ACHIEVING BORO RICE PRODUCTION TARGETS IN FY2009-10: CHALLENGES AND ACTIONS REQUIRED

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The present paper titled **Achieving Boro Rice Production Targets in FY2009-10: Challenges and Actions Required** has been prepared under the CPD-IRBD programme. The paper was presented at the CPD Dialogue on **Achieving Boro Rice Production Targets in FY2009-10: Challenges and Actions Required,** on 23 December 2009, at CIRDAP Auditorium, Dhaka by *Uttam Deb*, Head, Research Division, CPD.

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Acronyms

ADB	Asian Development Bank
ADP	Annual Development Programme
AIS	Agricultural Information Service
AWD	Alternate Wet and Dry
BADC	Bangladesh Agriculture Development Corporation
BARI	Bangladesh Agricultural Research Institute
BBS	Bangladesh Bureau of Statistics
BCIC	Bangladesh Chemical Industries Corporation
BMDA	Barind Multipurpose Development Authority
BPDB	Bangladesh Power Development Board
BRRI	Bangladesh Rice Research Institute
BWDB	Bangladesh Water Development Board
CPD	Centre for Policy Dialogue
CSD	Central Storage Depot
DAE	Department of Agricultural Extension
DAM	Department of Agricultural Marketing
DAP	Diammonium Phosphate
DESCO	Dhaka Electric Supply Company Limited
DPDC	Dhaka Power Distribution Company
FAO	Food and Agriculture Organization
FPMU	Food Planning and Monitoring Unit
ha	Hectare
HYV	High-yielding Variety
ICT	Information and Communication Technology
IRRI	International Rice Research Institute
LCC	Leaf Colour Chart
LGED	Local Government Engineering Department
LSD	Local Storage Depot
MISM	Management Information System and Monitoring
MT	Metric Ton
MW	Mega Watt
MoA	Ministry of Agriculture
MoF	Ministry of Finance
MoFDM	Ministry of Food and Disaster Management
MoP	Muriate of Potash
MkWh	Million Kilowatt-hours
NGO	Non-government Organisation
PPP	Public-Private Partnership
RDA	Rural Development Academy
REB	Rural Electrification Board
SCB	State-owned Commercial Bank
SPARRSO	Bangladesh Space Research and Remote Sensing Organization
SRI	System of Rice Intensification
TE	Triennium Ending
TSP	Triple Super Phosphate
UP	Union Parishad
USD	United States Dollar
USDA	United States Department of Agriculture
WZPDCL	West Zone Power Distribution Company Limited

1. INTRODUCTION

Bangladesh has made remarkable progress in food production and achieving its food security. Since independence in 1971, production and consumption of foodgrains grew substantially over time. Even though, there were ups and downs, production of foodgrains generally experienced an upward trend. An all time high production of foodgrains (32.16 million tonnes) was attained in FY2008-09 which was more than three times of production in FY1972-73 (9.99 million tonnes). Highest production of rice (31 million tonnes) also occurred in FY2008-09, which was three times of FY1972-73.

Along with increase in rice production, structure of rice production in the country has remarkably changed over time. During the time of independence, Aman was the major food crop, comprising major share of total rice production. With the development of rice cultivars for Boro season and expansion of irrigation system, both area and production of Boro rice increased over time. Since FY1999-00, Boro contributes more than half of the total rice production in Bangladesh. Average area under Boro rice in TE 2008-09[1] was 4.53 million hectare (ha) which produced about 16.85 million metric tonnes (MT) of rice. Currently, Boro occupies about 41.9 per cent of total rice area and contributes 57.7 per cent of total rice production in Bangladesh. On the other hand, Aman rice occupies 49.2 per cent of total rice area and contributes 36.7 per cent of total production. Aus rice contributes about 8.9 per cent of total rice area and 5.6 per cent of rice production. Structural change in rice production in Bangladesh and more dependence on Boro season has made rice production a function of input supply, policies and prices rather than vagaries of nature. This structural change has made attainment and sustenance of food security more of a matter of governance and management. It has also posed serious challenges for the government and development agencies particularly for ensuring availability of inputs at a reasonable price, and also to find an appropriate balance between the interest of the producers and the consumers.

Boro production in the current season has special significance due to the recent developments in the global and domestic food security situation. Global economy has currently been facing financial crisis and economic recession. Though Bangladesh economy has been spared the worst consequences of the crisis, particularly because its financial and capital markets are by and large isolated from the global markets, there was no escaping from the adverse effects once the crisis started to deepen. As the crisis evolved and developed, Bangladesh suffered from slowing down in its export earnings, lower number of people going abroad, lower revenue earnings and loss of competitiveness in view of stimulus packages put in place by other countries (Rahman *et al*. 2009a). Relatively high growth of agriculture sector (4.6 per cent) in FY2008-09 had a positive impact toward containing the adverse impact of the global financial crisis on Bangladesh's employment situation (Rahman *et al*. 2009b). Production of foodgrains in FY2008-09 was 8.0 per cent higher than the previous year. Asian Development Bank (ADB) has recently projected that agricultural growth rate in Bangladesh is likely to be 4.1 per cent in FY2009-10 which was 4.6 per cent in FY2008-09 (ADB 2009). If this becomes a reality, then Bangladesh will have serious problem in terms of employment and food security as well as in prices and inflation

[1]TE stands for "triennium ending." Thus, the data for TE2008-09 represents the average for the three years 2006-07, 2007-08 and 2008-09.

(see Section 2 for details). Therefore, to ensure food security and to keep inflation in check, much will depend on whether Bangladesh can replicate its recent success in crop production. In this context balancing the apparently conflicting interest of consumers and producers will once again be the major challenge for Bangladesh's policymakers. Stimulating productivity of agriculture through prudent subsidy policy, providing incentives to promote adoption of high-yielding varieties (HYVs) and adoption of technology, must be given due priority in policy making (CPD 2009).

Considering the special importance of the Boro production in FY2009-10, this paper attempts to analyse the Boro production plan for this year. It has also reviewed the policy measures and programmes taken so far. It also reports the implementation status of various projects for delivering seed, fertiliser, irrigation, credit and subsidy. Finally, the paper puts forward some suggestions for ensuring Boro production and procurement of Boro rice.

2. RECENT DEVELOPMENTS IN GLOBAL AND DOMESTIC FOOD SITUATION

2.1 Global Food Situation: Production, Prices and Trade

Global rice production in FY2009-10 is going to be lower than previous year. According to the USDA Rice Outlook (11 December 2009), global rice production in FY2009-10 will decline by 3.0 per cent and production will be 433.9 million MT. Decline in production is primarily due to reduction in area. Substantial decline in production in India, due to erratic monsoon, has been forecasted. Rice production in the Philippines is going to be lower due to damage from several typhoones. On the other hand, production in Uruguay, Brazil and Argentina is likely to drop by 5 per cent because of drought. FAO Rice Market Monitor (September 2009) also predicted a decline in rice production in 2010.

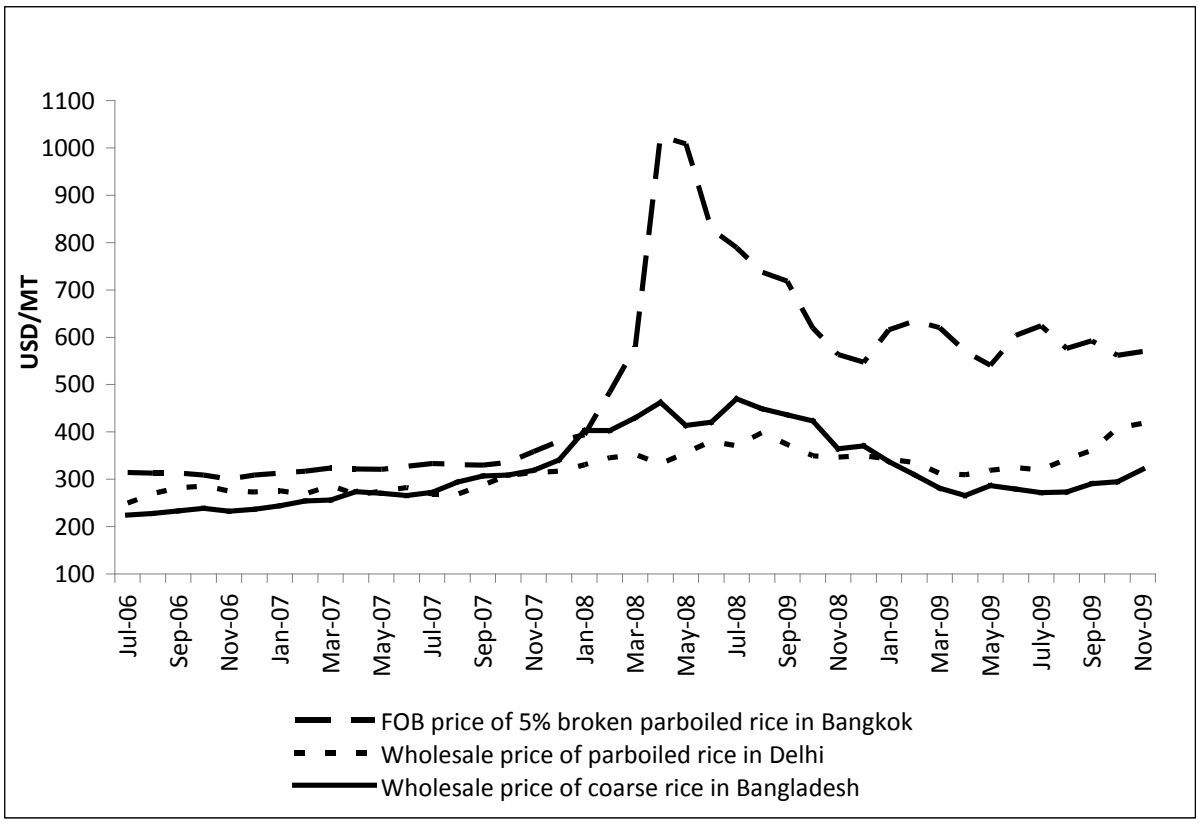
According to the first advanced estimate of the Indian government (made by the Department of Agriculture and Cooperation on 3 November 2009), production of Kharif rice will be 69.45 million MT in FY2009-10 against 84.58 million MT in FY2008-09 (i.e. reduction of 15.13 million MT of rice). In response to the emerging situation, Indian Finance Minister *Mr Pranab Mukherjee* said on 18 November 2009, "There is a projection that there will be a shortfall of our Kharif crop. So, we may have to make some imports." But, on 7 December 2009, State Minister of Commerce and Induastry of India *Mr Jyotiraditya Scindia* told the *Lok Sabha*, "The government has assessed the stock position of rice and decided that import of rice for the central pool is not required at this stage." On October 2009, the government of India removed 70 per cent import tax on certain varieties of rice to boost supplies, after late and uneven monsoon rains led to a significant reduction in the main (Kharif) crop plantings and production. Duty-free imports of semi and wholly-milled rice will now be permitted until 30 September 2010. International Rice Research Institute (IRRI) predicted that India might import as much as 3.0 million MT next year. Currently, India has a ban on rice exports. If India imports large amounts then global price will rise sharply. Studies indicate that an increase of 1.0 million MT in rice exports by India results in 4.7 per cent change in the price of rice in the international market (Jha and Srinivasan 1999). In addition, at times of production shortfall, India's imports (to meet domestic demand) can raise international prices by up to 40 per cent (Chand 2003). During the food crisis in 2007 and 2008, export

restrictions created by India had a negative impact on prices in Bangladesh and international rice price.

The Philippines has already decalred that it will import 2.0 million MT of rice in 2010, which is higher than previous years. Same way, rice import level is likely to be higher for Brazil and Switzerland in 2010. Thus, if there is any production shortfall in Bangladesh, then it might be difficult to import from the international market.

A comparison of rice prices in Bangladesh, India and Thailand since July 2006 revealed that rice price in Bangladesh was lower than that of Thailand (Figure 1). Rice price in Bangladesh was also generally lower than in India with some exceptions. Currently (third week of December 2009), average wholesale price of coarse rice in Bangladesh is Tk. 22,190 per MT (USD 321), compared to USD 427 in India (Delhi) and USD 606 (5% broken parboiled rice) in Thailand (Bangkok). Thus, it is clear that even if Bangladesh is able to import from the international market then it will be at a higher cost than current domestic price. In other words, feeding her population at a lower cost is only possible through self-sufficiency in rice production.

Figure 1: Comparison of Domestic Rice Prices in Bangladesh, India (Delhi) and Thailand (Bangkok): July 2006 – November 2009



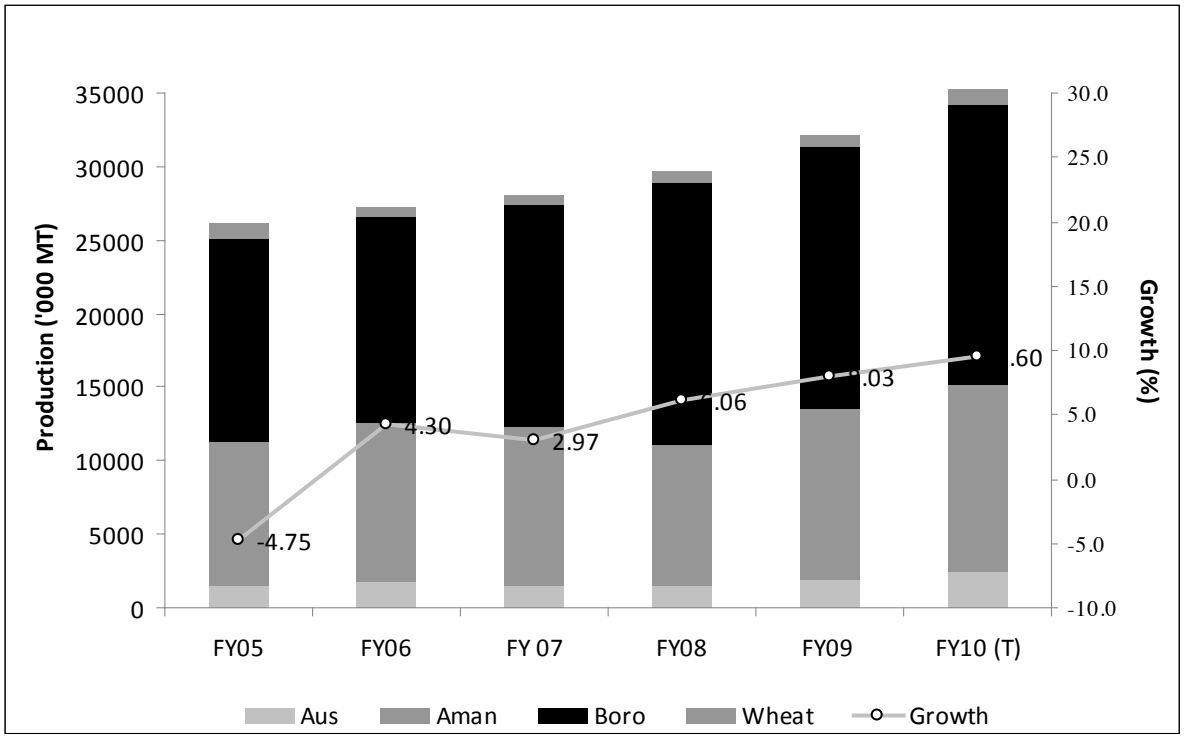
Source: Department of Agricultural Marketing (DAM) for Bangladesh; United States Department of Agriculture (USDA) for Thailand; and Ministry of Consumer Affairs, Food and Public Distribution, Government of India.

2.2 Domestic Food Situation: Production, Prices and Import

Production

In FY2008-09, total production of foodgrains (rice and wheat) was 32.2 million MT, which is the highest production in Bangladesh's history (Figure 2). According to the Bangladesh Bureau of Statistics (BBS), production of Boro rice in FY2008-09 was 17.8 million MT while production of Aman rice was 11.6 million MT, and production of Aus rice was 1.9 million MT. On the other hand, production of wheat was 0.85 million MT in FY2008-09. Production of total foodgrains and rice were respectively 8.0 and 8.2 per cent higher than previous year (FY2007-08). Higher production of foodgrains in FY2008-09 was due to good harvest of rice in all seasons (Aus, Aman and Boro) and wheat. Government's decision to reduce price of non-urea fertilisers in January 2009, and supply of electricity to irrigation pumps along with expectation of good profit by farmers contributed to high level of Boro production in FY2008-09.

Figure 2: Production of Foodgrains in FY2008-09



Source: Bangladesh Bureau of Statistics (BBS) and Department of Agricultural Extension (DAE).

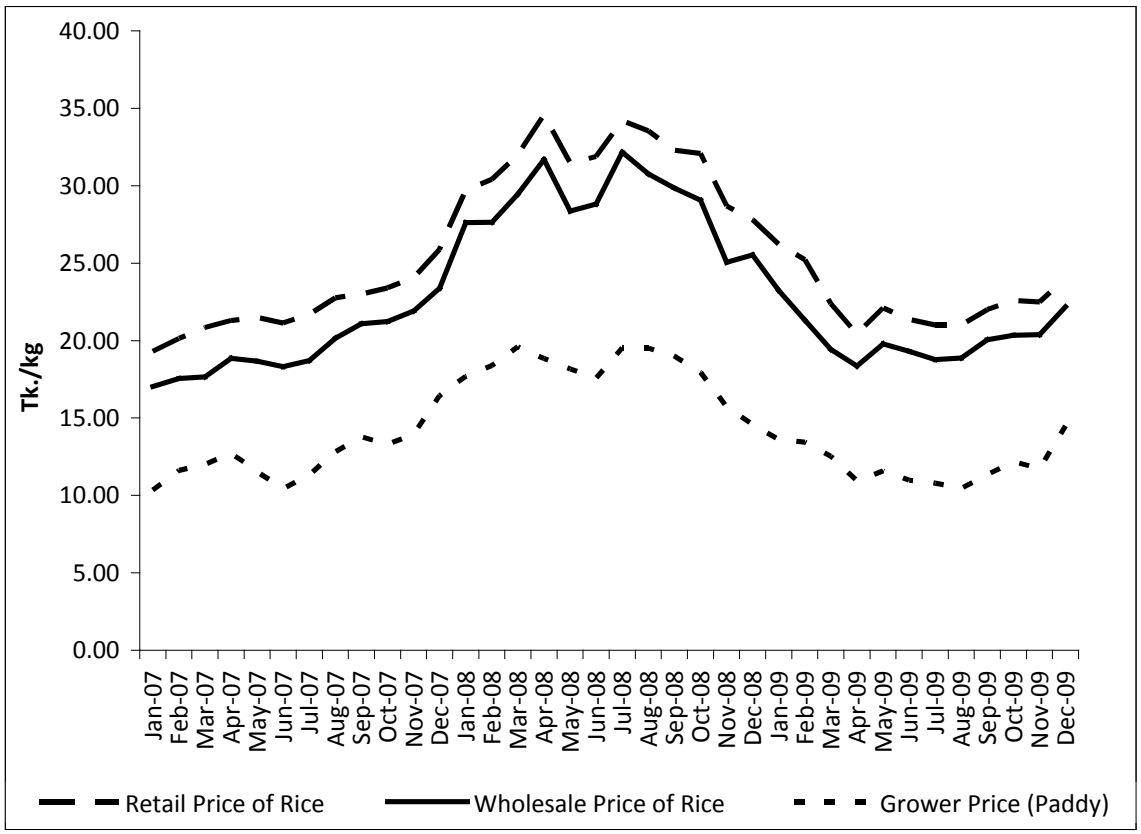
Though in terms of production, FY2008-09 was a good year but it was a disappointing year for Boro rice growers in terms of profitability. During the harvesting period, farm-level price of coarse rice and paddy was so low that farmers had to sell their paddy lower than the cost of production (CPD 2009). Farm-level visit by a team of Centre for Policy Dialogue (CPD) researchers in mid-May 2009, to some selected areas of Naogaon, Rangpur, Bogra and Mymensingh, revealed that at the then prevailing market price of paddy farmers' loss was about Tk. 1,700-Tk. 4,000 per acre.

Low price of paddy at the farm-level during May-July had a negative toll on the production of Aus rice and probably also on Aman rice. Production of Aus rice in FY2009-10 is 1.71 million MT, which is 9.8 per cent lower than that of last year. Planting of Aman was delayed and hampered by low rainfalls and early droughts. Ministry of Agriculture (MoA) declared free electricity for irrigation pumps in the drought-prone areas for Aman cultivation. This was a positive policy measure but it could not fully offset the negative incentive created by low price of paddy prevailing at that time and also because of limited number of electricity-operated pumps. Farmers have already harvested Aman rice. BBS and DAE are yet to publish production estimate. There is apprehension that Aman production may be lower this year.

Prices and Inflation

In recent months, domestic rice prices have been on the rise (Figure 3). During the first three weeks (17 days) of December 2009, average wholesale price of coarse rice was Tk. 22.19 per kg. On the other hand, retail price of rice was Tk. 24.00 per kg. Farm-level price of paddy was Tk. 14.50 per kg. The recent rise in price of coarse rice has so far been considered as an incentive for the farmers. If the farm-level paddy price increases upto Tk. 15 to Tk. 16 per kg then it would not be considered as a concern, rather an incentive to the farmers. However, if it rises beyond that then consumers may find it uncomfortable. It may be recalled that domestic prices (both for wholesale and retail) of coarse rice increased exponentially during February 2007 to April 2008, which had a negative impact on food security and poverty in the country at that time. The situation eased to some extent after the harvest of Boro rice in May 2008, but started to decline from September 2008 when global price situation eased and possibility of a good production in Aman season emerged. There is some correlation between wholesale and retail prices of rice and farm-level price of paddy. Therefore, balancing the interests of farmers and consumers will be needed. To this end, input prices and the attendant subsidies are important.

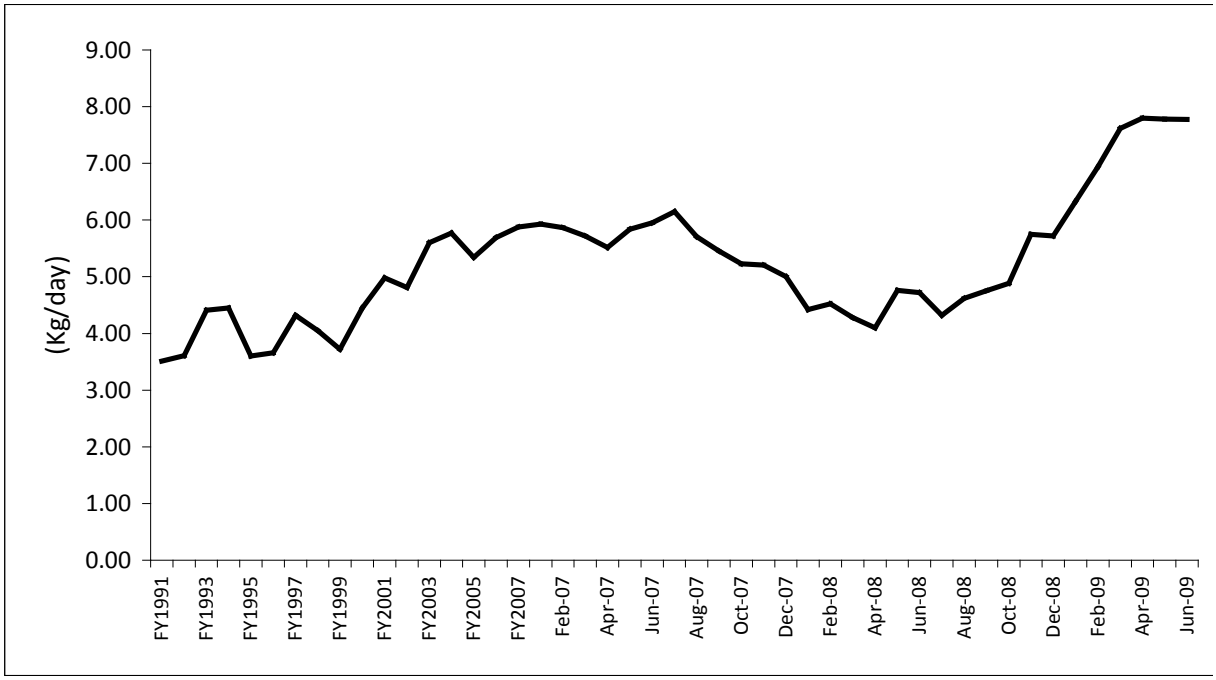
Figure 3: Monthly Wholesale and Retail Price of Rice (Coarse) and Paddy at Farm-level: July 2007 – December 2009



Source: Department of Agricultural Marketing (DAM).
Note: Data for December 2009 indicates first 17 days average.

Decline in rice price has positive impact on real wage and food security. Agricultural labour wage (in terms of rice equivalent) has substantially increased with the decrease in rice price. Rice equivalent wage of agricultural labourers have increased from 4.1 kg per day in April 2008 to 7.8 kg in May-June 2009 (Figure 4). Therefore, keeping rice price at a lower level is important for food security as well as for increasing real wage of workers.

Figure 4: Average Daily Rice Wage of Agricultural Labour (without Food) in Bangladesh: FY1990-91 – FY2008-09

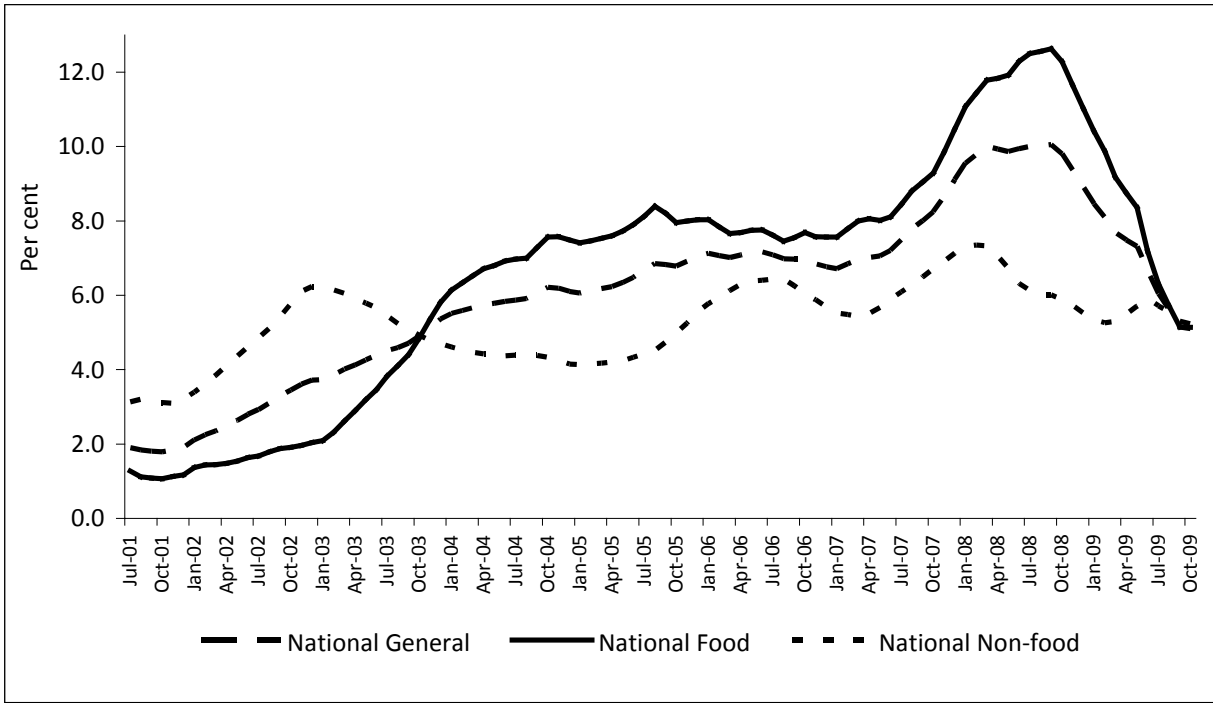


Source: Bangladesh Bureau of Statistics (BBS), Monthly Statistical Bulletin (*various issues*).

Trends in inflation (moving average) in Bangladesh have been presented in Figure 5. Bangladesh was enjoying lower inflation rates of below 6.0 per cent during the early years of the current decade. However, since the beginning of 2004 inflation had started to rise. High growth in consumer prices continued in 2007 and maintained steep rising trend during the first half of 2008. Overall inflation at the national level generally showed an increasing trend with some exceptions. General inflation in Bangladesh has increased from 1.90 in July 2001 to 10.05 in September 2008. After September 2008, it started to decline and decreased to 5.11 per cent in October 2009.

Until October 2003, food inflation at the national level was lower than non-food inflation. Since November 2003, food inflation has been consistently higher than the non-food inflation. Food inflation has gradually increased from 1.27 per cent in July 2001 to 12.63 per cent in September 2008. After that food inflation started to decline and decreased to 5.14 per cent in October 2009. Rate of non-food inflation showed a declining trend during December 2002 to May 2005, from 6.23 per cent in December 2002 to 4.24 per cent in May 2005. Since June 2005, non-food inflation was on the rise and reached 6.44 per cent in July 2006, and gradually declined to 5.42 per cent in March 2007. Since April 2007, non-food inflation posted a continuing rise and reached its highest level (7.35 per cent) in February 2008. In October 2008, non-food inflation rate was 5.23 per cent.

Figure 5: Trends in Inflation (Moving Average): July 2001 – October 2009



Source: Bangladesh Bureau of Statistics (BBS).

Point-to-point basis, inflation particularly food inflation in recent months has been showing an upward trend, which is a concern. In October 2009, food inflation at the national level was 7.78 per cent compared to 3.34 per cent in July 2009. Rural food inflation increased to 7.26 per cent in October 2009 against 2.99 in July 2009. Urban food inflation increased to 9.00 per cent from 6.73 per cent in July 2009. It is pertinent to mention here that rice price is an important determinant of food inflation since it contributes 42 per cent share of the total food inflation.

Import of Foodgrains

In FY2008-09, total foodgrains import was 3.01 million MT (rice: 0.6 million MT and wheat: 2.4 million MT), out of which .11 million MT was food aid, .68 million MT was commercial import by public sector, and 2.22 million MT was imported by the private sector (Table 1). In FY2008-09, total import of foodgrains was 12.8 per cent lower than the previous year. Quantity of rice import was 70.5 per cent lower while wheat import increased by 70.9 per cent. All commercial imports of rice by the government in FY2008-09 (.38 million MT) were actually delivery of the purchase contract made in FY2007-08 for import of 0.5 million MT of rice from India. Decline in rice import was due to lower domestic price of rice in Bangladesh. It is pertinent to mention here that during the last quarter of FY2008-09 (April-June) private sector imported only 4,600 MT of rice. It was mentioned earlier that it was the period when rice farmers had to sell their paddy at a price lower than their production cost. Increased domestic demand for wheat along with decline in international price was the underlying reasons behind increased import of wheat by Bangladesh. International price of wheat

declined from USD 343 per MT in July 2008 to USD 242 per MT in May 2009 (i.e. 29.4 per cent decrease). Wheat price had a sudden jump in June 2009 (USD 270 per MT) which declined to normal trend afterwards. Wheat import has increased substantially during the first half of FY2009-10 (1.72 million MT) which was about 2.5 times higher than the previous year (.70 million MT).

Table 1: Import of Foodgrains by Bangladesh in FY2008-09

(in '000 MT)

Category of Imports	FY2007-08			FY2008-09		
	Rice	Wheat	Total Foodgrains	Rice	Wheat	Total Foodgrains
Food aid	80	175	255	30	86	116
Public commercial import	536	97	633	386	294	680
Private import	1431	1138	2569	187	2030	2217
Total	2047	1410	3457	603	2410	3013

Source: Food Planning and Monitoring Unit (FPMU), Ministry of Food and Disaster Management (MoFDM).

Availability of rice from domestic production and low rice price prevailing in the domestic market has slowed down import during the first half of FY2009-10. During this period, there was no commercial import of rice by public or private sector, only 3,600 MT of rice was obtained as food aid (Table 2).

Table 2: Import of Foodgrains by Bangladesh in FY2009-10

(in '000 MT)

Category of Imports	FY2008-09 (1 July-15 December)			FY2009-10 (1 July-15 December)		
	Rice	Wheat	Total Foodgrains	Rice	Wheat	Total Foodgrains
Food aid	20.6	26.4	47.0	3.6	16.1	19.8
Public commercial import	398.7	200.3	599.0	0.0	68.4	68.4
Private import	27.2	475.2	502.4	0.0	1638.9	1638.9
Total	446.5	701.9	1148.4	3.6	1723.5	1727.1

Source: Food Planning and Monitoring Unit (FPMU), Ministry of Food and Disaster Management (MoFDM), and Management Information System and Monitoring (MISM) Division, Directorate General of Food.

3. BORO PRODUCTION TARGET: IS IT REALISTIC?

The Department of Agricultural Extension (DAE) has set the operational target (revised) for foodgrains production in FY2009-10 at 35.25 million MT; if achieved, this will register a 9.60 per cent annual growth over FY2008-09 (Table 3). For Boro, the target is to occupy 4.80 million ha of land comprising of 1.0 million ha Hybrid rice, 3.75 million ha of HYV rice and 50,000 ha of local Boro rice. According to the BBS, total area under Boro rice in FY2008-09 was 4.71 million ha which was comprised of 0.81 million ha of hybrid rice, 3.78 million ha of HYV rice and 0.12 million ha of local Boro rice (Table 4). In other words, targeted total Boro area is 1.8 per cent higher than actual Boro area in the last year (FY2008-09). In case of hybrid rice, this year's target is 22.9 per cent higher than last year while it is 0.8 per cent lower for HYV Boro rice. In case of Boro rice production, target is set at 19.0 million MT which is 6.7 per cent higher than the actual production in FY2008-09. Is this a realistic and achievable target? If so, what interventions are required?

Table 3: Area and Production of Rice in FY2009-10

Crop	FY2008-09		FY2009-10 (Target)	
	Area (lakh ha)	Production (lakh MT)	Area (lakh ha)	Production (lakh MT)
Aus	10.66	18.94	12.00	24.90
Aman	54.97	116.13	58.00	127.44
Boro	47.16	178.09	48.00	190.00
Total rice	112.79	313.16	118.00	342.34
Wheat	3.95	8.49	4.25	10.20
Total foodgrains (rice and wheat)	116.74	321.65	122.25	352.54

Source: Bangladesh Bureau of Statistics (BBS) and Department of Agricultural Extension (DAE).

Table 4: Targeted Boro Area and Production in FY2009-10 against Actual Area and Production in FY2008-09

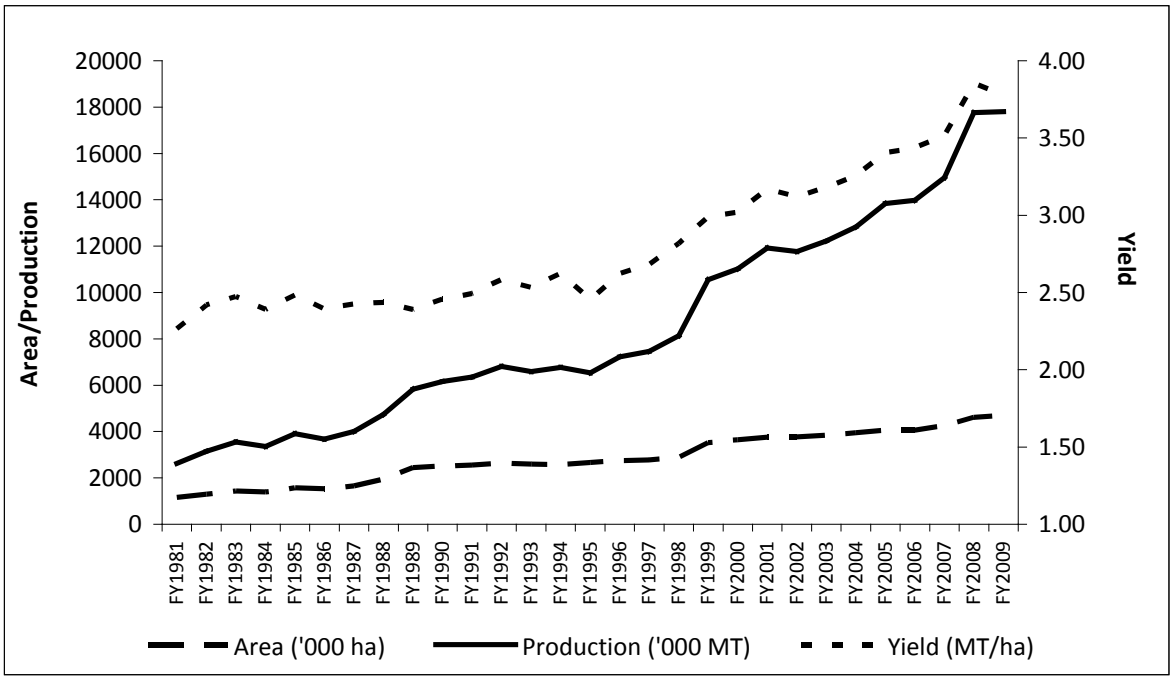
Description	Hybrid	HYV	Local	Total
Area				
Targeted area (lakh ha) in FY2009-10	10.0	37.5	0.5	48.0
Actual Boro area (lakh ha) in FY2008-09	8.1	37.8	1.2	47.1
Target of FY2009-10 as % of actual Boro area in FY2008-09	***122.9***	***99.2***	***40.9***	***101.8***
Production				
Targeted production (lakh MT) in FY2009-10	47.9	141.3	0.8	190.0
Actual production (lakh MT) in FY2008-09	37.3	138.7	2.2	178.1
Target production in FY2009-10 as % of actual production in FY2008-09	***128.6***	***101.9***	***37.7***	***106.7***

Source: Bangladesh Bureau of Statistics (BBS) and Department of Agricultural Extension (DAE).

3.1 Reality Check for Target in Boro

An analysis of area and production of Boro rice during FY1980-81 to FY2008-09 revealed that both area and production of Boro rice has increased (Figure 6). Area under Boro rice has increased from 1.16 million ha in FY1980-81 to 4.72 million ha in FY2008-09. On the other hand, production of Boro rice has increased from 2.63 million MT to 17.8 million MT; while per hectare yield of Boro rice has increased from 2.27 ton/ha to 3.78 ton/ha. During this period, annual compound rate of growth in area, production and yield of Boro rice was 4.75, 6.48 and 1.73 per cent, respectively. Thus, increase in area as well as yield was the major reason for increased Boro production in Bangladesh. Increase in Boro yield was the ultimate outcome of research, extension and overall development efforts. Investment for irrigation and water resources development also played an important role.

Figure 6: Trends in Area, Production and Yield of Boro Rice: FY1980-81 – FY2008-09



Source: : Bangladesh Bureau of Statistics (BBS).

Boro is produced in the dry season. Therefore, availability of irrigation is a necessary pre-condition for growing Boro rice. According to the Minor Irrigation Survey Report 2008-09, irrigated area in the Rabi season was 5.12 million ha which includes Boro rice, potato and other Rabi season crops. Available information also revealed that there was adequate number of irrigation equipments in good operating conditions. As is known, currently a total of 1.55 million irrigation equipments comprising 32,174 deep tube-wells (electricity-operated: 28,984; diesel-driven: 3,190); 1.37 million shallow tube-wells (electricity-operated: 214,315; diesel-driven: 1,160,233); and 148,800 low lift pumps are in operation. This information indicates that the necessary infrastructure or the hardware aspect of irrigation supports to achieve the Boro production target is available.

Aggregate level situation may not be prevailing at the district and upazila level. Therefore, an analysis of the upazila-level area under modern irrigation in FY2008-09 was carried out. Data available in the Minor Irrigation Survey Report 2008-09 was used for this purpose. In FY2008-09, out of the 464 upazilas, coverage of modern irrigation was very high (>25,000 ha) in 30 upazilas; high (10,001 – 25,000 ha) in 183 upazilas; medium (2,001 – 10,000 ha) in 184 upazilas; low (501 – 2,000 ha) in 41 upazilas; and negligible (<500 ha) in another 24 upazilas (Figure 11 and Annex Table 1). Modern irrigation system was not used in two upazilas (Narayanganj Sadar and Sandwip). So, upazila-level analysis also pointed out that the necessary infrastructure for irrigation was available to achieve the targeted Boro area.

Production of Boro rice also depends on other inputs like seed, fertiliser, pesticide, availability of agricultural credit. But these inputs are not binding constraints such as irrigation infrastructure. In addition to the existing irrigation infrastructure, the government

has also declared to expand surface water irrigation system in the south-western coastal areas and other areas. A total of Tk. 4,000 crore has been allocated for irrigation and drainage projects in the budget of FY2009-10. The existing irrigation infrastructure along with new irrigation projects will be capable of supporting the target, therefore, it can be said that the target set for Boro area and production is a realistic one.

3.2 Targets at the District Level

In FY2009-10, target area for total Boro rice cultivation is very high (>150,000 ha) in 10 districts (Bogra, Comilla, Dinajpur, Jessore, Kishoreganj, Mymensingh, Naogaon, Netrokona, Sunamganj and Tangail); high (100,000 – 150,000 ha) in seven districts (Brahmanbaria, Gaibandha, Habiganj, Jamalpur, Kurigram, Rangpur and Sirajganj); medium (50,000 – 100,000 ha) in 24 districts (Barisal, Bhola, Chandpur, Chittagong, Cox's Bazar, Dhaka, Gazipur, Gopalganj, Jhenaidaha, Joypurhat, Khulna, Lalmonirhat, Manikganj, Narsingdi, Natore, Nawabganj, Nilphamari, Noakhali, Pabna, Rajshahi, Satkhira, Sherpur, Sylhet and Thakurgaon); low (10,000 – 50,000 ha) in 18 districts (Bagerhat, Chuadanga, Faridpur, Feni, Khagrachhari, Kushtia, Lakshmipur, Madaripur, Magura, Meherpur, Moulovibazar, Munshiganj, Narail, Narayanganj, Panchagarh, Pirojpur, Rajbari and Shariatpur); and negligible (<10,000 ha) in another five districts (Bandarban, Barguna, Jhalokati, Patuakhali and Rangamati) (Figure 7).

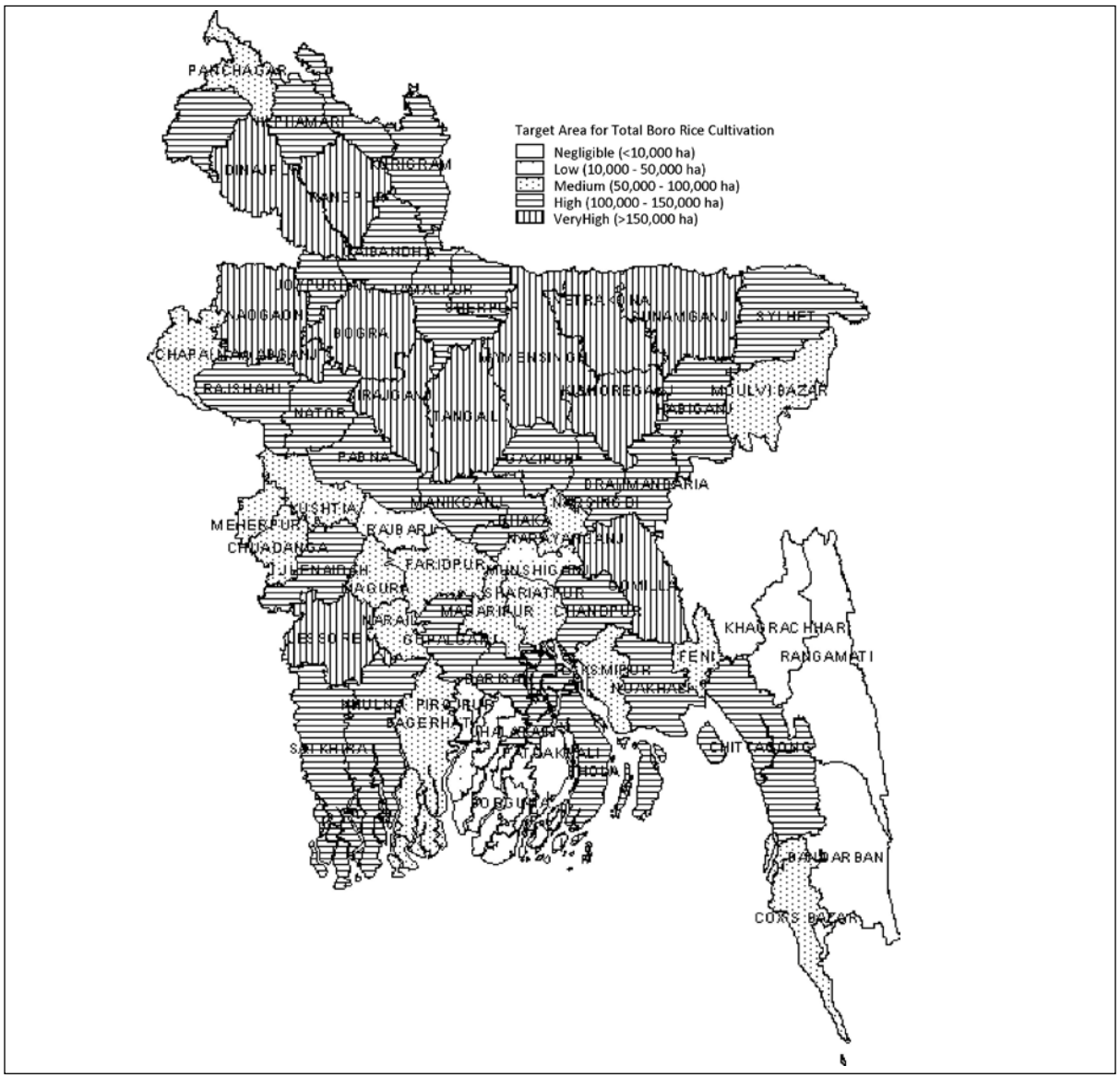
Targeted Boro area in FY2009-10, is substantially higher compared to Boro area in FY2008 - 09 (>5,000 ha) in nine districts (Gaibandha, Khulna, Kurigram, Madaripur, Mymensingh, Naogaon, Noakhali, Satkhira and Sherpur); higher (0 – 5,000 ha) in 31 districts (Bagerhat, Bandarban, Barguna, Barisal, Bhola, Bogra, Chandpur, Comilla, Dhaka, Faridpur, Gazipur, Gopalganj, Habiganj, Jamalpur, Jhalokati, Joypurhat, Khagrachhari, Kushtia, Lakshmipur, Magura, Manikganj, Moulovibazar, Narail, Natore, Nawabganj, Nilphamari, Patuakhali, Rajshahi, Rangamati, Rangpur and Shariatpur) (Figure 8). On the other hand, targeted Boro area is lower (0 – 5,000 ha) in 21 districts (Brahmanbaria, Chittagong, Chuadanga, Cox's Bazar, Dinajpur, Feni, Jessore, Jhenaidaha, Kishoreganj, Lalmonirhat, Meherpur, Munshiganj, Narayanganj, Narsingdi, Netrokona, Pabna, Panchagarh, Pirojpur, Rajbari, Sylhet and Tangail); and substantially lower (<5,000 ha) in another three districts (Sirajganj, Thakurgaon and Sunamganj) (Figure 8).

In case of production target for Boro rice in FY2009-10, it is very high (>500,000 MT) in 12 districts (Mymensingh, Bogra, Naogaon, Dinajpur, Netrokona, Kishoreganj, Comilla, Sunamganj, Tangail, Jessore, Rangpur and Sirajganj); high (200,000 – 500,000 MT) in 27 districts (Barisal, Bhola, Brahmanbaria, Chandpur, Chittagong, Dhaka, Gaibandha, Gazipur, Gopalganj, Habiganj, Jamalpur, Jhenaidaha, Joypurhat, Khulna, Kurigram, Lalmonirhat, Manikganj, Narsingdi, Natore, Nilphamari, Noakhali, Pabna, Rajshahi, Satkhira, Sherpur, Sylhet and Thakurgaon); medium (100,000 – 200,000 MT) in 16 districts (Bagerhat, Chuadanga, Cox's Bazar, Faridpur, Feni, Kushtia, Lakshmipur, Madaripur, Magura, Meherpur, Moulovibazar, Narail, Narayanganj, Nawabganj, Panchagarh and Shariatpur); low (50,000 – 100,000 MT) in three districts (Munshiganj, Rajbari and Pirojpur); and negligible (<50,000 MT) in another six districts (Bandarban, Barguna, Jhalokati, Khagrachhari, Patuakhali and Rangamati) (Figure 9).

Compared to FY2008-09, targeted Boro production in FY2009-10 is substantially higher (>25,000 MT) in 20 districts (Bagerhat, Barisal, Chandpur, Chittagong, Comilla, Cox's Bazar, Gaibandha, Habiganj, Jhenaidaha, Khulna, Kurigram, Moulovibazar, Mymensingh, Netrokona, Noakhali, Rangpur, Satkhira, Sherpur, Sunamganj and Sylhet); higher (0 – 25,000 MT) in 25 districts (Bandarban, Barguna, Bhola, Dinajpur, Feni, Gazipur, Jamalpur, Jhalokati, Joypurhat, Khagrachhari, Kushtia, Lakshmipur, Lalmonirhat, Madaripur, Magura, Naogaon, Narail, Narayanganj, Narsingdi, Nilphamari, Panchagarh, Patuakhali, Pirojpur, Rajshahi and Rangamati); lower (0 – 25,000 MT) in 17 districts (Bogra, Brahmanbaria, Chuadanga, Dhaka, Faridpur, Gopalganj, Jessore, Kishoreganj, Manikganj, Meherpur, Munshiganj, Natore, Nawabganj, Pabna, Rajbari, Shariatpur and Tangail); and substantially lower (< 25,000 MT) in two districts (Sirajganj and Thakurgaon) (Figure 10).

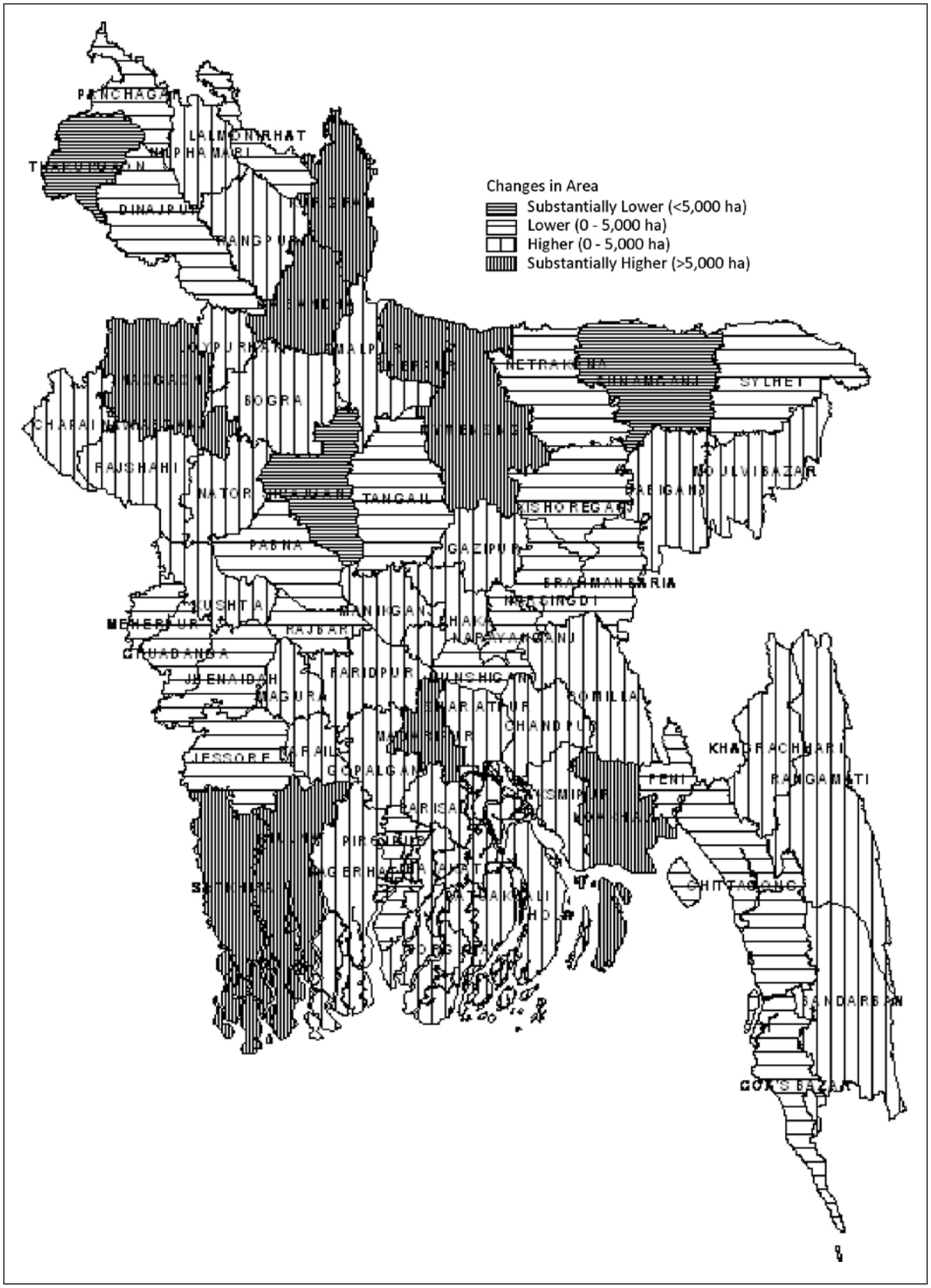
In 40 districts, targeted Boro rice area in FY2009-10 is more than actual Boro area in FY2008-09. On the other hand, targeted Boro areas in 24 districts are lower than actual area in previous year (Table 5).

Figure 7: Targeted Area Under Boro Rice Cultivation: FY2009-10



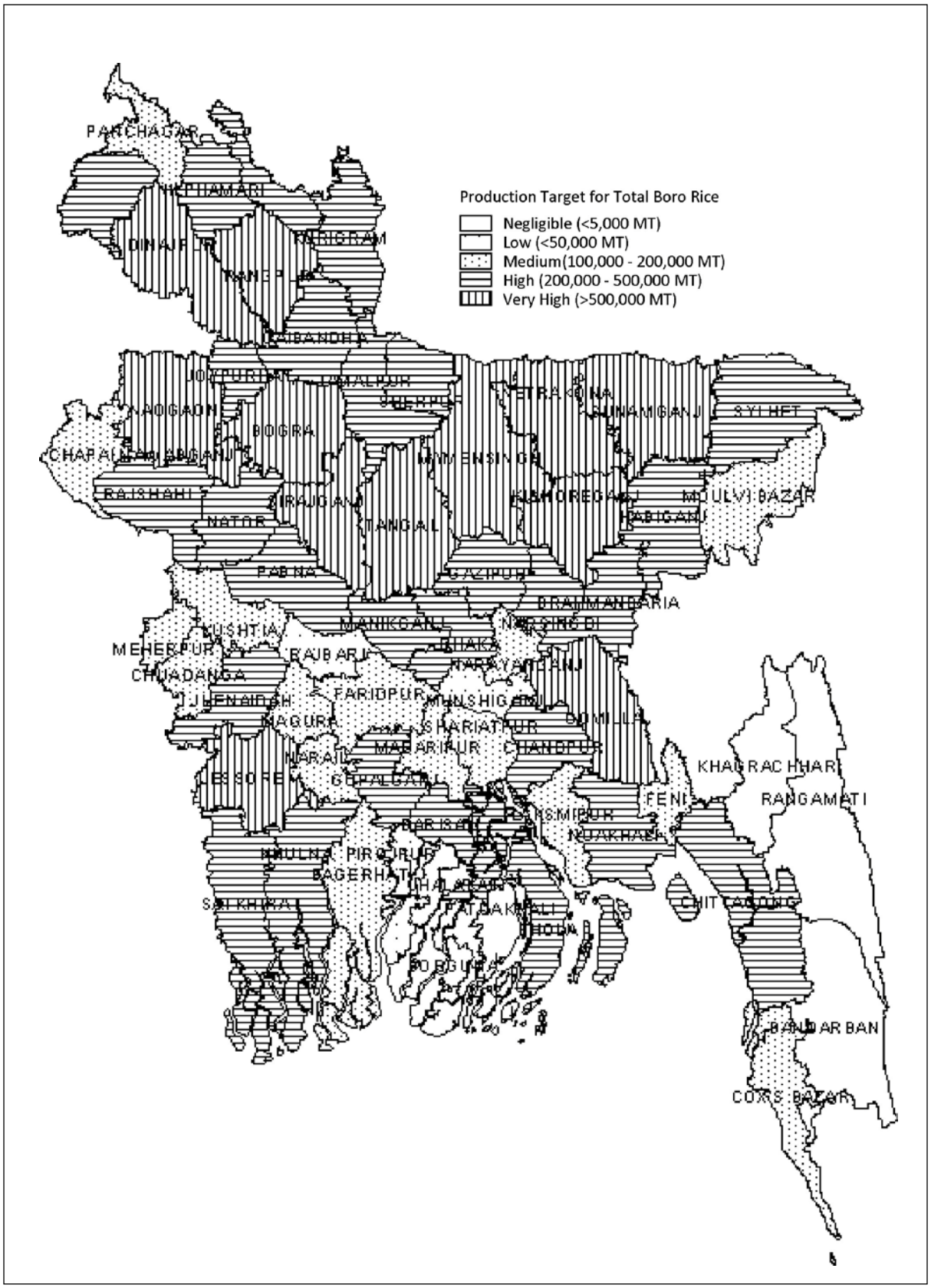
Source: Prepared by CPD, based on data from Department of Agricultural Extension (DAE).

Figure 8: Changes in Target Area in FY2009-10 Compared to Achieved Area in FY2008-09



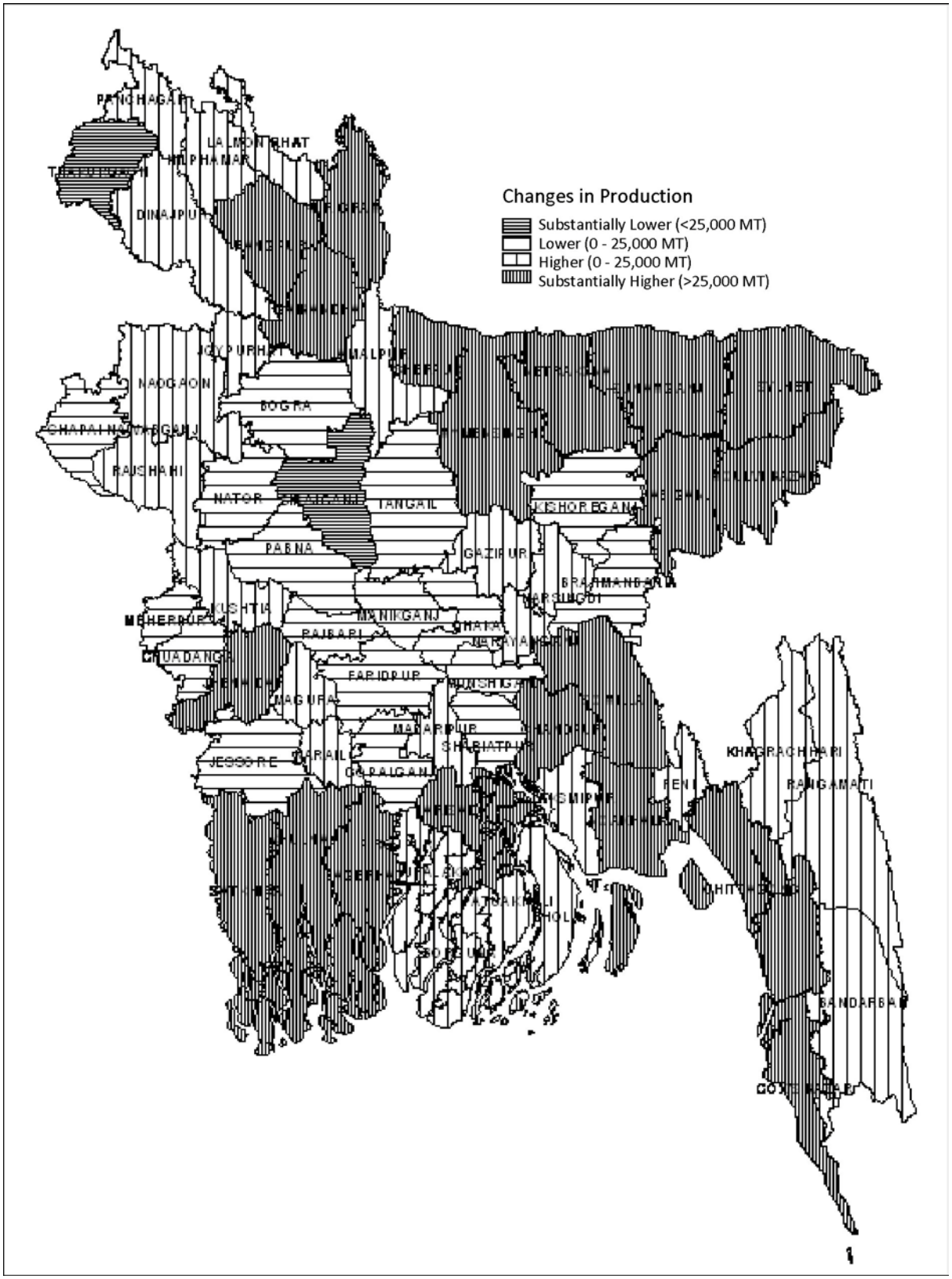
Source: Prepared by CPD, based on data from Bangladesh Bureau of Statistics (BBS) and Department of Agricultural Extension (DAE).

Figure 9: Target of Boro Rice Production: FY2009-10



Source: Prepared by CPD, based on data from Department of Agricultural Extension (DAE).

Figure 10: Changes in Production Target in FY2009-10 Compared to Achieved Production in FY2008-09



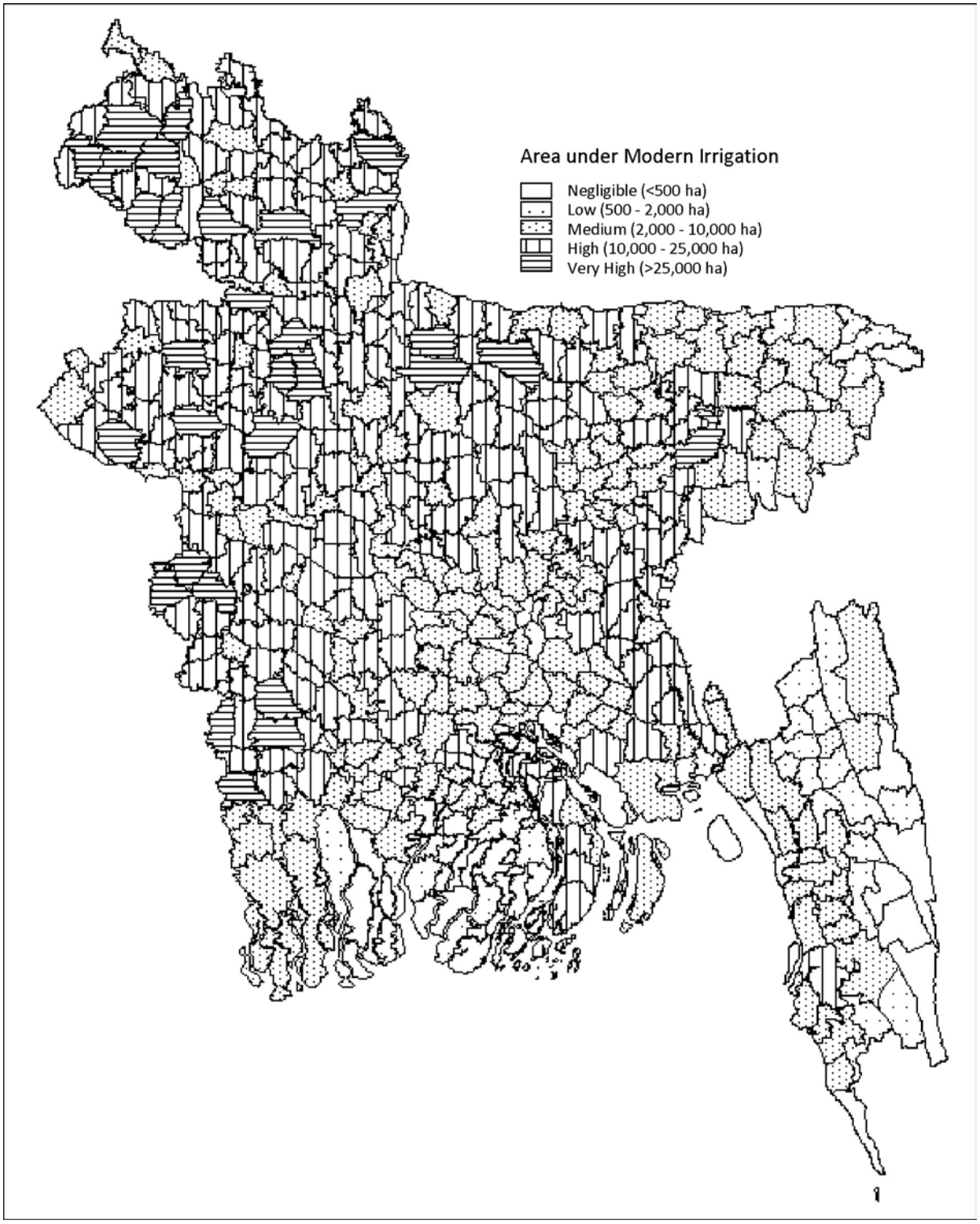
Source: Prepared by CPD, based on data from Bangladesh Bureau of Statistics (BBS) and Department of Agricultural Extension (DAE).

Table 5: District-wise Targeted Boro Rice Area (ha) in FY2009-10 as Percentage of Boro Rice Area in FY2008-09

District	Target Area in FY2010	Achieved Area in FY2010	Target Area as % of Achieved Area	District	Target Area in FY2010	Achieved Area in FY2010	Target Area as % of Achieved Area
Bagerhat	43483	38498	112.95	Madaripur	45008	39558	113.78
Bandarban	6051	4138	146.23	Magura	41993	41171	102.00
Barguna	1040	315	330.16	Manikganj	55265	54731	100.98
Barisal	66788	62476	106.90	Meherpur	26289	26630	98.72
Bhola	55310	54427	101.62	Moulovibazar	46334	42372	109.35
Bogra	190757	188889	100.99	Munshiganj	22322	23101	96.63
Brahmanbaria	105309	108181	97.35	Mymensingh	248817	241137	103.18
Chandpur	67176	66726	100.67	Naogaon	193957	184400	105.18
Chittagong	60996	64113	95.14	Narail	37271	36486	102.15
Chuadanga	41381	42376	97.65	Narayanganj	31753	31828	99.76
Comilla	162086	161039	100.65	Narsingdi	55536	55672	99.76
Cox's Bazar	48023	50544	95.01	Natore	71536	69680	102.66
Dhaka	52429	50990	102.82	Nawabganj	51769	50881	101.75
Dinajpur	171592	176236	97.36	Netrokona	170086	170963	99.49
Faridpur	39909	38084	104.79	Nilphamari	80035	76349	104.83
Feni	31416	31647	99.27	Noakhali	59383	53874	110.23
Gaibandha	117631	111756	105.26	Pabna	68393	70223	97.39
Gazipur	59649	59101	100.93	Panchagarh	46333	46494	99.65
Gopalganj	75880	74498	101.86	Patuakhali	5916	3225	183.44
Habiganj	105102	101761	103.28	Pirojpur	18628	19419	95.93
Jamalpur	111119	110503	100.56	Rajbari	21739	22444	96.86
Jessore	151132	152008	99.42	Rajshahi	83811	79161	105.87
Jhalokati	9337	8990	103.86	Rangamati	7251	6887	105.29
Jhenaidaha	89019	91257	97.55	Rangpur	127814	123139	103.80
Joypurhat	69689	69548	100.20	Satkhira	79220	67281	117.74
Khagrachhari	10883	9749	111.63	Shariatpur	34693	33279	104.25
Khulna	56461	39794	141.88	Sherpur	85202	76650	111.16
Kishoreganj	167760	170814	98.21	Sirajganj	127859	135064	94.67
Kurigram	107811	89594	120.33	Sunamganj	172142	187425	91.85
Kushtia	37704	34608	108.95	Sylhet	66487	69337	95.89
Lakshmipur	27323	25830	105.78	Tangail	163405	164744	99.19
Lalmonirhat	53927	55894	96.48	Thakurgaon	59580	68261	87.28
				BANGLADESH	4800000	4716250	101.78

Source: Bangladesh Bureau of Statistics (BBS) and Department of Agricultural Extension (DAE).

Figure 11: Upazila-wise Area under Modern Irrigation System in the Rabi Season: FY2008-09



Source: Prepared by CPD, based on data from Minor Irrigation Survey Report 2008-09.

4. INPUT DELIVERY STRATEGY

Achieving the targets in production requires smooth delivery of inputs such as seed, fertiliser, irrigation, pesticides and agricultural credit to purchase all required inputs. In order to ensure delivery of subsidised inputs, the MoA has decided to distribute "Agri-input Assistance Cards" (Krishi Upakaran Sahayata Card) among 1.82 crore farmer families from mid-January 2010. These cards will contain detailed personal information of the farmers along with their requirement of inputs such as seeds, fertiliser, pesticides and agricultural credit, and provision for irrigation subsidy. It will keep record about the amount of subsidy given to the farmer in each season. The government has planned to construct a national farmer database using these cards. It has also decided to deliver input subsidy only to these card holders through Banks. This is an appreciative initiative which will be helpful in enhancing efficiency and transperency in the distribution mechanism.

A brief review of the input requirement and supply situation in Bangladesh is reported below.

4.1 Seed

Supply of quality seed is very important to ensure rice production. Hossain *et al.* (2002) have shown that Bangladesh can increase its rice production to the tune of 20 lakhs alone by ensuring supply of quality seeds of the same varities to the farmers. Several modern rice varities are available for cultivation in the Boro season. Farmers can grow BRRI Dhan 28, BRRI Dhan 29, BRRI Dhan 25, BRRI Dhan 36, BINA 5, BINA 6, IRATOM 24, BRRI Dhan 47, and BRRI Dhan 50 in the Boro season. BRRI Dhan 47 has been developed for cultivation in the salinity-affected southern coastal region. A list of the districts, where these varieties are suitable for cultivation is given in Table 6 and Figure 12. Among the HYVs, BRRI Dhan 28 and BRRI Dhan 29 are the most popular. These two varieties cover approximately 60 per cent of the area under HYV.

Table 6: HYVs Suitable for Cultivation in the Boro Season in FY2009-10

Boro Variety	Districts
BINA 5	Low and medium high land districts
BINA 6	Low, medium high land, southern part and *monga*-prone districts
IRATON 24	Medium high land districts
BR 16	Feni, Lakshmipur, Noakhali
BRRI Dhan 28	Bagerhat, Bandarban, Barguna, Barisal, Bhola, Bogra, Brahmanbaria, Chandpur, Chuadanga, Comilla, Dhaka, Dinajpur, Faridpur, Feni, Gaibandha, Gazipur, Gopalganj, Habiganj, Jamalpur, Jessore, Jhalokati, Jhenidaha, Joypurhat, Khulna, Kishoreganj, Kurigram, Kushtia, Laksmipur, Lalmonirhat, Madaripur, Magura, Manikganj, Meherpur, Moulovibazar, Munshiganj, Mymensingh, Narail, Narayanganj, Narsingdi, Natore, Nawabganj, Netrokona, Nilphamari, Naogaon, Pabna, Panchagarhh, Patuakhali, Pirojpur, Rajbari, Rajshahi, Rangamati, Rangpur, Satkhira, Shariatpur, Sherpur, Sirajganj, Sylhet, Tangail, Thakurgaon

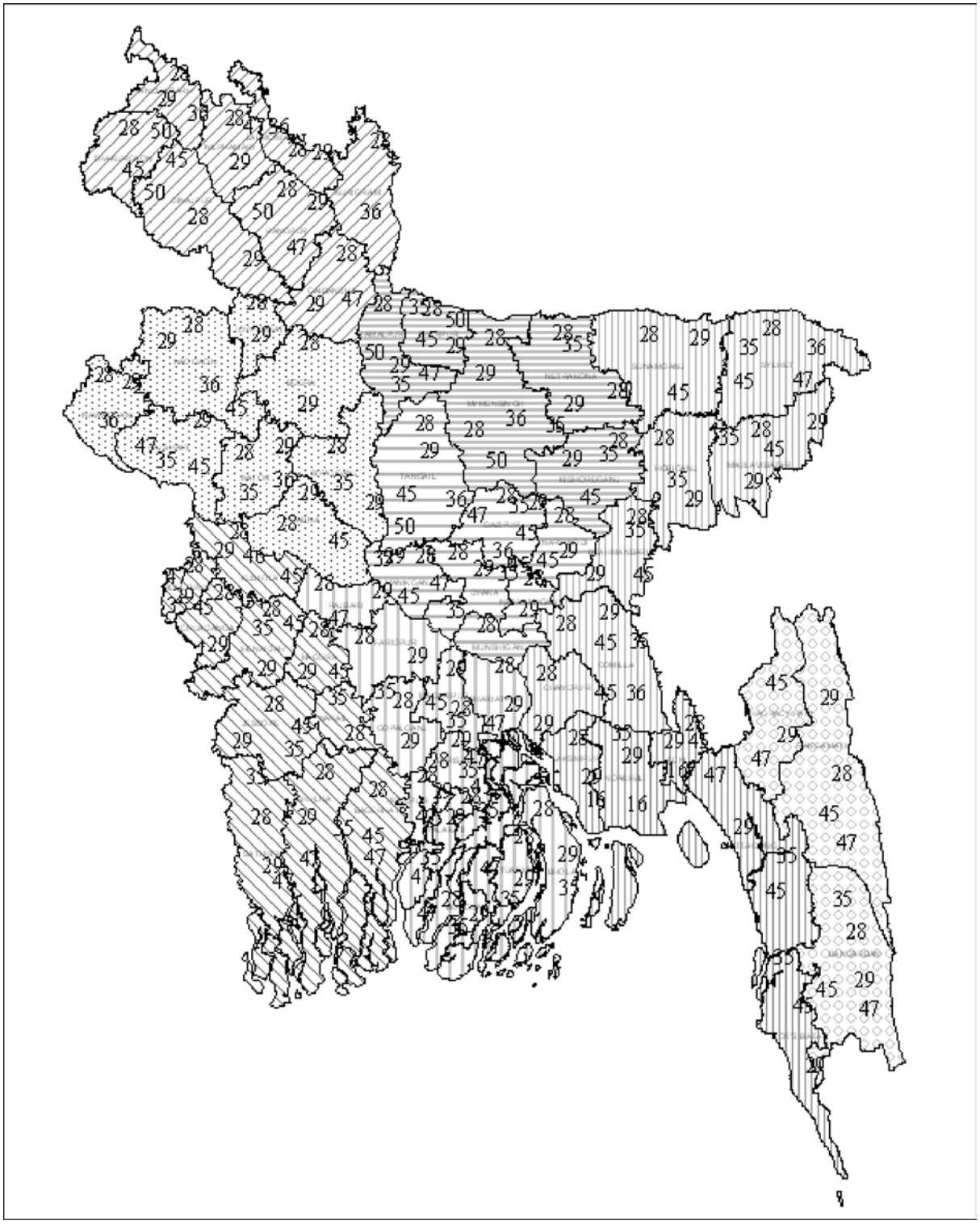
(Table 6 contd.)

(Table 6 contd.)

Boro Variety	Districts
BRRI Dhan 29	Bandarban, Barguna, Barisal, Bhola, Bogra, Brahmanbaria, Chandpur, Chittagong, Chuadanga, Comilla, Cox's Bazar, Dhaka, Dinajpur, Faridpur, Feni, Gaibandha, Gazipur, Gopalganj, Habiganj, Jamalpur, Jessore, Jhalokati, Jhenaidaha, Joypurhat, Khagrachhari, Khulna, Kishoreganj, Kushtia, Lakshmipur, Lalmonirhat, Madaripur, Magura, Manikganj, Maulovibazar, Meherpur, Mymensingh, Naogaon, Narayanganj, Narsingdi, Natore, Nawabganj, Netrokona, Nilphamari, Noakhali, Pabna, Panchagarhh, Patuakhali, Pirojpur, Rajbari, Rajshahi, Rangamati, Rangpur, Satkhira, Shariatpur, Sherpur, Sirajganj, Sunamganj, Tangail
BRRI Dhan 35	Bagerhat, Barguna, Barisal, Bhola, Brahmanbaria, Chandpur, Chittagong, Chuadanga, Comilla, Cox's Bazar, Dhaka, Gazipur, Gopalganj, Habiganj, Jamalpur, Jessore, Jhalokati, Jhenidaha, Khulna, Kishoreganj, Madaripur, Manikganj, Meherpur, Moulovibazar, Mymensingh, Narail, Natore, Netrokona, Noakhali, Patuakhali, Pirojpur, Rajshahi, Satkhira, Sherpur, Sirajganj, Sylhet, Tangail
BRRI Dhan 36	Comilla, Gazipur, Kurigram, Lalmonirhat, Mymensingh, Naogaon, Natore, Nawabganj, Panchagarhh, Sylhet, Tangail
BRRI Dhan 45	Bandarban, Barisal, Brahmanbaria, Chandpur, Chittagong, Chuadanga, Cox's Bazar, Dinajpur, Feni, Gazipur, Jessore, Jhenidaha, Kishoreganj, Kushtia, Madaripur, Magura, Manikganj, Moulovibazar, Naogaon, Narayanganj, Narsingdi, Pabna, Rajshahi, Rangamati, Sherpur, Sunamganj, Sylhet, Tangail, Thakurgaon
BRRI Dhan 47	Bagerhat, Bandarban, Barguna, Barisal, Chittagong, Cox's Bazar, Gaibandha, Gazipur, Jamalpur, Khagrachhari, Khulna, Manikganj, Meherpur, Nilphamari, Patuakhali, Pirojpur, Rajbari, Rajshahi, Rangamati, Rangpur, Satkhira, Shariatpur, Sylhet
BRRI Dhan 50	Dinajpur, Jamalpur, Mymensingh, Rangpur, Sherpur, Tangail, Thakurgaon

Source: Compiled from BRRI (2007); AIS (2008); and DAE project materials on "Production, Storage and Distribution of Quality Rice, Wheat and Jute Seeds at Farmers Level."

Figure 12: HYVs Suitable for Cultivation in Boro Season: FY2009-10



Source: Compiled from BRRI (2007); AIS (2008); and DAE project materials on "Production, Storage and Distribution of Quality Rice, Wheat and Jute Seeds at Farmers Level."

Different seed companies have registered till date about 68 hybrids with the National Seed Board for cultivation in the Boro season in Bangladesh (Table 7). This season, different seed

companies have marketed 30-35 rice hybrids. However, only few hybrids are popular which includes Hira, Aloran, Jagoron, Shakti, Sonar Bangla, Aftab, ACI Hybrid, Lal Teer, etc.

Table 7: Rice Hybrids Registered for Cultivation by National Seed Board: 1998 - 2009

Hybrid	Company	Year of Release	Released for Cultivation in the Following Area
AALOK-6201	ACI Limited	1998	All areas
Loknath-505	Macdonald	1998	All areas
Amarsri-1	Ganges D. Co.	1998	All areas
CNSGC-6	Mollika Seed Co.	1998	All areas
IAHS-100001	Aftab Multipurpose Farm Limited	2000	All areas
IR69690	Bangladesh Rice Research Institute (BRRI)	2001	Jessore, Barisal
ZF-31	Aftab Multipurpose Farm Limited	2001	Dhaka, Rajshahi, Rangpur
ZF-37	Aftab Multipurpose Farm Limited	2001	Mymensingh, Jessore
Hybrid Rice No. 99-5	Supreme Seed Company Limited	2001, 2003	Mymensingh, Jessore, Comilla, Rajshahi, Rangpur
RICER-101	Chense Crop Science Bangladesh Limited	2005	All areas
GB-4 (Jagoron)	BRAC	2003	All areas
LP-50	Aftab Multipurpose Farm Limited	2002, 2004, 2005	Mymensingh, Jessore, Comilla, Rajshahi, Rangpur
HS-273	Supreme Seed Company Limited	2003, 2005	Comilla, Rajshahi, Dhaka, Mymensingh
AALOK 93024	ACI Limited	2003	Comilla, Rajshahi
HB-8	BRAC	2005	All areas
TINPATA-40	Tinpata Quality Seed Bangladesh Limited	2005, 2006	Dhaka, Mymensingh, Comilla, Jessore, Rajshahi
TAJ-1(GRA-2)	National Seed Company Limited	2006	Mymensingh, Comilla, Rangpur
TAJ-2 (GRA-3)	National Seed Company Limited	2006	Mymensingh, Comilla
HTM-4 (Sonar Bangla-6)	Mollika Seed Co.	2006	Dhaka, Mymensingh, Comilla, Jessore
HTM-606	North South Seed Limited	2006	Mymensingh, Comilla
HTM-707	North South Seed Limited	2006	Mymensingh, Comilla
HTM-202	East West Seed Bangladesh Limited	2006	Mymensingh, Comilla
HTM-303	East West Seed Bangladesh Limited	2006	Dhaka, Mymensingh, Comilla, Rajshahi
LP-108	Sea Trade Fertiliser Limited	2006	Mymensingh, Comilla, Rajshahi
LU You-2 (Surma-1)	Sinzenta Bangladesh Limited	2006	Dhaka, Mymensingh, Comilla
LU You-3 (Surma-2)	Sinzenta Bangladesh Limited	2006	Mymensingh, Comilla, Jessore, Rajshahi
TINPATA-10	Tinpata Quality Seed Bangladesh Limited	2006	Mymensingh, Comilla, Rajshahi

(Table 7 contd.)

(Table 7 contd.)

Hybrid	Company	Year of Release	Released for Cultivation in the Following Area
TINPATA SUPER	Tinpata Quality Seed Bangladesh Limited	2006	Mymensingh, Comilla
LP-70	Aftab Multipurpose Farm Limited	2006	Mymensingh, Comilla, Jessore
ACI-1	ACI Limited	2006	Mymensingh, Comilla, Jessore
ACI-2	ACI Limited	2006	Mymensingh, Comilla, Jessore, Rajshahi
BW001 (Jagoron-3)	BRAC	2006	Mymensingh, Comilla, Jessore
L.P. 106	Aftab Multipurpose Farm Limited	2007	Mymensingh, Comilla, Rangpur
HR-422 (Surma-4)	Sinzenta Bangladesh Limited	2007	Mymensingh, Comilla, Jessore
S-2B (Krishan-2)	Muktapur Bhandar	2007	Mymensingh, Comilla, Rangpur
HRM-01 (Agrani-7)	Metal Seed Co. Limited	2007	Mymensingh, Comilla
HRM-02 (Sharathi-14)	Metal Seed Co. Limited	2007	Mymensingh, Comilla
Ruposhi Bangla -1	Kamal Seed Co. Limited	2007	Mymensingh, Comilla
HB-09 (Aloron-2)	Ayesha Abed Foundation Limited	2007	Mymensingh, Comilla, Rangpur
Supreme Hybrid-5 (Heera-5)	Supreme Seed Co. Limited	2007	Mymensingh, Comilla
WBR-2 (Modhumoti-2)	United Seed Store Limited	2007	Mymensingh, Comilla
HG-202 (Manik-2)	Siddique Seeds Co. Limited	2007	Mymensingh, Comilla, Rangpur
WBR-5 (Modhumoti-5)	United Seed Store Limited	2007	Mymensingh, Comilla, Jessore
L.P. 05	Aftab Multipurpose Farm Limited	2007	Mymensingh, Comilla, Jessore
Arizetaz	Bayer Crop Science Limited	2008	Jessore, Rajshahi
Jamuna	Autocrop Company	2008	Mymensingh, Comilla, Jessore, Rajshahi
Hira 6	Mitali Agroseed Limited	2008	Dhaka, Mymensingh, Rangpur
Hira 4	Supreme Seed Company	2008	Comilla, Jessore, Rajshahi
Lili 1	Lilian Company	2008	Mymensingh, Comilla, Jessore, Rajshahi
Rajkumar	ACI Formulation Limited	2008	Mymensingh, Comilla, Jessore, Rajshahi
Sampad	ACI Formulation Limited	2008	Mymensingh, Jessore
Falan	FX Crop Limited	2008	Mymensingh, Comilla, Rajshahi, Rangpur
Agro G1	Energypac Agro Limited	2008	Mymensingh, Comilla
Agro G2	Energypac Agro Limited	2008	Mymensingh, Jessore
Panna 1	Quality Seed Company	2008	Mymensingh, Jessore, Rangpur
TK 6	Nipa Trading International	2008	Rangpur, Jessore
BRRI Hybrid 2	Bangladesh Rice Research Institute (BRRI)	2008	Dhaka, Comilla, Jessore, Rajshahi
BRRI Hybrid 3	Bangladesh Rice Research Institute (BRRI)	2009	Comilla, Rajshahi
Malati 8	United Seed Company	2009	Comilla, Jessore, Rajshahi
BRAC Shakti 2	BRAC	2009	Comilla, Jessore
BRAC Shakti 3	BRAC	2009	Comilla, Jessore

(Table 7 contd.)

(Table 7 contd.)

Hybrid	Company	Year of Release	Released for Cultivation in the Following Area
HM 604	Metal Seed Company	2009	Comilla, Jessore, Rajshahi
Golden 1	Alpha Seed Company	2009	Mymensingh, Comilla, Rajshahi
Swachchhal	Northern Seed Company	2009	Comilla, Jessore
Shankar 3	ACI Formulation Limited	2009	Comilla, Jessore, Rajshahi
Mongal	Northern Seed Company	2009	Comilla, Rangpur
Lili 10	Tropical International	2009	Mymensingh, Comilla
China King 2	Carnel International	2009	Comilla, Jessore, Rajshahi

Source: National Seed Board, Bangladesh.

According to an estimate of MoA, total demand for rice seed in FY2009-10 would be about .12 million MT, which is 4.23 per cent higher than that of FY2008-09 (Table 8). Bangladesh Agriculture Development Corporation (BADC) is expected to supply about two-fifth of total seed demand. About one-tenth of the demand for seed would be met up from farmers own seed. Private sector and non-government organisations (NGOs) are expected to supply 12.1 per cent of total seed demand. About 10 per cent of total seed demand would be met through import by private sector. Major seed importing companies of Bangladesh are BRAC, Supreme, ACI, Aftab and Mollika constituting about more than 90 per cent of total import in Bangaldesh. Private sector companies will supply 2.9 per cent of total seed requirement from their own seed production. It is known from the seed sellers that sale of hybrid rice seed is lower this season than last season. It could be due to the lower price of hybrid paddy that prevailed last Boro season compared to the BR 28 and BR 29 varieties. Before 2008, the price difference between the hybrid paddy and BR 28 and BR 29 was around Tk. 25 /maund, but last year it was around Tk. 120-150 /maund. According to the Seed Wing of MoA, only 5,500 MT of hybrid rice seeds were sold till the third week of December this year against the target of 11,500 MT. Therefore, achieving the targets for area under hybrid rice in the current Boro season does raise some extent of uncertainity.

Table 8: Demand and Supply of Boro Seed in Bangladesh

(in MT)

	FY2008-09 (Actual)				FY2009-10 (Target)			
	Local	**HYV**	**Hybrid**	**Total**	**Local**	**HYV**	**Hybrid**	**Total**
Demand	19700 (17.77)	80142 (72.30)	11000 (9.92)	110842 (100.00)	9500 (8.22)	90062 (77.95)	15969 (13.82)	115531 (100.00)
Supply								
BADC		35862 (44.75)		35862 (32.35)		43946 (48.80)	69 (0.43)	44015 (38.10)
DAE		22500 (28.08)		22500 (20.30)		30616 (33.99)		30616 (26.50)
Private and NGO		18000 (22.46)		18000 (16.24)		14000 (15.54)		14000 (12.12)
Private sector import			7500 (68.18)	7500 (6.77)			11500 (72.01)	11500 (9.95)

(Table 8 contd.)

(Table 8 contd.)

	FY2008-09 (Actual)				FY2009-10 (Target)			
	Local	**HYV**	**Hybrid**	**Total**	**Local**	**HYV**	**Hybrid**	**Total**
Private sector production			2800 (25.45)	2800 (2.53)			3400 (21.29)	3400 (2.94)
Unsold in the last year			700 (6.36)	700 (0.63)			1000 (6.26)	1000 (0.87)
Farmers	19700 (100.00)	3780 (4.72)		23480 (21.18)	9500 (100.00)	1500 (1.67)		11000 (9.52)
Total	**19700 (100.00)**	**80142 (100.00)**	**11000 (100.00)**	**110842 (100.00)**	**9500 (100.00)**	**90062 (100.00)**	**15969 (100.00)**	**115531 (100.00)**

Source: Seed Wing, Ministry of Agriculture (MoA).
Note: Figures in parentheses indicate percentage of total.

To increase the availability of quality seed for agricultural production, Tk. 280 crore has been allocated in the national budget for FY2009-10. Special projects have been approved under the annual development programme (ADP) of FY2009-10. Table 9 reports the implementation status of various seed-related projects under the ADP. It is revealed from the Table that during the first five months (July-November), implementation rate ranged between 42.1 to 50.7 per cent with exception for one project component (6.7 per cent). This is an encouraging sign for ADP implementation.

Table 9: Implementation Status of Seed Projects in ADP FY2009-10

(in Lakh Tk.)

Project Name	Implementing Agency	Allocation for FY2009-10	Expenditure during July-November 2009	Expenditure as % of Allocation
Modernisation and strengthening of facilities to increase supply of quality seeds	BADC	15945.00	6919.00	
Integrated project for increasing the production of onion, garlic, ginger, turmeric and chili	BADC	585.51	39.27	6.71
	BARI	82.82	42.00	50.71
	DAE	151.00	75.50	50.00
	AIS	6.30	3.00	47.62
Pulses and oil seed project	BADC	1327.00	613.00	46.19
Production, storage and distribution of quality rice, wheat and jute seeds at farmers level	DAE	2000.00	647.50*	32.38
Quality seed production at farmers level	BMDA	27.00	7.26*	26.89
Research and development of hybrid rice in Bangladesh	BRRI	80.00	n.a.	n.a.
Strengthening of rice breeders' seed production and maintenance of nucleus stock	BRRI	150.00	n.a.	n.a.

(Table 9 contd.)

(Table 9 contd.)

Stregthening of pulses and oilseed research programme in Bangladesh	BARI	341.00	143.68	42.13
Development of hybrid maize research in Bangladesh	BARI	116.00	n.a.	n.a.

Source: Respective institutes.
Note: * Expenditure during July-October 2009.
BARI: Bangladesh Agricultural Research Institute; AIS: Agricultural Information Service; BMDA: Barind Multipurpose Development Authority.

To know the problems facing by farmers as regard availability of quality Boro rice seeds, five major newspapers were reviewed (Prothom Alo, Samakal, The Daily Star, The Financial Express and New Age) for the months of November and December 2009. Reports published in these newspapers revealed that farmers in several areas like Jhenaidaha, Jessore (Keshobpur), Mymensingh (Fulbaria, Nolitabari), Nawabganj, Pabna, Naogaon (Naogaon Sadar, Manda, Harinakunda), Nilphamari (Dimla, Saidpur), Dinajpur, Panchagarh, Joypurhat, Rangpur (Badarganj), Kishoreganj (Tarail), Moulovibazar have been facing problem of obtaining quality rice seeds due to the shortage of seed and higher price than the price set by BADC.

4.2 Fertiliser

Supply of adequate level of fertiliser is essential to ensure production. Trends in fertiliser supply during the last five years are reported in Table 10. Total supply of fertiliser in FY2008-09 was 28.00 lakh MT comprising 24.00 lakh MT of urea, 2.00 lakh MT of triple super phosphate (TSP), 0.50 lakh MT of diammonium phosphate (DAP) and 1.50 lakh MT of muriate of potash (MoP). The MoA has estimated total demand for fertiliser in FY2009-10 as 40.95 lakh MT comprising 28.00 lakh MT of urea, 5.95 lakh MT of TSP, 2.50 lakh MT of DAP and 4.50 lakh MT of MoP. Estimated fertiliser demand in FY2009-10, compared to the last year is substantially higher for all fertilisers. However, it seems that supply of fertiliser in FY2008-09 was very low compared to the other years.

Table 10: Supply of Fertiliser in Bangladesh

(in lakh MT)

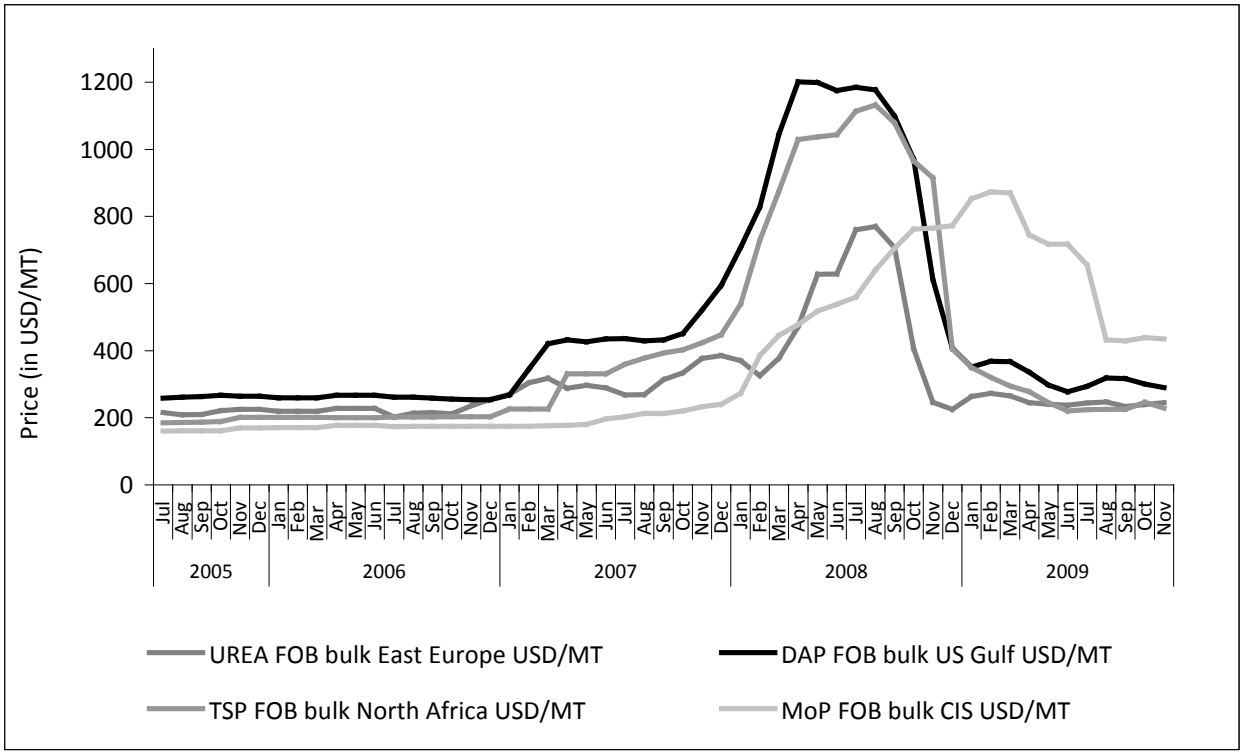
Fertiliser	FY2004-05	FY2005-06	FY2006-2007	FY2007-08	FY2008-09	FY2009-10 (Allocation)
Urea	25.23	24.61	25.27	26.68	24.00	28.00
TSP	4.20	4.36	3.40	4.61	2.00	5.95
DAP	1.71	1.30	1.15	2.50	0.50	2.50
MoP	2.60	2.91	2.30	4.01	1.50	4.50
Total	33.74	33.18	32.12	37.80	28.00	40.95

Source: Department of Agricultural Extension (DAE), Ministry of Agriculture (MoA).

International prices of all types of fertilisers have decreased significantly between January and November 2009 (Figure 13). Within this period, international price of urea decreased from USD 263 to USD 245 per MT (7 per cent decrease), while that of DAP decreased from

USD 351 to USD 290 per MT (17 per cent decrease). During this same time, price of TSP decreased from USD 350 to USD 229 per MT (around 35 per cent decrease), and price of MoP decreased from USD 853 to USD 435 per MT (about 49 per cent decrease).

Figure 13: International Prices of Fertilisers (Urea, DAP, TSP and MoP): July 2005 - November 2009



Source: Commodity Market Review (*various issues*), World Bank.

To encourage balanced use of fertilisers and in view of the decline in fertiliser prices at the international market, recently (on 2 November 2009) the government has declared to reduce administered price of non-urea fertilisers. Administered prices of a kg of TSP, MoP and DAP has been reduced to Tk. 22, Tk. 25 and Tk. 30 from Tk. 40, Tk. 35 and Tk. 45, respectively.

The MoA has already implemented a new policy for appointing fertiliser dealer and rearranged the fertiliser distribution system to ensure proper and timely reach of fertiliser. As per the new policy one dealer will be appointed for each union and each municipality area. In case of the municipality area, the dealer must have agricultural land. Citizen of the union will get priority for having appointment as new dealer. The applicants for dealership should provide the proof of nationality, must have owned or rental storage facility with minimum capacity of 50 MT and proper maintenance facility. He should be financially solvent and will provide the proof of solvency from local bank of minimum Tk. 5 lakh. The applicant should also have trade license from respective union parishad (UP) or municipality, city corporation. Most importantly, the applicant cannot have previous record of cancellation of the dealership. To ensure smooth availability of fertilisers, the government has also set up fertiliser and seed monitoring committees at the upazila and district level, with representation from all stakeholders. The committee will sort out the applications and will send those to district fertiliser and seed monitoring committee, which will send its final proposal to Bangladesh Chemical Industries Corporation (BCIC).

Responsibility of the district committee will include dealer appointment, monitoring of all affairs related to efficient fertiliser distribution, fixation of retail price of fertiliser for each upazila, etc. On the other hand, responsibilities of upazila fertiliser and seed monitoring committee include sorting out application of dealer, preparing proposal for for appointment of dealers, estimation of fertiliser demand for the respective union or municipality, ensuring proper distribution of fertiliser to the farmers at proper price, providing ID card to the dealers, appointing one tag officer for monitoring the fertiliser distribution programme, preparing weekly report on storage and supply of fertiliser in the union and sending it to the district monitoring committee, etc. There will also be another committee for appointing and issueing ID to the retailers. Number of the retailers will be limited from five to nine for each union. Dealer will maintain a detail list of retailers including amount and date of purchase. The policy emphasises the fact that the farmers can purchase fertiliser both from dealers and retailers. District representative of BCIC will have the power to cancel the dealership through district fertiliser and seed monitoring committee if any discrepancy found.

A review of five major dailies revealed that there was no report on availability problem of fertiliser in November and December 2009. However, there were complains about adulterate and low quality fertilisers being sold in some places like Kurigram, Gaibandha (Fulchhari). Also there were some incidences of smuggling of low quality fertilisers through Raomari, Fulbari and Bhurungabari upazila under Kurigram district.

4.3 Crop Husbandry Practices and Technology Dissemination

Efficiency of water used for irrigation is low in Bangladesh. Scientists have already proved that adoption of Alternate Wet and Dry (AWD) irrigation technology for Boro rice cultivation can save 25 per cent irrigation water, and also save energy (electricity, diesel) without reducing the yield level. Therefore, special efforts should be made to promote AWD instead of current practice of constant irrigation with standing water in the field. This technology was widely published last year by media as “magic pipe.” It is expected that farmers in many areas will take advantage of the better irrigation technique. Even so, special efforts will be required by the DAE and media to promote it further in FY2009-10. This will reduce per unit production cost of rice. Introduction of System of Rice Intensification (SRI) has also the potentiality for reduction in cost and increase in yield. Special efforts should be made to promote SRI technology. Use of information and communication technology (ICT) and electronic media for dissemination of agricultural technologies should be promoted. Mobile phone-based extension services have already been introduced. It needs to be strengthened. For efficient utilisation of urea fertilisers, leaf colour charts (LCC) have been introduced. Promotional campaign will be needed for optimum utilisation of these initiatives.

4.4 Irrigation

Irrigation is a major challenge for farmers growing crops in the dry season. Majority of the farmers purchase water from pump-owners. Three modes of payment for water charge are currently in place. These are crop sharing arrangement, fixed charge on per acre basis, and machine rental system where the farmers directly supply diesel. The fixed water charge has increased to Tk. 2,000 to Tk. 2,500 per bigha for Boro paddy, from Tk. 1,200 to Tk. 1,500 a few years ago. The water charge is paid in installments and must be paid fully by the time of

flowering of the plant. In case of crop sharing arrangement, currently one-fourth of the produce is paid to the shallow tube-well owner, and the crop is shared in the field at the time of the harvest. Two types of engines – electricity-operated and diesel-driven – are used for irrigation in Bangladesh. About three-fourth of the total irrigated area is under diesel-operated, while rest of the area is under electricity-operated engines. Irrigation cost for diesel-driven engines are higher than electricity-operated engines. Electricity-operated engines used to enjoy 20 per cent subsidy for irrigation pumps. The high cost for diesel-driven irrigation is a concern for both the pump-owners and Boro farmers. In these circumstances, the recent announcement to provide subsidy for diesel for irrigation to the tune of Tk. 350 crore to nine million Boro farmers is a welcome measure.

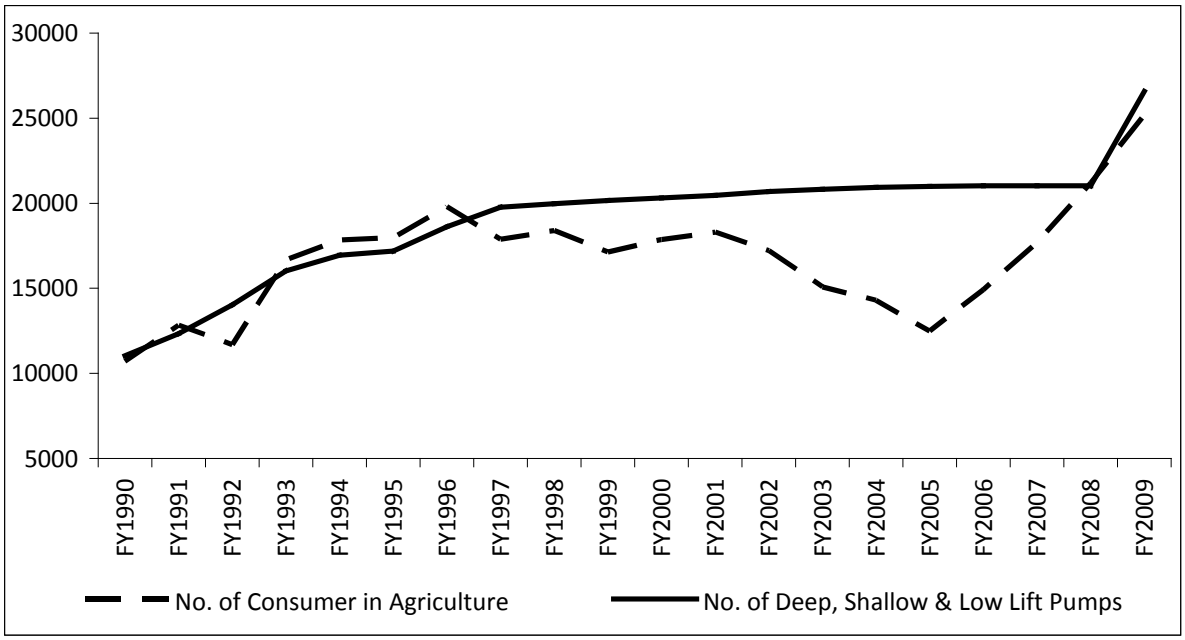
Given that more than 70 per cent of the total irrigation in Bangladesh depends on diesel-driven engines. It is pertinent to mention here that irrigation cost in Bangladesh is two to three times higher than in India, Thailand and Vietnam, have the scope to irrigate through subsidised electricity and large-scale irrigation project.

4.4.1 Electricity for Irrigation

Generally, farmers experienced a shortfall of electricity supply in the Boro season. During the last two years (FY2007-08 and FY2008-09), the government paid special attention to the supply of electricity to irrigation pumps. As a result, electricity consumption for agricultural irrigation during November-March FY2008-09 was 764.08 mkwh (PDB and REB), which was substantially higher than the comparable months of previous years. The government subsidy on account of electricity for irrigation was about Tk. 75 crore in FY2007-08. In FY2009-10, government decided to continue the subsidy on electricity for irrigation at the same rate. A similar support along with ensuring uninterrupted supply of electricity will be needed for another bumper Boro production. The government has already committed for supplying adequate electricity for irrigation pumps in the current Boro season. According to the MoA and DAE, about 15.54 lakh irrigation pumps (comprising of 0.32 lakh deep tube-wells, 13.75 lakh shallow tube-wells, and 1.45 lakh low lift pumps) will be used this season, of which 2.5 lakh (0.29 lakh deep and 2.14 lakh shallow tube-wells, and 0.10 lakh low lift pumps) will be run by electricity. So, 1,000 mega watt (MW) of extra electricity will be needed for the purpose. The government has already directed the Bangladesh Power Development Board (BPDB) to ensure 1,664 MW electricity supply to Rural Electrification Board (REB) to run the electricity-driven pumps during the Boro season (The Financial Express, 3 December 2009).

Both the numbers of irrigation pump users and electricity-operated pumps under the BPDB have increased over time (Figure 14). In FY2008-09, number of electricity consumers for agriculture was 25,175; and 32,407 pumps were operated through electricity.

Figure 14: Trends in Electricity Users in Agriculture



Source: BPDB (2009).
Note: Data for PDB excludes West Zone Power Distribution Company Ltd. (WZPDCL); Rural Electrification Board (REB); Dhaka Power Distribution Company (DPDC); and Dhaka Electric Supply Company Ltd. (DESCO).

An analysis of irrigated area data of FY2008-09 Rabi season revealed that total area under electricity-operated engines in Bangladesh was 15.1 lakh ha (i.e. 30.2 per cent of total irrigated area under modern method). There was differential distribution of irrigated area under electricity (Figures 15 - 17). In FY2007-08 Rabi Season, area irrigated under electricity in the Dhaka district was 16,935 ha (43.6 per cent of the irrigated area of the district); Chittagong district 21,964 ha (44.6 per cent of the irrigated area of the district); Rajshahi district 93,253 ha (50.2 per cent of the irrigated area of the district), Comilla district 97,053 ha (60.0 per cent of the irrigated area of the district); and Narayanganj district 10,004 ha (65.0 per cent of the irrigated area of the district). Considering this reality, it is suggested that the decision taken by the concerned authority in FY2007-08 as regards closure of shops after 8:00 pm may also be implemented this year. Priority could be given to those districts where absolute area and relative share is high.

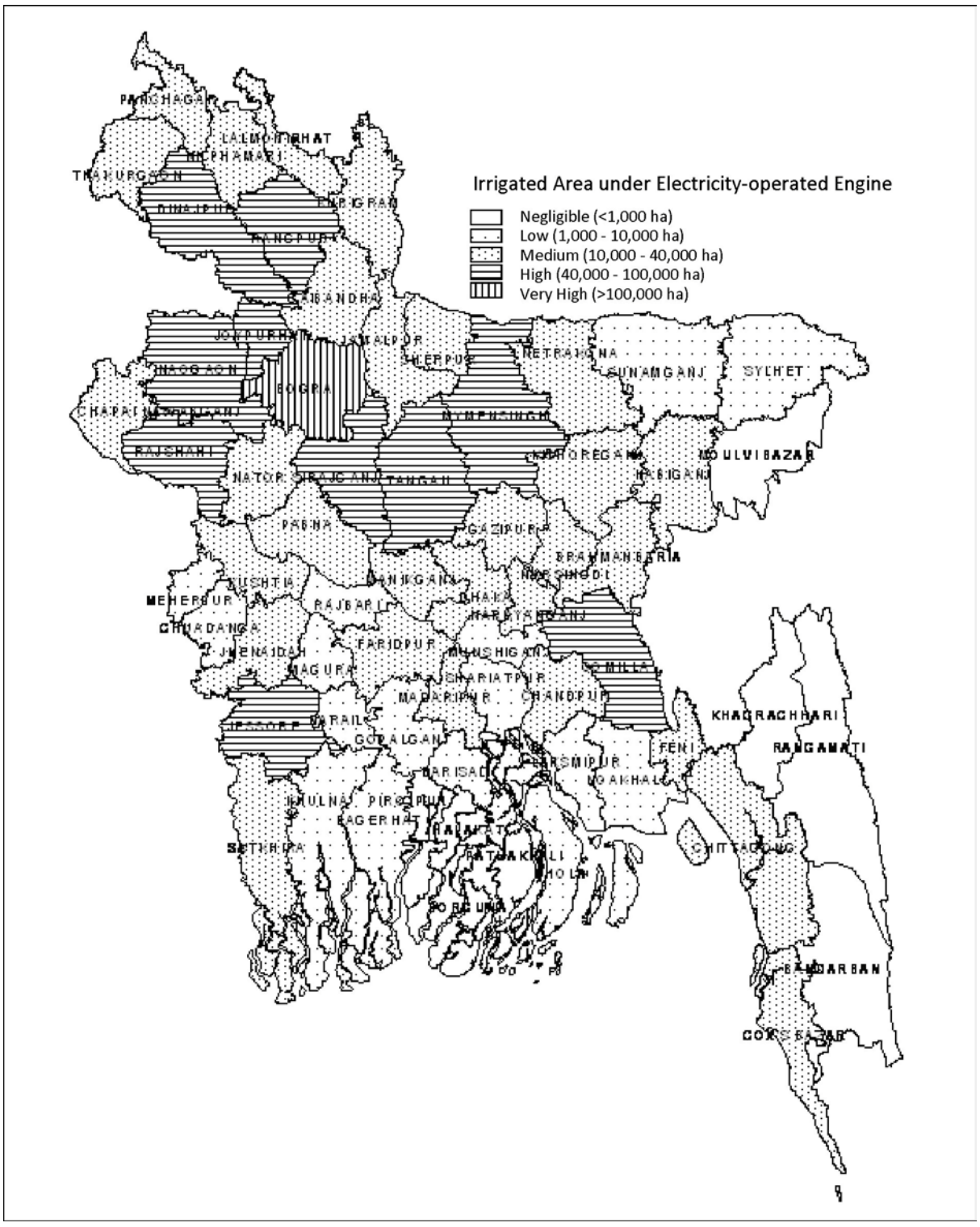
An analysis of distribution of irrigated area under electricity in FY2008-09 revealed that in two districts (Jhalokati and Patuakhali), there is no electricity-operated engines (Figure 15). Six districts (Bandarban, Barguna, Khagrachhari, Moulovibazar, Pirojpur and Rangamati) have negligible (<1,000 ha) area under electricity-operated irrigation system; 16 districts (Bagerhat, Barisal, Bhola, Chuadanga, Gopalganj, Khulna, Lakshmipur, Magura, Meherpur, Munshiganj, Narail, Noakhali, Rajbari, Shariatpur, Sunamganj and Sylhet) have low (1,000 - 10,000 ha) area under electricity-operation, 29 districts (Brahmanbaria, Chandpur, Chittagong, Cox's Bazar, Dhaka, Faridpur, Feni, Gaibandha, Gazipur, Habiganj, Jamalpur, Jhenaidaha, Kishoreganj, Kurigram, Kushtia, Lalmonirhat, Madaripur, Manikganj, Narayanganj, Narsingdi, Natore, Nawabganj, Netrokona, Nilphamari, Pabna, Panchagarh, Satkhira, Sherpur and Thakurgaon) have medium area (10,000-40,000 ha) under electricity-operated engines; and 10 districts have high area (40,000 - 100,000 ha) under irrigation (Comilla, Dinajpur, Jessore, Joypurhat, Mymensingh, Naogaon, Rajshahi, Rangpur, Sirajganj

and Tangail). Only one district (Bogra) has very high area (>100,000 ha) under electricity-operated irrigation.

In terms of percentage of irrigated area under electricity in FY2008-09, two districts (Jhalokati and Patuakhali) do not have any electricity-operated engines (Figure 16). Seven districts (Bagerhat, Barguna, Moulovibazar, Pirojpur, Rangamati, Sunamganj and Sylhet) have negligible (0-5 per cent) area under electricity-operated engines; 18 districts (Bandarban, Barisal, Bhola, Chuadanga, Faridpur, Gopalganj, Jhenaidaha, Khagrachhari, Khulna, Kushtia, Lalmonirhat, Magura, Meherpur, Narail, Natore, Noakhali, Rajbari and Satkhira) have low (5-20 per cent) area under electricity-operated engines. 25 districts (Bogra, Brahmanbaria, Cox's Bazar, Dinajpur, Gaibandha, Gazipur, Habiganj, Jamalpur, Jessore, Kishoreganj, Kurigram, Lakshmipur, Madaripur, Manikganj, Munshiganj, Mymensingh, Netrokona, Nilphamari, Pabna, Panchagarh, Rangpur, Shariatpur, Sherpur, Sirajganj and Thakurgaon) have medium (20-40 per cent) area under electricity-operated irrigation; and 12 districts (Chandpur, Chittagong, Comilla, Dhaka, Feni, Joypurhat, Naogaon, Narayanganj, Narsingdi, Nawabganj, Rajshahi and Tangail) have high (>40 per cent) area under electricity- operated irrigation system.

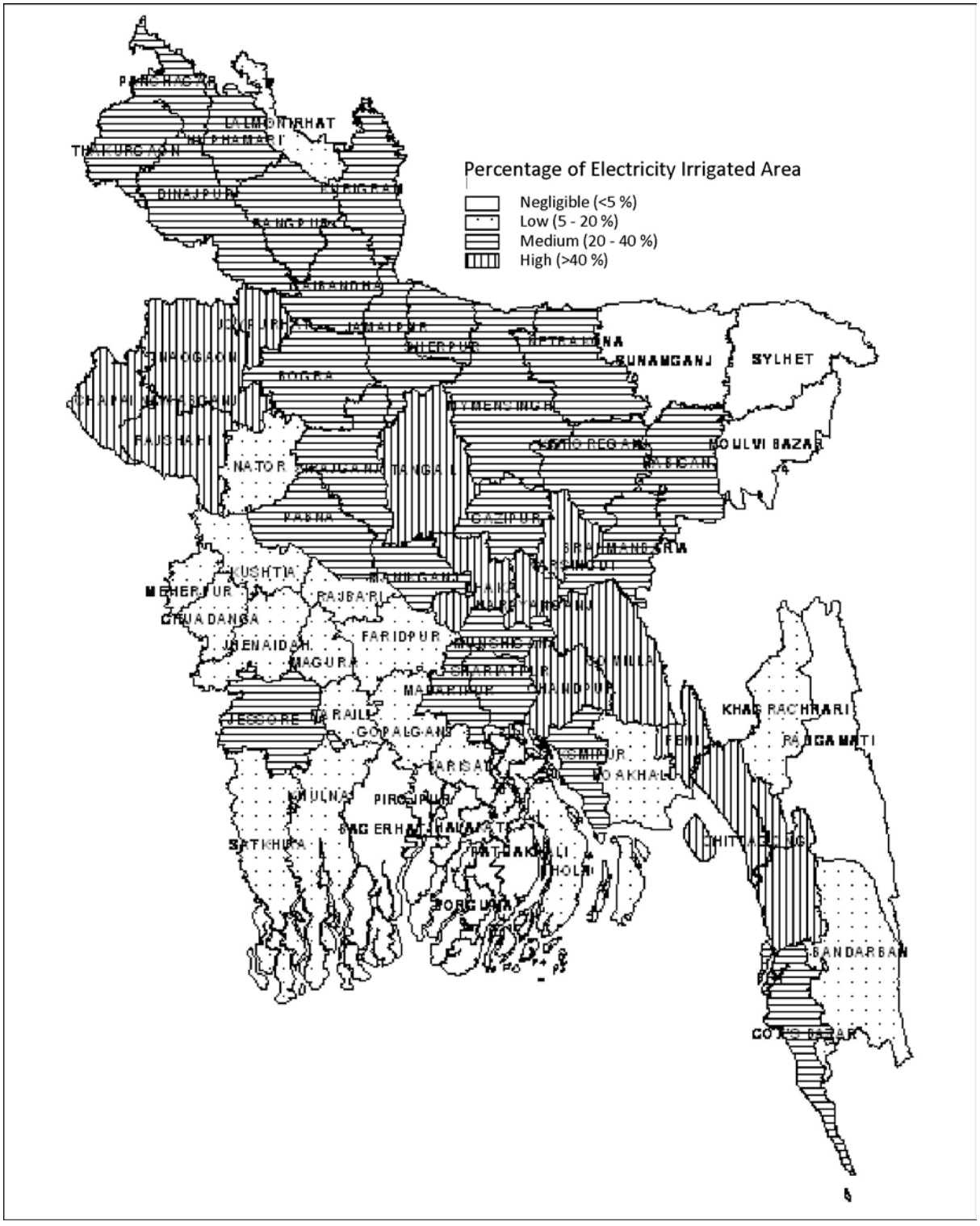
Upazila level analysis of electricity-operated irrigation system is presented in Figures 17 and 18; and Annex Tables 2 and 3. MoA, particularly those who are responsible to monitor electricity supply situation, could find these useful. Based on the level of electricity-operated irrigation system and relative dependence on electricity for irrigation, all upazilas were grouped into five categories: (i) no electricity-operated irrigation; (ii) negligible; (iii) low; (iv) medium; (v) high and (vi) very high. The Committee may look into the electricity supply situation in the upazilas under medium, high and very high category.

Figure 15: District-wise Irrigated Area under Electricity-operated Engines in the Rabi Season: FY2008-09



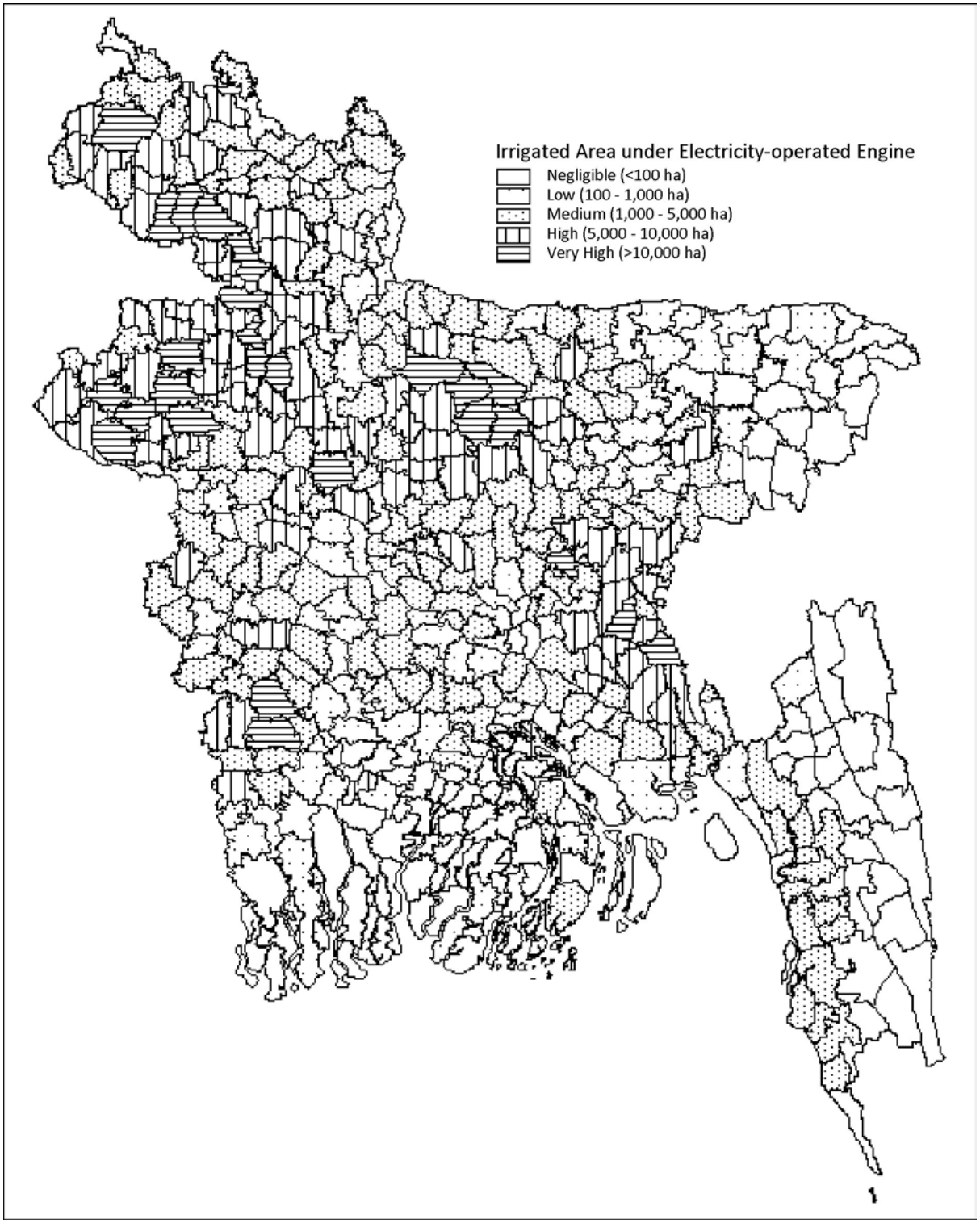
Source: Prepared by CPD, based on data from Minor Irrigation Survey Report 2008-09.

Figure 16: District-wise Share of Irrigated Area under Electricity-operated Engines in the Rabi Season: FY2008-09



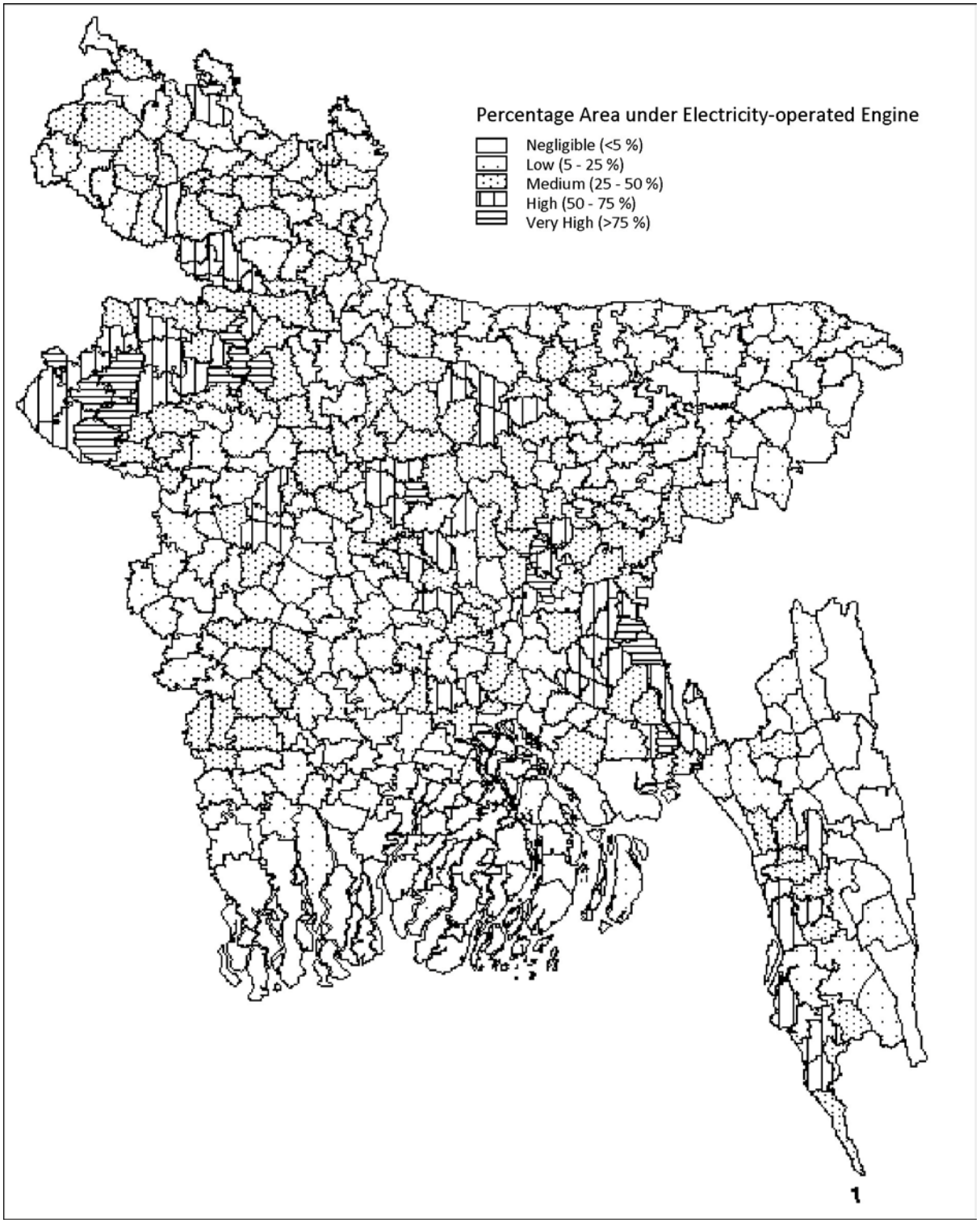
Source: Prepared by CPD, based on data from Minor Irrigation Survey Report 2008-09.

Figure 17: Upazila-wise Irrigated Area under Electricity-operated Engines in the Rabi Season: FY2008-09



Source: Prepared by CPD, based on data from Minor Irrigation Survey Report 2008-09.

Figure 18: Upazila-wise Percentage of Irrigated Area under Electricity-operated Engines in the Rabi Season: FY2008-09



Source: Prepared by CPD, based on data from Minor Irrigation Survey Report 2008-09.

4.4.2 Diesel Subsidy for Irrigation

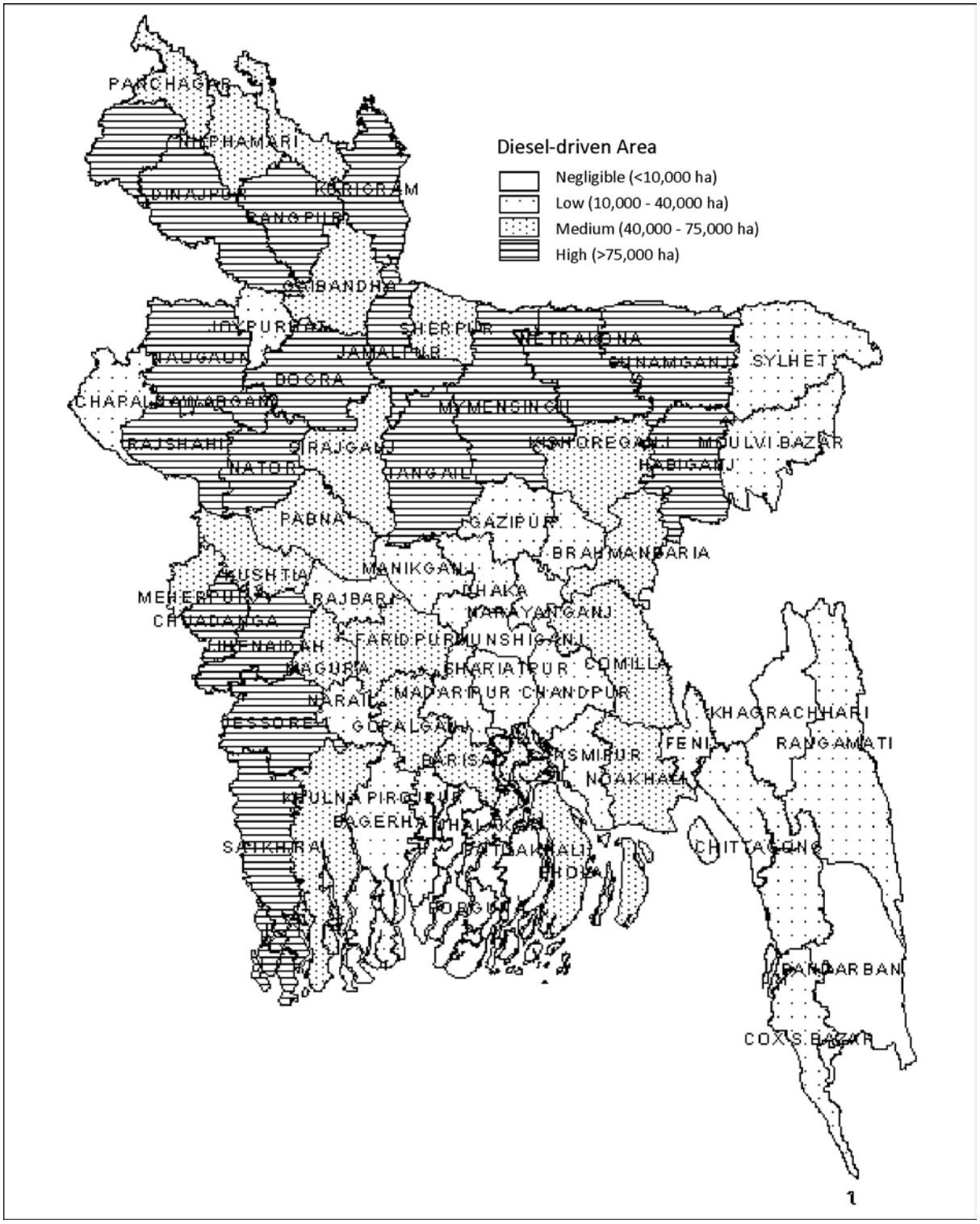
The government has declared to provide Tk. 350 crore as diesel subsidy for irrigation to nine million small and marginal farmers. Small and marginal farmers will get the direct subsidy on diesel for the irrigation of maximum 3 bighas of land for the ongoing Boro season (upto Tk. 500). Farmers will receive the subsidy through their Agricultural Input Distribution Card. This is a welcome move considering the high cost of irrigation in Bangladesh.

District and upazila level analysis of diesel-driven irrigation system (Figures 19-22; Annex Tables 4 and 5) reveal that, based on the level of usage, all upazilas can be grouped into five categories: (i) negligible; (ii) low; (iii) medium; (iv) high; and (v) very high. The MoA may look into the diesel supply situation in the upazilas under medium, high and very high category.

An analysis of distribution of irrigated area under diesel-driven system in FY2008-09 revealed that seven districts (Bandarban, Barguna, Jhalokati, Khagrachhari, Munshiganj, Narayanganj and Patuakhali) have negligible (<10,000 ha) area; 20 districts (Bagerhat, Chandpur, Chittagong, Cox's Bazar, Dhaka, Feni, Gazipur, Joypurhat, Lakshmipur, Madaripur, Manikganj, Moulovibazar, Narail, Narsingdi, Nawabganj, Pirojpur, Rajbari, Rangamati, Shariatpur and Sylhet) have low area (10,000 - 40,000 ha); 19 districts (Barisal, Bhola, Brahmanbaria, Comilla, Faridpur, Gaibandha, Gopalganj, Khulna, Kishoreganj, Kushtia, Lalmonirhat, Magura, Meherpur, Nilphamari, Noakhali, Pabna, Panchagarh, Sherpur and Sirajganj) have high area (40,000 - 75,000 ha) under irrigation (Figure 19). The rest 18 districts (Bogra, Chuadanga, Dinajpur, Habiganj, Jamalpur, Jessore, Jhenaidaha, Kurigram, Mymensingh, Naogaon, Natore, Netrokona, Rajshahi, Rangpur, Satkhira, Sunamganj, Tangail and Thakurgaon) have very high area (>75,000 ha) under diesel-irrigated system.

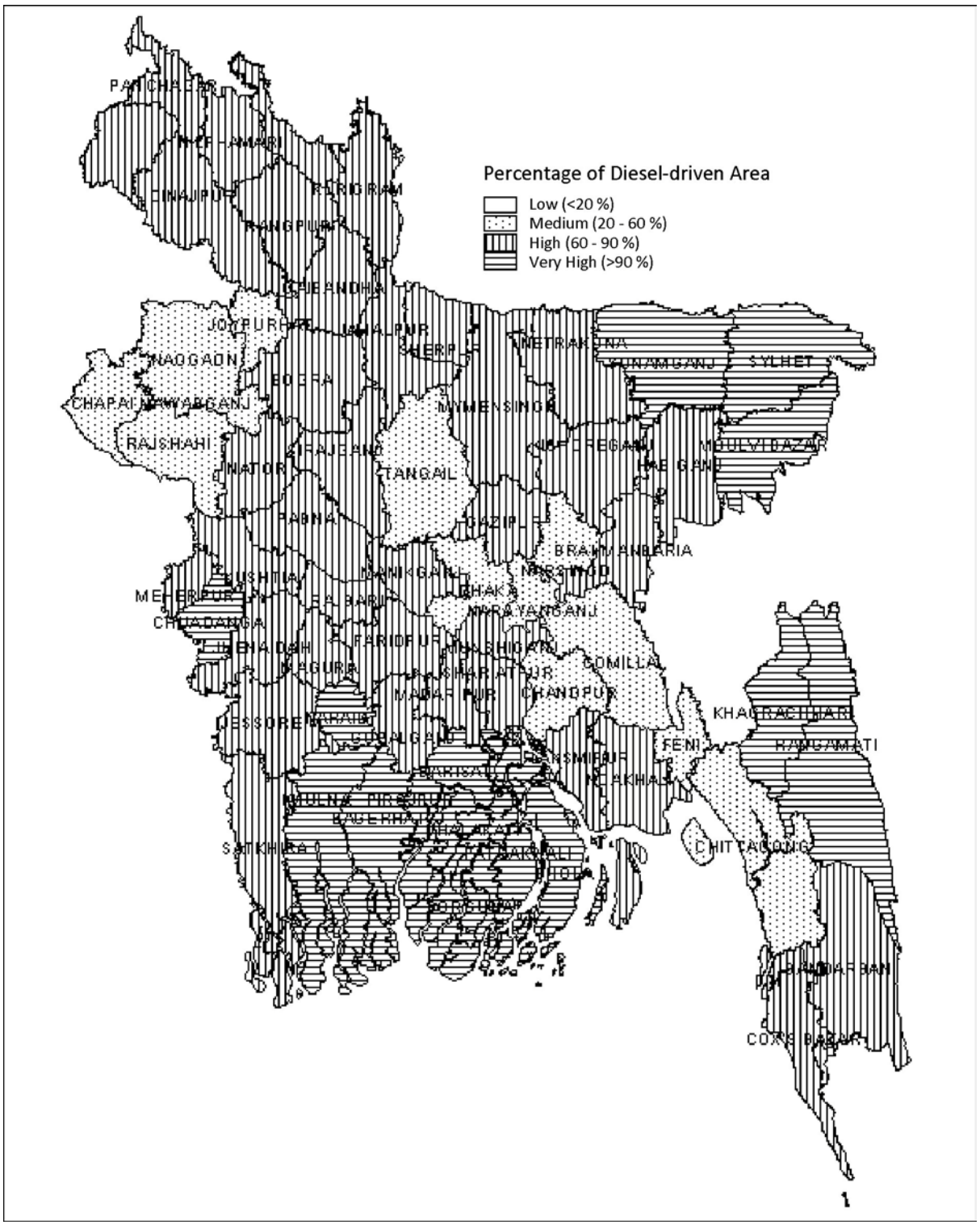
In case of percentage of irrigated area under diesel in FY2008-09, no districts were found under low (<20 per cent) category of diesel-operated engines (Figure 20). 12 districts (Chandpur, Chittagong, Comilla, Dhaka, Feni, Joypurhat, Naogaon, Narayanganj, Narsingdi, Nawabganj, Rajshahi and Tangail) have medium (20-60 per cent) area under diesel-driven engines; 37 districts (Bandarban, Gopalganj, Meherpur, Satkhira, Rajbari, Kushtia, Lalmonirhat, Faridpur, Jhenaidaha, Natore, Noakhali, Magura, Kurigram, Kishoreganj, Munshiganj, Jamalpur, Habiganj, Panchagarh, Netrokona, Shariatpur, Thakurgaon, Sherpur, Lakshmipur, Jessore, Rangpur, Gaibandha, Pabna, Brahmanbaria, Manikganj, Sirajganj, Cox's Bazar, Gazipur, Nilphamari, Mymensingh, Bogra, Dinajpur and Madaripur) have high (60-90 per cent) area under diesel-driven engines. 15 districts (Jhalokati, Patuakhali, Rangamati, Pirojpur, Barguna, Sunamganj, Moulovibazar, Bagerhat, Sylhet, Chuadanga, Barisal, Narail, Bhola, Khulna and Khagrachhari) have very high (>90 per cent) area under diesel-driven irrigation system.

Figure 19: District-wise Irrigated Area under Diesel-driven Engines in the Rabi Season: FY2008-09



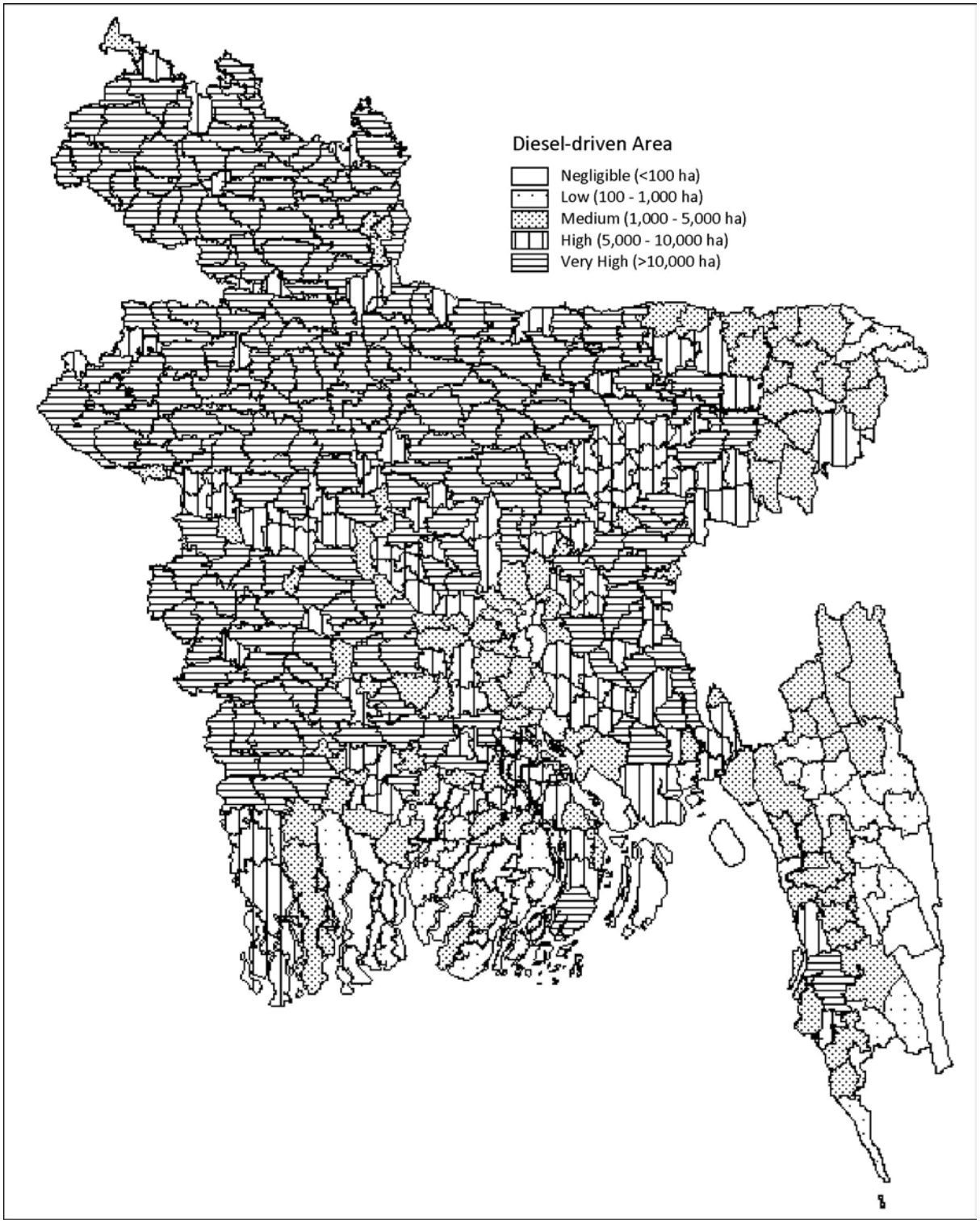
Source: Prepared by CPD, based on data from Minor Irrigation Survey Report 2008-09.

Figure 20: District-wise Percentage of Irrigated Area under Diesel-driven Engines in the Rabi Season: FY2008-09



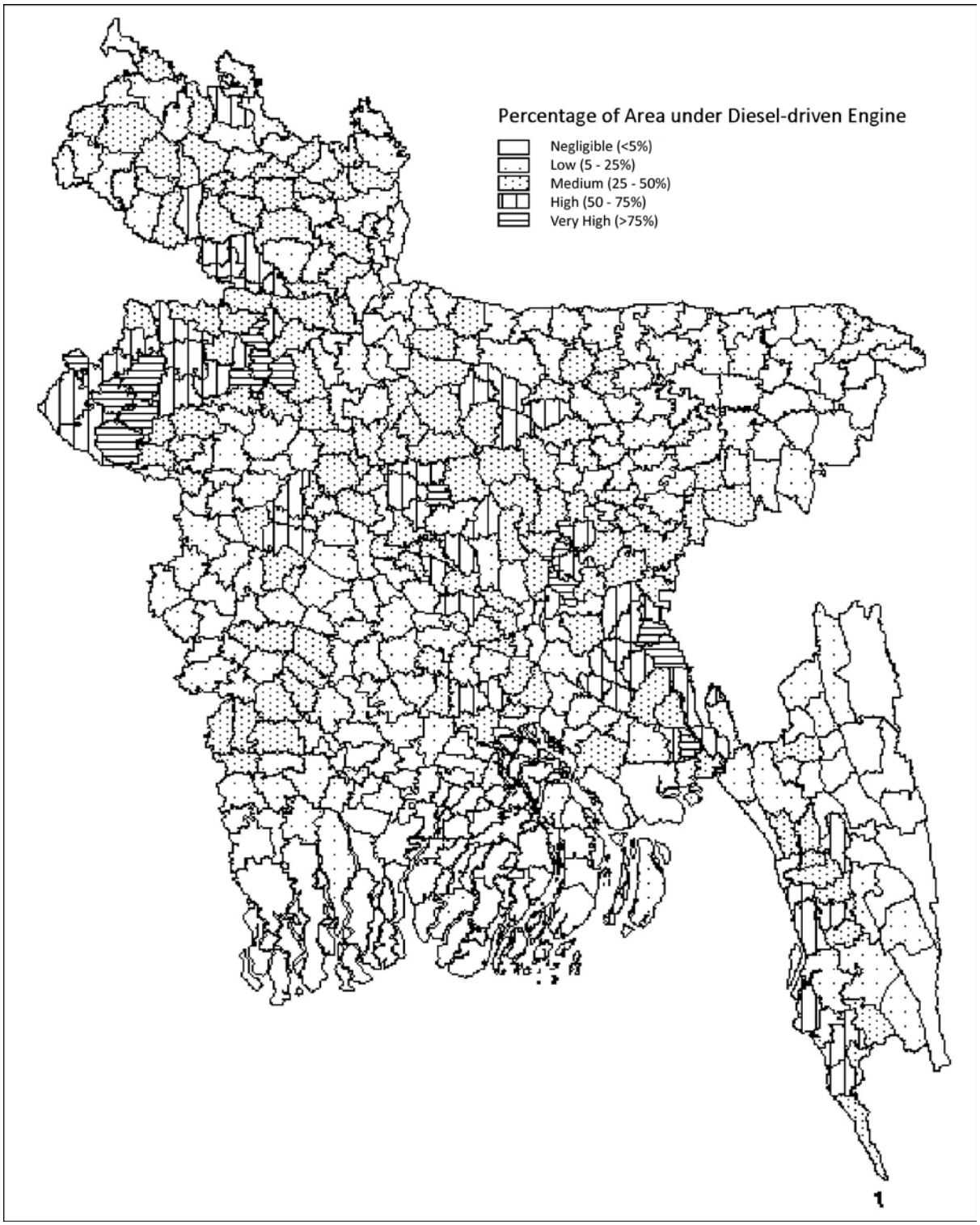
Source: Prepared by CPD, based on data from Minor Irrigation Survey Report 2008-09.

Figure 21: Upazila-wise Irrigated Area under Diesel-driven Engines in the Rabi Season: FY2008-09



Source: Prepared by CPD, based on data from Minor Irrigation Survey Report 2008-09.

Figure 22: Upazila-wise Percentage of Irrigated Area under Diesel-driven Engines in the Rabi Season: FY2008-09



Source: Prepared by CPD, based on data from Minor Irrigation Survey Report 2008-09.

4.4.3 Implementation Status of Irrigation Projects

The Ministry of Finance (MoF) has allocated Tk. 4,000 crore for development of irrigation and drainage projects in the country. These are being implemented by different organisations such as Bangladesh Water Development Board (BWDB), BMDA, BADC, Local Government Engineering Department (LGED), and Rural Development Academy (RDA). A review of the implementation status of these projects during July - November 2009 revealed that implementation rate ranged between no starters (0 per cent) to full implementation (100 per cent) (Table 11). Expedition in implementation is required.

Table 11: Implementation Status of Irrigation Projects: FY2009-10

(in Lakh Tk.)

Project Name	Implementing Agency	Allocation for FY2009-10	Expenditure during July-November 2009	Expenditure as % of Allocation
Mihuri-Kahua Flood Control, Drainage and Irrigation Project	BWDB	600.00	145.00	24.17
Matamuhuri Irrigation Project (Phase-II) (1st Revised)	BWDB	2500.00	362.00	14.48
South Comilla-North Noakhali Integrated Drainage and Irrigation Project	BWDB	1000.00	0.00	0.00
Southwest Area Integrated Water Resources Planning and Management Project	BWDB	2500.00	126.00	5.04
Kurigram Irrigation Projects (North Unit)	BWDB	425.00	45.00	10.59
Kurigram Irrigation Projects (South Unit)	BWDB	600.00	56.00	9.33
Expansion of Activities of Chowddamadar Beel Embankment and Khal Excavation Project	BWDB	150.00	16.00	10.67
Teesta Barrage Project (2nd Phase)	BWDB	4000.00	651.00	16.28
Protection of Chandpur Irrigation Project from the Erosion of Meghna River (1st Revised)	BWDB	1200.00	300.00	25.00
Extension of Mohamaya Chhara Irrigation Project under Mirsharai upazila in Chittagong	BWDB	1000.00	0.00	0.00
Dhepa-Punorbhaba Water Management under Biral upazila in Dinajpur	BWDB	500.00	0.00	0.00
Barind Rain Water Conservation and Irrigation Project	BMDA*	2075.00	524.19	25.26
Deep Tubewell Installation Programme (Unit 2), Thakurgaon	BMDA*	481.00	358.10	74.45
Barind Integrated Area Development Project (Phase-III) (1st Revised)	BMDA*	5000.00	3459.95	69.20
Command Area Development and Training Project (2nd Phase)	BMDA*	4000.00	1082.19	27.05
Activiting Inoperable Deep Tubewells for Irrigation	BMDA*	4000.00	1221.16	30.53
Smart Card Base Prepaid Pump Usage and Energy Measuring System	BMDA*	1335.00	275.35	20.63
Greater Barisal-Patuakhali Integrated Agriculture Development Project	BADC	241.00	241.00	100.00

(Table 11 contd.)

(Table 11 contd.)

Project Name	Implementing Agency	Allocation for FY2009-10	Expenditure during July-November 2009	Expenditure as % of Allocation
Pilot Project for Agricultureal Production in Monga Prone Area through Modern Minor Irrigation	BADC	700.00	76.66	10.95
Ashuganj-Palash Irrigation Project (4th Phase)	BADC	500.00	250.00	50.00
Second Small Scale Water Resources Development Sector Project	LGED	2868.26	2376.85	82.87
Rehabilition and Upgradation of Small Scale Water Resource Sub-sector	LGED	604.00	528.00	87.42
Small Scale Water Resources Development Project in Greater Mymensingh, Sylhet and Faridpur Areas	LGED	1625.92	1138.15	70.00
Action Research Project on Increasing Irrigated Area through Transferring RDH-model of Irrigation and Technology in Southern and Hill Districts of Bangladesh	RDA	426.00	n.a.	n.a.
Action Research Project on Command Area Development Using Surface Water for Rural Livelihood Improvement	RDA	467.00	n.a.	n.a.

Source: Respective institutes.
Note: *Expenditure during July-October 2009.

4.5 Agricultural Credit

Availability of working capital for agriculture is needed to ensure timely purchase of inputs. The government has given special emphasis for expansion of agricultural credit to the farmers. Private banks and NGOs have been engaged in distribution of agricultural credit. In the national budget for the FY2009-10, Tk. 11,512.30 crore for agricultural credit has been proposed which is 24.0 per cent higher than that of actual distribution in the FY2008-09. For the first time, Bangladesh Bank announced an allocation of Tk. 500 crore exclusively for the sharecroppers as agriculture credit during FY2009-10. This will be disbursed to the tenant farmers through BRAC. Government also mentioned a number of strategies in its Annual Agriculture/Rural Credit Policy and Programme for FY2009-10 to reach finance to the farmers through various local organisations. Through the agriculture policy the banks have been directed to give priority to the underdeveloped and neglected areas. The agricultural loan disbursement and recovery showed a hailing trend mainly due to Bangladesh Bank's strong move to encourage private commercial banks to provide such loans.

During July-November period, total disbursement of agricultural credit stood at Tk. 4,249.69 crore, which was 25.78 per cent (Tk. 3,378.56 crore) higher than the disbursement during the comparable period of FY2007-08 (Table 12). On June 2009, Bangladesh Bank issued a directive to all state-owned commercial banks (SCBs) to suspend agricultural loan recovery activities in the *Aila*-hit areas for next one year. However, the recovery of agricultural credit was substantially higher than the previous fiscal year, which stood at Tk. 4,049.09 crore during July-November of FY2009-10 as compared to Tk. 2,170.83 crore in the comparable

months of FY2008-09. Thus, in net terms, credit flow to the agriculture sector registered a significant rise both for inflow and recovery trends during this fiscal. The maximum rise took place for irrigation equipment, livestock and crop sub-sectors. During the same period, total disbursement of agricultural credit was 36.9 per cent of the total target for FY2009-10.

Table 12: Agricultural Credit Disbursement in FY2009-10

(in Crore taka)

Agriculture Credit	Disbursement FY2007-08	Disbursement FY2008-09	Disbursement (Jul-Nov FY2008-09)	Disbursement (July-Nov FY2009-10)	Growth of Disbursement in FY2009-10 as % of FY2008-09
Crop	2578.73	2084.17	1062.98	1452.65	36.66
Irrigation equipment	13.79	102.19	19.37	28.86	48.99
Agriculture equipment	34.03	107.16	26.20	28.48	8.70
Livestock	447.86	464.79	216.62	297.37	37.28
Fisheries	395.18	477.01	156.56	202.62	29.42
Grain storage and marketing	143.93	310.92	51.49	43.88	-14.78
Poverty alleviation	2262.97	1945.07	625.10	1008.19	61.28
Others	2704.17	2793.15	1220.24	1187.64	-2.67
Total disbursement	8580.66	9284.46	3378.56	4249.69	25.78
Recovery	6003.70	8377.62	2170.83	4049.09	86.52

Source: Bangladesh Bank.

As is known, private banks disbursed 59 per cent higher amount of agricultural loan during July-November in FY2009-10 compared to the same period of previous fiscal year. In spite of this remarkable success, there is report that small and marginal farmers have been facing problem to obtain loan since they are unable to submit proper documents to the banks (The Daily Star, 22 October 2009).

5. PROCUREMENT STRATEGY TO ENSURE BORO PRODUCTION

In general, farmers of Bangladesh are responsive to the prices, policies and technologies (Deb 2005; Hossain and Deb 2009). Considering low price of Boro rice immediately after the harvest in the last Boro season, farmers may have some reluctance for Boro cultivation. Government has already made some efforts through reduction in non-urea fertiliser prices, expansion of agricultural credit, and announecement of subsidy for irrigation diesel. In addition to these measures, public procurement of rice may also be used to ensure Boro rice production in the current Boro season. Government needs to design its Boro procurement programme considering the following issues: (1) cost of Boro production; (2) adequate incentives for the Boro rice growers; (3) market price at the time of fixation of price; (4) consumers' interest as regards affordable price for rice; and (5) increased public stock of rice.

5.1 Projected Cost of Boro Production

Projected cost of production of Boro rice during the current Boro season is provided in Table 13.

Production cost per acre

- Per acre production cost of diesel-irrigated HYV Boro rice: Tk. 28,208
- Per acre production cost of electricity- irrigated HYV Boro rice: Tk. 25,058
- Per acre production cost of diesel-irrigated Hybrid Boro rice: Tk. 31,015
- Per acre production cost of electricity- irrigated Hybrid Boro rice: Tk. 27,865

Production cost per kg

- Per kg production cost of diesel-irrigated HYV Boro paddy: Tk. 11.75
- Per kg production cost of electricity- irrigated HYV Boro paddy: Tk. 10.44
- Per kg production cost of diesel-irrigated Hybrid Boro paddy: Tk. 11.49
- Per kg production cost of electricity- irrigated Hybrid Boro paddy: Tk. 10.32
- Per kg production cost of diesel-irrigated HYV Boro rice: Tk. 18.72
- Per kg production cost of electricity- irrigated HYV Boro rice: Tk. 16.73
- Per kg production cost of diesel-irrigated Hybrid Boro rice: Tk.18.31
- Per kg production cost of electricity- irrigated Hybrid Boro rice: Tk. 16.55
- Weighted average production cost of Boro paddy: Tk. 11.43 per kg and Boro rice: Tk. 18.22 per kg

Table 13: Projected per Acre Production Cost of Boro Rice in Bangladesh during the April-June 2010 Harvesting Season

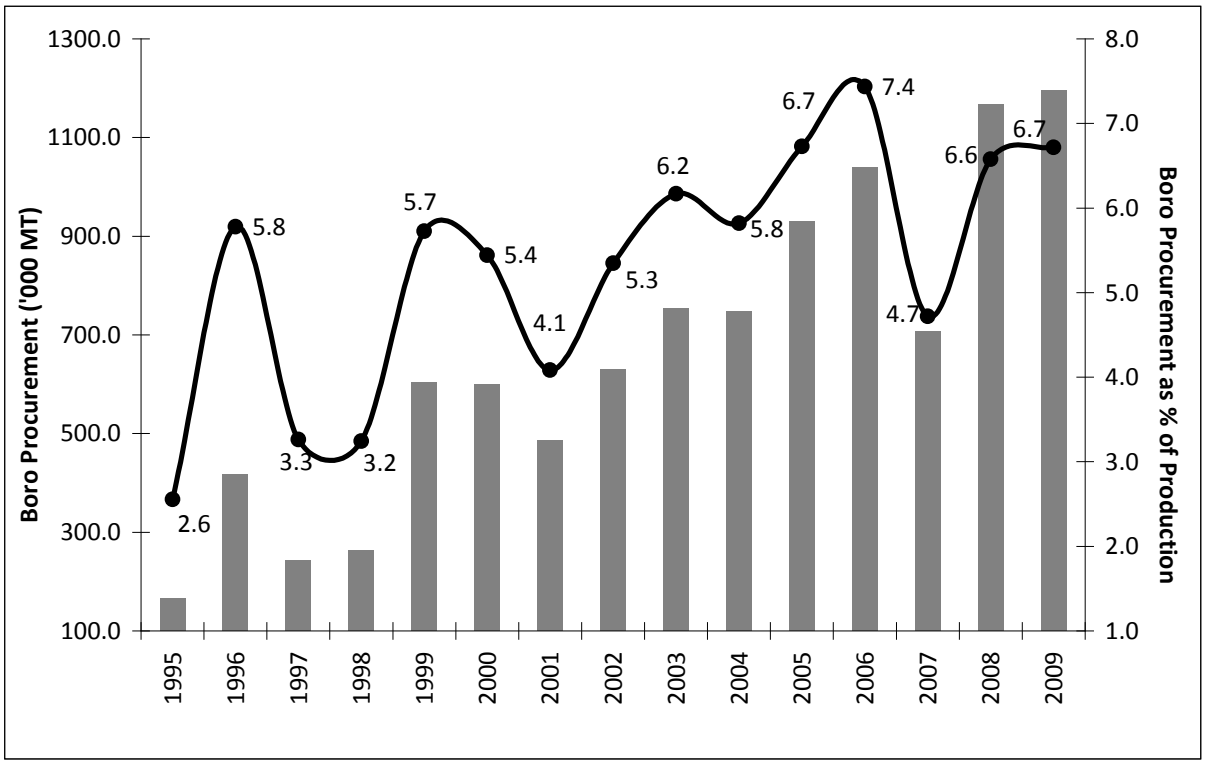
	Input Use	Unit	HYV Boro Rice (2009-10)				Hybrid Rice (2009-10)			
			Unit Price (Tk.)	Quantity per Acre	Diesel-irrigated (Tk.)	Electricity-operated (Tk.)	Unit Price (Tk.)	Quantity per Acre	Diesel-irrigated (Tk.)	Electricity operated (Tk.)
1	Seed	kg	25.00	25	625.00	625.00	200.00	6	1200.00	1200.00
2	Fertiliser	kg								
2.1	Urea		12.00	100	1200.00	1200.00	12.00	110	1320.00	1320.00
2.2	TSP		22.00	35	770.00	770.00	22.00	40	880.00	880.00
2.3	MoP		25.00	30	750.00	750.00	25.00	40	1000.00	1000.00
2.4	Gypsum (S)		6.00	22	132.00	132.00	6.00	25	150.00	150.00
2.6	Manure	Maund	1.75	200	350.00	350.00	1.75	200	350.00	350.00
3	Pesticide	Tk.			500.00	500.00			1000.00	1000.00
4	Human labour	Man-days	140.00	70	9800.00	9800.00	140.00	80	11200.00	11200.00
5	Land cultivation (bullock/PT)	Tk.			2500.00	2500.00			2200.00	2200.00
6	Irrigation	Tk.			5000.00	2000.00			5000.00	2000.00
7	Interest on operating capital	Tk.			1081.35	931.35			1215.00	1065.00
8	Land rent	Tk.			5500.00	5500.00			5500.00	5500.00
9	Per acre total production cost	Tk.			28208.35	25058.35			31015.00	27865.00
10	Paddy productionper acre	kg		2400				2700		
11	Per kg production cost: Paddy	Tk			11.75	10.44			11.49	10.32
12	Rice (clean) production per acre	Tk			1584.00	1584.00			1782.00	1782.00
13	Milling cost (including parboiling)	Tk	0.60		1440.00	1440.00	0.60		1620.00	1620.00
14	Per kg production cost: Rice	Tk			18.72	16.73			18.31	16.55

Source: Author's estimation.
Note: Weighted average cost of production of Boro paddy: Tk. 11.43/kg and Boro rice: Tk. 18.22/kg.

5.2 Procurement Strategy

Trends in procurement of Boro rice during the last 15 years (1995-2009) is shown in Figure 23. It is evident from the figure that total Boro rice procured (in terms of rice equivalent) in 2006, 2007 and 2008 were 10.39 lakh MT, 7.06 lakh MT, and 11.68 lakh MT, respectively. In terms of Boro rice procured as per cent of total Boro production was 7.4 per cent, 4.7 per cent and 6.6 per cent, in 2006, 2007 and 2008, respectively. In 2009, amount of Boro rice procured by the government was 11.96 lakh MT, which was 6.7 per cent of production of Boro rice.

Figure 23: Government Internal Procurement of Boro Rice: 1995-2009



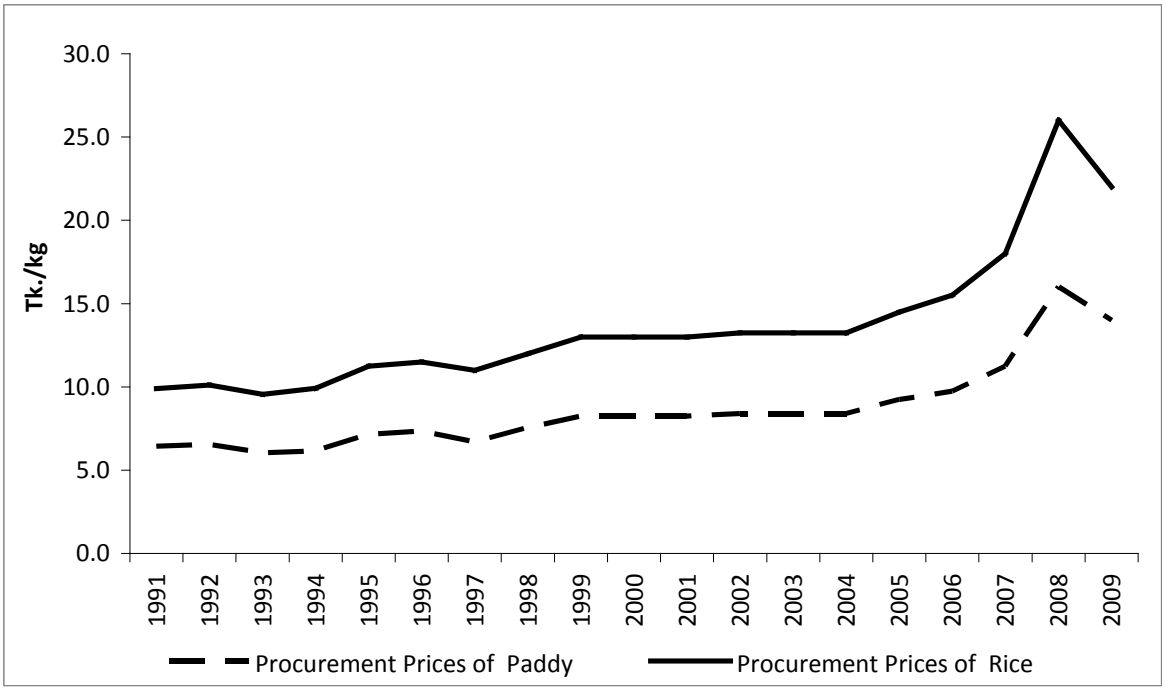
Source: Based on data collected from Food Planning and Monitoring Unit (FPMU), Ministry of Food and Disaster Management (MoFDM).

It is pertinent to mention here that procurement prices of both Boro paddy and Boro rice have been increased over time (Figure 24). Procurement price of Boro paddy has increased from Tk. 6.40 per kg in 1991 to Tk. 18.00 per kg in 2008. During this period, procurement price of Boro rice has increased from Tk. 9.90 per kg to Tk. 28.00 per kg. It may be noted here that 2008 was an exceptional year when international prices of rice crossed USD 1,000 per MT. In 2009, procurement price of Boro paddy and rice was fixed at Tk. 14 and Tk. 22 per kg, respectively.

To provide adequate incentive for production of Boro rice the government may now declare the procurement price of Boro rice. Considering the likely average cost of production of Boro paddy (Tk. 11.88 per kg) and Boro rice (Tk.18.84 per kg), procurement price for Boro

paddy (Tk. 15.00 per kg) and Boro rice (Tk. 25.00 per kg) may be declared to protect the farmers.

Figure 24: Procurement Prices of Boro Paddy and Rice in Bangladesh: 1991-2009



Source: Food Planning and Monitoring Unit (FPMU), Ministry of Food and Disaster Management (MoFDM).

It is always a great challenge to transmit the declared procurement price to the farmers. It is easy to procure from big rice mills to fulfill the target and minimise transaction cost, and overcome technical difficulties of procuring paddy directly from the farmers and managing afterwards. On the other hand if procured from the large auto-rice mills then farm-level prices often remain much lower than declared procurement prices. To overcome this problem following steps may be considered:

- Procure from the small rice millers who have limited financial, processing and storage capacity so that they are forced to supply immediately and buy more rice from the farmers.
- Farmers may be encouraged to set up rice mills by forming cooperatives. This will require special encouragement through financing and procurement from them.
- Encourage establishment of grain storage facilities at the union level through public private partnership (PPP) where farmers will be able to store their grains on rental basis. This will be helpful to reduce distressed sell if accompanied with loan facilities.

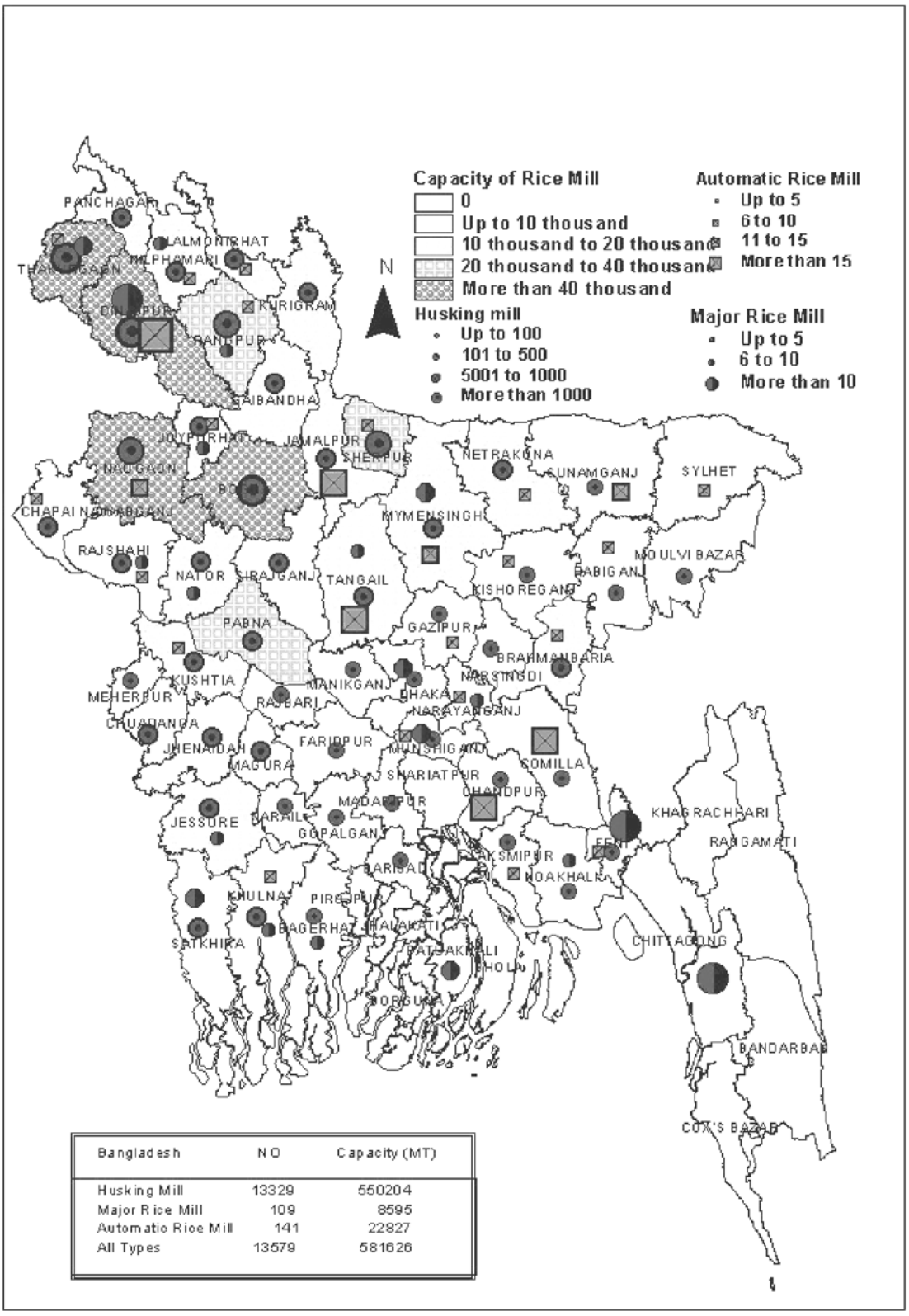
To achieve the targets of Boro rice procurement which areas should get priority? In 2007, the government procured Rice and Boro paddy equivalent to 7.06 lakh MT of clean rice from 42 districts. About 53 per cent of the procured Boro rice was from six districts (Dinajpur, Bogra, Thakurgaon, Naogaon, Rangpur and Joypurhat) while about 27 per cent of the total Boro rice procurement was from eight districts (Kurigram, Gaibandha, Sherpur, Natore,

Pabna, Mymensingh, Jamalpur and Netrokona). These districts may also be the major source of Boro procurement this year.

Procurement strategy needs to consider the rice milling capacity and the storage capacity of the government. Figure 25 shows the number and capacity of rice mills in Bangladesh. Total number of rice mills in Bangladesh is 13,579 with a total capacity of 5.8 lakh MT. Among the rice mills, 98 per cent are husking mills. Number of *major rice mills* is 109 and number of automatic rice mills is 141. Husking mills are more concentrated in Dinajpur, Bogra and Thakurgaon districts.

In case of grain storage facility, the government has 649 storage facilities with a total capacity of 17 lakh MT for rice and wheat (Figure 26). Out of these, 632 local storage depot (LSD) have the capacity to store 11 lakh MT while rest of the storage facilities are in central storage depot (CSD) and silo. About 28 per cent of the total storage capacity of LSD is in eight districts (Dinajpur, Bogra, Mymensingh, Naogaon, Patuakhali, Chittagong, Comilla and Sylhet).

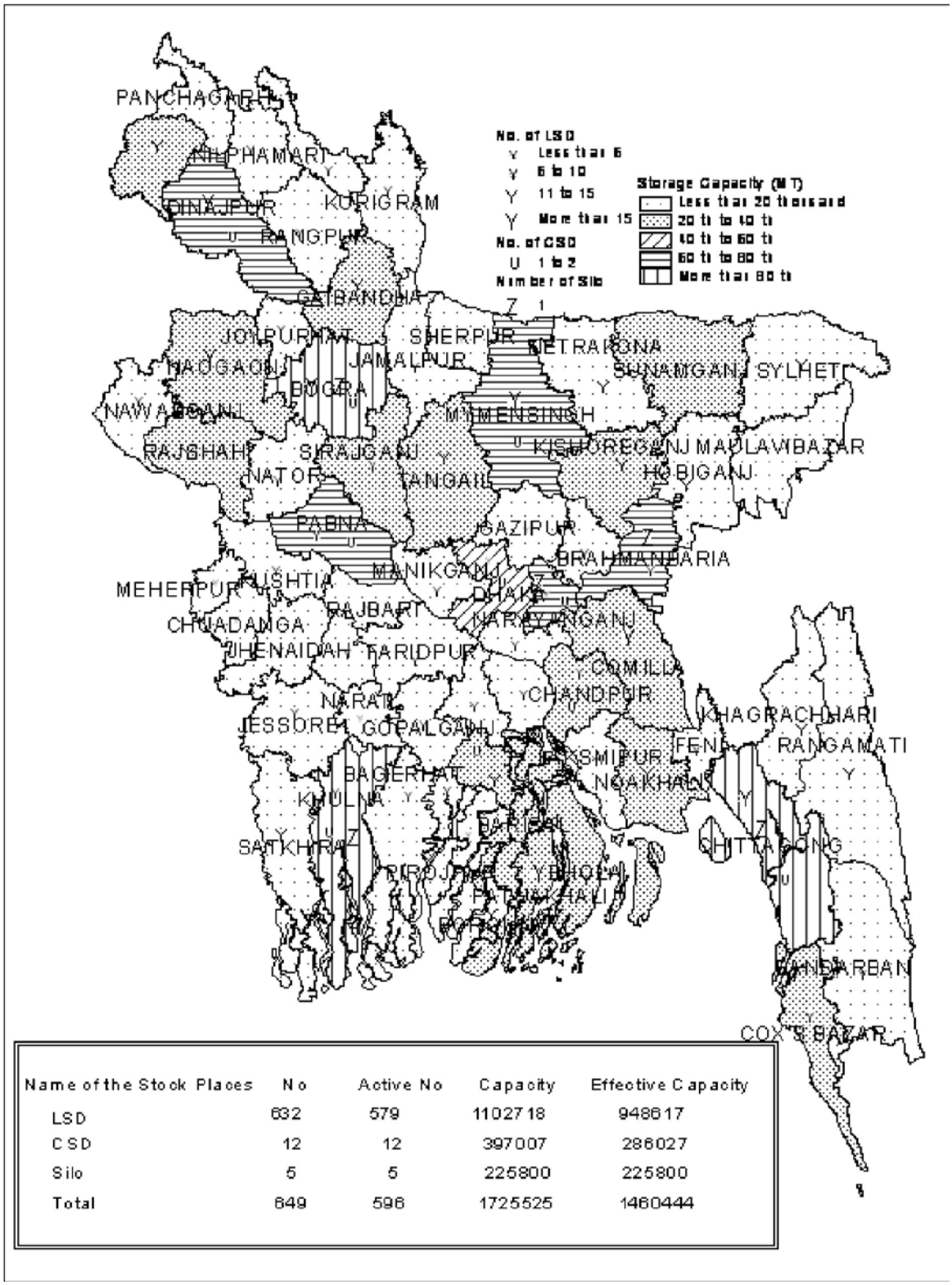
Figure 25: Number and Capacity of Rice Mills in Bangladesh



Bangladesh	NO	Capacity (MT)
Husking Mill	13329	550204
Major Rice Mill	109	8595
Automatic Rice Mill	141	22827
All Types	13579	581626

Source: Prepared by CPD, based on data collected from Directorate of Food.

Figure 26: Foodgrain Storage Capacity in Bangladesh: December 2009



Name of the Stock Places	No	Active No	Capacity	Effective Capacity
LSD	632	579	1102718	948617
CSD	12	12	397007	286027
Silo	5	5	225800	225800
Total	649	596	1725525	1460444

Source: Prepared by CPD, based on data collected from the Directorate of Food.

6. POLICY IMPLICATIONS

To achieve targeted Boro production in the current season, government has already taken many pragmatic steps. In addition to those steps, following additional measures will be helpful to attain the objective.

Seed supply

In view of the reports about seed scarcity in some areas, concerned agencies and committees should monitor the situation and ensure supply in the deficit areas. Progress of seed projects under ADP in FY2009-10 is noteworthy. Successful implementation will surely deliver desired results.

Fertiliser delivery

In case of fertilisers, farmers in some areas have been facing quality problem where adulterated and contaminated fertiliser s are sold. Concerned committee should monitor and take firm actions.

Electricity for irrigation and subsidy for diesel

Ensuring electricity and diesel supply for irrigation is another challenge for higher Boro production. To confirm uninterupted electricity supply, government has already declared steps. Faithful and timely implementation is expected. For diesel-driven pumps, timely disbursement of the declared subsidy will be required.

Procurement strategy

To keep up the spirit and endeavour of Boro farmers, government should give some indication that they are going to get fair price of their paddy. To do this, government should declare procurement price now. Considering the likely average cost of production of Boro paddy (Tk. 11.43 per kg) and Boro rice (Tk. 18.22 per kg), procurement price for Boro paddy (Tk. 15.00 per kg) and Boro rice (Tk. 25.00 per kg) may be declared to encourage the farmers. Any kind of delay in declaring procurement price, amount, and storing system might adversely affect the production. Government procurement centres can be established so that farmers can directly sell their product at these points. A decentralised storage chain among rural areas needs to be constructed immediately. Regarding this, construction of storehouses at union level through PPP can be a useful option. Government may consider procuring rice from small millers than large millers only. In addition, government should encourage farmers to set up rice mills as cooperatives.

Agricultural credit

To overcome the shortage of working capital in agricultural sector a well coordinated initiative has already been taken by the Bangladesh Bank. Specialised government banks along with involvement of the private sector banks and NGOs are now disbursing agricultural credit to farmers and tenants. Bangladesh Bank is monitoring the progress of

disbursement. A review of the special credit programme for tenants will be helpful for its expansion.

Others

Agricultural forecast system should be modernised and easily accessible to the farmers, so that they can take the best cultivation strategy for higher production. In this regard, government should revive Bangladesh Space Research and Remote Sensing Organization (SPARRSO) to get effective forecast support.

Protection against smuggling of agricultural inputs, especially fertiliser and diesel in neighbouring countries should be ensured.

Telecommunication and media can play important role in raising agricultural production through providing information on efficient use of seeds and fertiliser, time and technique of cultivation, procedure of irrigation, preventing diseases, and preventing huge harvest loss by catastrophic events through appropriate weather forecasting.

REFERENCES

ADB. 2009. *Bangladesh Quarterly Economic Update, September*. Dhaka: Asian Development Bank (ADB).

AIS. 2008. *Krishi Diary 2008*. Dhaka: Agricultural Information Service (AIS), Khamar Bari.

BADC. 2009. *Minor Irrigation Survey Report 2008-09*. Dhaka: Bangladesh Agricultural Development Corporation (BADC), Ministry of Agriculture (MoA).

BPDB. 2009. *Annual Report 2008-2009*. Dhaka: Bangladesh Power Development Board (BPDB).

BRRI. 2007. *Adhunik Dhaner Chash – 13th Edition* (in Bangla). Gazipur: Bangladesh Rice Research Institute (BRRI).

Chand, R. 2003. *Government Intervention in Foodgrain Markets in the New Context*. Policy Paper 19. New Delhi: National Centre for Agricultural Economics and Policy Research.

CPD. 2009. *State of the Bangladesh Economy in FY2008-09 and Outlook for FY2009-10*. Dhaka: Centre for Policy Dialogue (CPD).

Deb, U. 2005. *Agricultural Trade Liberalisation and Changes in Cropping Pattern in Bangladesh.* Keynote presented at the dialogue on "Impact of Agricultural Trade Liberalisation on Cropping Pattern in Bangladesh," organised by Centre for Policy Dialogue (CPD), 5 May, Dhaka.

Hossain, M., Janaiah, A., Husain, A.M.M. and Naher, F. 2002. *Rice Seed Delivery System and Seed Policy in Bangladesh.* CPD-IRRI Policy Brief 1. Dhaka: Centre for Policy Dialogue (CPD).

----. and Deb U. 2009. "Food Security and Containing Price Escalation: Facts and Implication for Policy." In *Development of Bangladesh with Equity and Justice: Immediate Tasks for the New Government*. Dhaka: Centre for Policy Dialogue (CPD).

Jha, S. and Srinivasan P.V. 1999. "Food Security through Price Stabilisation: Buffer Stocks vs Variable Levies." *Economic and Political Weekly*, 34 (46&47): 3299-3304.

Rahman, M., Iqbal, M.A., Khan,T.I. and Dasgupta, S. 2009. *Addressing the Impact of the Global Financial Crisis: Bangladesh Country Study*. Report submitted to the Overseas Development Institute (ODI).

----., Moazzem, K.G. and Hossain, S.S. *Impact of the Global Economic Crisis on the Employment and Labour Market of Bangladesh: A Rapid Assessment*. CPD Research Monograph Series (*Forthcoming*).

Annex Table 1: Total Irrigated Area under Modern Irrigation System: FY2008-09

Category	Name of the Upazilas
No modern irrigation	Narayanganj Sadar, Sandwip **(2 upazilas)**
Negligible (>500 ha)	Bamna, Barguna Sadar, Barkal, Belai Chhari, Betagi, Bhandaria, Dashmina, Galachipa, Kala Para, Kanthalia, Kawkhali, Manpura, Mirzaganj, Mongla, Patharghata, Patuakhali Sadar, Rajapur, Ramgati, Rowangchhari, Ruma, Sitakunda, Teknaf, Thanchi, Zakiganj **(24 Upazilas)**
Low (500 - 2000 ha)	Sreemangal, Companiganj, Boalia, Panchhari, Nanner Char, Companiganj, Gazaria, Mathbaria, Bakerganj, Bauphal, Dighinala, Sonagazi, Char Bhadrasan, Beani Bazar, Khagrachhari Sadar, Kutubdia, Alikadam, Bandar, Kawkhali, Betbunia, Naikhongchhari, Matiranga, Rangamati Sadar, Jurai Chhari, Fenchuganj, Pirojpur Sadar, Manikchhari, Haim Char, Ramgarh, Kaptai, Munshiganj Sadar, Bandarban Sadar, Jaintiapur, Lakshmichhari, Lohajang, Chittagong City, Rajasthali, AMTali, Khulna Sadar, Dacope, Kanaighat, Sarankhola **(41 upazilas)**
Medium (2000 - 10000 ha)	Akhaura, Akkelpur, Anowara, Araihazar, Assasuni, Atgharia, Atpara, Austagram, Babuganj, Bagati Para, Bagerhat Sadar, Baghai Chhari, Bahubal, Bajitpur, Balaganj, Banarpara, Banchharampur, Banshkhali, Barhatta, Barisal Sadar, Barlekha, Basail, Batiaghata, Belabo, Belkuchi, Bhairab, Bhanga, Bhedarganj, Bheramara, Bholahat, Bhuapur, Bishwambarpur, Bishwanath, Boalkhali, Brahman Para, Burichang, Chandanaish, Chandpur Sadar, Char Rajibpur, Charghat, Chatkhil, Chauhali, Chhagalnaiya, Chhatak, Chilmari, Chunarughat, Daganbhuiyan, Damudia, Daulatkhan, Daulatpur, Debhata, Dhaka City (Tejgaon), Dhobaura, Dighalia, Dohar, Dowarabazar, Durgapur, Fakirhat, Faridganj, Faridpur, Fatikchhari, Fulchhari, Gaurnadi, Ghior, Ghoraghat, Goalandaghat, Golabganj, Gosairhat, Gowainghat, Habiganj Sadar, Hajiganj, Hakimpur, Harirampur, Hathazari, Hatia, Hizla, Homna, Hossainpur, Ishwardi, Jagannathpur, Jaldhaka, Jamalganj, Jhalokati Sadar, Jhenaigati, Kachua, Kaliakair, Kaliganj, Kalkini, Kamalganj, Kamarkhanda, Karimganj, Katiadi, Kazipur, Keraniganj, Khaliajuri, Khansama, Khoksa, Kishoreganj Sadar, Kotali Para, Kotchandpur, Koyra, Kulaura, Kuliar Char, Lalpur, Lama, Langadu, Lohagara, Madan, Madaripur Sadar, Madhukhali, Madhupur, Mahalchhari, Maheshkhali, Manikganj Sadar, Manohardi, Matlab, Moulovibazar Sadar, Mirsharai, Mithamain, Mohammadpur, Mohanganj, Mollarhat, Morelganj, Muksudpur, Muladi, Nalchity, Naria, Narsingdi Sadar, Nawabganj, Nazirpur, Nesarabad, Nikli, Noakhali Sadar, Paikgachha, Pakundia, Palash, Palong, Panchagarhh Sadar, Parshuram, Patiya, Phultala, Porsha, Rajarhat, Rajnagar, Rajoir, Ramganj, Rampal, Ramu, Rangunia, Raozan, Roypur, Rupganj, Rupsa, Sadarpur, Saidpur, Satkania, Savar, Senbagh, Serajdikhan, Shahrasti, Shib Char, Shibalaya, Shibganj, Shyamnagar, Singair, Sonargaon, Sreenagar, Sreepur, Sunamganj Sadar, Sylhet Sadar, Tahirpur, Taraganj, Tarail, Tazumuddin, Tentulia, Terokhada, Tongibari, Tungi Para, Ukhia, Zanjira, **(184 upazilas)**
High (10000 - 25000 ha)	Abhaynagar, Adamdighi, Aditmari, Agailjhara, Ajmiriganj, Alfadanga, Atrai, Atwari, Badalgachhi, Badarganj, Bagha, Bagher Para, Bakshiganj, Baliakandi, Baliadangi, Baraigram, Barura, Begumganj, Bera, Bhaluka, Bhangura, Bhola Sadar, Bhurungamari, Birampur, Boalmari, Bochaganj, Boda, Brahmanbaria Sadar, Burhanuddin, Chokoria, Chandina, Char Fashion, Chatmohar, Chauddagram, Chaugachha, Chirirbandar, Chitalmari, Chuadanga Sadar, Comilla Sadar, Damurhuda, Daudkandi, Daulatpur, Debidwar, Delduar, Derai, Dewanganj, Dhamoirhat, Dhamrai, Dharampasha, Dhunat, Dhupchanchia, Dimla, Domar, Dumuria, Durgapur, Faridpur Sadar, Feni Sadar, Fulbari, Fulbaria, Gabtali, Gaffargaon, Gaibandha Sadar, Gangachar, Gauripur, Gazipur Sadar, Ghatail, Gobindaganj, Gomastapur, Gopalganj Sadar, Gopalpur, Gurudaspur, Haluaghat, Harinakunda, Haripur, Hatibandha, Ishwarganj, Islampur, Itna, Jhenaidahaa Sadar, Jhikargachha, Jiban Nagar, Joypurhat Sadar, Kaharole, Kalai, Kalaroa, Kalia, Kaliganj, Kalihati, Kalmakanda, Kapasia, Kasba, Kashiani, Kaunia, Kendua, Keshabpur, Khetlal, Kishoreganj, Kumarkhali, Kurigram Sadar, Kushtia Sadar, Lakhai, Laksam, Laksmipur Sadar, Lalmohan, Lalmonirhat Sadar, Madarganj, Madhabpur, Madhupur, Magura Sadar, Maheshpur, Manda, Mehendiganj, Melandaha, Mirpur, Mirzapur, Mohanpur, Muktagachha, Muradnagar, Mymensingh Sadar, Nabiganj, Nabinagar, Nachole, Nagarkanda, Nakla, Nalitabari, Nandail, Nandigram, Nangalkot, Naogaon Sadar, Narail Sadar, Nasirnagar, Natore Sadar, Nawabganj, Nawabganj Sadar, Netrokona Sadar, Niamatpur, Nilphamari Sadar, Paba, Pabna Sadar, Palashbari, Pangsha, Patgram, Patnitala, Phulbari, Pirgachha, Pirganj, Purbadhala, Puthia, Rajbari Sadar, Rangpur Sadar, Raninagar, Raumari, Royganj, Roypura, Sadullapur, Saghatta, Sakhipur, Santhia, Sapahar, Sarail, Sariakandi, Sarishabari, Saturia, Shahjadpur, Shailakupa, Shalikha, Sherpur, Shibpur, Sirajganj Sadar, Sonatola, Sreebardi, Sreepur, Sujanagar, Sulla, Sundarganj, Tala, Tangail Sadar, Tanore, Tarash, Trishal, Ullah Para, Wazirpur **(183 upazilas)**
Very high (>25000 ha)	Alamdanga, Baghmara, Baniachong, Biral, Birganj, Bogra Sadar, Debiganj, Dinajpur Sadar, Gangni, Godagari, Jamalpur Sadar, Kahaloo, Kotwali, Mahadebpur, Manirampur, Meherpur Sadar, Mitha Pukur, Nageshwari, Panchbibi, Parbatipur, Phulpur, Pirganj, Ranisankail, Satkhira Sadar, Sharsha, Sherpur Sadar, Shibganj, Singra, Thakurgaon Sadar, Ulipur **(30 upazilas)**

Source: Authors' calculation, based on data from Minor Irrigation Survey Report 2008-09.

Annex Table 2: Irrigated Area under Electricity: FY2008-09

Category	Name of the Upazilas
No electricity-operated irrigation	AMTali, Baghai Chhari, Bamna, Barkal, Bauphal, Beani Bazar, Belai Chhari, Betagi, Bhandaria, Bishwanath, Dashmina, Galachipa, Jhalokati Sadar, Jurai Chhari, Kachua, Kala Para, Kanthalia, Kawkhali, Kutubdia, Lakshmichhari, Langadu, Mahalchhari, Manikchhari, Manpura, Mathbaria, Mirzaganj, Mongla, Morelganj, Nalchity, Nanner Char, Narayanganj Sadar, Nesarabad, Patharghata, Patuakhali Sadar, Pirojpur Sadar, Rajapur, Rajasthali, Ramgati, Rangamati Sadar, Rowangchhari, Sandwip, Sarankhola, Sitakunda, Thanchi **(44 upazilas)**
Negligible (< 100 ha)	Bakerganj, Banarpara, Bandarban Sadar, Barguna Sadar, Boalia, Char Rajibpur, Chauhali, Companiganj, Dacope, Derai, Dhaka City (Tejgaon), Dharampasha, Fenchuganj, Golabganj, Haim Char, Jagannathpur, Kanaighat, Kaptai, Kawkhali, Betbunia, Khagrachhari Sadar, Khaliajuri, Khulna Sadar, Koyra, Kulaura, Matiranga, Mollarhat, Munshiganj Sadar, Nazirpur, Rajnagar, Rampal, Ruma, Shyamnagar, Sulla, Teknaf, Terokhada, Tongibari, Zakiganj **(37 upazilas)**
Low (100 - 1000 ha)	Alfadanga, Alikadam, Assasuni, Austagram, Babuganj, Bagerhat Sadar, Bahubal, Bakshiganj, Balaganj, Baliakandi, Bandar, Barisal Sadar, Barlekha, Batiaghata, Bera, Bheramara, Bishwambarpur, Burhanuddin, Chandanaish, Char Bhadrasan, Char Fashion, Chatkhil, Chhagalnaiya, Chhatak, Chitalmari, Chittagong City, Chuadanga Sadar, Companiganj, Damudia, Daulatkhan, Debhata, Dewanganj, Dhobaura, Dhunat, Dighalia, Dighinala, Dowarabazar, Fakirhat, Faridpur, Gaurnadi, Gazaria, Gosairhat, Gowainghat, Harinakunda, Hatia, Hizla, Homna, Itna, Jaintiapur, Jamalganj, Jiban Nagar, Kalia, Kaliganj, Kamalganj, Karimganj, Keraniganj, Kotali Para, Kuliar Char, Lalmohan, Lalpur, Lama, Lohagara, Lohajang, Moulovibazar Sadar, Mehendiganj, Mirsharai, Mithamain, Mohammadpur, Muladi, Nabiganj, Naikhongchhari, Noakhali Sadar, Paikgachha, Panchhari, Patiya, Phultala, Ramganj, Ramgarh, Raumari, Santhia, Sariakandi, Serajdikhan, Shibalaya, Sonagazi, Sonatola, Sreemangal, Sreenagar, Sreepur, Sunamganj Sadar, Sylhet Sadar, Tahirpur, Tarail, Tazumuddin, Tentulia, Tungi Para, Wazirpur, Zanjira **(98 upazilas)**
Medium (1000 - 5000 ha)	Abhaynagar, Aditmari, Agailjhara, Ajmiriganj, Akhaura, Alamdanga, Anowara, Araihazar, Atpara, Atrai, Atwari, Bagati Para, Bagha, Bajitpur, Banchharampur, Banshkhali, Baraigram, Barhatta, Begumganj, Belabo, Belkuchi, Bhairab, Bhanga, Bhedarganj, Bhola Sadar, Bholahat, Bhuapur, Bhurungamari, Biral, Boalkhali, Boalmari, Bochaganj, Boda, Brahman Para, Chokoria, Chandpur Sadar, Charghat, Chaugachha, Chilmari, Chunarughat, Daganbhuiyan, Damurhuda, Daulatpur, Debiganj, Dohar, Dumuria, Durgapur, Faridganj, Faridpur Sadar, Fatikchhari, Fulchhari, Gabtali, Gangachar, Gangni, Gauripur, Ghior, Ghoraghat, Goalandaghat, Gopalganj Sadar, Gurudaspur, Habiganj Sadar, Hakimpur, Haluaghat, Haripur, Harirampur, Hathazari, Hatibandha, Hossainpur, Ishwardi, Islampur, Jaldhaka, Jhenaigati, Kaliakair, Kaliganj, Kalkini, Kalmakanda, Kamarkhanda, Kapasia, Kashiani, Katiadi, Kazipur, Kendua, Keshabpur, Khansama, Khoksa, Kishoreganj, Kishoreganj Sadar, Kotchandpur, Kumarkhali, Kurigram Sadar, Kushtia Sadar, Lakhai, Lalmonirhat Sadar, Lohagara, Madan, Madarganj, Madhabpur, Madhukhali, Madhupur, Maheshkhali, Maheshpur, Manikganj Sadar, Manohardi, Matlab, Meherpur Sadar, Melandaha, Mirpur, Mirzapur, Mohanganj, Muksudpur, Nagarkanda, Nageshwari, Nakla, Nalitabari, Narail Sadar, Naria, Nasirnagar, Natore Sadar, Nawabganj, Netrokona Sadar, Nikli, Pakundia, Palashbari, Palong, Panchagarhh Sadar, Pangsha, Patgram, Phulbari, Phulpur, Pirgachha, Pirganj, Porsha, Purbadhala, Puthia, Rajarhat, Rajbari Sadar, Rajoir, Ramu, Raozan, Roypur, Roypura, Rupganj, Rupsa, Sadarpur, Sadullapur, Saidpur, Sakhipur, Sarail, Satkania, Saturia, Savar, Shahrasti, Shailakupa, Shalikha, Shib Char, Shibganj, Singair, Sonargaon, Sreebardi, Sreepur, Sujanagar, Tala, Taraganj, Tarash, Ukhia **(168 upazilas)**
High (5000 - 10000 ha)	Akkelpur, Atgharia, Badalgachhi, Badarganj, Bagher Para, Baliadangi, Baniachong, Barura, Basail, Bhaluka, Bhangura, Birampur, Birganj, Brahmanbaria Sadar, Burichang, Chandina, Chatmohar, Chauddagram, Daudkandi, Debidwar, Delduar, Dhamoirhat, Dhamrai, Dimla, Domar, Durgapur, Feni Sadar, Fulbari, Fulbaria, Gaffargaon, Gaibandha Sadar, Gazipur Sadar, Ghatail, Gobindaganj, Gomastapur, Gopalpur, Hajiganj, Ishwarganj, Jhenaidahaa Sadar, Jhikargachha, Joypurhat Sadar, Kachua, Kaharole, Kalai, Kalaroa, Kalihati, Kasba, Kaunia, Laksam, Laksmipur Sadar, Madaripur Sadar, Madhupur, Magura Sadar, Mitha Pukur, Mohanpur, Muradnagar, Nabinagar, Nandail, Nandigram, Nangalkot, Naogaon Sadar, Narsingdi Sadar, Nawabganj, Nawabganj Sadar, Paba, Pabna Sadar, Palash, Parbatipur, Parshuram, Pirganj, Rangpur Sadar, Rangunia, Raninagar, Ranisankail, Royganj, Saghatta, Sapahar, Sarishabari, Satkhira Sadar, Senbagh, Shahjadpur, Sharsha, Sherpur, Sherpur Sadar, Shibpur, Singra, Sirajganj Sadar, Sundarganj, Tangail Sadar, Ulipur **(90 upazilas)**
Very high (>10000 ha)	Adamdighi, Baghmara, Bogra Sadar, Chirirbandar, Comilla Sadar, Dhupchanchia, Dinajpur Sadar, Godagari, Jamalpur Sadar, Kahaloo, Khetlal, Kotwali, Mahadebpur, Manda, Manirampur, Muktagachha, Mymensingh Sadar, Nachole, Niamatpur, Nilphamari Sadar, Panchbibi, Patnitala, Shibganj, Tanore, Thakurgaon Sadar, Trishal, Ullah Para **(27 upazilas)**

Source: Authors' calculation, based on data from Minor Irrigation Survey Report 2008-09.

Annex Table 3: Percentage of Area under Electricity: FY2008-09

Category	Name of the Upazilas
No Electricity-operated irrigation	Amtali, Baghai Chhari, Bamna, Barkal, Bauphal, Beani Bazar, Belai Chhari, Betagi, Bhandaria, Bishwanath, Dashmina, Galachipa, Jhalokati Sadar, Jurai Chhari, Kachua, Kala Para, Kanthalia, Kawkhali, Kutubdia, Lakshmichhari, Langadu, Mahalchhari, Manikchhari, Manpura, Mathbaria, Mirzaganj, Mongla, Morelganj, Nalchity, Nanner Char, Narayanganj Sadar, Nesarabad, Patharghata, Patuakhali Sadar, Pirojpur Sadar, Rajapur, Rajasthali, Ramgati, Rangamati Sadar, Rowangchhari, Sandwip, Sarankhola, Sitakunda, Thanchi **(44 upazilas)**
Negligible (<5%)	Alamdanga, Assasuni, Bakerganj, Balaganj, Banarpara, Barisal Sadar, Barlekha, Bishwambarpur, Boalia, Burhanuddin, Char Fashion, Char Rajibpur, Chauhali, Chitalmari, Chuadanga Sadar, Companiganj, Daulatkhan, Debhata, Derai, Dewanganj, Dhaka City (Tejgaon), Dharampasha, Dhunat, Golabganj, Haim Char, Harinakunda, Jagannathpur, Jiban Nagar, Kalia, Kaliganj, Kaptai, Kawkhalia, Betbunia, Khaliajuri, Khulna Sadar, Koyra, Kulaura, Lalmohan, Matiranga, Moulovibazar Sadar, Mehendiganj, Mohammadpur, Mollarhat, Munshiganj Sadar, Nazirpur, Noakhali Sadar, Phultala, Rajnagar, Rampal, Raumari, Shyamnagar, Sonatola, Sreepur, Sulla, Tazumuddin, Terokhada, Tongibari, Tungi Para **(57 upazilas)**
Low (5-25%)	Abhaynagar, Agailjhara, Alfadanga, Alikadam, Atrai, Atwari, Austagram, Babuganj, Bagati Para, Bagerhat Sadar, Bagha, Bahubal, Bakshiganj, Baliakandi, Bandarban Sadar, Baniachong, Baraigram, Barguna Sadar, Batiaghata, Begumganj, Bera, Bheramara, Bhola Sadar, Bhurungamari, Biral, Boalmari, Bochaganj, Boda, Chokoria, Chandpur Sadar, Char Bhadrasan, Chatkhil, Chaugachha, Chhagalnaiya, Chhatak, Chittagong City, Companiganj, Dacope, Damurhuda, Daulatpur, Debiganj, Dhobaura, Dighalia, Dighinala, Dowarabazar, Dumuria, Durgapur, Fakirhat, Faridganj, Faridpur, Faridpur Sadar, Fatikchhari, Fenchuganj, Fulchhari, Gabtali, Gangni, Gaurnadi, Gazaria, Goalandaghat, Gopalganj Sadar, Gosairhat, Gowainghat, Gurudaspur, Haluaghat, Haripur, Harirampur, Hatibandha, Hatia, Hizla, Homna, Islampur, Itna, Jaldhaka, Jamalganj, Jhenaigati, Kaliganj, Kalmakanda, Kamalganj, Kanaighat, Karimganj, Kashiani, Katiadi, Kazipur, Kendua, Keshabpur, Khagrachhari Sadar, Kishoreganj, Kotali Para, Kotchandpur, Kuliar Char, Kushtia Sadar, Lakhai, Lalmonirhat Sadar, Lalpur, Lama, Lohagara, Madan, Madarganj, Madhukhali, Maheshpur, Matlab, Meherpur Sadar, Melandaha, Mirpur, Mirsharai, Mirzapur, Mithamain, Mohanganj, Muksudpur, Muladi, Nabiganj, Nagarkanda, Nageshwari, Nakla, Narail Sadar, Nasirnagar, Natore Sadar, Nikli, Paikgachha, Pakundia, Panchhari, Pangsha, Patgram, Phulpur, Pirgachha, Pirganj, Purbadhala, Puthia, Rajbari Sadar, Ramganj, Ranisankail, Roypur, Ruma, Sadarpur, Sadullapur, Santhia, Sariakandi, Satkhira Sadar, Savar, Shailakupa, Shib Char, Shibalaya, Singra, Sreebardi, Sreemangal, Sujanagar, Sunamganj Sadar, Sylhet Sadar, Tahirpur, Tala, Tarail, Tarash, Tentulia, Ulipur, Wazirpur, Zakiganj, Zanjira **(160 upazilas)**
Medium (25-50%)	Aditmari, Ajmiriganj, Akhaura, Atpara, Badalgachhi, Badarganj, Bagher Para, Baghmara, Bajitpur, Baliadangi, Banchharampur, Barhatta, Belabo, Belkuchi, Bhairab, Bhaluka, Bhanga, Bhangura, Bhedarganj, Bhuapur, Birganj, Boalkhali, Bogra Sadar, Brahmanbaria Sadar, Chandanaish, Charghat, Chilmari, Chunarughat, Damudia, Daudkandi, Daulatpur, Dhamoirhat, Dinajpur Sadar, Dohar, Domar, Durgapur, Fulbaria, Gaffargaon, Gaibandha Sadar, Gangachar, Gauripur, Gazipur Sadar, Ghatail, Ghior, Gobindaganj, Gopalpur, Habiganj Sadar, Hathazari, Ishwardi, Jaintiapur, Jamalpur Sadar, Jhenaidahaa Sadar, Jhikargachha, Joypurhat Sadar, Kaharole, Kalaroa, Kaliganj, Kalkini, Kamarkhanda, Kapasia, Kasba, Kaunia, Keraniganj, Khansama, Khoksa, Kishoreganj Sadar, Kotwali, Kumarkhali, Kurigram Sadar, Laksam, Laksmipur Sadar, Lohagara, Lohajang, Madhabpur, Madhupur, Magura Sadar, Manirampur, Manohardi, Mitha Pukur, Mohanpur, Nabinagar, Naikhongchhari, Nalitabari, Nandail, Nandigram, Nangalkot, Naria, Netrokona Sadar, Nilphamari Sadar, Paba, Palashbari, Panchagarhh Sadar, Panchbibi, Parbatipur, Patiya, Phulbari, Rajarhat, Rajoir, Ramgarh, Rangpur Sadar, Raninagar, Raozan, Royganj, Roypura, Rupganj, Rupsa, Saghatta, Saidpur, Sakhipur, Sapahar, Sarail, Sarishabari, Saturia, Serajdikhan, Shahjadpur, Shalikha, Sharsha, Sherpur, Sherpur Sadar, Shibganj, Singair, Sirajganj Sadar, Sonagazi, Sreenagar, Sreepur, Sundarganj, Taraganj, Teknaf, Thakurgaon Sadar, Ullah Para **(131 upazilas)**
High (50-75%)	Akkelpur, Anowara, Atgharia, Bandar, Banshkhali, Barura, Birampur, Brahman Para, Chandina, Chatmohar, Chauddagram, Chirirbandar, Debidwar, Delduar, Dhamrai, Dimla, Feni Sadar, Fulbari, Ghoraghat, Gomastapur, Hajiganj, Hakimpur, Hossainpur, Ishwarganj, Kachua, Kalai, Kaliakair, Kalihati, Madaripur Sadar, Mahadebpur, Maheshkhali, Manda, Manikganj Sadar, Muktagachha, Muradnagar, Mymensingh Sadar, Naogaon Sadar, Narsingdi Sadar, Nawabganj, Nawabganj Sadar, Pabna Sadar, Palong, Parshuram, Patnitala, Porsha, Ramu, Rangunia, Satkania, Senbagh, Shahrasti, Shibganj, Shibpur, Sonargaon, Tangail Sadar, Trishal, Ukhia **(57 upazilas)**
Very High (>75%)	Adamdighi, Araihazar, Basail, Bholahat, Burichang, Comilla Sadar, Daganbhuiyan, Dhupchanchia, Godagari, Kahaloo, Khetlal, Nachole, Niamatpur, Palash, Tanore **(15 upazilas)**

Source: Authors' calculation, based on data from Minor Irrigation Survey Report 2008-09.

Annex Table 4: Irrigated Area under Diesel: FY2008-09

Category	Name of the Upazilas
No diesel-driven irrigation	Narayanganj Sadar, Sandwip **(2 upazilas)**
Negligible (<100 ha)	Manpura, Mirzaganj, Patuakhali Sadar, Ramgati, Zakiganj **(7 upazilas)**
Low (100 - 1000 ha)	AMTali, Bamna, Bandar, Bandarban Sadar, Barguna Sadar, Barkal, Belai Chhari, Betagi, Bhandaria, Chittagong City, Dacope, Daganbhuiyan, Dashmina, Galachipa, Haim Char, Jaintiapur, Kala Para, Kanaighat, Kanthalia, Kaptai, Kawkhali, Khulna Sadar, Lakshmichhari, Lohajang, Mongla, Munshiganj Sadar, Nachole, Naikhongchhari, Patharghata, Rajapur, Rajasthali, Ramgarh, Rowangchhari, Ruma, Sarankhola, Sitakunda, Teknaf, Thanchi **(38 upazilas)**
Medium (1000 - 5000 ha)	Adamdighi, Akhaura, Akkelpur, Alikadam, Anowara, Araihazar, Atgharia, Atpara, Austagram, Babuganj, Bagati Para, Baghai Chhari, Bahubal, Bajitpur, Bakerganj, Banarpara, Banchharampur, Banshkhali, Barhatta, Barura, Basail, Batiaghata, Bauphal, Beani Bazar, Belabo, Belkuchi, Bhairab, Bhedarganj, Bheramara, Bholahat, Birampur, Bishwambarpur, Boalia, Boalkhali, Brahman Para, Burichang, Chandanaish, Chandina, Chandpur Sadar, Char Bhadrasan, Char Rajibpur, Chauddagram, Chauhali, Chhatak, Chilmari, Chunarughat, Comilla Sadar, Companiganj, Damudia, Daulatkhan, Daulatpur, Debidwar, Dhaka City (Tejgaon), Dhupchanchia, Dighalia, Dighinala, Dohar, Dowarabazar, Fenchuganj, Feni Sadar, Gazaria, Ghior, Ghoraghat, Goalandaghat, Godagari, Golabganj, Gomastapur, Gowainghat, Hajiganj, Hakimpur, Hathazari, Hizla, Homna, Hossainpur, Ishwardi, Jurai Chhari, Kachua, Kaliakair, Kamalganj, Kamarkhanda, Karimganj, Kawkhali, Betbunia, Keraniganj, Khagrachhari Sadar, Khetlal, Khoksa, Kishoreganj Sadar, Koyra, Kulaura, Kuliar Char, Kutubdia, Lama, Langadu, Lohagara, Madaripur Sadar, Madhukhali, Madhupur, Mahalchhari, Maheshkhali, Manikchhari, Manikganj Sadar, Manohardi, Mathbaria, Matiranga, Moulovibazar Sadar, Mirsharai, Mithamain, Mohanganj, Morelganj, Muladi, Nalchity, Nanner Char, Naria, Narsingdi Sadar, Nawabganj, Nesarabad, Niamatpur, Palash, Palong, Panchagarhh Sadar, Panchhari, Parshuram, Patiya, Pirojpur Sadar, Porsha, Rajnagar, Rajoir, Rampal, Ramu, Rangamati Sadar, Rangunia, Raozan, Roypur, Rupganj, Rupsa, Sadarpur, Saidpur, Satkania, Senbagh, Serajdikhan, Shahrasti, Shibganj, Sonagazi, Sonargaon, Sreemangal, Sreenagar, Sylhet Sadar, Tahirpur, Tanore, Tarail, Tazumuddin, Tentulia, Terokhada, Tongibari, Tungi Para, Ukhia, Zanjira **(160 upazilas)**
High (5000 - 10000 ha)	Aditmari, Agailjhara, Ajmiriganj, Alfadanga, Assasuni, Atwari, Badalgachhi, Badarganj, Bagerhat Sadar, Bagher Para, Balaganj, Barisal Sadar, Barlekha, Bera, Bhanga, Bhangura, Bhola Sadar, Bhuapur, Bishwanath, Boalmari, Charghat, Chatkhil, Chatmohar, Chhagalnaiya, Chirirbandar, Debhata, Delduar, Dhamrai, Dhobaura, Dimla, Domar, Durgapur, Fakirhat, Faridganj, Faridpur, Fatikchhari, Fulbari, Fulbaria, Fulchhari, Gaffargaon, Gangachara, Gaurnadi, Gazipur Sadar, Ghatail, Gopalpur, Gosairhat, Habiganj Sadar, Harirampur, Hatia, Ishwarganj, Jagannathpur, Jaldhaka, Jamalganj, Jhalokati Sadar, Jhenaigati, Joypurhat Sadar, Kahaloo, Kaharole, Kalai, Kaliganj, Kalihati, Kalkini, Kasba, Kashiani, Katiadi, Kaunia, Kazipur, Khaliajuri, Khansama, Kotali Para, Kotchandpur, Kumarkhali, Kurigram Sadar, Laksmipur Sadar, Lalpur, Lohagara, Madan, Madhabpur, Manda, Matlab, Mirzapur, Mohammadpur, Mohanpur, Mollarhat, Muksudpur, Muktagachha, Muradnagar, Nabinagar, Nakla, Nandail, Nangalkot, Naogaon Sadar, Nawabganj, Nawabganj Sadar, Nazirpur, Netrokona Sadar, Nikli, Noakhali Sadar, Paba, Pabna Sadar, Paikgachha, Pakundia, Palashbari, Patnitala, Phulbari, Phultala, Rajarhat, Rajbari Sadar, Ramganj, Royganj, Roypura, Sadullapur, Saghatta, Sakhipur, Sarail, Saturia, Savar, Shahjadpur, Shailakupa, Shib Char, Shibalaya, Shibpur, Shyamnagar, Singair, Sreepur, Sunamganj Sadar, Tangail Sadar, Taraganj, Trishal **(131 upazilas)**
Very high (>10000 ha)	Abhaynagar, Alamdanga, Atrai, Bagha, Baghmara, Bakshiganj, Baliakandi, Baliadangi, Baniachong, Baraigram, Begumganj, Bhaluka, Bhurungamari, Biral, Birganj, Bochaganj, Boda, Bogra Sadar, Brahmanbaria Sadar, Burhanuddin, Chokoria, Char Fashion, Chaugachha, Chitalmari, Chuadanga Sadar, Damurhuda, Daudkandi, Daulatpur, Debiganj, Derai, Dewanganj, Dhamoirhat, Dharampasha, Dhunat, Dinajpur Sadar, Dumuria, Faridpur Sadar, Gabtali, Gaibandha Sadar, Gangni, Gauripur, Gobindaganj, Gopalganj Sadar, Gurudaspur, Haluaghat, Harinakunda, Haripur, Hatibandha, Islampur, Itna, Jamalpur Sadar, Jhenaidaha Sadar, Jhikargachha, Jiban Nagar, Kalaroa, Kalia, Kaliganj, Kalmakanda, Kapasia, Kendua, Keshabpur, Kishoreganj, Kotwali, Kushtia Sadar, Lakhai, Laksam, Lalmohan, Lalmonirhat Sadar, Madarganj, Madhupur, Magura Sadar, Mahadebpur, Maheshpur, Manirampur, Mehendiganj, Meherpur Sadar, Melandaha, Mirpur, Mitha Pukur, Mymensingh Sadar,

(Annex Table 4 contd.)

(Annex Table 4 contd.)

Category	Name of the Upazilas
	Nabiganj, Nagarkanda, Nageshwari, Nalitabari, Nandigram, Narail Sadar, Nasirnagar, Natore Sadar, Nilphamari Sadar, Panchbibi, Pangsha, Parbatipur, Patgram, Phulpur, Pirgachha, Pirganj, Purbadhala, Puthia, Rangpur Sadar, Raninagar, Ranisankail, Raumari, Santhia, Sapahar, Sariakandi, Sarishabari, Satkhira Sadar, Shalikha, Sharsha, Sherpur, Sherpur Sadar, Shibganj, Singra, Sirajganj Sadar, Sonatola, Sreebardi, Sreepur, Sujanagar, Sulla, Sundarganj, Tala, Tarash, Thakurgaon Sadar, Ulipur, Ullah Para, Wazirpur **(128 upazilas)**

Source: Authors' calculation, based on data from Minor Irrigation Survey Report 2008-09.

Annex Table 5: Percentage of Area under Diesel: FY2008-09

Category	Name of the Upazilas
No diesel-driven irrigation	Narayanganj Sadar, Sandwip **(2 upazilas)**
Negligible (<5%)	No upazila
Low (5-25%)	Adamdighi, Araihazar, Basail, Bholahat, Burichang, Comilla Sadar, Daganbhuiyan, Dhupchanchia, Godagari, Kahaloo, Khetlal, Nachole, Niamatpur, Palash, Tanore **(15 upazilas)**
Medium (25-50%)	Akkelpur, Anowara, Atgharia, Bandar, Banshkhali, Barura, Birampur, Brahman Para, Chandina, Chatmohar, Chauddagram, Chirirbandar, Debidwar, Delduar, Dhamrai, Dimla, Feni Sadar, Fulbari, Ghoraghat, Gomastapur, Hajiganj, Hakimpur, Hossainpur, Ishwarganj, Kachua, Kalai, Kaliakair, Kalihati, Madaripur Sadar, Mahadebpur, Maheshkhali, Manda, Manikganj Sadar, Muktagachha, Muradnagar, Mymensingh Sadar, Naogaon Sadar, Narsingdi Sadar, Nawabganj, Nawabganj Sadar, Pabna Sadar, Palong, Parshuram, Patnitala, Porsha, Ramu, Rangunia, Satkania, Senbagh, Shahrasti, Shibganj, Shibpur, Sonargaon, Tangail Sadar, Trishal, Ukhia **(56 upazilas)**
High (50-75%)	Aditmari, Ajmiriganj, Akhaura, Atpara, Badalgachhi, Badarganj, Bagher Para, Baghmara, Bajitpur, Baliadangi, Banchharampur, Barhatta, Belabo, Belkuchi, Bhairab, Bhaluka, Bhanga, Bhangura, Bhedarganj, Bhuapur, Birganj, Boalkhali, Bogra Sadar, Brahmanbaria Sadar, Chandanaish, Chilmari, Chunarughat, Damudia, Daudkandi, Daulatpur, Dhamoirhat, Dinajpur Sadar, Dohar, Domar, Durgapur, Fulbaria, Gaffargaon, Gaibandha Sadar, Gangachara, Gauripur, Gazipur Sadar, Ghatail, Ghior, Gobindaganj, Gopalpur, Habiganj Sadar, Hathazari, Ishwardi, Jaintiapur, Jamalpur Sadar, Jhenaidaha Sadar, Jhikargachha, Joypurhat Sadar, Kaharole, Kalaroa, Kaliganj, Kalkini, Kamarkhanda, Kapasia, Kasba, Kaunia, Keraniganj, Khansama, Khoksa, Kishoreganj Sadar, Kotwali, Kumarkhali, Kurigram Sadar, Laksam, Laksmipur Sadar, Lohagara, Lohajang, Madhabpur, Madhupur, Magura Sadar, Manirampur, Manohardi, Mitha Pukur, Mohanpur, Nabinagar, Naikhongchhari, Nalitabari, Nandigram, Nangalkot, Naria, Netrokona Sadar, Nilphamari Sadar, Paba, Palashbari, Panchagarhh Sadar, Panchbibi, Parbatipur, Patiya, Phulbari, Rajarhat, Rajoir, Ramgarh, Rangpur Sadar, Raninagar, Raozan, Royganj, Roypura, Rupganj, Rupsa, Saghatta, Saidpur, Sakhipur, Sapahar, Sarail, Sarishabari, Saturia, Serajdikhan, Shahjadpur, Shalikha, Sharsha, Sherpur, Sherpur Sadar, Shibganj, Singair, Sirajganj Sadar, Sonagazi, Sreenagar, Sreepur, Sundarganj, Taraganj, Teknaf, Thakurgaon Sadar, Ullah Para **(129 upazilas)**
Very high (75-99%)	Abhaynagar, Agailjhara, Alamdanga, Alfadanga, Alikadam, Assasuni, Atrai, Atwari, Austagram, Babuganj, Bagati Para, Bagerhat Sadar, Bagha, Bahubal, Bakerganj, Bakshiganj, Balaganj, Baliakandi, Bandarban Sadar, Baniachong, Baraigram, Barguna Sadar, Barisal Sadar, Barlekha, Batiaghata, Begumganj, Bera, Bheramara, Bhola Sadar, Bhurungamari, Biral, Bishwambarpur, Boalia, Boalmari, Bochaganj, Boda, Burhanuddin, Chokoria, Chandpur Sadar, Char Bhadrasan, Char Fashion, Char Rajibpur, Charghat, Chatkhil, Chaugachha, Chauhali, Chhagalnaiya, Chhatak, Chitalmari, Chittagong City, Chuadanga Sadar, Companiganj, Companiganj, Dacope, Damurhuda, Daulatkhan, Daulatpur, Debhata, Debiganj, Dewanganj, Dhobaura, Dhunat, Dighalia, Dighinala, Dowarabazar, Dumuria, Durgapur, Fakirhat, Faridganj, Faridpur, Faridpur Sadar, Fatikchhari, Fenchuganj, Fulchhari, Gabtali, Gangni, Gaurnadi, Gazaria, Goalandaghat, Gopalganj Sadar, Gosairhat, Gowainghat, Gurudaspur, Haluaghat, Harinakunda, Haripur, Harirampur, Hatibandha, Hatia, Hizla, Homna, Islampur, Itna, Jaldhaka, Jamalganj, Jhenaigati, Jiban Nagar, Kalia, Kaliganj, Kalmakanda, Kamalganj, Kanaighat, Kaptai, Karimganj, Kashiani, Katiadi, Kawkhali, Betbunia, Kazipur, Kendua, Keshabpur, Khagrachhari Sadar, Kishoreganj, Kotali Para, Kotchandpur, Koyra, Kulaura,

(Annex Table 5 contd.)

(Annex Table 5 contd.)

Category	Name of the Upazilas
	Kuliar Char, Kushtia Sadar, Lakhai, Lalmohan, Lalmonirhat Sadar, Lalpur, Lama, Lohagara, Madan, Madarganj, Madhukhali, Maheshpur, Matlab, Moulovibazar Sadar, Mehendiganj, Meherpur Sadar, Melandaha, Mirpur, Mirsharai, Mirzapur, Mithamain, Mohammadpur, Mohanganj, Muksudpur, Muladi, Munshiganj Sadar, Nabiganj, Nagarkanda, Nageshwari, Nakla, Narail Sadar, Nasirnagar, Natore Sadar, Nazirpur, Nikli, Noakhali Sadar, Paikgachha, Pakundia, Panchhari, Pangsha, Patgram, Phulpur, Phultala, Pirgachha, Pirganj, Purbadhala, Puthia, Rajbari Sadar, Ramganj, Ranisankail, Raumari, Roypur, Ruma, Sadarpur, Sadullapur, Santhia, Sariakandi, Savar, Shailkupa, Shib Char, Shibalaya, Shyamnagar, Singra, Sonatola, Sreebardi, Sreemangal, Sreepur, Sujanagar, Sunamganj Sadar, Sylhet Sadar, Tahirpur, Tala, Tarail, Tarash, Tazumuddin, Tentulia, Terokhada, Tungi Para, Ulipur, Wazirpur, Zakiganj, Zanjira, Satkhira Sadar **(203 upazilas)**
Fully diesel-driven	AMTali, Baghai Chhari, Bamna, Banarpara, Barkal, Bauphal, Beani Bazar, Belai Chhari, Betagi, Bhandaria, Bishwanath, Dashmina, Derai, Dhaka City (Tejgaon), Dharampasha, Galachipa, Golabganj, Haim Char, Jagannathpur, Jhalokati Sadar, Jurai Chhari, Kachua, Kala Para, Kanthalia, Kawkhali, Khaliajuri, Khulna Sadar, Kutubdia, Lakshmichhari, Langadu, Mahalchhari, Manikchhari, Manpura, Mathbaria, Matiranga, Mirzaganj, Mollarhat, Mongla, Morelganj, Nalchity, Nanner Char, Nesarabad, Patharghata, Patuakhali Sadar, Pirojpur Sadar, Rajapur, Rajasthali, Rajnagar, Ramgati, Rampal, Rangamati Sadar, Rowangchhari, Sarankhola, Sitakunda, Sulla, Thanchi, Tongibari **(57 upazilas)**

Source: Authors' calculation, based on data from Minor Irrigation Survey Report 2008-09.