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# Technological Progress and Emergence of Policies with Priorities for the Development of Land-Poor Farmers in Bangladesh

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## Abstract

This macro-level research analyzed sequential changes in agricultural policies and evaluated their impacts among various groups of farmers classified based on the land ownership. All supply-side agricultural policies from their origins to current year were divided into four phases where, government supports for agriculture were changed from adverse circumstances support, to direct enormous support, to reform-embedded support, and finally to collaborative support with private sector and Non-government Organizations (NGOs). The changing policies favored all types of farmers among whose reform policies contributed more. The small farmers in the past were not benefited from government policies but they were lately more benefited from coherent policies emphasized on the development of land-poor farmers.

## 1. Introduction

Bangladesh agriculture is often affected by natural calamities like floods and draughts. There were severe famines come out in 1770, 1866 and 1896 in greater India including Bangladesh due to hamper of crop productions during natural calamities. A great food disaster lately appeared in 1943 during the Second World War just before the ending of British colony in 1947. The government of the free nation then started to support the green revolution through supply of inputs, extension service and research activities that helped the farmers to increase foodgrain production since the mid 1960s (Adnan 1999). However, a famine again attacked Bangladesh due to repeated floods in 1974. The new government just after a few years of independence could not support to all distressed farmers because of scarcity of resources (Banglapedia, 2004). Some NGOs appeared in supporting the land-poor households in the mid 1970s (Datta, 2004). The government updated her policies over time to work with NGOs and private sector upon the evaluations made by the government and donor agencies.

There were many researches conducted on the impacts of changes in agricultural development policies in Bangladesh. Hossain (1989) evaluated the impacts of agricultural policies using data covering 1950/1 to 1984/5. He found that the growth of grain production was accelerated from 2.6% per year during 1950 and 1971 to 3.4% during 1971 and 1985, mostly due to increase in yield. He analyzed the technological progress in farming until 1985 and also made a projection on the diffusions of modern inputs. However, he did not emphasize much on the privatization policies of input markets because it was in inaugural stage of the process.

Subsequently, Ahmed (1995), in his research, traced out the path of evolutionary reforms and the impacts of reforms on input markets. The gradual process based on well-designed sequencing steps was identified as a crucial factor for the success of privatization policies. The reform measures on fertilizer and irrigation markets contributed for nearly 32% increase in rice production during 1984 and 1992. Ahmed (1998), in another research, assessed the impacts of previous policies focusing on the input supply policies as overall agricultural policies. However, the supply-side agricultural policies included the policies of input supply, agricultural extension service and research activities.

There were a few researches found on the agricultural extension and research. Siddiqui (1998) identified some issues of agricultural extension covering periods until the drafting of a new policy. However, many initiatives came after the adoption of new policy. Modal (1999) conducted a study on NGOs participations in technology transfer and on scopes of private sectors to participate in research. He described a few initiatives of some NGOs in seeds production and forestry since the late 1980s. Subsequently, World Bank (2005) evaluated the institutional structures, activities and funding of institutes engaged in agricultural technology (research and extension) system. The study suggested for some institutional reforms to revitalize the technology system in order to generate and disseminate appropriate technologies in the context of changing needs in Bangladesh agriculture.

This research would recognize all the supply-side agricultural policies including the policies for input supply, agricultural extension service and research activities; used to support the farmers in Bangladesh. The sequential changes of all these policies and their impacts among unequal landowner farmers were not analyzed together in earlier researches. The objectives of this research were (1) to identify the pattern of changes in all supply-side agricultural policies from their origins to present, and (2) to evaluate the impacts of evolving policies on technology diffusions in crop farming among farmer groups. Phase analysis were adopted to differentiate the sequential changes in policies and the impacts of policies were evaluated among groups of farmers classifying them as small farmer owning land up to 1.0 ha, medium farmer from 1.0 to 3.0 ha and large farmer above 3.0 ha. This research is a comprehensive review of supply-side agricultural policies used only secondary data collected from books, journal articles, statistical reports and websites of some organizations.

## 2. Evolution of Supply-Side Agricultural Policies

Government program for supporting farmers was absent before establishment of a section for agriculture under the Department of Revenue in 1870. It worked for rehabilitation of disaster-affected farmers with seeds aiming to keep smooth collection of land revenue (Banglapedia, 2004). Subsequently, the government started to create infrastructures for supplying seeds and the seed storing and its multiplication became major activities of the Department of Agriculture established in 1906. The researches on commercial crops were started with an establishment of the Bengal Agricultural Research Laboratory in 1908 (DAE, 2006). The government supports to farmers were very limited

just to resist any peasantry movement. However, the colonial government even established the Debt Settlement Board in 1937 in favor of insolvent farmers who were losing lands during the great depression periods in 1930s for non-repayment of high interest loans taken from local moneylenders (Banglapedia, 2004).

The new government of Pakistan started to provide huge supports to farmers using financial and technical assistances supplied by the international donor agencies. The Agricultural Development Finance Corporation was first established in 1951 because the shortage of credit supply after debt settlement was said as a cause of the 1943 famine. It was then converted into a specialized bank, Bangladesh Agricultural Bank, in 1961. Meanwhile, the Comilla cooperative model was initiated in 1959 aiming to distribute agricultural credit on easy terms in Comilla region (Banglapedia, 2004). The Bangladesh Agricultural Development Corporation (BADC) was established in 1961 as a single authority for procurement and distribution of inputs at subsidized prices (BADC, 2005).

The Bangladesh Jute Research Institute (BJRI) was established in 1951 with a high attention to increase production of main commercial crop (DAE, 2006). There were two Agricultural Training Institutes (ATI) initially established in 1958 for basic training to extension workers. Some mono-crop agencies were then created to provide agricultural extension service (Banglapedia, 2004). The research on rice got priority and the Bangladesh Rice Research Institute (BRRI) was established in 1970. Subsequently, Bangladesh Agricultural Research Council (BARC) was established in 1973 as a coordinating agency of research activities (BARC, 2006).

It was observed that many institutions were established during 1951 and 1976 because of the remarkable government initiatives for agricultural development in the 2<sup>nd</sup> five-year (1960-1965) and 3<sup>rd</sup> five-year (1965-1970) plans in Pakistan. Many other new institutions were established during the early years of Bangladesh regime. However, a few institutions were created during the 1980s and no new institution came after 1989 (Banglapedia, 2004) because, the donor agencies emphasized on the reforms of existing institutions and did not support for the development of new institutions.

Many reform measures on institutional set-up and distribution system of inputs were undertaken since the late 1970s with the suggestions and sometimes for pressures of donor agencies (Adnan, 1999). The major involvements of BADC were in irrigation and fertilizer markets. All installed low lift pumps (LLP) and deep tube wells (DTW) under the maintenance of the BADC were started to sell out to private ownership. The shallow tube well (STW), which required lower investment, appeared in the late 1970s and the BADC started to sell those to farmers at subsidized price (Banglapedia, 2004). Subsequently, the government removed the restriction on private sector to import STW engines in 1987 and standardization restriction was also removed in 1989 (MOA, 2006). Meanwhile, private dealers were appointed for fertilizer distribution in 1978. The import of all fertilizers except urea was allowed in 1992 after withdrawing almost entire subsidies (Ahmed, 1995).

The procurement and distribution of pesticides belonging to the BADC were handed over to the Pesticide Association of Bangladesh (PAB) all on a sudden after withdrawing entire subsidies in 1979 (Banglapedia, 2004). The government intervention on pesticide market became nil after removing the band restriction on import in 1989. Subsequently, seed market was liberalized in 1990 by allowing private sectors to import all seeds except rice, wheat, potato, jute and sugarcane (MOA, 2006). The government also privatized the import of agricultural machineries with a waiver of tariff in 1989. However, the investment credit programs on machineries were even expanded since the early 1980s because of limited investment by the farmers (Rahman, 2000).

The extension service was provided mainly on rice farming and on farming of a few other cash crops by respective mono-crop agencies since the late 1960s. The extension approach was top-down where the participation of beneficiaries was almost absent (DAE, 2006). The new extension policy was adopted in 1996 that favored the smallholder taking private sector and NGOs as partners of development (MOA 1996). Meanwhile, increasing numbers of NGOs were found to provide extension service and also to be engaged in research activities besides government agencies (World Bank, 2005). The New Agriculture Policy (NAP) of 1999 put a mandate for the research institutes to coordinate and incorporate private sector and NGOs in their programs (MOA, 1999).

It was noted that the government had full control on the institutions engaging in input supply, extension service and researches until the late 1970s. Subsequently, reform measures were taken to privatize the input supply system and to make participation of the private sector to support agriculture. The participation of private sector was strengthened since late 1990s incorporating them into government development programs. The government reduced her expenditures on agricultural development through reforms in input market and other supporting institutions since the late 1970s. The development expenditures went down due to a decrease in foreign aids, from \$70.56 million to \$48.91 million and also due to a decrease in government development expenditure from \$163.84 million to \$131.76 million during 1999/00 and 2004/05 (MOF, 2006).

The government even cut a huge amount of development expenditures through reduction of subsidies. The subsidy on fertilizers was reduced from \$83 million to \$0.6 million during 1979/80 and 1992/93. The subsidy on tube well irrigation was \$66.7 million in 1979/80 that was reduced to \$33 million in 1983/4 and almost entire subsidy was eliminated in 1986 (Ahmed, 1998). The budgetary allocation in crop sub-sector was reduced from 22.76% to 2.45% of the Annual Development Program (ADP) during 1979/80 and 2005/06 (MOA, 2006). The development expenditures on agricultural extension and research were found unstable because of the dependency on foreign aids varied among years. The share of project aids to total development expenditure was 61% for extension service and 14% for research activities in 2004/5. The research activities were reported to suffer from fund shortage because of decreasing project aids by donor agencies (World Bank, 2005).

The World Bank was the top donor agency for Bangladesh and the International Fund for Agricultural Development (IFAD) also contributed to agricultural projects since the late 1970s. The World Bank only supported irrigation projects during 1961 and 1975. It also supported fertilizer, irrigation, agricultural credit, agricultural extension and research projects since the late 1970s aiming to develop those activities to cope up with market economy. On the other hand, IFAD supported credit projects for small farmers and micro-credit besides irrigation and fertilizer projects during 1976 and 1985 (IFAD, 2006). Meanwhile, the World Bank reduced her supports only to two projects on irrigation and agricultural extension during 1986 and 1995 (World Bank, 2005) whereas the IFAD supported for the development of small farmers and micro-credit during the same period. The micro-credit was also added in the World Bank projects since 1996. Moreover, the Asian Development Bank included micro-credit in her agriculture projects in recent years (ADB, 2006).

It was understood that the priorities of policies and supports had been changed towards the development of land-poor farmers. The donor agencies provided more emphasis on NGOs participations in their projects, might be because of widening the coverage of the land-poor and small farmers. It was notable that the number of small farmers became more than thrice during 1960 and 1996, which accounted for about 80% of total farmers in 1996 (PACO 1962 and BBS 1999). As a matter of fact, the government agricultural policies also emphasized NGOs participations in development projects since the late 1990s (MOA 1996 and MOA 1999).

## 2.1. Phases in the development of agricultural policies

The government policies for agricultural development were changed from limited rehabilitation programs to general development of farmers. The sequential changes in policies were divided into four phases that are presented in Table 1 and are described below.

**Table 1.** Phases in the development of agricultural policies in Bangladesh

	Phases of development policies	Objective of the policies	Targeted farmers	Sources of expenditure	Establishment of institutions
(1)	Adverse circumstances policy (1870s - 1940s)	Smooth collection of land revenue	Disaster affected farmers	Government only	A few for critical needs
(2)	Supportive policy (1950s– late 1970s)	Increase food production	Progressive land-rich farmers	Government + donors' support	Many for more support
(3)	Reform-embedded policy (late 1970s–late 1990s)	Privatization for reduction of expenditure	No specific farmer group	Government + decreasing donor support	Reform of existing, new in viable sector
(4)	Collaborative policy (late 1990s– present)	Development with private sectors participation	All farmers, emphasis on the land-poor	Government + limited donor support	Not any new

Source: Review of the previous discussions

### **(1) Adverse circumstance development policies (1870s to 1940s)**

The agricultural development policies during the British regime were aimed to smooth collection of land revenue. The government supported seriously affected farmers to resist any peasantry movement. She took a few initiatives and established a few institutions for supporting agriculture. The seed supply was the major activity of the Department of Agriculture and the supports were given using only government revenue fund. This phase would be read as ‘adverse circumstances’ policy phase in subsequent discussions.

### **(2) Supportive development policies (1950s – late 1970s)**

The agricultural development policies during early 1950s and late 1970s were aimed to general development of agriculture. The progressive land-rich farmers got priorities in development programs. The government established many institutions for supplying all essential inputs and supported farmers using the financial and technical aids collected from international donors. The NGOs came to appear in support of land-poor households. This phase would be read as ‘supportive’ policy phase in subsequent discussions.

### **(3) Reform-embedded development policies (late 1970s - late 1990s)**

The agricultural policies during the late 1970s and late 1990s were aimed to reform the input markets and other facilitating institutions. A few institutions were created in viable sectors. The reform measures were taken on existing institutions. The development expenditures on agricultural decreased because of reduction of donors’ supports and their pressure for cutting government expenditures. The government privatized all inputs markets by the mid 1990s and the role of private sector and NGOs was subsequently become dominant. This phase would be read as ‘reform’ policy phase in subsequent discussions.

### **(4) Collaborative development policies (late 1990s -present)**

The agricultural policies since late 1990s to current year were aimed to develop agriculture with the participations of private sectors. The development expenditure on agriculture was reduced because of a gradual decrease in project aids from donor agencies. There was no new institution established in this phase. The policies allowed the NGOs to work in collaboration with government development programs. This phase would be read as ‘collaborative’ policy phase in subsequent discussions.

## **3. Impacts of Evolving Policies on Technological Progress in Crop Farming**

The changing responsibilities and interventions of government and private sectors with evolving policies of input supply, extension service and research activities are presented in Appendix Table 1

and Appendix Table 2. The impacts of ‘adverse circumstances’ policy was not included in subsequent discussion because of the negligible government interventions only to supply seeds occasionally in that phase. The strong and direct interventions of government were appeared in the ‘supportive’ policy phase and some structural changes were taken place in the ‘reform’ policy phase. Evolved policies had different level of impacts on technology diffusions, access to technologies and incomes among farmers’ groups. The summary impacts of evolving policies on access technologies among various groups of farmers are presented in Table 2.

### **3.1. Impacts of evolving policies on input supply**

There was no more change in markets of irrigation devices, pesticides and agricultural machineries after the ‘reform’ policy phase. However, the government was contributing to control the privatized fertilizers’ market and even increased the involvements in seeds and agricultural credit supply in the ‘collaborative’ policy phase. The influences evolving policies on supply and uses of inputs from the ‘supportive’ to ‘collaborative’ policy phase are presented in Figure 1 – Figure 6 and are described below taking various groups of farmers into consideration.

#### **(a) Fertilizers**

Fertilizer use in the country increased since after their adoption in the ‘supportive’ policy phase. Fertilizer use was lower in the ‘supportive’ policy phase that increased relatively at a higher rate since the ‘reform’ policy phase. The higher use of all fertilizers over the trend between 1975 and 1985 and the higher use per ha since the ‘reform’ policy phase in Figure 1 indicated positive impact of evolving policies. However, there was a negative impact of reform policies with a decrease in supply of TSP fertilizer in the early 1990s. The farmers were cheated in buying of low nutrient SSP fertilizer because of almost the same color of TSP and SSP (Akanda, *et al.*, 1999). Lately, the government started to import TSP and MOP fertilizers which would ensure their qualities (Daily Inqilab, 02 July 2006).

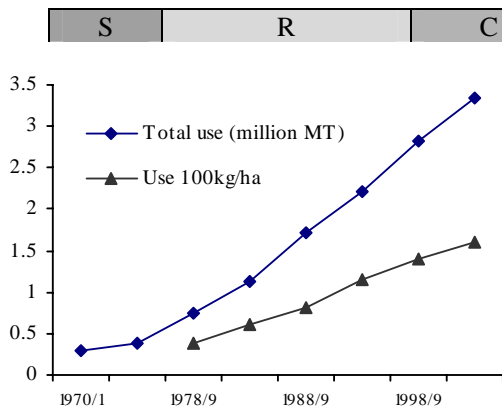
The large and medium farmers, who were early adopters of new technology, were benefited more from higher use until the end of ‘supportive’ policy phase (Zohir, 2001). The share of fertilized area to total cropped area increased from 39% to 79% for small, from 35% to 78% for medium and from 32% to 75% for large farmers during 1983/4 and 1996 in the ‘reform’ policy phase (BBS 1986 and BBS 1999). Small farmers were found relatively more to expand fertilized areas. However, fertilizer use per acreage was higher for large and medium farmers followed by small farmers in HYV Boro rice farming in 1998 in the ‘collaborative’ policy phase (Abedin, *et al.*, 1999).

#### **(b) Seeds**

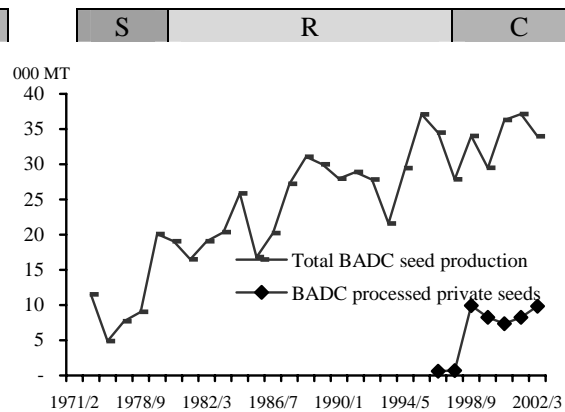
The BADC was the sole producer and distributor of improved seeds in the ‘supportive’ policy phase. The amount of seed distribution by the BADC increased from 19 to 30 thousands MT during



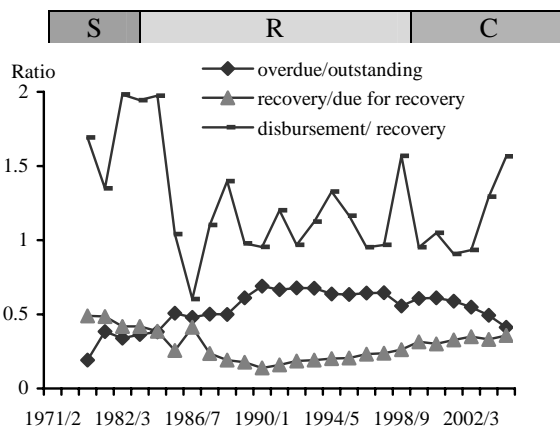
**Note:** S, R and C in Figures 1-6 indicated the 'supportive', 'reform' and 'collaborative' phase, respectively



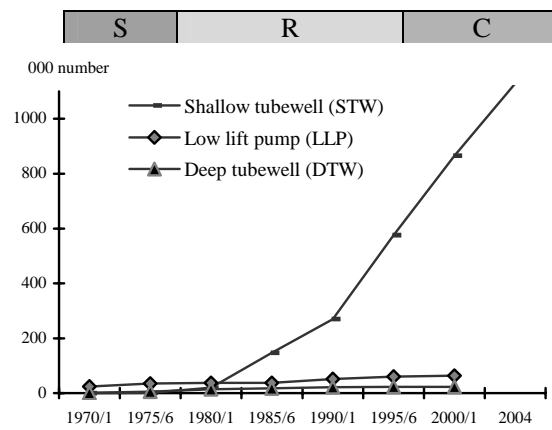
**Figure 1.** Fertilizer use in Bangladesh (1971-2003)  
Sources: BBS 1977 and MOA 2006



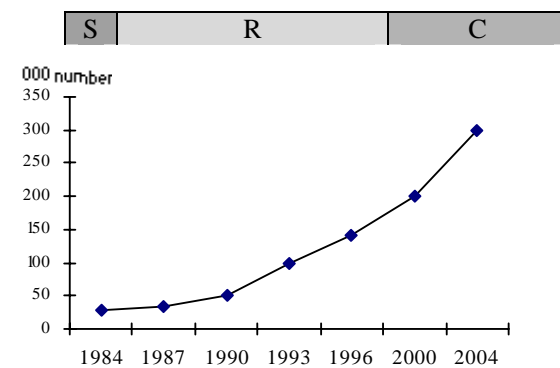
**Figure 2.** BADC production and processed seeds of private producers (1971-2003)  
Sources: BBS 1977, BADC 2005 and MOA 2006



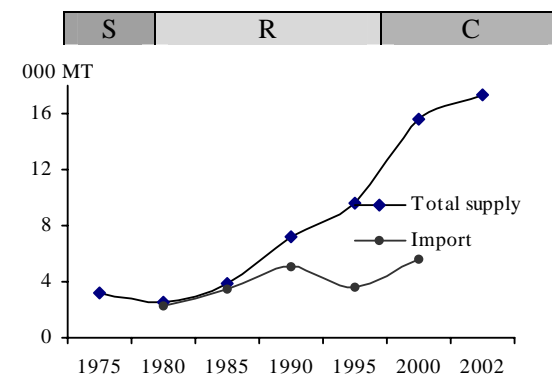
**Figure 3.** Nature of disbursement and recovery of agric. credit by govt. banks (1980-2005)  
Sources: MOA, 2006



**Figure 4.** Number of irrigation devices in Bangladesh (1971-2004)  
Sources: World Bank 1977, Mandal 2000, BADC 2002 and Daily Ajker Kagoj 06 September 2005



**Figure 5.** Number of Power Tillers in Bangladesh (1983-2004)  
Sources: BBS 1986, Jaim & Rahman 1999, BBS 1999 and Kabir & Ahmmed 2005



**Figure 6.** Pesticide use and import in Bangladesh (1975-2002)  
Sources: BBS 1977 and MOA 2006

1981 and 1990 in the 'reform' policy phase that continued to increase until the 'collaborative' policy phase (Figure 2) because of insufficient infrastructures for private seed production. The private sector and NGOs were found to be engaged in seed production after market liberalization in 1990, for example; Grameen Krishi Foundation started seed production with 266 MT in 1993 that increased to 781 MT in 1997 (Mondal, 1999). Lately, more than 100 seed companies were engaged in seed production, for example, BRAC had a seed production unit with eight seed farms and two processing centers in 2004 (Holiday, 18 June 2004).

The large and medium farmers were belonged to progressive farmer group who got access to improved seeds in the 'supportive' policy phase (Griffin, 1974). The land-poor and small farmers got a little access to improved seeds in the 'reform' policy phase because of the privatized distribution system and the involvement of NGOs. Moreover, some NGOs were found to provide seeds, fertilizers, pesticides, etc. to the beneficiaries in their agricultural programs (World Bank, 2005).

#### ***(c) Agricultural credit***

The government expanded her agricultural credit programs from the 'supportive' to 'collaborative' policy phase though farmers had a tendency not to repay loans. Even after increasing of outstanding debts from \$568 million (Tk. 13,515 million) to \$2,289 million (Tk. 140,398 million), the government expanded her yearly credit flow from \$285 million (Tk 6,786 million) in 1982/3 to \$807 million (Tk 49,567 million) in 2004/5 (MOF, 2006). The government tried to keep 'disbursement to recovery ratio' at one in the mid 1980s, but had to disburse more after frequent flood disasters. However, 'overdue to outstanding debts' ratio of government loans was decreased and the ratio of 'recovery to due for recovery' was increased since early 1990s (Figure 3) because of (a) much efforts of recovery with legal procedures in the 'reform' policy phase and (b) incorporating local elites in the Credit Committees in the 'collaborative' policy phase (MOA, 1999).

The collateral-based traditional credit system of government banks used to help large and medium farmers where the land-poor farmer had no access. However, the government in the 'reform' policy phase took some programs for small farmer (Banglapedia, 2004). It was notable that the NGOs started to work for the landless and small farmers providing them micro-credit since the 'reform' policy phase, recovery of which was nearly 98% (Datta, 2004). Lately, the government had also created a co-coordinating body to help NGOs to participate in micro-credit programs (Banglapedia, 2004). The DAE took several collaborative programs with NGOs to make them involved in group formation, disbursement and recovery of micro-credit (DAE, 2006).

#### ***(d) Irrigation devices***

The irrigated area, mechanized irrigated area and the number of various mechanized irrigation devices in Bangladesh increased over time (Mandal, 2000). The number of STWs increased much

since their adoption in the early 'reform' policy phase because of subsidized sales with credit supports (Figure 4). The area under STWs was 10% of mechanized irrigated area in 1980/1, which increased to 35% in 1985/6. Irrigation coverage of STWs became nearly double during 1985/6 and 1990/1 and increased thereafter because of cheaper price of STWs after market reform (Mandal, 2000). The numbers of DTWs and LLPs did not increase after 1996. The irrigation coverage by STWs accounted for 66% of mechanized irrigated area in 2004/05 (MOA, 2006).

The small farmer rarely owned STWs in the early 'reform' policy phase because of shortage of own capital and limited access to credit. The STW ownership of small farmers increased significantly in the late 'reform' policy phase. They owned only 8% of STW in 1995 (as per IIMI/BSERT study) in a less irrigation-developed district. However, they were dominated owning 76% STWs in an irrigation-developed district (Mandal, 2000). Moreover, some NGOs took over some irrigation devices during 'reform' policy phase; for example, Grameen Krishi Foundation took 805 DTWs in 1988 those were maintained by small farmers' groups (Sattar, 1999). The irrigation market became competitive and the STW non-owner could use irrigation from any STW owner (Mandal, 2000).

#### *(e) Agricultural machineries*

The government tried to adopt power tillers in the 'supportive' policy phase but there were only 27,000 power tillers found in 1983/4 (BBS, 1986). The area under power tiller tillage grew at about 3.5% per year in the 'reform' policy phase after its market liberalization in 1989 (MOA, 2006). The number of power tillers reached to 141,000 in 1996 (BBS, 1999) and then to 300,000 in 2004 cultivating nearly 70% of cropped area (Hossain, 2005).

The power tiller was affordable by large and medium farmers because of decreasing its price to \$800 after import liberalization in the mid 'reform' policy phase. However, small farmers were rarely found to invest on power tillers. Many small farmers became the owners of power tillers in the 'collaborative' policy phase because of cheaper price. Meanwhile, locally made power tillers using STW engines became very cheap. The NGOs even provided credit to landless and small farmers to purchase power tillers for using into non-farm earning. (Kabir and Ahmmed, 2005).

#### *(f) Pesticides*

There was a slight decrease in supply of pesticides in the early 'reform' policy phase in 1980 when responsibilities went to the private sector. The supply was then increased from 2,490 MT to 17,392 MT during 1980 and 2002 (MOA, 2006). The reform policy was favorable for home production that could be understood from the increasing gap between total pesticides use and imported amount in Figure 6. All types of farmers became concentrated in pesticide use because the pest attack not only reduce productions but also destroy crops. Small farmers used relatively more improper doses of pesticides than medium and large farmers because of their lower level of literacy.

### **3.2. Impacts of evolving policies on extension service**

The introduction of Training and Visit (T&V) system was initiated in the very early 'reform' policy phase in 1978 that assigned the extension workers to go to farmers' fields. The government brought some mono-crop agencies into a single Department of Agricultural Extension (DAE) in 1982 for better co-ordination of extension programs (DAE, 2006). The land-poor farmers, who were late adopters, did not get access to the rice farming development-led extension service until the 'reform' policy phase (Siddiqui, 1998). The new extension policy (NAEP) came in 1996 as a milestone of targeting the majority group of farmers that positively influenced on crop farming (MOA, 1996).

Increasing numbers of NGOs were found to provide extension service to the land-poor and small farmers under their own programs in the 'collaborative' policy phase. The BRAC had a broad extension program engaging 500 agriculturists and 10,000 extension workers all over the country (World Bank, 2005). The NGOs were taken into government development projects because the major donors preferred the NGOs participations (World Bank 2006, IFAD 2006 and ADB 2006). The DAE included NGOs as partners in the Smallholder Agricultural Improvement Project (SAIP) started in 2000 and the Northwest Crop Diversification Program (NCDP) started in 2002 aiming to improve food security and income level of beneficiaries. The SAIP would assist 131,000 smallholders within 6,535 groups and the NCDP to 200,000 small farmers within 10,000 groups with extension service and micro-credit (DAE 2000 and DAE 2006). The government incorporated non-farm households (owner of <0.02 ha cultivable land not dependent on farming) in agricultural projects that were not found in earlier projects.

### **3.3. Impacts of evolving policies on research activities**

Farming system research adopted a system of trials for developed technologies in farmers' field in the early 'reform' policy phase in 1981 under a project of BARC. It even helped farmers to get extension service from researchers. The monitoring and evaluation of research programs since 1982 made the research institutes accountable in innovating need-based technology (BARC, 2006). The FAO with two other donor agencies started a vegetable development project and the Horticultural Research Center (HRC) was built in 1989 as a need-based institute in supporting vegetable and fruit production (FAO, 2005). The NGOs were incorporated in research activities in the 'collaborative' policy phase. Meanwhile, several research memorandums were signed between NGOs and BARC and some NGOs were participated in collaborative research programs (BARC, 2006).

Large and medium farmers got more benefits from research activities because they had more access to new seeds since the 'supportive' policy phase. The more involvement of NGOs in research activities would help innovating need-based technology suitable at grassroots (World Bank, 2005). Some NGOs had even investment in basic research, like the BRAC soil-testing laboratory, Aftab biotech research center, Rantik tissue culture-based potato seed production, Proshika research and

demonstration program, etc. (Mondal 1999, Proshika 2006 and BRAC 2006). Lately, the on-farm research activities even put priorities to trial technologies on the fields of small farmers.

**Table 2.** Summary of impacts of evolving policies on access to technology by farmers’ groups

Phases of agricultural policy	Policy favors								
	Access to and use of inputs			Access to extension service			Access to research benefits		
	S	M	L	S	M	L	S	M	L
Adverse circumstances policy phase (1870s - 1940s)	O*	×	×	×	×	×	×	×	×
Supportive policy phase (1950s– late 1970s)	O**	O	O	×	O	O	×	O	O
Reform policy phase (late 1970s–late 1990s)	O	⊕	⊕	O	⊕	⊕	O	⊕	⊕
Collaborative policy phase (late 1990s – current)	⊕	⊕	⊕	⊕*	⊕	⊕	⊕	⊕	⊕

**Note:** S, M and L stand for Small, Medium and Large farmers, respectively

Availability/use level: × =absent, O =limited extent, ⊕ =moderate and ⊕\* =moderate but sometime sufficient

O\*: access to seeds during natural disaster and O\*\*: very occasional

The policy changes on extension and research activities were also found effective to raise income level of farmers because they got access to need-based extension service in the ‘collaborative’ policy phase. Akanda and Isoda (2006) in a research on the expansion of vegetable farming found that small farmers had relatively expanded the vegetable farming more than that of large and medium farmers in order to earn more from their limited crop areas. The need-based agricultural extension services from the DAE and efforts for smallholders’ development along with NGOs micro-credit (by SAIP that discussed earlier) were found to favor the small farmers.

## 4. Conclusions

This research analyzed the sequential changes of all supply-side agricultural development policies in Bangladesh dividing them into four phases based on their origins, objectives, targeted farmers, pattern of supports, etc. The (1) ‘adverse circumstances’ policy phase (1870s - 1940s) was characterized by a few government measures to face the adverse and critical conditions aiming to keep a smooth collection of revenue, (2) ‘supportive’ policy phase (1950s – late 1970s) was characterized by general development of agriculture with enormous government supports and subsidies, (3) ‘reform’ policy phase (late 1970s - late 1990s) was characterized by market liberalization to cope up with market economy, and (4) ‘collaborative’ policy phase (late 1990s - current) was characterized by development initiatives under partnership of government and private sector including NGOs aiming to reach the smallholder. The result indicated that agricultural policies in Bangladesh were changed towards emphasizing on the development of small landholders, from a ‘landlord biased’ policy favoring land-rich farmers reported in earlier research (Griffin, 1974).

Structural changes in policies were mainly started in the late 1970s through reforms of existing institutions with the suggestions of donor agencies aiming to reduce government expenditures. The

government interventions on supply of irrigation devices, pesticides and agricultural machineries became nil in the 'reform' policy phase. The private sector played prominent role in distribution of almost all inputs in the 'collaborative' policy phase. However, government involvements in supplies of seeds and agricultural credit were even increased over time because, the infrastructures for private seed production were not sufficiently developed and the credit was very essential to face natural disasters. Lately, the government incorporated NGOs in credit disbursement and recovery as they could achieve high recovery rate that had ensured the government to get money back. Moreover, the responsibilities of both government and NGOs increased in extension service and research activities. The private sector appeared as an important issue of collaborations between the developments of government and private sector since the late 1990s.

The evolving policies influenced positively on technology diffusions though it was not much effective in the 'supportive' policy phase. However, all types of farmers were acquainted with new technologies during this phase. The availability and farm level use of fertilizers, small-scale irrigation devices and power tillers were increased much after market liberalization because of decreasing prices for competitive imports. The participations of private sector and NGOs in seed production had made the improved seeds more available to the farmers. However, the government had to re-introduce subsidy and even to import fertilizers as per election manifesto. Moreover, all changes in extension and research policies had helped farmers to access in need-based technologies.

The large and medium farmers were mostly benefited from new technologies in the 'supportive' policy phase. However, the technologies became accessible to small farmers on the 'reform' phase that became equally accessible as like as medium and large farmers in the 'collaborative' policy phase. On-farm research activities had even prioritized on the small farmers to trial innovated technologies. Recent collaborative development programs of government with NGOs were found effective to reach to the small farmer because, those programs emphasized on the development of land-poor farmers even with credit and technical supports. Bangladesh with a large number of highly experienced and well-developed NGOs could take the opportunity to move forward with partnership and collaborative developments of agriculture and rural areas as well in larger scale.

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**Appendix Table 1.** Changes in government interventions on the supply of inputs, agricultural extension and agricultural research from the ‘supportive’ to ‘collaborative’ policy phase in Bangladesh

Items	Supportive policy phase (1950s – late 1970s)	Reform policy phase (late 1970s - late 1990s)		Collaborative policy phase (late 1990s - current)	
	<i>Situation existed</i>	<i>Measures taken</i>	<i>Year</i>	<i>Measures taken</i>	<i>Year</i>
<b>Inputs</b>					
<i>Fertilizers</i>	Supplied at subsidized price	Subsidy was gradually withdrawn	1979-92	Re-introduction of subsidy	1997
	BADC procured fertilizers and sold to BADC dealers from Primary Distribution Points (PDPs)	BADC sold to private dealers from the PDPs	1978-	Enacted an Act for market control	1999
	Complex process of appointment of BADC dealers	Dealers were allowed to sell fertilizers at their own fixed price in competitive market	1982-84		
	Dealers sold fertilizers to the farmer at fixed prices after buying from PDPs	Licensing process for private dealership of fertilizer was simplified	1982		
		Dealers were allowed to collect fertilizer from factory gates or ports	1989		
	Allowed traders to import only except Urea	1992			
	Monitoring of market and pre-estimation of local demand were done by government	1995-			
<i>Seeds</i>	Restriction on private sector import	Private sector import was allowed except of rice, wheat, jute, potato and sugarcane seeds	1990	Allowed private sector to import and produce all kinds of seeds	1999
				Provided technical and financial supports for private seed industry development	2000
<i>Agric. credit</i>	Short term loans for seasonal crop expenses	Investment credit was provided to privatize the ownership of minor irrigation devices	1980 -	Formed credit committee by local elite and leaders for loan disbursement	1999
		Provided much attention to loan recovery	1986		
		Non-eligibility of taking new loan for loan defaulters for getting high recovery	1990		

Note: The 2<sup>nd</sup> step liberalization of seed market in 1999 was taken into ‘collaborative’ policy phase because it aimed to increase seed supply with more participation of private sectors besides strengthening of seed production by the government.

Source: Osmani 1985, Ahmed 1995, MOA 1996, MOA 1999, Akanda, *et al.* 1999, Rahman 2000, Banglapedia 2004 and MOA 2006

**Appendix Table 1** (continued). Changes in government interventions on the supply of inputs, agricultural extension and agricultural research from ‘supportive’ to ‘collaborative’ policy phase in Bangladesh

Items	Supportive policy phase	Reform policy phase		Collaborative policy phase	
	<i>Situation existed</i>	<i>Measures taken</i>	<i>Year</i>	<i>Measures taken</i>	<i>Year</i>
<b>Inputs</b>					
<i>Irrigation devices</i>	BADC used to install pumps for farmers’ use against a flat charge	BADC sold Shallow Tube Wells to private ownership of farmers	1980-85	No change	
	Restriction on private sector import	BADC sold all pumps to private ownership	1980-92		
		Allowed private sector import	1987		
		Standardization restrictions and import duty were removed	1989		
<i>Agric. machinery</i>	BADC attempted to adopt power tillers	Private sector was allowed duty free import without any restriction	1989	No change	
<i>Pesticides</i>	BADC imported and distributed to the farmers at subsidized price	Privatized import and distribution after withdrawing entire subsidies	1979	No change	
		Withdrew import restriction by brand names	1989		
<b>Agricultural extension</b>	Traditional teaching methods in delivery of extension service	Training and visit (T&V) approach was adopted	1978-83	Taken a formal policy to provide a participatory and demand-led service	1996
	Provided service by many mono-crop extension agencies	Created DAE through unification of the mono-crop agencies	1982	Some projects were taken to ensure the participation of NGOs	1999-
		Decentralized the service considering the districts as focal points of DAE operations	1982		
<b>Agricultural Research</b>	Laboratory based research activities	On-farm research was adopted with coordination of BARC	1981	Taken ARMP (a project) to incorporate NGOs and private sectors	1996-2001
	Research activities without evaluation	Created the Monitoring and Evaluation division in BARC	1982	National Agricultural Policy allowed participation of NGOs and private sector	1999
	Research institutes did not coordinate with private sectors or with each other	Research institutes were taken under National Agricultural Research System (NASR)	1996		

Source: Ahmed 1995, MOA 1996, MOA 1999, Rahman 2000, Banglapedia 2004, DAE 2006, BARC 2006 and MOA 2006

**Appendix Table 2.** Changing pattern of government and private sectors responsibilities into different policy phases on input supply, agricultural extension and research activities in Bangladesh (based on Appendix Table 1)

Items	Sectors	Responsibilities			Changed responsibility
		Supportive policy phase (1950s – late 1970s)	Reform policy phase (late 1970s - late 1990s)	Collaborative policy phase (late 1990s - current)	
<b>Inputs</b>					
<i>Fertilizer</i>	Government	Procurement of all fertilizers + Subsidized supply to farmers	Supply urea fertilizer for traders + Control of privatized market	Supply urea for traders + Control of privatized market + Subsidy	Decreased
	Private sector and NGOs	None	Distribution of all fertilizers + Import all except urea fertilizer	Distribution of all fertilizers + Import all except urea fertilizer	Increased
<i>Seeds</i>	Government	Production + Distribution to farmer level	Production + Certification of private sector produced seeds	Production + Certification + Support to private seed industries	Increased
	Private sector and NGOs	None	Procurement of a few crops seeds + Distribution of all seeds	Procurement of all crops seeds + Distribution of all seeds	Increased
<i>Agric. credit</i>	Government	Formal seasonal credit	Seasonal credit + Investment credit	Seasonal credit + Investment credit	Increased
	Private sector and NGOs	Non-formal high interest loan from moneylenders	Non-formal loan + Semi-formal (Micro-credit of NGOs)	Non-formal loan + Micro-credit + NGOs operate with government loan	Increased
<i>Irrigation devices</i>	Government	Procurement + Installation	Sale out to private ownership	None	Ended
	Private sector and NGOs	None	Procurement + distribution	Procurement + Distribution	Increased
<i>Agric. machinery</i>	Government	Procurement + Distribution	Became nil	None	Ended
	Private sector and NGOs	None	Procurement + Distribution	Procurement + Distribution	Increased
<i>Pesticides</i>	Government	Procurement + Distribution	Became nil	None	Ended
	Private sector and NGOs	None	Procurement + Distribution	Procurement + Distribution	Increased
<b>Agricultural Extension</b>	Government	Traditional advice + Support by mono-crop agencies	Advice by Training & Visit + Support by unified DAE + Decentralization	Demand-led advice + Support + Development project with NGOs	Increased
	Private sector and NGOs	None	Own extension program + Support	Own extension program + Support (Own + Government project)	Increased
<b>Agricultural Research</b>	Government	Laboratory based research	On-farm research + Evaluation + Unification of research system	On-farm research + Evaluation + Unified system + Work with NGOs	Increased
	Private sector and NGOs	None	No basic research	Research with government agency + Basic research by NGOs	Increased