reform continues to be part of an important unfinished agenda for inclusive development.

In South Asia, land reform had limited success. In the 1950s, India abolished the long-standing zamindari or “permanent settlement” system, ending one of the most iniquitous landownership systems in north India. Under the zamindari system, introduced at the end of the 18th century, feudal lords were declared proprietors of the land, peasants became tenant farmers, and rents were collected by a series of intermediaries who squeezed the farmers. In the 1950s, Pakistan also worked to reform systems similar to the zamindari.

The subsequent reforms in India to redistribute land rights and improve terms of tenancy were implemented unevenly across states and remain incomplete. Surplus land was distributed to landless and near-landless poor farmers, while there was widespread evasion and avoidance of ceilings legislation. During the 1970s and 1980s, “5.7 million households received an average of 0.4 hectare each from direct ceilings effects alone, benefiting some 27 million people; further, tenurial rights to almost 10 million hectares of land were transferred.” Although there were large absolute numbers of beneficiaries and affected land areas, nationwide implementation remained limited as reforms were

concentrated in just a few Indian states. In two Indian states—Kerala and West Bengal—political activism helped enforce tenancy contracts, benefiting many poor tenants.

The Government of India has a clear stance on continuing land reform and improving land administration, outlined in recent planning documents. Implementation continues to be a major challenge for several reasons. India’s land tenure governance is complex both in terms of legislation and organizational framework. Rural land markets are inefficient due to poor land records, tenancy restrictions, and land ceiling laws that lead to concealed ownership and transaction barriers. These institutional constraints continually fragment operational landholdings. And the ever smaller farm size limits the potential for growth in agricultural productivity.

Socialist countries took rather different paths to address landownership. For example, the People’s Republic of China (PRC) in the early 1950s took drastic measures to confiscate holdings from landowners and distributed them to the landless. Several years later, the government began collectivization and peasants returned the land they had received. The collective agriculture system continued until the late 1970s, when the government started comprehensive economic reforms, initially in rural areas (Box 4.1).

There were other approaches in dealing with land distribution. After World War II, Thailand initiated land settlement programs to encourage rural people to settle on previously forested land. Malaysia introduced a land allocation program to encourage the expansion of rubber plantations. In the Pacific, customary land rights continue to be respected when addressing land distribution.

Land policies (including land reform) remain important. In India, for example, 40% of farmers were landless in early 2000. More than half of rural households were landless in the early 2010s. In the Philippines, the share of landless farmers rose from 58% in the 1970s to 70% in 2010. Past assessments of land reform remain relevant.

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ADB’s 2nd Asian Agriculture Survey in 1978 cited key lessons to strengthen land reform in Asia: (i) the need for serious commitment at the top, (ii) simple and clear technical design of enactments, (iii) effective organization among beneficiaries, and (iv) the provision of necessary support services to beneficiaries. Further measures are needed to modernize, simplify, and strengthen land administration. In some countries, land title records are neglected or not updated. Land titling systems need to be upgraded and digitized if possible. This is to address the growing concern of land fragmentation. It also enables land markets to function efficiently and to use land as collateral for credit.

Box 4.1: Agrarian Reform in the People’s Republic of China, Viet Nam, and Central Asian Republics

People’s Republic of China: Rural reform began in 1978 with the introduction of the household responsibility system; agricultural land was distributed to individual farmers through land use rights, with the state remaining as the formal owner. This land reform, together with the increased procurement prices for agricultural products, unleashed farmers’ production incentives and led to significant increases in output. The success of these reforms gave the government confidence to pursue further change. A series of land laws since 1979 have extended contract periods. The standard contract term for agricultural land was extended to 30 years, according to the Land Administration Law of 1998. The 2007 Property Law established that farmers’ land use rights were private property rights.

Viet Nam’s Doi Moi: After the war with the United States ended in 1975, socialist transformation in Viet Nam forced farmers to join agricultural cooperatives—although collectivization in the south was not particularly successful. During 1987–1989, Viet Nam implemented a package of measures under its Doi Moi policy, which fundamentally changed the nature of the economy from a centrally planned to market-oriented system. One of the measures (Resolution 10) started de-collectivization. Resolution 10 obliged agricultural cooperatives to contract land to peasant households for 15 years for annual crops and 40 years for perennial crops. The 1993 Land Law extended these to 20 years and 50 years, respectively. Throughout the reform period, agricultural production grew steady.

continued on next page

**Central Asian Republics:** Immediately after the collapse of the Soviet Union, the Central Asian republics saw a severe decline in agricultural output. Comprehensive reforms were introduced covering land privatization, trade liberalization, and the liberalization of input and output markets. Farmers obtained land and could decide on what to produce. Their immediate response was to produce for food self-sufficiency—because the dissolution of the Soviet Union disrupted existing supply chains. In southern countries, the production of cereal and root crops, such as potatoes, increased significantly as they could no longer rely on imports from Kazakhstan and other former Soviet Union countries. Gross production of cereal and root crops almost doubled in the Kyrgyz Republic and tripled in Uzbekistan. Gradually, new trade relationships developed across the subregion and with other countries—contributing to the growth of nonfood crops where there was comparative advantage.


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**4.4 Green Revolution and efforts to sustain its momentum**

**Start of the Green Revolution**

The Green Revolution, which began in Southeast Asia during the late 1960s, was a major technological advancement—instrumental in transforming traditional agriculture. It boosted grain productivity, successfully solved the food problem during economic transformation, and moved Asia into a new stage of agricultural development.

The Green Revolution is a package of modern farming practices that includes using high-yielding varieties of primarily rice and wheat, applying modern inputs (especially fertilizer), and improving irrigation. There are two salient points. First, developing high-yielding varieties is not a one-shot phenomenon. It is best understood as a process of crop breeding and steady productivity gains, as varieties need to continuously improve to adapt to evolving crop disease and production conditions. Second, the effect of improved technologies on production can occur only when sufficient fertilizer and irrigation are available.
For irrigation, governments, with the support of external financiers such as ADB, made significant investments (Box 4.2). On average, Asian countries spent 15.4% of public expenditure on agriculture in 1972. They doubled agricultural spending in real values by 1985.25

Modern wheat and rice strains were developed by crossing varieties that were fertilizer responsive, short-statured, and suitable for moderate climate and tropical weather.26 Modern wheat varieties were developed by the Maize and Wheat Breeding Program of the Rockefeller Foundation in Mexico. Later, the program was renamed the International Maize and Wheat Improvement Center (CIMMYT). Modern wheat varieties quickly spread across India and other wheat-producing countries.

In 1966, the International Rice Research Institute (IRRI) in the Philippines developed an improved rice variety by crossing a tall tropical Indonesian rice strain and a short variety from Taipei, China. The new variety was named IR8, later commonly known as “miracle rice.” Because IR8 was short, it could remain standing with heavy grains at its head and had strong resistance against tropical disease and conditions because of genes inherited from its Indonesian parent.

Previously, any increase in rice production came only from expanding cultivated land. With the necessary inputs, modern varieties significantly increased yields. In addition, with improved irrigation, modern varieties could grow during any season and had medium growth duration. This allowed farmers to grow rice two to three times a year.

The successful development of modern varieties led to subsequent improvements that enhanced resistance to crop disease. The results were staggering. Rice yields increased from 2 tons per hectare in the early 1960s to about 7 tons per hectare in East Asia and 4 tons per hectare in South Asia and Southeast Asia in the mid-2010s. Wheat yields also increased from 1 ton per hectare in the early 1960s to over 5 tons per hectare in East Asia and 3 tons per hectare in South Asia in the mid-2010s.27

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26 The idea of developing short modern varieties of rice and wheat can be found in prewar Japan, and a short wheat variety called Norin 10 became one of the parental varieties for Green Revolution wheat. This was developed by Norman Borlaug who won a Nobel Prize in 1976 for his contribution to global food security.

Box 4.2: ADB Support for Adopting Green Revolution Technologies

The Asian Development Bank (ADB) assisted its developing member economies in adopting Green Revolution technologies, mostly by financing investments to develop and rehabilitate irrigation systems. In 1969, ADB approved the Tajum Irrigation Project, covering 3,200 hectares in Central Java, Indonesia. This was ADB’s first loan to Indonesia and the first agriculture project supporting the Green Revolution in Asia. Before the project, Tajum farmers were only able to cultivate one crop of rice *padi* (wet rice growing) during the wet season. With the project, a three-crop sequence was possible with much higher yields.

Starting with this project, ADB expanded agricultural financing. In 1968–1976, agricultural loans amounted to 19% of total ADB lending. In 1977–1986, agriculture accounted for 31% of ADB financing, making it the largest operational sector. In subsequent years, ADB support for agriculture declined as lending priorities shifted toward broad-based infrastructure and social development, governance and public management, and regional cooperation.

Following the 2008 food price crisis, ADB reignited its support for food security. Strategy 2030 explicitly emphasizes agriculture and rural development given the sector’s role in addressing the development priorities of climate change, nutrition and health, poverty reduction, and gender equality (responding to the feminization of agriculture).


India, Indonesia, and the Philippines

India had to deal with the 1942–1944 Bengal famine during the last few years of British rule. At least 1.5 million people perished due to food shortages largely caused by food supply mismanagement.28 After independence in 1947, India was unable to feed its population and had to depend on imports and food aid from the US. Indonesia and the Philippines also relied on large volumes of food-grain imports. In the Philippines, imports peaked at 18% of consumption in 1965.

In Indonesia, rice imports tripled in the second half of the 1950s, and despite large imports, prices doubled in 1957–1958. Fluctuating international prices of staple crops and rapid population growth raised fears among consumers and politicians of food shortages and potential famine.29

In the mid-1960s, the governments of the Philippines, Indonesia, and India introduced agricultural policies that offered a package of modern variety seeds, investments in irrigation systems, subsidized farm inputs, and extension services.30 The Philippines created the Rice and Corn Production Council under President Ferdinand Marcos to coordinate government agencies and the private sector to increase rice and maize production. Farmers quickly adopted the modern varieties released from IRRI and began using chemical fertilizers. As a result, by the mid-1970s, more than 60% of land devoted to rice used modern varieties, and fertilizer use increased to more than 50 kilograms per hectare (Figures 4.1a and 4.1b).

In Indonesia, the fall of the Sukarno government in late 1965 marked a drastic policy change. In 1967, the new Suharto government introduced several programs to increase rice production and stabilize food supply. He created the Badan Urusan Logistik, a food logistics agency directly under the President. It set a high floor price for rice to encourage production and a ceiling price for consumers. By the mid-1980s, with investment and input subsidies, 60% of the rice area cultivated used modern varieties and fertilizer application, with yields reaching 3.9 tons per hectare (Figures 4.1a and 4.1b).

India’s Prime Minister Jawaharlal Nehru strongly supported agricultural development. The real progress, however, started only after his death in 1964. Improved varieties of wheat and rice began spreading across fertile and irrigated areas in Punjab and Haryana. Modern varieties of wheat had instant success, while rice varieties needed further improvement to fit India’s heterogeneous agroecological conditions, especially in the south and east. Areas using modern varieties of wheat and rice and fertilizers gradually increased throughout the 1970s and 1980s.

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Because of modern agricultural technology and strong policy support, the three countries increased rice and wheat production and reduced cereal imports. The Philippines achieved rice self-sufficiency periodically in the late 1960s and early 1980s (Figure 4.1d). Indonesia briefly achieved self-sufficiency in the mid-1980s. India’s rice production more than doubled from the late 1970s to the 2000s, helping the country achieve self-sufficiency in the 1980s. And this was during the period when India’s population doubled. In 2016, India became the world’s largest rice exporter, surpassing Thailand.

**Bangladesh, the People’s Republic of China, and Viet Nam**

In 1979, the Government of Bangladesh liberalized agricultural inputs, privatizing imports and marketing irrigation equipment and chemical fertilizers. Low-cost shallow well (or groundwater) irrigation pumps helped farmers cultivate rice during the dry season (called *Boro*). Over time, *Boro* rice production accounted for 60% of the country’s rice production. New rice varieties more suitable for rainy and dry seasons contributed to the expansion of fields using modern varieties. Still, chronic flooding during monsoon seasons, worsening salinity near bay areas, and overexploitation of underground water supply due to the increased use of tube wells remain challenges.

The PRC’s Green Revolution was marked by two periods—before and after the 1978 economic reforms. As early as the late 1950s, PRC agronomists successfully cross-bred short, high-yielding rice varieties, introducing them on a limited scale in the south. By 1975, the PRC established a national high-yielding variety rice seed system over a much wider region. After the 1979 reforms, the Green Revolution had a substantial impact on the country’s agriculture. This was due to several factors. First, the PRC’s opening up facilitated active research exchange with other countries including agriculture that contributed to further improving farm technology. Second, the high-yielding rice variety was rapidly adopted nationwide due to much-improved producer incentives under the household responsibility system and increased rice prices. Adding to the momentum was a renewed

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32 Yuan Longping of Hunan Agricultural College, PRC, made pioneering contributions to developing hybrid rice varieties in the 1970s. Yuan is called the “Father of Hybrid Rice” in the PRC.
Figure 4.1: Impacts of Modern Variety Rice Adoption, Selected Asian Economies, 1961–2016
Areas under Modern Varieties, Fertilizer Use, Paddy Yields, and Self-Sufficiency

Figure 4.1a: Share of Sown Area of Modern Rice Variety (% of total area)

Figure 4.1b: Fertilizer Use (kg/ha)
Figure 4.1 continued

**Figure 4.1c: Rice Yield (ton/ha)**

![Graph showing rice yield trends for Bangladesh, India, Indonesia, People’s Republic of China, Philippines, and Viet Nam from 1960 to 2016.](graph)

**Figure 4.1d: Rice Self-Sufficiency: Net Import as % of Domestic Availability (3-year average)**

![Graph showing rice self-sufficiency trends for Bangladesh, India, Indonesia, People’s Republic of China, Philippines, and Viet Nam from 1962 to 2016.](graph)

ha = hectare, kg = kilogram.

emphasis on public investment in rural infrastructure and strengthening farming support services. Areas using improved rice varieties increased over 100 times from 135,000 hectares in 1976 to 15.3 million hectares in 1990, and rice yields increased by over 40%. Third, the Green Revolution extended from rice and wheat to maize and other food crops.

In Viet Nam, the number of modern varieties rose rapidly in 1981–1990 after the Doi Moi liberalization in 1986. Agricultural reform made Viet Nam a major rice exporter. Rice production growth came from continuous improvement in seed varieties. Hybrid and improved varieties imported from the PRC contributed to the Green Revolution in north Viet Nam while those developed by IRRI were cultivated in south Viet Nam. National agricultural research systems successfully developed location-specific varieties.

**Sustaining Green Revolution momentum**

The widespread adoption of Green Revolution technologies contributed to solving the region’s food problems. Sustaining this transformative momentum has continued to be a strategic priority for Asian agriculture. Two issues are particularly important. One is the role that public policies play to allow markets to function better. The second is the need to sustain farm productivity by continuing research support, agricultural mechanization, and sustained public infrastructure investment.

First, the Green Revolution presumed a strong and proactive public sector to help farmers adopt modern farming technology. Over time, it was realized that the outcome depended on the effectiveness and appropriateness of public engagement. As early as 1972, Hla Myint, a prominent economist from Myanmar, said “the fundamental question raised by the Green Revolution is ... what policies ... to turn it from a technological innovation into a genuine dynamic force for economic development ... without appropriate policies, the Green Revolution might be cut short before its full benefits are realized.”

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Myint said that appropriate policies refer to how to organize the delivery of agricultural support services such as input supply, product processing and marketing, and rural credit systems. A critical issue is the involvement of private entrepreneurs. Appropriate policies also refer to the pricing principles supporting food production and stimulating broad-based rural development. He questioned the wisdom of raising the price of rice paid to farmers and subsidizing the use of modern inputs. While these pricing policies succeeded in inducing farmers to expand production scale rapidly, the question was whether economic incentives given to farmers were able to efficiently allocate resources between rice production and other crops—and more generally between agriculture and the rest of the economy.

The issues Myint raised in the 1970s continued to occupy policy makers’ attention. In many countries, agricultural reforms started in the 1980s. With trade liberalization, agricultural price distortions declined over time when measured against border prices, although trade restrictions remained for some politically important tradable agricultural products. Rice was the main example, with importing countries maintaining explicit import quotas and exporting countries restricting the types and amounts of rice for exports. Rice trade policy reforms continue in Asia. In 2018, the Government of the Philippines introduced the Rice Tariffication Act to replace quantitative restrictions to rice import with tariffs.

Asian developing countries also gradually restructured input supply and output marketing systems. State involvement was reduced and policy environments improved to enable private sector participation in support services. Domestic food prices became more realistic by phasing out input subsidies for farmers and general food subsidies for consumers. Countries identified and introduced direct and transparent methods to support low-income consumers and needy farmers to improve productivity.37

The second concern is about the sustainability of agricultural productivity. The international technology transfer underlying the Green Revolution had first taken place in favorable agricultural

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areas and later extended to unfavorable agricultural areas. Because of this sequence, rice yield in Asia continued to increase. Since the 1990s, national budget support and international donor assistance have declined. The apparent complacency over current and future food supplies remains worrying.  

Research support must push technological frontiers—introducing new varieties is critical, given climate change and soil salinity. Also, more investment is needed to develop, diffuse, and adopt new technologies.

Asian countries have taken multipronged approaches to raise farm productivity while focusing on reducing production costs for both rice and agriculture as a whole. Mechanization came to East Asia, and also to areas in South Asia and Southeast Asia, where labor shortages developed out of rapid economic transformation. Tractors, harvesters, and rice planters replaced manual labor. Unlike large machines developed and used in Europe and North America, small-scale machines were developed to suit the small plots in developing Asia. With rising labor costs, mechanization became increasingly important. There remain concerns, however, that small and fragmented land plots and insecure land rights could slow the land consolidation needed for mechanization to enjoy scale economies.

Declining investment and research support for agriculture became a global phenomenon. The full impact of the neglect became evident much later, in 2008, when a food price crisis, coupled with the global financial crisis, hurt developing countries, particularly in Africa. It awakened the international community to refocus more on agriculture.  

Comprehensive measures to enhance land, labor, and water efficiencies are needed. Expanding the scope and scale of agricultural research and extension services is also needed. Countries and international organizations are repackaging agricultural interventions to address challenges such as macro- and micro-nutritional deficiencies, gender inequality, and climate change.

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40 Chapter 12 discusses gender in detail. Chapter 13 also discusses agriculture-related environmental and resource depletion challenges.
4.5 Changing patterns of food consumption and product diversification

Changes in consumption patterns

Asia’s food consumption patterns in terms of calorie intake changed substantially over the past few decades, as several recent studies point out. There is (i) a decline in consumption of rice and wheat, and (ii) an increase in consumption of animal-sourced foods and fruits and vegetables. A staple is the most important source of calories. Rice is traditionally the staple for most people; wheat is a staple in some areas. Though not shown in Figure 4.2, traditional staples in the Pacific are mostly root crops such as sweet potatoes and taro. Per capita consumption of staple foods, especially rice, has started to level off or decline after a long period of increase. This is most notable in East Asia and Southeast Asia (Figure 4.3).

Figure 4.2: Food Consumption Patterns, Developing Asia, 1961–2013
(average kilocalories/person/day)


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Dietary diversity is important for a balanced intake of different nutrients. The main food groups beyond staples are animal-sourced foods (including meat, fish, eggs, and dairy products), fruits, vegetables, and beans. Consumption of animal-sourced foods and fruits and vegetables has been rising in the region. For animal-sourced foods, the increases were most rapid in East Asia and Southeast Asia. Available refrigeration at home and within value chains may be partially behind the increased consumption of perishable foods such as meat, fish, fruits, and vegetables.

Changing consumption patterns are mainly due to rising incomes. As incomes increase, starchy staples account for a smaller share of dietary energy, reflecting a desire for dietary diversity. This leads to decreased consumption of these staples on a per capita basis given the limits of an individual's energy intake. Declines in rice consumption have been greater in urban than rural areas, and declines have been greater for those at the upper end of the income distribution than the poor.42

A Food and Agriculture Organization of the United Nations (FAO) study43 found diversification within starchy staples, again reflecting the desire for variety, especially for urban residents and young people. Urban residents in southern PRC, where rice is the traditional staple, tend to increase wheat consumption (up to a point) and reduce rice consumption as incomes rise. The reverse is true in urban areas in northern PRC, where traditional wheat consumers tend to increase rice consumption (again up to a point) as incomes increase. Data from household surveys show that income is a key driver for consumption of several different types of nutritious foods.

Prices of fruits and vegetables rose more rapidly than the overall price of food in nearly all countries. This occurred over 10 to 15 years. These sustained price increases reflect reinforcing demand and supply. First, consumers want to diversify their diets as their incomes grow (demand). Second, fruit and vegetable cultivation (supply) is relatively labor intensive, implying that farmers need to find ways to use labor more efficiently.

Production diversification

As consumption patterns change, Asian agriculture has gradually transformed, moving from largely cereal- or grain-based production to higher-value production—such as high-value crops, livestock, and fisheries. The value of agricultural production (in 2010–2014 constant prices) increased over six times in 50 years. In the 1960s, cereal production dominated, accounting for 40% of total agricultural production. In the 1990s, livestock, and vegetable and fruit production significantly increased, now exceeding the value of cereal production.
These changes, however, occurred unevenly across Asia (Figure 4.4). In East Asia, mostly in the PRC, the change has been drastic. The production share of cereals declined from 50% in 1971–1974 to 20% in 2010–2014. During the same period, the production value of fruits and vegetables increased from 15% to 40%, and the production value of livestock increased from 20% to 35%. Although less drastic, the share of cereal production value declined by 10 percentage points from about 50% in 1971–1974 in Southeast Asia, while the share of other crops, including oil crops, sugarcane, and other industrial crops, expanded.

**Figure 4.4: Shares of Agriculture Sector Gross Production Value, Developing Asia, 1971–1974 and 2010–2014 (% of total)**

Notes: “Other crops” include oil crops, roots and tubers, and sugar. Pacific economies are excluded due to data unavailability of Papua New Guinea.

Meat production in Asia grew significantly over the past 5 decades. A large share of increased meat production occurred in the PRC. The country is the world’s largest producer of pork, accounting for about 45% of global production. Outside the PRC, India is the largest meat producer—with beef and poultry as the main products. Indonesia, Myanmar, Pakistan, the Philippines, Thailand, and Viet Nam follow. In Central Asia, the share of livestock production decreased as diets diversified, though total meat production continues to grow.

Production diversification goes hand in hand with farm specialization, with different farms specializing in different crops. In Thailand, the PRC, and elsewhere, farmers have increasingly specialized in a smaller number of crops, particularly over the past 10 to 15 years. Today, livestock farms are often specialized in particular livestock (such as poultry, pig, beef cattle, or dairy). This trend is important, as more Asian farmers are moving out of subsistence agriculture and producing for markets. Farmers are becoming commercially oriented, connected to markets through improved logistics and transport, and respond quickly to changing market conditions, often assisted by information technology.

4.6 Agricultural trade and food value chains

_Shifting patterns of agricultural trade_

Aside from domestic product diversification, international trade allows countries to specialize in production based on comparative advantage and economic opportunity. Trade liberalization in agriculture (as discussed earlier) contributed to increased external engagement. Because a country’s agricultural production depends on agroecological conditions, those with less diverse conditions benefit from international trade. Indeed, agricultural trade benefits from comparative advantage. Trade in processed food, such as vegetables and meat, has grown significantly due to the high income elasticities of demand and where there are fewer trade barriers or quarantine-related restrictions.

One example that took advantage of trade liberalization is the expansion of oil-crop (palm oil) production in Malaysia, targeted for the lucrative export market. Oil-crop production is suitable for Malaysia, with its narrow range of latitude. As this occurred, rice and maize cultivation areas declined—with Malaysia relying more on imports. In contrast, countries with comparative advantage in cereal production have become net exporters.
Thailand became a major rice exporter in Asia in the 1970s and remained the world’s largest rice exporter until 2016, when India became the top exporter (Figure 4.5a). India exports high-value basmati rice to Europe and other high-income countries as well as non-basmati rice to Africa, the Middle East, and other Asian countries. Following India, Pakistan has become a major basmati rice exporter and is now the fourth-largest rice exporter globally. The third-largest rice exporter is Viet Nam. The combined share of these four rice exporters is around two-thirds of global exports. Cambodia and Myanmar are expected to become major rice exporters in the future.44 One caveat is that if the production expansion is based on subsidies or distorted prices for water, fertilizer, and other inputs, these could misallocate resources and create unsustainable patterns of agricultural production.

Rising production of fresh vegetables and fruits resulted in increased trade of these higher-value crops (Figures 4.5b and 4.5c). Before the 1970s, the number and volume of traded fruits and vegetables were limited. Since then, however, the traded number and volume of these products have grown significantly partly due to the development of value chain technology. Major traded vegetables include tomatoes, onions, cucumbers, and cabbage. They are exported as fresh, frozen, preserved, or processed. As value chains grow, their value expands both ways. The PRC is the largest exporter of both vegetables and fruits (Figures 4.5b and 4.5c). It also imports large volumes, although India imports more vegetables than the PRC. Thailand and Viet Nam also export and import vegetables and fruits.

Meat production and trade have increased markedly, requiring massive imports of animal feed from outside Asia. The import volume of maize, soybeans, and sorghum increased dramatically among major Asian livestock producers (Figure 4.5d). Viet Nam is the largest maize importer, followed by the PRC.

**Growth of food value chains and agribusinesses**

Significant changes in consumption patterns, product diversification, and international trade have helped transform Asia’s “agri-food” economy, especially with the rapid expansion of food value chains and agribusiness—various businesses connected with producing,

Figure 4.5: International Trade of Rice, Fruits, and Vegetables, Selected Economies, 1974–2016
(average annual, $ billion)

Figure 4.5a: Rice Trade

Figure 4.5b: Vegetables Trade

Figure 4.5c: Fruits Trade

Figure 4.5d: Maize Trade

processing, and distributing farm products such as food and beverage manufacturing.\textsuperscript{45} Food supply chains have shifted from locally fragmented chains to geographically integrated ones. Some segments have declined—the influence of traditional village traders giving way to urban wholesale markets and specialized wholesale and logistics stores. The steady growth of physical infrastructure such as roads and storage over the past decades greatly improved transportation, communications, and knowledge sharing for the agriculture sector.

Market-led value chains continue to change as well. The private sector's role is critical, as the scale of investment and knowledge required are far beyond the capacity of governments to provide. New information technology has been adopted for more efficient processing and distribution of food products, to ensure quality and safety, and for contract enforcement. Food traceability system is also introduced in food supply chains and agricultural trade. These changes form an integrated feedback loop from table to farm, with contracts giving farmers production instructions.

Contract farming is a special production–procurement system designed to address logistics challenges. It is commonly used in vegetable and fruit production. Due to their perishable nature, coordination is critical to ensure timely delivery from producers to retail stores using proper equipment such as cold storage. Contract farming helps ensure product quality to meet market demand in high-end urban and export markets, often by providing farmers the technical assistance to meet food safety requirements. In contract farming, farmers and buyers make advance agreements on volume, quality, time of delivery, use of inputs, and pricing. In Asia, vegetables and fruits are increasingly produced and marketed through contract farming.\textsuperscript{46}

Major changes have occurred almost unnoticed, even in staple food value chains. A recent three-country study (Bangladesh, India, and the PRC)\textsuperscript{47} by ADB and the International Food Policy Research Institute documents the transformation of value chains of rice and potatoes. The changes included the rapid rise of supermarkets, modern cold storage facilities, large rice mills, and commercialized


small farmers using input-intensive, mechanized technology. In recent years, the spread of information and communication technology into rural areas has been an important driver of change within the rural economy.

Although the GDP share of direct “agricultural value added” has declined, “agribusiness value added” (which includes manufacturing, processing, and food value chains, such as transport, logistics, and distribution services) has grown significantly over the past 2–3 decades. In Indonesia, for example, agribusiness value added in 2014 was equivalent to 70% of agricultural value added. Expanding agribusiness not only increases value added but also absorbs surplus rural labor.

Urbanization and increasing women’s participation in the labor market have also been important in expanding agribusiness. Studies find that, due to urban traffic congestion, longer work hours, and more women working outside the home, urban residents tend to place high value on the convenience of food preparation, leading to increased expenditures on processed foods.

4.7 Expanding the rural nonfarm economy

Traditionally, rural nonfarm economic activities have been important in Asia. Diversification into nonfarm income helps households diversify income risk from different sources. According to Asian household studies over the years, income diversification contributed significantly to risk coping for rural households. This is especially true for households in low-potential agricultural areas without irrigation. Farming is inevitably a risky business. Weather shocks, crop disease, insect and animal damage, postproduction losses, and price fluctuations can ravage output and revenues. Current prevention or mitigation is insufficient.

As Asia continues to transform, the rural nonfarm economy has become a critical driving force. It helps integrate rural and urban economies. Agriculture is land-intensive, so farming is naturally located in rural areas. High value-added industry and services tend to be in urban or peripheral areas. Income gaps between rural residents (farmers) and urban residents (factory and office workers) tend to increase. The rural nonfarm sector helps narrow these gaps.
Historically, the rural nonfarm sector played a significant role in industrial development. As economies made the industrial transition from light to heavy industry, many saw vibrant rural nonfarm economic development initially fostering light industry, then widening to a variety of other industries. In Japan, for example, important industries during the prewar period—especially silk production, reeling, and weaving for silk export—operated from cottage-type factories in rural areas. Local traders played a major role in transmitting market information and technology. Taipei, China (with its development of small and medium-sized enterprises) and the PRC (with rural township and village enterprises) showed how rural-based industries could successfully integrate into urban economies. In South Asia, the cotton industry was an important part of the rural economy until the 19th century. Today, it is reviving.

Nonfarm sector development is needed because they help create employment opportunities for rural labor, slow rural–urban migration, promote more equitable income distribution, and reduce rural poverty. In the Philippines, for example, rural nonfarm employment, as a share of rural employment, increased from 35% in 1983 to 41% in 2003. The rural labor force has been moving out of farming, as nonfarm work has become more profitable.

Agriculture and farming are decreasing in importance as a share of rural household income—there are fewer Asian households specializing exclusively in agriculture. A recent review of field survey findings shows that from 1992 to 2004, the percentage of rural households specializing in farming decreased from 44% to 25% in Viet Nam, 35% to 16% in Indonesia, and 27% to 19% in Nepal. Nonfarm incomes are a growing share of rural household incomes. Most rural households earn income off the farm from a variety of sources.

4.8 Looking ahead

There have been significant changes to Asia’s agriculture and rural economies over the past 50 years, but the progress has been uneven across the region. Asia’s agriculture and rural sectors continue to

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face major challenges, both old and new. Food security, nutrition and food safety, diversification, rural employment, land consolidation, strengthening of agricultural markets and food supply chains, and rural–urban integration all remain important priorities for many developing Asian countries.

Going forward, policy makers will also need to take into account new opportunities, emerging concerns, and changing circumstances. For example, there is an opportunity for greater adoption and application of information technology and other new technologies in agriculture and rural areas. The changing demographics, especially the aging of rural populations, must be a part of rural revitalization strategies. Looming impacts of climate change, environmental stress, and natural resources depletion add to the urgency and complexity of agricultural policymaking and implementation.

Specifically, the following key priorities are critical to continue agricultural transformation and rural development. These are among salient features of ADB’s new operational priority on promoting rural development and food security under ADB’s Strategy 2030.

First, technology remains a key driver of productivity growth. Research and the application of technology will occur both in agricultural production systems and across the entire food chain. This enables connecting smallholder farmers to markets, while measures are introduced to mitigate risks in adopting new smart technologies. Climate-smart technologies (such as drip irrigation and drought-tolerant crop varieties) have been developed with more coming. Smart technologies are also increasingly being applied—ranging from satellite images, the internet of things, artificial intelligence, and big data analytics.

Second, land reform and land administration remain part of the ongoing agenda for many Asian countries. The lack of clear land rights impedes effective land and credit markets, and discourages land consolidation for mechanization and agricultural productivity growth. Farmland consolidation can be an important solution for countries with rural labor shortages and aging farmers.

Third, improving food value chains and agribusiness supports the promotion of agricultural trade. This requires more investment to improve transport infrastructure and logistics services. Continuing efforts are also needed to reduce trade barriers and improve customs and quarantine services for agricultural trade.
Fourth, food safety and nutrition standards must be developed and enforced across the entire food system. Public policy and investment need to accord greater attention to the issue of safety and nutrition. Malnutrition is a development concern of multiple dimensions with impacts lasting through generations. Addressing this concern will require active engagement and support of many stakeholders including government ministries, communities, the private sector, and families.

Fifth, remaining agricultural price distortions should be addressed. This helps improve transparency of government expenditures and resource allocation efficiency. More Asian countries are moving in this direction, including a shift from food price subsidies to targeted income transfers to poor households.

Sixth, emerging challenges must be addressed—including ecosystem protection for forest, land, and water resources; environmental management for air, soil, and water pollution; and climate resilience to drought, floods, and salinization. Agriculture can also contribute to climate change mitigation by better managing forests and land, and adopting low-carbon farming practices.

Finally, agricultural and rural development policy design and implementation must be better integrated into national development strategies for more balanced, inclusive, and sustainable growth.