

Growth and Stagnation of Agriculture in Eastern India and Bangladesh

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EASTERN INDIA, AS A PART of South Asia, has been characterized as one of the most poverty-stricken regions in the world alongside sub-Saharan Africa mainly as a result of its low agricultural productivity. Following the 1980s, however, the agricultural sector in eastern India experienced rapid growth, substantially raising rural income and reducing malnutrition and poverty levels for the majority of the population. For instance, the average per capita per day caloric intake increased rapidly in South Asia from 2,000 to 2,200 calories by the late 1980s, whereas it remained stagnant in sub-Saharan Africa at around 2,000 calories.¹ Although South Asia still suffers from poverty, the 1980s represented a critical juncture at which the economic performance of the world's two poorest regions diverged.

However, there has still been large regional disparity within eastern India in terms of agricultural development and economic growth. West Bengal and Bangladesh (hereafter Bengal) showed high performance while other areas like Bihar and Orissa relatively stagnated. The introduction of seed-fertilizer technology, which was complemented by the control of water, facilitated agricultural development in Bengal. In particular, a large-scale introduction of private shallow tube-wells (STWs) contributed significantly to agricultural development in Bengal, especially in the rice sector. This contrasted sharply with the case of Orissa, where irrigation development was almost absent. Additionally, a rather mysterious case is Bihar, where despite a large-scale diffusion of STWs since the late 1960s, the agricultural sector did not rapidly grow.

The term "water control," which is linked to agricultural growth in eastern India, not only refers to irrigation during the dry season. In the wet season, there

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are diverse farmlands with different ecological conditions characterized as shallow flood, deep flood, drought prone, and coastal saline. Improving farmland conditions through investment in flood control, drainage, and supplementary irrigation is key for agricultural development in the wet season. Here, however, we must stress that water control in the wet season is normally costly. Therefore, endeavors have been made by the public sectors to develop high-yielding varieties suitable to diverse agroecological conditions and farmers in eastern India adopted such varieties for development. While investment and technology determine agricultural productivity and agrarian structure, distribution of farmland ownership and mode of transactions of land among various rural households such as landlords and tenants can greatly affect the investment and/or technology adoption behavior in agriculture. In this regard, the radical land reform implemented in West Bengal since the late 1970s under the Left Front Government is notable, whereas other areas—including Bangladesh, Bihar, and Orissa—failed to do such radical land reforms.

This essay will investigate how agricultural development performance diverged in various parts of eastern India by untying complicated cause and effect relations, including both technological factors and institutional factors. First, it will show the agricultural development performance in eastern India has been determined basically by technological factors, including investment in STWs and development of local-specific high-yielding varieties, and not by institutional factors like land reforms. Second, this essay will challenge the widely accepted views that West Bengal radical land reforms since the late 1970s constituted the main cause of agricultural development after the 1980s in the state and that Bihar agriculture remains backward mainly due to the problems in its highly inequitable agrarian structure. Third, however, this essay appreciates the vital role of land reforms in West Bengal in the sense that it facilitated economic development in the state by helping create a wide outlet market for nonagricultural products and services by redistributing assets and income in rural area.²

GREEN REVOLUTION IN EASTERN INDIA

India's Green Revolution began in the mid-1960s in Punjab, the wheat crop region of northern India. After a decade, the movement spread to rice crop in the same area as a wet season crop following wheat growing in the dry season. Since the early- or mid-1970s, southern India followed in the rice Green Revolution. However, eastern India—a major rice-producing area—largely lagged behind

in this movement mainly due to the lack of water control. Bihar, West Bengal, and Bangladesh—comprising a major region in eastern India—are highly affected by monsoon season, which brings about a great deal of rain from June to October. In contrast, November to March marks a cool and dry season, which is followed by the hot months of April and May before the rainy season starts again. The climate becomes drier as one moves from the east (Bangladesh) to the west (Bihar). In the region, rice had been traditionally produced in the wet season, which was either followed by less remunerative crops such as pulses and beans or fallow fields in the dry season. Bihar is located in the marginal area for wet season rice production with annual rainfall of around 1000 millimeters, which is the minimum requirement for growing rice under rain-fed conditions.

Local varieties of rice suitable to diverse agroecological conditions have been adopted in eastern India, resulting in low yields. With the advent of seed-fertilizer technology both in wheat and rice crops since the mid-1960s, new opportunities emerged for development. However, irrigation was still indispensable for introducing either rice or wheat crops in dry season. Another challenge was how to develop high yielding varieties (HYVs) suitable for the diverse agroecological conditions in wet season without investing in flood control or drainage.

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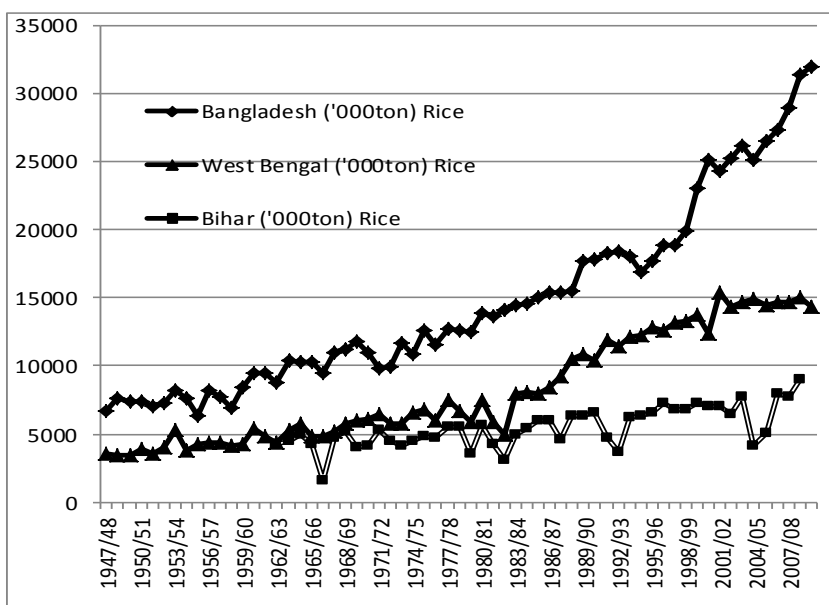


Figure 1: Production Trend of Rice in Bihar, West Bengal, and Bangladesh

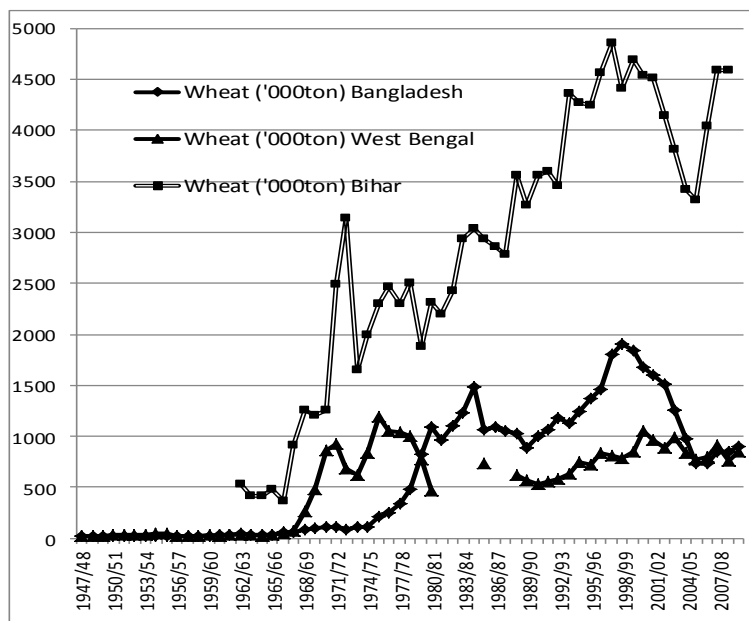


Figure 2: Production Trend of Wheat in Bihar, West Bengal, and Bangladesh

Source: Government of India, *Agricultural Statistics at a Glance*, Government of West Bengal, *Economic Review: Statistical Appendix*, Bangladesh Bureau of Statistics, *Yearbook of Agricultural Statistics of Bangladesh*.

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Figures 1 and 2 illustrate the production trend of rice and wheat in Bihar, West Bengal, and Bangladesh. As they show, rice production had long stagnated in the region at least until the end of the 1970s. Even before that, rice production in Bengal increased but at almost the same pace of the population growth rate. However, after the 1980s Bengal experienced a rapid growth in rice production with the diffusion of Green Revolution technology, whereas rice production in Bihar continued to remain stagnant.

Two main factors explain how Bengal achieved rapid growth in rice production following the 1980s. The first was the diffusion of private shallow tube-wells (STWs) and the associated expansion of irrigated dry season rice, in which mainly HYVs developed by the International Rice Research Institute (IRRI) were adopted. The second was the development and diffusion of HYVs for wet season rice suitable to various local agroecological conditions in terms of flood, drought, and types of soil.

Wealthy farmers, who typically had more than two-and-a-half acres of land, were the ones who largely invested in STWs. They started dry season rice cultivation with HYVs in hitherto seasonally fallow land or by replacing low-

yielding rain-fed crops such as pulses and beans. However, the farmland of STW owners was fragmented and the irrigation capacity of a STW was 10 to 20 acres. As a result, at first STW owners only irrigated a part of their land and rented surrounding land from other small-scale farmers. However, after a few years, small-scale farmers noticed the profitability of dry season rice production and started engaging in it themselves by purchasing water from STW owners. The price for the water was first determined at very high rates and received criticism for seemingly developing a new class of “water-lords.” However, after the 1990s, as a result of the wide-scale diffusion of STWs and competition amongst STW owners, the price of water declined sharply and even small-scale farmers without STWs were able to fully benefit from the technology.³

On the other hand, for the wet season rice cultivation, most of the HYVs developed in the IRRI were difficult to apply directly in eastern India. Endeavors continued in local agricultural experimental stations such as the Rice Research Station in West Bengal and the Bangladesh Rice Research Institute (BRRI) to develop more suitable HYVs for local conditions. As a result, now there are approximately 60 HYVs suitable for wet season rice in West Bengal, of which 44 varieties were developed in the local research stations including the Rice Research Station. The most successful and widely disseminated variety is *Swarna*, which accounted for more than 50 percent of the wet season rice cultivated area, because of its high adaptability to a wider range of agroecological conditions. In Bangladesh, BR11 and BR22 (developed in BRRI) are the major HYVs diffused in wet season rice cropping besides *Swarna* and *Pajam*. As a result, the average yield of wet season rice increased from one ton per hectare in the late 1970s to two to two-and-a-half ton per hectare in recent years. It should also be noted that for dry season rice as well, many HYVs were developed in local research stations. BR28 and BR29 are the two major varieties for dry season rice in Bangladesh, which now account for roughly two-thirds of the total area, contributing to a very high average yield of dry season rice—nearly four tons of milled rice per hectare.

The improvements from the rice Green Revolutions were felt in nearly all parts of the economy in Bengal. First, the price of rice remained low, which benefitted not only urban residents but also landless and marginal farmers who were without a rice surplus. Second, as rural income rose, growth occurred in a wide range of nonagricultural sectors mainly through final demand effect.⁴ The increase in final demand for consumption as a result of income increase stimulates the production activities of a wide range of industries, including non-agricultural sectors.⁵ The final demand effect also stimulated the development

of high-valued agricultural sectors—such as vegetables and fruit, livestock, and fisheries—which benefitted a wider range of workers by creating employment in rural areas.

LAND REFORM IN WEST BENGAL AND ITS CONSEQUENCES

West Bengal is well known for its radical land reforms, especially after 1977 when the Left Front Government took power for more than 30 years until 2011. The land reforms were comprised of mainly two components. First, land vested in the state was redistributed to landless and marginal farmers. Second, sharecroppers were protected through a registration program called Operation Barga.⁶ By registration, sharecroppers benefitted from more secured right of land tenancy—they could even inherit the right of tenancy to their children—and increased share of produce—the share of sharecroppers was regulated at 75 percent, compared to the market-determined rate of 50 percent.

Large landlordism in Bengal has been a major problem for a long time. After India gained its independence in 1947, a series of land reform laws were enacted in West Bengal, such as the Bargadar Act (1950), West Bengal Estates Acquisition Act (1953), West Bengal Land Reforms Act (1955), and West Bengal Land Reforms (Amendment) Act (1972), which already included almost all the measures for redistributing vested land and protecting sharecroppers. In other words, the majority of land reform measures were already enacted before the Left Front Government took power in 1978. However, in general, the actual enforcement of laws depends on political will. The role of the Left Front Government was to strongly enforce these laws through their party organizations and farmer organizations at local levels. The Operation Barga program that the left Front Government initiated also contributed to strong enforcement of the existing laws, including the security of tenancy right and regulation in land rent for registered sharecroppers. The government also implemented local government reforms that further pushed the land reforms ahead.

A total of 1.15 million acres of land—roughly nine percent of total farmland—was appropriated by the state and redistributed to more than 3.0 million landless and marginal farmers. Nearly 1.5 million sharecroppers possessing 1.14 million acres of tenancy land were registered, tenancy rights including inheritance came under protection, and land rent was fixed at one-fourth of total production rather than one-half under the sharecropping system. The priority of beneficiaries was given to socially disadvantaged people belonging to scheduled caste and scheduled tribe. It is estimated that roughly half of small and marginal farmers

benefited from either of the two land reform measures.⁷

As previously mentioned, rice production in West Bengal started to grow rapidly only after the 1980s. It was a real breakthrough after a prolonged stagnancy that lasted since the beginning of the twentieth century—absolute stagnancy in the first half of the century, followed by slow growth that was the same as the population growth rate after independence in 1947. Not surprisingly, many people, including academics, believed that the agricultural growth after the 1980s was a result of the radical land reforms implemented by the Left Front Government.

However, directly linking agricultural growth with rural institutional reforms, such as land reform, is generally incorrect. The case of West Bengal is not an exception. First, as summarized earlier, the major engine of growth in rice sector development in West Bengal was the investment in STWs mainly by large-scale farmers and investment in agricultural R&D mainly by the government. The land reforms created a large number of marginal farmers and protected sharecroppers. Evidence shows that although they were generally at a disadvantage in adopting new technologies, they achieved almost the same performance as most other farmers.⁸ They purchased water from STW owners to start HYV rice cultivation in the dry season and they also adopted HYVs for wet season rice cultivation.

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Abhijit V. Banerjee and his colleagues posited that Operation Barga had an effect on rice production growth by showing that the positive effect of increased investment—arising from secured tenancy rights enjoyed by sharecroppers—outweighed the negative effect of work disincentive arising from the same secured tenancy rights for sharecroppers.⁹ However, their conclusion is not persuasive because they consider investment only abstractly. In the context of Bengali rice production development the most critical investment was in STWs, which was actually performed mostly by large-scale farmers. They also do not discriminate between wet and dry season rice cultivation in their analysis, although the difference in the composition in wet and dry season rice between West Bengal and Bangladesh decisively affected the rice growth performance after the 1980s. Bardhan and Mookherjee showed the decisive contributions of subsidized farm input program of the government to the rice production growth from 1982 to 1995, and as a result also refuted the argument by Banerjee and his colleagues on the role of land reforms.¹⁰

However, the assertion of this article goes further than the Bardhan and

Mookherjee argument by asking how we should consider the high growth performance in rice production in Bangladesh where either radical land reform or subsidized farm input program was lacking. The rapid rice production increase in Bengal after the 1980s should be attributed to both the investment in STWs by mainly large-scale farmers and in rice research and development by the government.¹¹

It should be emphasized here, however, that it is not the case that the land reform measures in West Bengal did not contribute to economic growth at all. On the contrary, land reforms played a vital role on overall economic development in the state by spreading the benefit of agricultural growth to a greater number of individuals living in rural areas, which helped create a wider market for nonagricultural products and services in rural areas.

STAGNATION IN AGRICULTURE IN BIHAR

Rice production continued to stagnate in Bihar, especially compared to West Bengal and Bangladesh. Bihar is the poorest state in India, with a per capita net state domestic product of only 33 percent of the Indian average and 54 percent of the next lowest state Uttar Pradesh as of the mid-2000s, and has been so since the early 1960s. The stagnation of the agricultural sector was one of the most decisive factors in determining Bihar's poorest economic performance.

It was widely believed that the "semi-feudal mode of production" in eastern India was the major reason why it failed to benefit from Green Revolutions, in

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contrast with the other parts of India such as Punjab and Tamil Nadu. Amit Bhaduri, for instance, asserted that large landowners refused to adopt new agricultural technologies so as to prevent their sharecroppers from escaping perpetual indebtedness, since

landowners profit from both land rent and interest on debt held by sharecroppers.¹² Immediately after its publication, Bhaduri's argument received several critiques with which this article accords.¹³ However, it is still widely believed that the major problem that has slowed agricultural development in Bihar resides in its agrarian structure. The seemingly positive effects of land reform in West Bengal implicitly support this idea.

However, Figure 1 shows that in wheat production Bihar achieved rapid growth since the mid-1960s. The growth in wheat production was accompanied

by developments in irrigation in private STWs alongside canal irrigation by the public sector. In fact, recently the share of irrigated area in total cultivated area is approximately 60 percent and the share of tube-wells in total irrigated area is more than 60 percent. Most irrigated areas were developed by the late 1990s.¹⁴

The very fact that the wheat Green Revolutions in Bihar were supported by the introduction of private STWs refutes the argument for “semi-feudal mode of production,” since large-scale farmers did invest in STWs to promote agricultural innovation, introducing wheat, a totally new crop, with HYVs in dry season.

Then why did rice production in wet season in Bihar remain stagnant? Why did Bihari farmers not adopt HYVs in wet season rice cultivation although they could use the STWs for irrigation? Note here that under the drier climate in Bihar, irrigation is indispensable to adopt HYVs even in the wet season rice cultivation.

The important fact that the STWs, which had been diffused in Bihar, were totally different from those observed in Bangladesh and West Bengal was noticed during my field survey from 2011 to 2012 in various parts of rural Bihar. There were small holes in the fields, and when irrigation was needed, farmers used a small diesel-powered cart to pump groundwater. Water was conveyed to the field through a very long hose—since there were no water channels—and the rate of water discharge was very low in comparison to Bengal.

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Summarizing in economic terms, the STWs widely diffused in Bihar can be characterized as low initial investment, but high cost per-unit of water pumped. Due to the drier climate in Bihar, if farmers want to adopt HYVs in wet season rice cultivation, they need to irrigate the crop very often—nearly 10 to 15 times in a season. When asked why they do not adopt HYVs instead of low-yielding local varieties, farmers cited the high cost of irrigation.

However, this is not the case for wheat since irrigation is needed only three to four times per season. In conclusion, farmers in Bihar continued using local varieties of rice, which required much less water. They did not adopt HYVs in rice despite the availability of irrigated water mainly because of the high cost of irrigation, which was fundamentally caused by investment in a special type of STW.¹⁵

There are at least two sets of evidence that support this hypothesis. First, farmers in Bihar recently started to adopt hybrid rice varieties, which require much less water compared to HYVs. I found many cases of farmers adopting hybrid seeds, which have been available in Bihar since the early 2000s, and I was surprised to see a case of farmers adopting hybrid varieties in a village under purely rain-fed conditions. The recent spike in rice production in Bihar (see

Figure 1) can mainly be attributed to this diffusion of hybrid varieties.

Second, there is a large disparity among regions in Bihar in terms of average rice yield. Higher yield is generally attained south of the Ganges River, especially in the southwestern parts of the state where canal irrigation is available. When district-level data of average rice yield and irrigated land ratio was plotted, rice yield was associated with the ratio of irrigated land by canal irrigation, but not irrigated land by tube-wells. It was also found that in the Rohtas District canal irrigation water was quite plentiful and farmers could get enough water when needed. Needless to say, the cost of water was much less than that procured by private STWs. They adopted HYVs early on and enjoyed a high yield. Some farmers even started to adopt Basmati varieties since high-valued Basmati is more profitable and promising despite its lower yield.

CONCLUSION

Agricultural development in eastern India after the 1980s was mainly led by technological breakthrough, not institutional reform. In dry season it was key to secure irrigation water, which was facilitated by introduction of private STWs. In wet season, on the other hand, the development and dissemination of HYVs suitable for local diverse agro-ecological conditions was essential. This was achieved by government investment in research and development as well as establishment of local level research stations or institutes. Rapid agricultural

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growth in West Bengal and Bangladesh can be attributed to these two types of investments in agriculture. However, because Bihar has adopted a different type of STW technology that was suitable for wheat cultivation in the dry season but not for wet season rice cultivation, agricultural production has continued to stagnate until very recently despite an earlier, large-scale diffusion of STWs for wheat production.

The rapid agricultural growth in West Bengal after the 1980s cannot be attributed to radical land reforms. By the same token, the lack of radical land reforms in Bihar was not a major cause of prolonged agricultural stagnation in the state. It should be considered that the role of land reforms is mainly confined to redistribution of assets and income in rural areas.¹⁶

However, the land reforms did contribute to the development of the national economy through their redistributive effects. In other words, by

redistributing rural assets and income, the land reforms created a wider outlet market for nonagricultural products and services, which is a very important precondition for industrialization and service sector development.

What will be the future prospects of Bihari agriculture? An important factor is the large-scale emigration of laborers from Bihar. The emigration of Bihar laborers and citizens started quite long ago. It began mainly to Kolkata and tea plantations in Assam during the colonial period. However, as Kolkata began to decline, migration destinations from Bihar shifted to northern India, such as advanced agricultural regions like Punjab, and then to the Delhi metropolitan area. Due to such a large-scale emigration, the labor market gradually tightened in Bihar, especially after the 1990s. Mainly because of large remittance income, although per capita net state domestic product was only 33 percent of the Indian average, the monthly per capita household expenditure data from the National Sample Survey shows that Bihar attained nearly 65 percent of the Indian average.

The tightened labor market resulted in improved labor and tenancy conditions in Bihar agriculture. Now farmers in Bihar complain that they face labor shortages, especially during peak seasons. In Bihar, harvesting wage is still paid in kind, either by paddy or wheat. Due to the surge in the wage levels, the wages paid for harvesting rice alone reached one-tenth to one-fifth.¹⁷ If threshing cost is added, the share of harvesting and threshing cost to total gross revenue from rice production reached between 15 and 25 percent. Under such circumstances, it is quite natural that tenancy conditions also improved since no one prefers to rent-in land under conditions in which their opportunity cost of labor is not realized. Since the Green Revolution technology is labor-intensive, it may not be so easy for Bihar farmers to further promote the rice Green Revolution at this stage of economic development. High-value added agriculture such as vegetable and fruit production is more promising in the state. 

NOTES

1. Food and Agriculture Organization, *World Agriculture in 2010* (1995).
2. Koichi Fujita, *Re-thinking Economic Development: Agrarian Structure, Green Revolutions and Transformation in Bangladesh* (Melbourne: Trans Pacific Press, 2010).
3. Ibid.
4. Note that the final demand effect is a concept in Input-Output Analysis.
5. An especially important point is that as rural income increases, the share of household expenditure spent on non-food items increases according to the Law of Engels.
6. *Barga* means sharecropping in Bengali language.
7. For more information on the ground level realities of beneficiaries, see: Anil K. Chacrabarti, Apurba K. Mukhopadhyay, and Debesh Roy, *Beneficiaries of Land Reforms: The West Bengal Scenario* (Calcutta: Spandan, 2003).
8. Sankar Kumar Bhaumik, *Tenancy Relations and Agricultural Development: A Study of West Bengal*

(Thousand Oaks, CA: Sage Publication, 1993).

9. Abhijit V. Banerjee, Paul J. Gertier, and Maitreesh Ghatak, "Empowerment and Efficiency: Tenancy Reform in West Bengal," *Journal of Political Economy* 110 (2002): 2.

10. Pranab Bardhan and Dilip Mookherjee, "Subsidized Farm Input Programs and Agricultural Performance: A Farm-Level Analysis of West Bengal's Green Revolution, 1982–1995," *American Economic Journal: Applied Economics* 3, no. 4 (2011).

11. Note, however, that because of large-scale migration of Hindu residents, many of them landlords, from Bangladesh to West Bengal during the Partition and afterward as well, redistribution of land was achieved in Bangladesh as well without major policy initiatives. On the other hand, there was a lack of programs like Operation Barga in Bangladesh.

12. Amit Bhaduri, "A Study of Agricultural Backwardness under Semi-feudalism," *Economic Journal* 83, no. 329 (1973).

13. David M.G. Newberry, "Crop-sharing Tenancy in Agriculture: A Comment," *American Economic Review* 64 (1974); Pranab K. Bardhan and Ashok Rudra, "Interlinkage of Land, Labour and Credit Relations: An Analysis of Village Surveys Data in East India," *Economic and Political Weekly* (1978).

14. P.C. Bansil, *Bihar Agriculture: A Perspective* (New Delhi: Concept Publishing, 2011).

15. The extremely low level of rural electrification in Bihar also creates a problem. The high irrigation cost is partly caused by the diesel-operated STWs. However, Bangladesh has the same problem, with roughly two-thirds of STWs operated by diesel oils, but it achieved the rice Green Revolution.

16. The case of Japan is not an exception. Rapid agricultural growth in Japan after World War II can be attributed to the nationwide coordinated crop-breeding program called the Assigned Experiment System, which was established first for wheat (1926) and second for rice (1927). In general, the fruit of such an investment appears after some time lag. In the case of the Assigned Experiment System, the major fruit appeared only after World War II. See: Yujiro Hayami and Vernon W. Ruttan, *Agricultural Development: An International Perspective* (Baltimore: Johns Hopkins University Press, 1985), 239.

17. Koichi Fujita, unpublished field survey, 2011–2012.

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