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Agricultural Transformation in Asia: Experiences and Emerging Challenges

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ABSTRACT

Agriculture plays a key role in economic development, alleviating poverty and malnutrition, especially in the early stages of agricultural development. Several studies have demonstrated that neglecting agriculture, especially at the early stages of industrialization, can disrupt the process of economic transformation. This paper reviews the process of agricultural transformation in Asia through the framework proposed by Timmer (1988). It finds that agricultural transformation in Asia has followed a uniform pattern with unique characteristics in each stage. Moreover, the public sector has been instrumental in facilitating and guiding agricultural transformation. Emerging challenges in the agri-food sector in Asia have prompted some countries to promote a more inclusive and integrated approach to rural and agri-food system development. The next phase of agricultural transformation—pioneered in Japan, Republic of Korea (South Korea), and China—seems relevant to most countries in Asia and elsewhere. In all three countries, the role of the state in facilitating the next phase of agricultural transformation is highly instrumental in terms of policy, strategy, incentives, and resources. However, there is insufficient evidence to assess the efficacy of the transformative initiatives dubbed as the “6th industrialization in agriculture.”

Keywords: Agricultural transformation, policy, institutions, technological progress and the role of the public sector, Asia, Republic of Korea, Thailand, Vietnam, Bangladesh

JEL codes: Q18, Q13, Q15, Q16, O13

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INTRODUCTION

Not long ago, economic development was viewed as a growth process requiring a systemic reallocation of factors of production from low productivity, traditional technology, and decreasing returns to one with higher productivity and increasing returns (Adelman 2001). Agriculture was seen as a traditional sector with low productivity, passively contributing to economic growth. In this view, most developing countries had “dual” economies, where factors of production—labor and savings—would be released to meet the growing demand for labor and financial capital in the more productive non-agriculture sectors (Lewis 1954). Satisfying basic needs implied that agricultural growth, at the very least, should keep pace with population growth to avoid the “Malthusian trap” and stagnant development (Diao et al. 2007).

The “Ricardian trap”—where agricultural growth stagnates, food prices soar, and pressure builds to raise wages—tends to compromise industrial growth, especially during the early stages of economic development when industry is typically labor intensive. Many developing countries had employed Lewis’s “dual economy” model to accelerate industrialization by heavily taxing the agriculture sector until as late as the 1980s (Schiff and Valdez 1992). De Janvry (1981) demonstrates the impact of neglecting agriculture in Latin America, which resulted in high import bills, trade imbalance, strains on the exchange rate, and inflationary pressures. Latin America’s initial success in rapid industrialization was reversed. Ruttan (2002) posits that while early development economists saw agricultural growth as essential for growth in the rest of the economy, the process of how growth in agriculture is facilitated was not a concern.

The Green Revolution in Asia from the late 1970s to the 1980s, despite some controversies, revealed the potential of agriculture to contribute to growth. Gollin, Parente, and Rogerson (2002), in their analysis of 62 countries over 1960–1990, find that growth in agriculture directly contributed to 54 percent of the gross domestic

product (GDP) growth and a further 29 percent in sectoral shift by releasing labor. Johnson and Mellor (1961) emphasize the linkages between agriculture and non-agriculture sectors as integral to economic development: the “forward linkages,” where agricultural outputs are supplied as inputs to non-agricultural production, and the “backward linkages,” where rising income in the agriculture sector creates demand for agricultural inputs and consumer goods. Both the “induced innovation” (Hayami and Ruttan 1985) and the Green Revolution models show that growth in the agriculture and non-agriculture sectors are mutually inclusive and require fostering between sectors (Diao et al. 2007).

Christiaensen and Martin (2018) demonstrate that during the early stages of economic development, agriculture is two to three times more effective in reducing poverty than equivalent growth in other sectors. Growth in agriculture disproportionately benefits the poorest at earlier stages of development (Ligon and Sadoulet 2018) and is more effective in addressing malnutrition (Headey 2013). A number of studies have amply demonstrated that agriculture’s value added per worker causes growth in GDP per capita (Tiffin and Irz 2006); hence, agriculture acts as an engine of growth. FAO (2002) found that GDP per capita in East and Southeast Asia grew by 2 percent if dietary energy supply increased by 500 kcal per day, which is equivalent to investment in human capital (Fogel 1994). Agriculture has the capacity and track record to stabilize domestic food production, enhance food security, and avoid periodic food crises and political and social instability, which affect the level and efficiency of investment (Timmer 1989; Dawe 1996).

Over the past few decades, some countries in Asia have been more successful than others in addressing poverty and malnutrition. A recent study of the Food and Agriculture Organization (FAO) (2021) sought to uncover key policies, strategies, institutional innovations, and public investments to facilitate inclusive agricultural transformation in Asia. Using the FAO study as basis, this paper highlights some of the main experiences, processes, and components of agricultural transformation in Asia.

THE PROCESS OF AGRICULTURAL TRANSFORMATION IN ASIA

Laborde et al. (2018) define agricultural transformation as the process by which the agri-food system evolves from being subsistence oriented and farm centered into being more commercialized, productive, and off-farm centered. Transformation is said to be inclusive if the results lead to food security and poverty alleviation, in particular, among socially and economically disadvantaged groups.

Timmer (1988) posits that agricultural transformation evolves through at least four distinct phases, and the role of public policies, strategies, and investments vary accordingly. The stylized stages, though not always clearly distinguishable, are useful in analyzing public interventions at different stages of agricultural development. They also help policymakers determine the relevance of certain policy measures to specific settings/countries. The stages include:

1. **Getting Agriculture Moving.** In this early phase of agricultural development, productivity per worker begins to increase from very low levels, improved technologies are adopted, and rural labor force begins to find alternative employments outside agriculture. Key policy options during this phase typically include institutional change, new technologies, market structures, incentives, and significant investments in rural infrastructure.
2. **Agriculture as a Contributor to Growth.** The non-agriculture sectors increase their labor-absorption capacity, facilitating labor exit from agriculture. The agriculture sector's continued adoption of productivity-enhancing technologies and innovative institutional change, including legislation, and other enabling environmental factors define this phase. Key policy options may include establishing agriculture-industry market linkages, as well as technology and incentives that support the creation of a sustainable agriculture sector.

3. **Integrating Agriculture into the Macroeconomy.** Progressive investment in rural infrastructure, market linkages, and diminishing factor productivity gap among agriculture and other sectors facilitate the integration of agriculture into the macroeconomy. Managing trade, shocks in commodity markets, and market interventions continue to be focus areas for policy in agriculture.

4. **Agriculture in Industrialized Economies.** Agriculture is a much smaller sector of the economy and food expenditures occupy a small share in consumer budgets. The policy focus includes rural employment generation, income support to farmers, environmental protection, and supply of verifiable healthy diets. In addition, some of the issues in phase 3—particularly agricultural protectionism, managing commodity market shocks, and environmental impacts—continue to be relevant and the focus of the policy agenda.

5. **Rural-Urban Integration.** This stage is not part of the original Timmer framework but has been a major policy agenda in some countries (particularly Japan, South Korea, and China) over the past decade. This is referred to as the “6th industrialization in agriculture,” where the key objectives are to bridge the rural-urban income gap and revitalize the rural economy by integrating production, processing, and marketing; increasing farm- or cluster-level value addition; and promoting agri-tourism with a focus on smallholder family farms.

KEY FACTORS OF AGRICULTURAL TRANSFORMATION

Given that extensive agriculture is not feasible in most cases, factor productivity is the main or only option for agricultural transformation where agricultural land is limited. Timmer (2012) suggests that productivity can be achieved in three key ways: (1) new and improved technology for a given amount of labor; (2) more labor absorbed

in other sectors away from agriculture, ensuring the same or higher agricultural output with fewer workers; and (3) improved agriculture terms of trade (higher real income for farmers). [FAO \(2021\)](#) adds two other ways: (1) agricultural livelihood diversification from monocropping staple crops to diversified, sustainable intensification and high-value crops, as well as value chain development; and (2) provision of secure and inclusive land tenure to farmers so they have more incentives to invest.

Agricultural Productivity Growth

Agricultural output growth has been robust over the past half century, especially in East Asia—China, in particular. Output growth in Southeast Asia and South Asia lagged initially, but accelerated from the 1970s and the 1980s, respectively. Total factor productivity (TFP) growth,¹ or efficiency improvement, has been the main driver of agricultural output growth since the 1990s (Table 1). In China, TFP grew by nearly 4 percent in the 1990s and 3.1 percent during 2001–2012. The output growth in both East Asia (mainly China) and Southeast Asia has consistently and significantly outpaced population growth since the early 1960s. However, Table 1 indicates that agricultural output productivity in South Asia, underpinned by a consistently low TFP, has barely kept pace with population growth. [FAO \(2021\)](#) suggests that prior

to the 1990s, agricultural output growth had relied mainly on increased use of inputs, such as land, labor, and fertilizers. Significant concerns have been raised more recently on the externalities of pushing productivity growth boundaries. Breaking environmental and socioecological boundaries is a key policy concern as long-term costs are becoming more apparent.

Technological Change

Improved inputs and farm mechanization, which are key to productivity growth, are essential elements of agricultural transformation. According to [FAO \(2021\)](#), farmers in Asia have shifted from non-purchased to purchased inputs. This includes switching from human to animal to machine power and from manure, by-products, and residues to chemical fertilizers, as well as greater use of improved seed varieties, pesticides, and herbicides. Similarly, [Dawe \(2015\)](#) and [Vos \(2018\)](#) report that capital intensity of Asian agriculture has significantly increased over the recent past, as reflected by the greater use of mechanization and less reliance on labor in both small and large farms. The rapid development of rental markets for agricultural machinery has facilitated farm mechanization. Nevertheless, accurate estimates of mechanization are lacking due to inadequate data availability ([Dawe 2015](#)).

Table 1. Agricultural output and TFP growth in Asia, 1961–2012 (annual growth rates in percent)

	1961–70		1971–80		1981–90		1991–2000		2001–12	
	Output	TFP	Output	TFP	Output	TFP	Output	TFP	Output	TFP
East Asia (mainly China)	4.8	0.9	3.3	0.7	4.5	1.8	5.0	3.9	3.5	3.1
Southeast Asia	2.6	0.5	3.9	1.9	3.3	0.4	3.0	1.4	4.0	2.5
South Asia	2.5	0.6	2.7	0.8	3.3	1.2	2.7	1.0	3.6	2.0

Source: [FAO \(2021\)](#) based on [Fuglie \(2015\)](#)

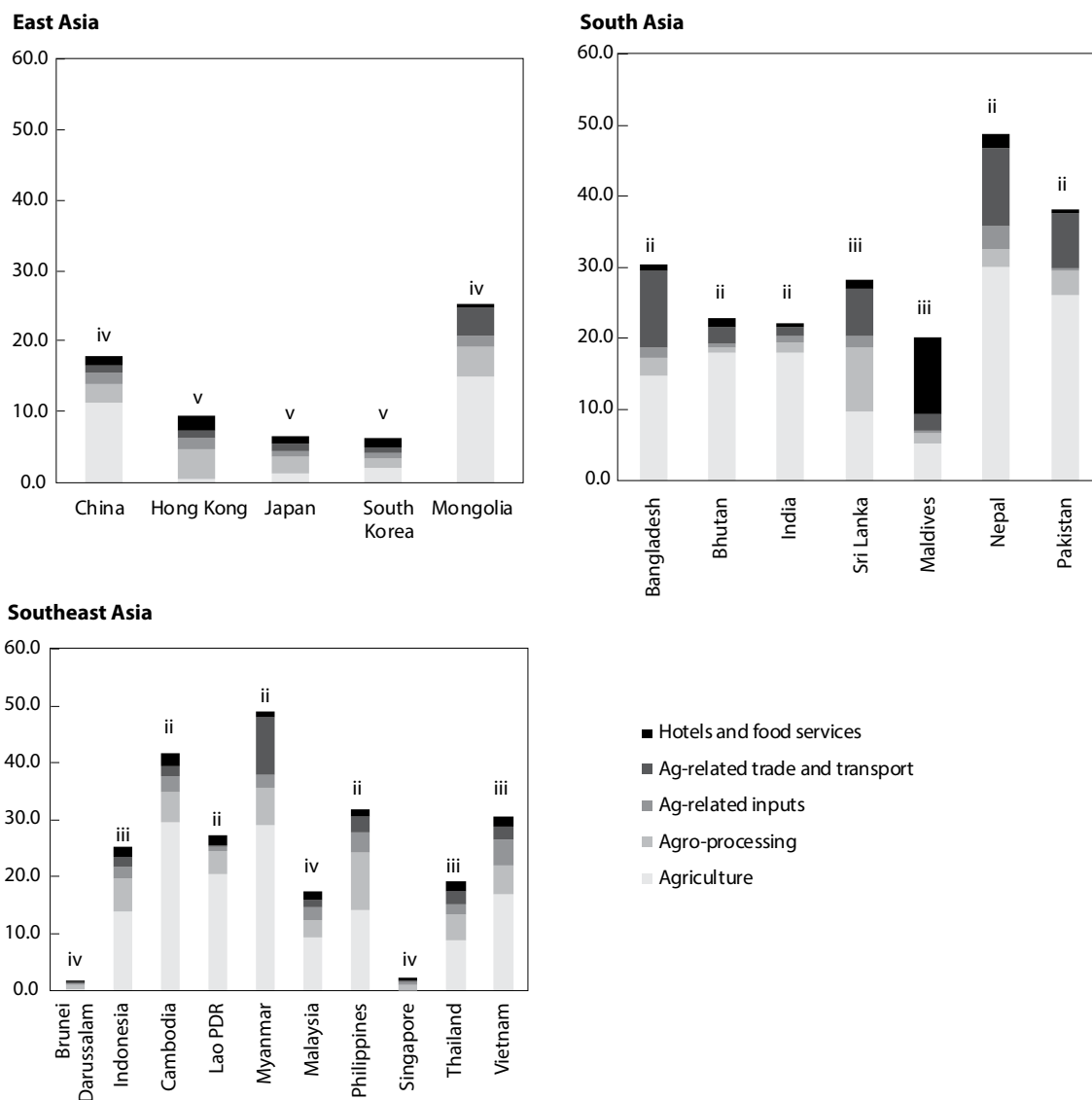
1 For a review and discussion of TFP, see: Saikia, Dilip. 2014. "Total Factor Productivity in Agriculture: A Review of Measurement Issues in the Indian Context." *Romanian Journal of Regional Science* 8(2): 45–61

Crop and Farm Diversification

Farm diversification refers to diversifying from crops to livestock and/or fisheries, and from annual to perennial crops and others. Crop diversification refers to switching crops. Economic growth, urbanization, globalization, and rapid growth in middle-income households have led to significant shifts in diets, resulting in changes

in farming systems (Pingali 2004). Timmer (2014) shows that agricultural production in Asia has diversified from predominantly cultivating basic grains toward greater production of fruits, vegetables, and animal-sourced foods. This phenomenon mirrors the dietary changes associated with higher incomes and increased urbanization (Vos 2019). Diversification in Asia is happening even as individual farms have become

Figure 1. Size of agri-food sector in Asia, 2015 (share of total GDP)



Source: FAO (2021)

Note: The numbers on top of each bar refer to the stage of agricultural transformation as defined in the paper.

more specialized, focusing on crops, livestock, poultry, or aquaculture (FAO 2021). Figure 1 presents the structure of the agri-food sector in selected countries in three regions of Asia in 2015. Agriculture in the early stages of transformation typically contributes a large share of GDP. Figure 1a shows that the GDP share of the agri-food sector in Japan, South Korea, and Hong Kong is much lower than in China and in other Asian countries. Furthermore, primary agricultural production is predominant in the early stages of agricultural transformation, while services and processing contribute more to agriculture GDP in later stages. Primary agricultural production is predominant in Myanmar, Cambodia, Lao PDR, Nepal, and Pakistan, which are in the second stage of agricultural transformation, as earlier defined in this paper. Agri-processing and trade in the agriculture GDP of countries in the third stage of agricultural transformation, such as Bangladesh, Sri Lanka, China, and Thailand, are bigger than in countries that are in the earlier stages of transformation.

Agricultural Transformation Beyond the Farm Gate

Expansion activities in the off-farm segments of the agri-food system are part of the transformation, driven by changes in supply and demand for food products as economies become more urbanized and industrialized (Barrett et al. 2019). These changes in Asia have followed a general trend: (1) home consumption of rural food production gradually declines and farm production shifts to more commercial and high-value crops, propelling a rise in marketing and logistical services; (2) urban food demand rises with increased urbanization, hence, more demand for supply chain services; (3) changing lifestyles and demographics increase demand for more processed and comfort food, so that local food processors emerge and regional and international companies enter national markets; and (4) retailing rapidly evolves with increased demand for food away from home, hence, the rapid rise of fast-food chains, restaurants, and supermarkets.

While transformation in the agri-food system brings new opportunities, it also poses a number of threats to family farms and smallholders (Maxwell 2005). Lowder, Sanchez, and Bertini (2021) make a useful distinction between family farms and smallholders. They define the latter as farms that operate less than 2 ha of land, while family farms are not necessarily small. Small farms account for 84 percent of all farms worldwide, 12 percent of all agricultural land, and about 35 percent of the world's food production (Lowder, Sanchez, and Bertini 2021). Family farms, which include smallholders, are farms operated by individuals or households and whose labor is mostly supplied by the family (FAO 2014; Lowder, Sanchez, and Bertini 2021). They occupy about 80 percent of the global farmland and produce 80 percent also of world food production. Thus, squeezing the smallholder family farms is of particular concern, given their important contribution to global food security, protection of biodiversity and natural resource base, as well as climate change mitigation and adaptation efforts (IFAD 2014). Meanwhile, in many developing countries, the off-farm sectors are unable to absorb excess labor from rural areas in the foreseeable future. The smallholder is also now expected to compete in a more globalized market and adhere to highly demanding and sophisticated standards in terms of quality and safety (Diao et al. 2007). Supermarkets control access to a large segment of the retail market, and direct links to exporters are essential for high-value export crops overseas (Reardon et al. 2003). If the situation is left unchecked, smallholder family farms would face daunting challenges. The survival of smallholder family farms depends on improving education, infrastructure, ensuring access to technology, promoting producer marketing institutions to build economies of scale to compete in the tilted playing field brought about by the agri-food system transformation. However, inclusive agri-food system transformation need not be injurious to smallholder family farms, where they are commercially viable (Mellor 2017).

POLICIES AND INSTITUTIONAL REFORMS

Public Expenditure in Agriculture

The main policies and public interventions in Asia have included price incentives, public spending on agricultural research and development (R&D), rural infrastructure, education, health, and reform of rural institutions dealing with land tenure security, credit, and savings. Agricultural institutions play a crucial role in agricultural transformation; their effective and timely reforms create a dynamic environment that is critical to successful transformation.

High public expenditure in agriculture has been associated with the early stages of agricultural transformation in Asia. This usually goes to infrastructure (irrigation, rural roads, and electrification); agricultural mechanization; and subsidies for modern inputs (seeds and fertilizers). Rice self-sufficiency has been the focus of public policy and investment in almost all countries in Asia, with some countries continuing to do so to this day. The continuation or sometimes spike in agricultural subsidies in Asia may not have always had economic rationale.

Investments in agricultural R&D, extension, and education have helped propel agricultural transformation and poverty alleviation in almost all countries in Asia. Average annual public expenditure in agriculture in China, for instance, increased by 240 percent during 1996–2010. This, in combination with other public policies, has resulted in a decline of poverty (measured by USD 1.90 per day) from 88.1 percent in 1981 to 0.3 percent in 2018 (WB and DRC 2022). In Indonesia, public investment in agriculture increased by about 10 percent per year in the 1970s, which propelled agricultural transformation from the 1980s onward. Investment in primary education and vocational training in Vietnam, Thailand, the Philippines, China, and South Korea have also played a critical role in inclusive agricultural transformation.

Public expenditure in agriculture in South Asia has been relatively modest and focused on irrigation and fertilizer subsidies. In India,

public expenditure in agriculture increased but consistently remained below the levels of support provided to farmers in successful early and late transformers in East and Southeast Asia. In Bangladesh, public investments in agricultural research and technology and rural infrastructure (e.g., irrigation and rural roads) over the recent past have contributed to productivity growth. Moreover, focusing research on developing new and high-yielding varieties, particularly for rice, has been instrumental in ensuring food security and improved well-being. Public expenditure in irrigation and agricultural research and extension has been modest but facilitated the adoption of the Green Revolution technologies. However, some studies (FAO 2021) suggest that investments in irrigation in South Asia have resulted in significant environmental consequences and may have disproportionately favored large landowners.

Trade and Pricing Policies

FAO (2021) reports that direct price interventions in many Asian countries had an anti-agriculture bias, at least until the early 1980s. However, more favorable price incentive policies were subsequently adopted to promote agriculture and reduce the urban-rural income gap. For example, until 1971, South Korea taxed agriculture and kept food prices artificially low in support of export-led industrialization. This led to low agricultural growth and further widened rural-urban income inequality. Subsequently, agriculture was given high priority through policies such as import restrictions (quotas) for agricultural products, higher public purchase prices for outputs, and subsidies for agricultural inputs such as mineral fertilizers, pesticides, and farm machinery. In the case of Japan, it addressed the widening rural-urban income gap by reversing net agriculture taxation and providing more support to agriculture through import restrictions and price support.

In China, the anti-agriculture price bias was reversed in 1979, when purchase prices for important agriculture commodities were raised. In the 1990s, the government introduced subsidies

for several crops, turning the negative rate of assistance to agriculture to positive for the first time. Indonesia, on the other hand, established in the 1960s a food procurement agency responsible for international trade and for setting minimum and maximum prices for essential commodities, particularly rice.

Price and trade policies in South Asia have historically been characterized by significant anti-agriculture bias. The net relative rate of assistance to agriculture in India remains negative despite some subsidies and trade liberalization since the late 1990s (FAO 2021). The anti-agriculture policy bias is still present in Pakistan, though at a much lower level today than in the 1960s.

Land Reform

Land reform has underpinned agricultural transformation in some Asian countries with unequal land distribution. Such policies have been more effective when coupled with other incentives for farmers. Korea's land reform in 1949 aimed to achieve equitable land distribution; support to the new landowners was highly important for agricultural development. The reform set an upper limit of 3 ha for each landowner. As a result, landowners increased from 14 percent of the rural population in 1945 to 70 percent in 1965. Similarly, Japan's land reforms in 1945 set an upper limit of 4 ha per landowner. Those land reforms, coupled with the introduction of technologies to improve farming, helped increase real incomes in rural Japan and Korea. On the other hand, India's land reform efforts during the 1970s were less successful, and that in Afghanistan was short-lived as a devastating civil war immediately ensued.

Land reform does not only refer to redistribution of land, as was the case in Afghanistan, but also involves a series of complementary policies and institutional arrangements to improve farming efficiency, sustainability, and tenure security. The exact set of policies and institutional arrangements are highly context specific. Land reform may also require consolidation and restructuring, as in the case of Turkey (OECD 2016) or policy

reforms based on the Voluntary Guidelines on the Responsible Governance of Tenure (FAO 2022).

Rural Finance

Rural finance is concerned with a plethora of services, including loans for agricultural investment, non-agricultural rural firms, consumption, social expenditures, and services for rural savings and insurance. In Asia, two types of rural financial service suppliers are common: formal and informal. Informal financial service suppliers are composed of private individuals, such as professional moneylenders, traders, commission agents, landlords, friends, and relatives. Civil society organizations, such as the Grameen Bank in Bangladesh, have increasingly occupied this space over the past few decades. The formal sector is comprised of commercial banks and other financial intermediaries that are covered by the national banking regulations and supervision (FAO 2005).

Mellor (2017) suggests that provision of loans to small commercial farmers increases their investment, which in turn significantly contributes to agricultural growth. Both the formal and informal rural financial intermediaries have important roles to play, but the former have been a key credit source for small commercial farmers (FAO 2021). FAO (2005) and Mellor (2017) argue that creating a specialized lending agency to meet the specific needs of small commercial farmers is a necessary step to ensure access to rural financing of agri-based livelihoods. It may be necessary for the specialized lending agency to be a public sector organization during the early stages of agricultural transformation. However, this option needs to be carefully considered so as not to crowd out the private sector and civil society organizations. Nevertheless, a more decentralized system of rural finance has been emphasized since the late 1990s for effective rural finance services. A recent food system transformation study by the Philippine government (DA 2022), with support from the Asian Development Bank and FAO, suggests having a "centrally supported decentralised service

delivery” system, including rural finance. This policy shift has increasingly been taking center stage in discussions among policymakers in several Asian countries, including Bangladesh, Nepal, and Laos, where the author is supporting agricultural transformation processes.

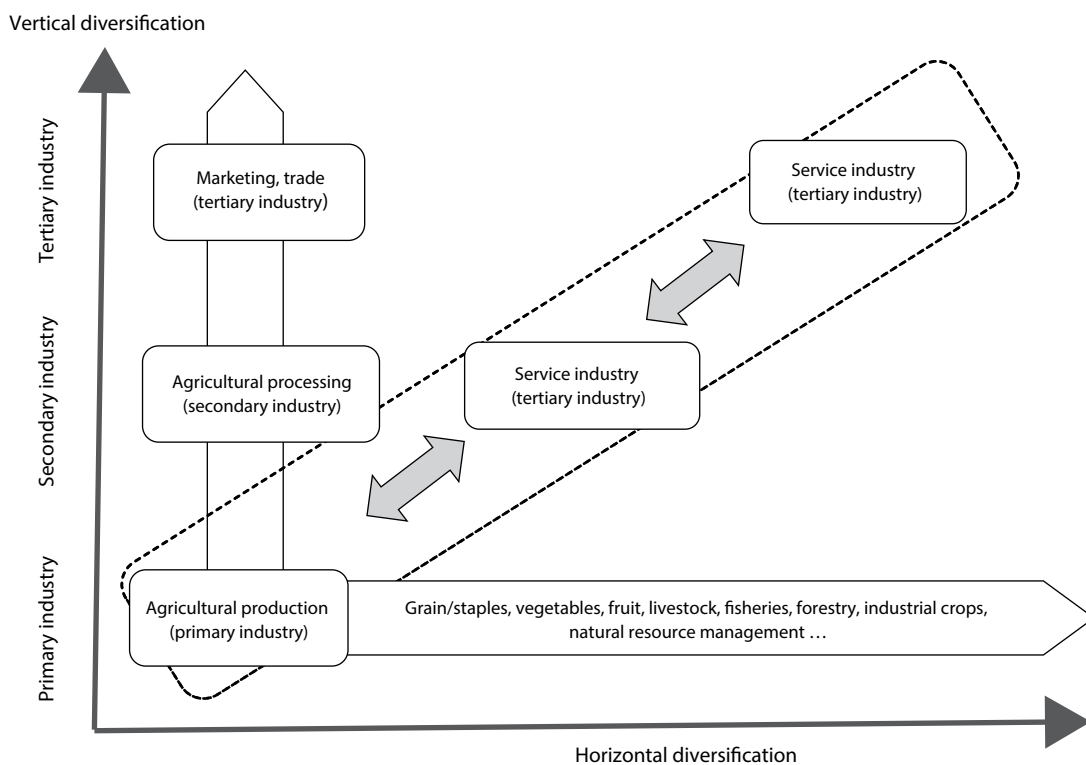
NEW TREND: INTEGRATED RURAL TRANSFORMATION

A series of policies commonly referred to as the “6th industrialization in agriculture” have been adopted by Japan, China, South Korea, and other countries in Asia to address key concerns and bank on emerging opportunities. These include the widening rural-urban income gap, aging farmers, changing food consumption patterns, increased exposure to international competition, and

reawakened interest of the youth in the agri-food system driven by technology. The main strategy in the 6th industrialization, with important variation across countries, envisages the development of a business ecosystem to integrate production, processing, marketing, tourism, value addition, and social capital related to specific geographic locations, with a focus on smallholder family farms (KREI, PRIMAFF, and IAED 2014).

Figure 2 presents the trajectory of the 6th industrialization of agriculture as a confluence of vertical and horizontal diversifications. The 6th industrialization is typically location-based as a development unit to improve the economies of scale at the village, district, town/city, and country levels. Establishing the development units involves (1) the identification of production bases and related services to be promoted, cultural heritage, social capital, geographic indication (GI), and

Figure 2. Convergence of vertical and horizontal diversification in support of the 6th industrialization of agriculture



Source: Based on KREI, PRIMAFF, and IAED (2014)

potential for marketing in local, national, and external markets; and (2) fostering institutional linkages across geographic units to build synergies and integrate local production, processing, manufacturing, tourism, and service industries.

The key public support to promote the 6th industrialization of agriculture usually includes: (1) improvement of production base at the farm-gate level; (2) business development and business cycle management service delivery; (3) installation and operation of common facilities such as processing, labeling, storage, and retailing; (4) branding, labeling, and marketing and related services (including GI, organic, and other forms of product differentiation); (5) product R&D and quality assurance; (6) capacity development of key stakeholders; (7) access to affordable financial services; and (8) access to digital services and related value chain digital platforms (KREI, PRIMAFF, and IAED 2014).

The approach and modalities of support have varied not only across the three pioneering countries (Japan, South Korea, and China) but also within country. In South Korea, the 6th industrialization of agriculture has taken different forms starting in 2007. These include: (1) community focus, where specialty agricultural produce are linked to social capital and tourism (e.g., Sumi Village, Okcheon Jangseong Village); (2) product focus, where specific products and agri-based crafts are developed to supply local and national markets and linked to local festivals (e.g., Naju Dew Village, Guryong-ro, Gangwon provinces); (3) retail and distribution focus, where specific brands are developed, with investment in retail and distribution networks to link consumers directly with producers of a specified range of agricultural products (e.g., Gok Farm Markets, Korea Women's Peasants Association Food Business Group, Hongwon-ri province); (4) farm-house restaurants and healing through food centers in villages, combining tourism with food and healthy living (e.g., Inwolsoo-gil, North Jeolla, South Chungcheong, and Gangwon provinces); and (5) export-centric ventures, which develop traditional and specialty food and beverage

products and export these to niche markets (Park et al. 2018).

To address the widening rural-urban income gap, aging, and depopulation of rural areas, the government of Japan adopted a series of policy measures under the 6th industrialization (KREI, PRIMAFF, and IAED 2014; Zhang 2019). It established a national institution to plan, guide, and manage the 6th industrialization initiatives at different levels. The key features of Japan's 6th industrialization include: (1) innovative hybrid financial services through public-private partnership to support the development of new agricultural enterprises; (2) clarity of vision and definition of responsibility among different players—public sector, corporations, farmer cooperatives, small and medium enterprises, and farmers; (3) increased value addition to factors of production through competition, increased capacity development, flow of information, adoption of more appropriate technologies, and a focus on product quality; (4) development and facilitation of agriculture-based service industries at scale in rural areas to promote the integration of production, processing, and marketing; and (5) public sector investment in rural areas to adapt rural infrastructure and skills to the needs and aspirations of the 6th industrialization.

Both Japan and South Korea illustrate the trajectory depicted in Figure 2 as a result of the vertical and horizontal diversification of the rural economy (KREI, PRIMAFF, and IAED 2014). In contrast, China's policies have focused on vertical integration of agriculture only, prompted by similar objectives. The policies encourage leading non-agricultural companies to increase the economies of scale and support smallholders by providing services and marketing support. The latter are considered too small to access markets and lack the necessary management and entrepreneurial skills to be sufficiently competitive. This, however, may create unequal power relations between large enterprises and small farmers (Park et al. 2018; Zhang 2019).

SOME EMERGING ISSUES THREATENING THE AGRI-FOOD SYSTEM IN ASIA

The World Development Report (WDR) 2016 (World Bank 2016) presents evidence of digital dividends—faster growth, more jobs, better services—that have benefited many private and public institutions in several countries. It also identifies a number of risks and the increasing digital divide among countries, as well as the rural-urban divide within countries. The WDR 2016 and a number of other studies have highlighted some of the key impediments to digitalization in developing countries (Deichmann, Goyal, and Mishra 2016). These include: (1) limited digital infrastructure and high cost of mobile internet, impeding access to the internet of most rural households; (2) low skill levels, which prevent many from leveraging digital technology; (3) e-governance initiatives often fail to improve service delivery, particularly extension and marketing services for farmers and agriculture value-chain stakeholders; and (4) without basic digital infrastructure and human capital in place, low likelihood for firms and farmers to invest in productivity-enhancing technologies that are prerequisite for competitiveness. Digitalization may require similar efforts given to the rural electrification drive in Asia during the early and middle of the 20th century.

Critical parts of the food system are increasingly becoming more capital intensive, vertically integrated, and in the hands of a very few (FAO 2017). The emerging food system structure sometimes excludes the smallholder farms and landless laborers. Indeed, the exit of labor from the agriculture sector is part of the transformation process, but only if the non-agriculture sectors are able to absorb the released labor and the latter has acquired the required marketable skills.

Population and economic growth are likely to boost agriculture demand by 50 percent in 2050 compared with 2013 levels (FAO 2017). There would be increased burden on agriculture as 690 million people are expected to be undernourished and over two billion people around the world

would have no access to nutritious and sufficient food. It was estimated that by 2021 more than half of the world's malnourished (425 million people) would be residing in Asia and 1.2 billion Asians would be living below the poverty line of USD 3.20 per day (FAO et al. 2022).

Moreover, most climate change projections suggest a disproportionate impact on food-insecure regions of the world, particularly on the capacity of agriculture to increase or even maintain current levels of production using existing farming practices. The frequency and severity of climate-related disasters, such as droughts, floods, cyclones, temperatures, and changes in the seasonal cycles in Asia have been on the rise and projected to worsen over time.

FAO (2017) projects intense competition for natural resources, increased greenhouse gas emissions, and further deforestation and land degradation if current agricultural practices continue in a bid to meet the rising demand for agricultural products. Thus, increased investment in agriculture to mitigate and adapt to the projected climate scenarios and to transform the agri-food system to sustainably eradicate hunger and malnutrition in all its manifestations is not an option but an urgent necessity.

CONCLUSION

Agriculture, particularly during the early stages of economic development, is two to three times more effective in poverty alleviation and in ensuring nutrition well-being. Thus, neglecting agriculture at the early stages of industrialization can derail the process of economic transformation. Agricultural transformation in Asia, like in other regions, has not always followed a uniform pattern; each stage has had unique characteristics. Its key characteristics usually include a progressive decline in the share of agriculture in GDP, more rapid growth in the non-agriculture sectors, increasing labor productivity, decline in the labor/land ratio, increased rural-urban migration, and a demographic transition.

The public sector has played a key role in facilitating and guiding agricultural transformation in the region. It continues to play a major role in the next phase of agricultural transformation under conditions imposed by the environment, demographic transitions, and international trade. Public policies have been key to agricultural transformation in Asia, especially those on agricultural research, extension, finance, rural infrastructure, capacity development, institutional innovation, trade, and pricing policies, as well as facilitating rural-urban linkages.

Japan, South Korea, and China have recently embarked on a series of policy reforms in support of the 6th industrialization in agriculture, in order to facilitate vertical and horizontal diversification in agriculture. The policies aim to address the widening rural-urban income divide and to ensure inclusive economic development. Feeding a growing population, environmental degradation, lack of inadequate investment in agriculture, declining or stagnant yields, high levels of malnutrition and poverty, increasing digital divide, and over capitalization of some agricultural value chains, as well as increased severity and frequency of disasters, are among the key challenges confronting Asian agriculture in the coming decades.

DISCLOSURE

This paper reflects the main findings of a FAO publication in 2021 titled *Agricultural Transformation in Asia – Policy and Institutional Experiences* edited by the author.

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