

Policies and Implementation Strategies for Strengthening Agricultural Mechanization in Bangladesh

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Abstract

The demand for mechanization as an important input to achieve higher agricultural production has lately been recognized by our policy makers and planners. For a long period of time agricultural mechanization, especially the use of machines like power tillers, irrigation pumps, threshers and many other equipment are expanding without any specific policy guidelines. Nonetheless mechanization has brought a substantial production increase through timely cultivation, irrigation, harvesting and threshing. The impacts of mechanization are now visible in the technical skills development within local workshops, better livelihoods for farm workers and employment in the rural non-farm sectors. Besides local manufacturing capacity of small machines, equipments and spare parts by light engineering industries are growing but at a slower space due to many problems faced by them. These enterprises are not capable enough to compete with foreign manufacturers in terms of quality and performances. The need for technical assistance, innovation, government support and proper policies are essential to make the local entrepreneurs viable and capable to meet the local demands of machines and equipments. This paper reviews the present status of mechanization, highlights the proposed policies and implementation strategies to be undertaken by the government to strengthen agricultural mechanization in order to make progress in the agricultural sector.

Key words: Draught animal, farm machinery, implements, agricultural mechanization, agricultural policies, livelihoods, rural non-farm employment.

1. Introduction

The demand of farm machinery that started with the introduction of HYV rice and Green Revolution in the late 1960s and 1970s has been increasing over the years and the demands are now spreading in the post-harvest operational areas also. Agricultural mechanization, especially the use of machines like power tillers (PT), low lift pumps (LLP), threshers and many other small agricultural equipment are expanding in Bangladesh without any specific policy guidelines. The Government was liberal regarding tariff and import of these machines but the growth of their usage has been stimulated mainly by the combination of traders' efforts and farmers' demands. Local manufacturing of some small machines, implements and spare parts have also grown at a slower pace inspite of the problems faced by local enterprises due to relatively higher tariff on imported raw materials and shortage of technical skills and other related inputs.

Mechanization of agriculture in Bangladesh has grown without any significant public sector intervention. Public sector agricultural R & D institutes have also put minimum effort on agricultural machinery due to poor government support / lower funding and DAE is yet to take up extension programs for expanding the use of

agricultural machines in the most effective way, though the use of these machines is recognized as one of the factors that helped growth and intensification of crop agriculture. Agricultural mechanization, as an important input, is playing a vital role on overall production increase, but it has so far received minimum attention in the agricultural development activities until very recently due to the fact that it is more directly associated with Rural Non Farm (RNF) employment and promotion of Small and Medium Enterprises (SME) in the traditional farming sector. Recognition of agricultural machinery and mechanization as an essential component of future agricultural development programs and policies is expected to help solve farmer's problems, increase productivity and contribute towards achieving the Millennium Development Goal (MDG) targets.

Recent National Agricultural Policies (NAP) prepared in 1999 has recognized the complementary role of the public sector for guiding and assisting the farmers, traders, service providers, manufactures and the R & D institutes involved in this sub-sector. Productivity and competitiveness of farmers are expected to grow with the provision of appropriate supports for agricultural mechanization. With that in view, NAP has made a number of policy recommendations to help expand and improve automation for

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commercial of agriculture. This paper mainly reviewed and discussed the impact of agricultural mechanization in general and highlighted the policy strategies and Implementation action plan for mechanization to be undertaken by the government in agricultural sector.

2. Background of Agricultural Mechanization in Bangladesh

Brief backgrounds and review of policies of agricultural mechanization in Bangladesh are as follows:

1. The then Government of East Pakistan introduced Power Tillers and Power Pumps in the late 1960s as a part of 'Green Revolution' activities. The Government of Bangladesh (GOB) allowed continued import of farm machinery since independence to help mechanize farming activities.
2. The GOB abolished standardization requirements and made the market open for import of agricultural machines (especially power tillers and pumps) at a nominal tariff following a devastating flood and loss of a large population of draught animal in 1988. Since then a large number of power tillers, small engines, implements and power pumps are imported every year, mainly from China, to meet the local demand.
3. Decreasing number of draught animals (DA), shortening of time available for land preparation and harvesting due to increased cropping intensity, shortage of labor at peak periods, and increasing demand for irrigation for the dry season crops are creating increasing demands for appropriate farm machinery. Hence appropriate policies and strategies for agricultural mechanization were suggested by experts/planners in the later part of eighties and early nineties (Mahtab, 1989).
3. Engagement of increasing number of people for operating, servicing, trading and fabricating simple agricultural machinery, tools and accessories is creating alternate livelihood opportunities and contributing to non-farm economy in rural areas though machines have reduced human labor requirement for land preparation (Barton, D. 2000). Mechanization has increased both yields and returns to the users (Table 1).
5. National Agricultural Policy of 1999 briefly states that: a) needs for farm machines in the different zones will be assessed and publicized to attract private sector, b) deficit of animal draught power will be supplemented by mechanization while animal will continue to be used in many areas, c) import of machines and raw materials needed for local fabrication will enjoy tax relief, d) credit will be made available to both users and traders to help mechanization and e) formation of user groups/cooperatives will be encouraged for owning or leasing agricultural machinery.
6. The NAP statements mentioned above have not yet been put into effect. Besides GOB is allowing import of foreign made agricultural machinery at no or low tariff. The policy guideline in respect of agro-tools manufacturing and trading of agricultural machinery in Bangladesh is not appropriate for the development of local entrepreneurship.

Table 1 Impact of Mechanization on Yield and Returns in Rice Cultivation

Crop & its production parameters	Draught Animal	Power Tiller	Both
Aman Rice			
Yield (kg/ha)	5307	5385	5483
Gross return (Tk/ha)	38635	39202	39916
Net return (Tk/ha)	8774	12785	12641
BCR (undiscounted)	1.29	1.48	1.46
Boro Rice			
Yield (kg/ha)	3540	3580	3530
Gross return (Tk/ha)	26373	26671	26298
Net return (Tk/ha)	12373	13746	13388
BCR (undiscounted)	1.88	2.06	2.04

Source: Barton, D (2000)

3. Status of Agricultural Mechanization

3.1 Present status of mechanization and farm machinery

Mechanization is gradually progressing in Bangladesh as the farmers are finding benefits in using various machines available for farming operations. Cost of tilling land with power tillers is found to be economically advantageous due to higher cost of using animal power. Moreover, mechanization is helping increase of cropping intensity and introduction of new crops. Preference for using machine power is seen in farmers of all sizes including very small ones. Animal power is becoming less available and over 80% of farming families are found to use power tillers now than draught animal. This picture may be taken as an indicative one for the whole country. A common observation that there are labour shortages during peak farming activities (planting and harvesting of rice) has been confirmed in some studies on different aspects of using farm machinery in Bangladesh (Sarker, 1997). The question of displacement of labour during off-peak periods with the increased use of machinery in farming activities has also apparently phased out in the recent years. A study by David Barton (2000) showed that introduction of power tillers provided employment for labourers despite the fact that it reduced human labour requirement for land preparation per unit area. The engines used with the power tiller were also used for many other activities including irrigation, threshing and various transportation.

An estimated 400,000-450,000 power tillers are in operation along with about 10,000 four-wheel tractors in Bangladesh. Bogra and North Bengal in general, greater Comilla, greater Dhaka and Tangail lead in the use of power driven machines. These machines are owned mostly by large farmers and/or available on custom hiring basis. Manually operated grain threshers along with power operated ones are in widespread use. These are all made in Bangladesh by local manufacturers. Low lift power pumps and mechanized shallow tube-wells (nearly two millions) are also in widespread use. These are also popular custom hiring items. The number of rural households reporting ownership of small-scale irrigation equipment (such as tube wells and power pumps) increased from 274,000 in 1983-84 to about 1.5 million in 2007. The cultivated area irrigated by mechanized means increased from about 20% in 1983-84 to about 65% in 2007. Other mechanical equipment in use includes seeders, drum seeder,

seed-cum-fertilizer applicators, manual weeders, hand-held and knapsack type sprayers and various hand tools.

Some mechanical grain dryers, sugarcane crushers, solar vegetable and fish dryers (not widely used), locally innovated / developed corn shellers and graders are also in use. These locally manufactured equipments / machines are gaining popularity. Only a few reaper or machines for harvesting rice and wheat are available. Machines for transplanting rice seedlings are mostly on trial. Rubber-roll hullers of small capacity suitable for small scale rice mills and itinerant rice hulling vendors are in operation in many places to replace the inefficient and obsolete 'Engelberg' type steel hulling machines. Large size rubber-roll hullers are being imported now a day for use at medium or larger rice mills.

3.2 Research and development of agricultural machinery

The following machines have been developed or adapted from available designs and tested by the R & D institutes. Some of them were produced locally by the private workshops/ manufacturers successfully.

- Power tiller (mostly imported)
- Weeder (Manual) – locally produced
- Treadle pumps –locally produced
- Seed drill –still on trial
- Seed / fertilizer applicator- recently produced locally
- Reaper (for rice & wheat) – on trial at R&D institutes
- Maize sheller (manual & power) – locally produced
- Thresher (manual & power)- all produced locally
- Dryer – mostly imported
- Power tiller-operated potato planter- under trial at R&D institutes

The relevant national R & D institutes specially dealing with agricultural machinery are:

- Bangladesh Rice Research Institute (BRRI)
- Bangladesh Agricultural Research Institute (BARI)
- Bangladesh Sugarcane Research Institute (BSRI)
- Bangladesh Jute Research Institute (BJRI)
- Bangladesh Agricultural University
- Bangladesh Council for Scientific and Industrial Research (BCSIR)

There is now dearth of skilled scientists-engineers in these R & D institutes. Funds flow for R & D on agricultural machinery is very low compared to other fields. As a result the R & D on farm machinery development in Bangladesh is low. Few important on-going R & D on agricultural machinery at the Research Institutes are:

- Development and evaluation of Chinese PT seeder
- Manually and power operated Paddy Transplanter
- Seed/fertilizer Applicator
- Development of multi-crop power thresher
- Design and Development of power tiller operated potato digger

3.3 Promotional activities of agricultural machinery

The National Research Institutes, such as BRRI and BARI have established linkages with a good number of manufacturers capable for fabrication and manufacturing of agricultural machineries. These private manufactures receive technical assistance i.e. prototypes, drawings and expert services from these national research institutes. NGOs are also promoting machines by organizing landless farmers as a poverty reduction campaign.

There has been no public sector agency responsible for the extension of the machineries to the farmers except one machinery and engineering extension unit under the Department of Agriculture Extension (DAE). Now a new 5-years duration project, titled, "Enhancement of Production and Rural Employment through Extension of Agricultural Engineering Technologies" is being implemented by DAE. CIMMYT and few NGOs have also supported mechanization through demonstration and training.

Project based attempts have been made to popularise the machineries in different locations of the country during 2002-2006 and found suitable for specific socio-economic settings of the farming system. The machineries have been put into trials/demonstrations for wider extension, adaptation through different specialized projects. The projects were/are:

The Popularisation of the agricultural machinery project (PAMP-Project): The project is designed for the extension of BRRI developed machineries with duration of four years through demonstration.

Research and extension in farm power issues (REFPI-DFID): The project was implemented by Bangladesh Agricultural University during 2000-2004 with the support of DFID- UK through number of sub-projects in association with NGOs and private sector. The project was designed for sustainable livelihood approach with special interest of entrepreneurship and skill development.

Enhancement of production and rural employment through extension of agricultural engineering technologies: The project is being implementing by DAE and will be continued for next few years (upto 2010).

The machineries those have been popularised are: Manual seeder, dryland weeder, rice-wheat reaper, open drum power thresher, rice-wheat thresher, manual and power maize sheller, seed/fertilizer applicator and dryers.

3.4 Impact of agricultural mechanization and farm machinery

(a) Agricultural mechanization and livelihood of rural poor: Recently completed BAU farm mechanization project (popularly known as REFPI) evaluation indicated that the achievements of interventions made real impacts on the livelihoods of the poor despite the relatively small scale and the short time period of implementation of RD & E projects. A wide and often unanticipated range of livelihood impacts were associated with increased accessibility to and information on farm power by the rural poor. Increased access to farm power information and technology has (Turton and Afsar, 2002):

- Increased labour productivity and reduced labour shortage bottlenecks
- Reduced workload and drudgery, especially for women
- Created livelihood opportunities for renting out implements, often by the landless
- Created a skilled labour pool amongst agricultural labourers
- Improved service availability for those who can not afford individual ownership of machinery
- Generated employment opportunities
- Stimulated entrepreneurship at the local level
- Empowered partners, entrepreneurs and women

The key lesson that emerged from REFPI Project is that the development and extension of farm power

technology is an important entry point for improving livelihoods of the poor. Indeed, we might extrapolate further that: 'If the poor are not given the appropriate support for access to farm power and technology, they are at risk of being further marginalised from development processes' (Turton and Afsar, 2002).

(b) Agricultural mechanization and farm women : Initially the farm mechanization has displaced women labourers from their traditional jobs but due to recent diversification of farm activities, employment opportunities have been created jobs for women both in farm and non-farm activities. The mechanization though very selective in the recent past has created ample scope to save time and reduce drudgery of work so that women could invest time in other household and income generating activities. It has been observed that the introductions of mechanized threshers, irrigation devices, weeders, hulling machine/dehusker and power operated small processing units has made a remarkable impact on women's role in rural areas as income earning members, contributing to women empowerment and participation in decision making. This has also increased social & physical capital of the family women in Bangladesh.

(c) Agricultural mechanization and promotion of rural non-farm sector (RNF): During the last couple of decades, rapid growth and transformation in agriculture has triggered a significant expansion of rural non-farm activities. The rapid growth of pump irrigation and power tillage technologies has stimulated various manufacturing and services activities at the local level. These include manufacturing and trading of farm machinery and equipment spare parts, machinery installation, repair and maintenance services, inputs and grain trade, crop and food-processing, rural transport, rural trade and shop keeping, etc. The rise in rural household income has resulted in a rapid increase in demand for materials and services in house construction, rural sanitation, household materials and personal services.

(d) Capacity of local manufacturers : A growth pattern is emerging in the manufacturing of agricultural machines and their spare parts in the country in spite of difficulties faced due to relatively high tariff on raw materials, shortage of technical facilities and skilled personnel, capital and experience. The manufacturers are promoting their products, trying to provide some essential after-sales services and organizing themselves into an association for collective benefit. They are also availing existing opportunities to obtain technical assistance from research institutions (BAU, BRRI and BARI) and some larger NGOs regarding product development, lab-testing and on-farm trial of their products.

There are more than 40,000 small and medium sized local metal working workshops spread all over the country. These workshops are doing reverse engineering and manufacturing spare parts of all kinds including agro-tools and machineries. Except power tiller and tractors, reapers, most of the agro-tools/machines/equipment are completely fabricated in the country; only the prime-movers, such as electric motors and IC engines are imported. Electric motors are also manufactured in the country to a large extent.

(e) Rural employment and labour productivity: Several studies confirmed that mechanical cultivation of land is a labour saving as well as cost reducing technology for the farmers. As a result, many farmers prefer this new mechanical technology for land preparation to the traditional DAP technology. Besides, the power tiller also facilitates planting and growing of additional crops, especially in the face of quick turn around period between crops. This in fact raises aggregate output and employment in the long run. Miah's (2000) study results shown in Table-2 confirms that all categories of PT using farmers earned relatively higher profits than the only DAP using farmers as well as DAP plus PT using farmers.

Table 2. Impact of PTs on cost, return and rural employment

Season	Power option	Gross return (Tk./ha.)	Gross cost (Tk./ha.)	Net return (Tk./ha)	Employment (mandays/ha.)
Boro	PT using farm	39230	26645	12585	152
	DAP using farm	38655	29073	9582	179
	Impact on PT	+575	-2428	+3003	-27
Aman	PT using farm	27160	12728	14432	127
	DAP using farm	26860	13447	13413	141
	Impact on PT	+300	-719	+1019	-14

Source: Miah, (2000)

The rural labor market in Bangladesh has undergone significant changes during the last decade with increasing mobility from farm to non-farm jobs and an improvement in rural agricultural wages. The estimates from Hossain (2003) based on a panel survey of 66 villages show that the proportion of farmers (self-employment in agriculture) in total rural employment declined from 43% in 1987 to 35% in 2000 and that of agricultural wage laborer halved from 22% in 1987 to 11% in 2000. Nearly identical trend in employment is observed for the land-poor workers; they have moved out of agricultural wage labor and into non-farm jobs mostly in services, trading and construction sectors.

Figure 1 explains in general the trend of employment in rural areas as mechanization progresses. Introduction of demand led machines requires less farm labour but demands higher labour in it's associated rural industry such as repair workshop, spare parts manufacture and trade, and service. People obtain job more in rural non farm sector. Thus there is a migration of labour force from farm to non-farm activities.

(f) Growth of custom hire service: The spread of minor irrigation equipment and power tiller have helped to develop a market for custom services. In the prevailing irrigation service market, the pump owners usually install their wells or pumps on their own plots to irrigate their own fields and deliver excess water to other farmers fields under varied

contractual arrangements. The water market involves over 1.7 million owners/managers of tube wells and pumps (because there are 2-3 owners per shallow tubewell) and 0.16 million rural mechanics who provide pump installation and repairing services (Mandal and Asaduzzaman, 2002). Private owners of power tillers (PT), who are generally medium and large farmers, provide tillage services on contract basis. Those owning several PTs in more concentrated areas send their machine and drivers to distant but less PT concentrated areas for the season and hire out tillage services through their appointed agents (Alam and Mandal, 2003). There is also a significant growth observed in custom hire services for grain threshing.

(g) Demands for new machines: As a result of impacts of mechanization farmers of Bangladesh are expressing their desire for using appropriate machines for more diverse use in addition to those they have already become familiar with. Recent PRA studies (Hamid, 2001) and field visits made by the APB Team revealed that new machinery the farmers would like to have access to include the following:

- ◆ Machines for harvesting rice and wheat (only a few are available on trial basis, further adaptive trials and assured supply of spare parts needed).
- ◆ Machines for transplanting rice seedlings

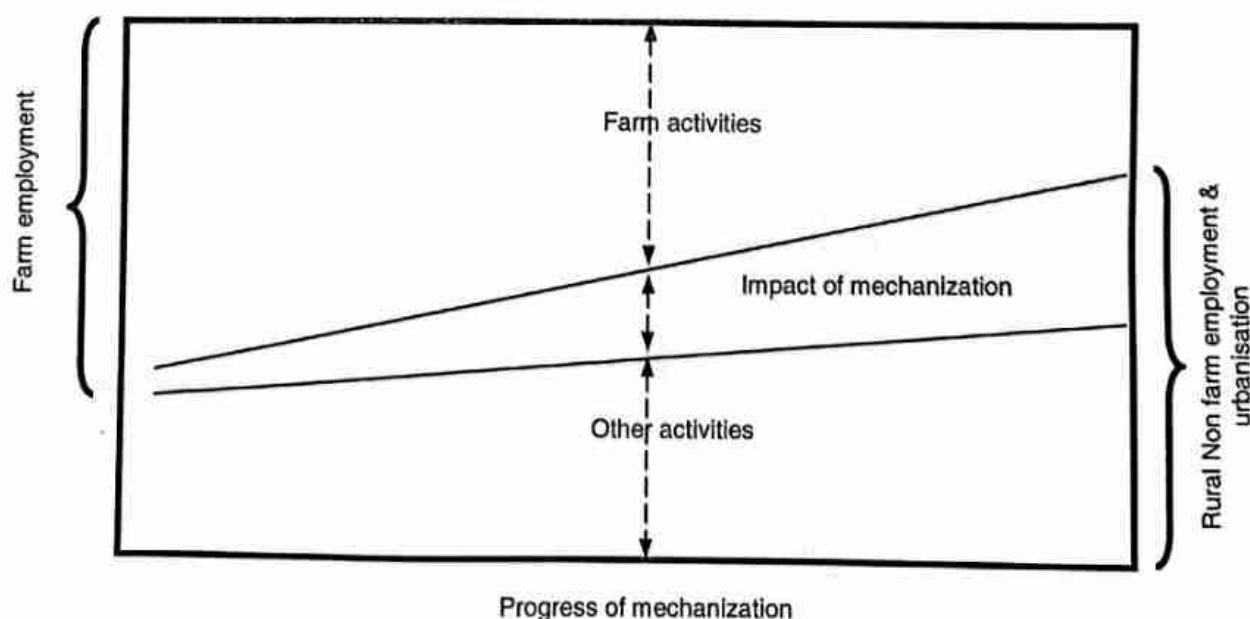


Fig. 1. The trend of rural employment & progress of agricultural mechanization

- ◆ Low cost and effective drying system for grains and other farm produce
- ◆ Rubber-roll hullers of small capacity suitable for small-scale rice mills and itinerant rice hulling vendors to replace the inefficient steel hulling machines.

Review of current policy

- a) There is no explicit set of actions to guide the nature and extent or to set goals of agricultural mechanization in Bangladesh.
- b) Except for making import of machines at low tariff, other items mentioned in the 1999 Agricultural Policy, especially encouraging local manufacturing, have not enjoyed any follow up action.
- c) The current policy ignores the necessity of training the users, traders and service providers to maximize the benefits of mechanization.

- d) The current policy also ignores the promotion/extension of machinery for essential post harvest operations (e.g. parboiling and milling of rice) wherein significant economic losses occur.

Mechanization policies for the near future

The Agriculture Sector Review Team recommends the following immediate and medium term policies for consideration of the Government (MOA, 2006a). These policies are designed to address key constraints of mechanization thereby contributing to sustained increase in land and labor productivity in agriculture, promoting concomitant investments and mitigate natural disaster and market related risks thus facilitating the transformation of subsistence agriculture to industrial/commercial agriculture. Against this backdrop, individual policies are stated below (Table 3) together with their respective advantages and limitations.

Table 3. Summary of Recommended Policy Statements

Policy	Advantage	Limitations
Immediate Priority		
Policy 1: Increase mechanization capacity and efficiency through training, demonstration and advisory programs for farmers and Union level mechanics/artisans to enhance their skills in operating, maintaining and repairing power tillers, pumps and other common agricultural machines. Give the responsibility and needed facilities and funds for these activities to DAE; introduce agriculture based vocational education/training in collaboration with ARIs, Universities, NGOs and private sector. Simultaneously, encourage formation of fanner/user groups (for owning, operating, maintaining and custom hiring of agricultural machines and equipment) through DAE and collaborating NGOs/private sector entities.	Skilled farmers and Union level mechanics/artisans will be available for operating, maintaining and repairing power tillers, pumps and other common agricultural machines. Farmer groups will help increase availability of equipment for custom hiring for small farmers and also advance non-farm rural economy.	Initially, it may be difficult to find adequate number of suitable trainers. Formation of coherent groups may also take time.
Policy 2: Formulate a comprehensive agricultural mechanization policy, and establish a high level "Agricultural Mechanization Advisory Committee" chaired by the Minister of Agriculture, with representation from all stakeholders to advise the government on agricultural mechanization issues and policies	This will provide technical support and guidance to the government in accelerating agricultural mechanization in the right course.	Little will be achieved if competent experts and persons, with high reputation in this field are included in the committee and due importance is given to the advice of the committee.
Policy 3: Provide adequate funds for priority research, development and extension works to capable institutions including selected ARIs and Universities on a competitive basis. (Private sector may also share R&D cost or pay royalties in exchange of patent or marketing rights.)	Competitive funding for development of appropriate machinery and solving mechanization problems will stimulate activities to the advantage of the farmers as well as the nascent agri-machinery industry.	Judicious allocation of funds, avoidance of duplication and close monitoring of activities by the funding authority will be needed.

Policy	Advantage	Limitations
Policy 4: Review and rationalize the current tariff rates affecting import of agricultural machines and spare parts and the raw materials needed to manufacture those locally so that local manufacturers feel encouraged to work on competitive basis.	This will provide local manufacturers and workshop owners a level field to compete with imported items.	Possible misuse of tariff structure for non-manufacturing activities will need close control.
Policy 5: Join the ESCAP-established 'Asia Pacific Centre for Agricultural Engineering and Machinery (APCAEM)'.	Joining APCAEM will enable Bangladesh to take advantage of agricultural machinery development works in other developing countries in the region.	Appropriate finance will have to be committed to get full benefit of the network through related local programs
Medium Term Priority		
Policy 6: Establish a "National Centre for Agricultural Machinery (NCAM)" using existing facilities available in the system for development, testing and evaluation of farm machinery, with technical facilities to serve the needs of the public and private sectors. Encourage the engineering divisions of research institutes, the Universities and the private industries to collaborate with and utilise this national centre.	The proposed NCAM will help identification and adaptation of suitable agricultural machinery in addition to providing testing services to the developers of machinery in Bangladesh. Private sector may share R&D and testing costs or pay royalties in exchange of patent or marketing rights. This Centre will facilitate collaboration with the other NARS Institutes, the Universities and the private sector as seen in similar establishments of other developing countries.	The national centre will need adequate operating funds to be effective. Fund use will have to be closely monitored with time bound output assessment. Effectiveness will depend upon the availability of technical facilities and the quality of staff in charge, their autonomy and accountability.
Policy 7: Provide support to local manufacture of agricultural machines (small sized diesel/ petrol/CNG/LPG engines, power tillers, pumps, reapers, etc.), accessories and spare parts by encouraging and inducing the private sector, including joint venture enterprises involving established world-class firms, through credit, tax relief, industrial estate facilities and other effective incentives.	This will reduce dependence on foreign machines and fuels, create employment, help growth of economy and assure availability of machines and spare parts to locally meet the needs of the farmers.	Comparative economic advantages and availability of needed capital and availability of willing collaborators for joint venture are to be assessed carefully.
Policy 8: Replace the inefficient and obsolete steel hullers with rubber-roll for proper parboiling and milling of rice to reduce milling loss (2-4%); and establish a separate standard for low cost, low pressure and safe steam boilers suitable for small scale rice mills by amending the existing 'Boiler Act of 1923'.	Rubber-roll hullers will reduce milling loss by 2 to 4%: improve the recovery of valuable rice bran; and generally assure quality of milled rice. Safe low-pressure boilers will eliminate hazards of often fatal accidents in small rice mills and reduce wastage of fuel.	This will require training and motivation of small scale rice mill owners and operators: some essential R & D works and inter-ministry collaboration will also be necessary.
Policy 9: Construct and lease out community threshing floors in haor areas.	This will help farmers use threshing machines in haor areas for quick threshing and also provide temporary collecting and stacking space for harvested crop and save it from flash floods.	Ownership and management of such publicly funded community threshing floors may be a problem.
Policy 10: Extended coverage of rural electrification and ensure regular supply of electricity to reduce cost of irrigation and sustain economic activities	This will help farmer reduce the cost of production and increase rural employment through	Requires coordinated planning, Implementation by REB; MOA should make continuous demand

Policy	Advantage	Limitations
and/or further mechanization of agro-processing activities in rural areas.	Increased non-farm activities.	on this issue
Policy 11: Government needs to provide subsidy directly to the farmers who are using diesel for irrigation, land tilling by PTs, and threshing. Modalities for this subsidy may be developed with strict monitoring mechanism (so that only the genuine farmers get benefited). In this connection issuance of Entitlement Card may be considered, till proposed national (voter) ID card is available.	This will help farmer reduce the cost of production. Implementation could be easier after obtaining national (voter) ID	National (voter) ID is a pre-requisite. Very careful monitoring will be needed.

'Bangladesh was a member of the 'Regional Network for Agricultural Machinery (RNAM), predecessor to 'APCAEM', for some time in the past.

Policy implementation strategies

The Ministry of Agriculture (MOA) has initiated implementation of some of the policy recommendations mentioned above and established a team of consultants with the support of UNDP and FAO for preparing the Action Plan (MOA, 2006b) for implementing rest of the recommendations that will require additional

studies and external support. Table 4 reproduces the outcome of the proposed action plan with a focus on the policy recommendations that require specific details of what needs to be done for implementing the policy agenda. An integrated effort is needed to accelerate the government's initiation to implement the policy agenda.

Table 4. Implementation of actionable policy recommendations

Policy Recommendation	Objective	Implementation period	Implementing Agency
Policy 1: Increase mechanization capacity and efficiency through training, demonstration and advisory programs for farmers and Union level mechanics/ artisans to enhance their skills in operating, maintaining and repairing power tillers, pumps and other common agricultural machines. Give the responsibility and needed facilities and funds for these activities to DAE; introduce agriculture based vocational education/training in collaboration with ARIs, Universities, NGOs and private sector. Simultaneously, encourage formation of fanner/user groups (for owning, operating, maintaining and custom hiring of agricultural machines and equipment) through DAE and collaborating NGOs/private sector entities.	To improve the basic knowledge and skills of the farmers, mechanics /artisans in operation, repair and maintenance of machines.	Phase 1:1.5 yrs	MOA
		Phase 2 :3.5 yrs	DAE
Policy 2: Formulate a comprehensive agricultural mechanization policy, and establish a high level "Agricultural Mechanization Advisory Committee" chaired by the Minister of Agriculture, with representation from all stakeholders to advise the government on agricultural mechanization issues and policies	To provide the direction and guide the development of mechanization	2 years	MOA BARC
Policy 3: Provide adequate funds for priority research, development and extension works to capable institutions including selected ARIs and Universities on a competitive basis. (Private sector may also share R&D cost or pay royalties in exchange of patent or marketing rights.)	To develop appropriate farm equipment	---	MOA MOFP
Policy 4: Review and rationalize the current tariff rates affecting import of agricultural machines and spare parts and the raw materials needed to manufacture those locally so that local manufacturers feel encouraged to work on competitive basis.	To encourage local manufacture of farm machinery	6 months	MOA MOFP NBR
Policy 5: Join the ESCAP-established "Asia Pacific Centre	To get benefit from the	3 – 6 months	MOA

Policy Recommendation	Objective	Implementation period	Implementing Agency
for Agricultural Engineering and Machinery" (APCAEM)".	prototypes of farm equipment developed in the region		BARC
Policy 6: Establish a "National Centre for Agricultural Machinery (NCAM)" using existing facilities available in the system for development, testing and evaluation of farm machinery, with technical facilities to serve the needs of the public and private sectors. Encourage the engineering divisions of research institutes, the Universities and the private industries to collaborate with and utilise this national centre.	To create facilities for designing, fabricating, testing and evaluating farm machinery	Phase 1 : 1 year	MOA
		Phase 2 : 5 years	BARC
Policy 7: Provide support to local manufacture of agricultural machines (small sized diesel/ petrol/CNG/LPG engines, power tillers, pumps, reapers, etc.), accessories and spare parts by encouraging and inducing the private sector, including joint venture enterprises involving established world-class firms, through credit, tax relief, industrial estate facilities and other effective incentives.	To create local manufacturing capacity in the private sector	----	GoB
Policy 8: Replace the inefficient and obsolete steel hullers with rubber-roll for proper parboiling and milling of rice to reduce milling loss (2-4%); and establish a separate standard for low cost, low pressure and safe steam boilers suitable for small scale rice mills by amending the existing 'Boiler Act of 1923'.	To reduce milling loss of 2 - 4 percent	3 years	MOA
			BARC
			MOFDM
			MOI
Policy 9: Construct and lease out community threshing floors in haor areas.	To minimize huge post harvest loss of paddy	Phase 1 : 6 months	LGED
		Phase 2 : 2 years	DAE
Policy 10 : Extended coverage of rural electrification and ensure regular supply of electricity to reduce cost of irrigation and sustain economic activities and/or further mechanization of agro-processing activities in rural areas.	To reduce the input cost of irrigation and boost the non-farm activities and create rural employment	-----	REB
			PDB
Policy 11: Government needs to provide subsidy directly to the farmers who are using diesel for irrigation, land tilling by PTs, and threshing. Modalities for this subsidy may be developed with strict monitoring mechanism (so that only the genuine farmers get benefited). In this connection issuance of Entitlement Card may be considered, till proposed national (voter) ID card is available.	To reduce irrigation and other input cost of production		MOA
			MOFP

Conclusions

- In order to disseminate mechanization & irrigation technologies, the Irrigation and Farm Mechanization Wing under DAE may be strengthened to cover whole of the country.
- Increase mechanization capacity and efficiency through training, demonstration and advisory programs for farmers and Union level mechanics/ artisans to enhance their skills in operating, maintaining and repairing power tillers, pumps and other common agricultural machines.
- An integrated effort is needed to accelerate the government's initiation to implement the policy agenda as mentioned in Table 4 above.
- Local manufacturers should be provided with technical support, import support and tax relief for raw materials import only for agricultural machinery.
- Capacity building of manufacturers, helping in developing business markets and enabling

environment for the manufacturers, traders, importers are to be facilitated by the GO institutes and departments.

6. Provide adequate funds for priority research, development and extension works to capable institutions including selected ARIs and Universities on a competitive basis.

References

- Alam G M M and Mandal M A S 2003. Dynamic linkages in power tiller service market in Bangladesh. A draft paper prepared for presentation at the regional seminar of Bangladesh Economic Association held in Mymensingh.
- Barton D 2000. Options for farm power use in primary cultivation on small farms: Summary of main findings. *Journal of Agricultural Machinery and Mechanisation*, 4(1): p 1-4.
- Hamid M A 2001. Summary of three Farm Power Need Assessment (FPNA) Reports. REFPI Project. Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh.
- Hossain M 2003. Rural non-farm economy in Bangladesh: A view from household surveys, background technical paper prepared for the dialogue on "Promoting rural non-farm economy: Is Bangladesh doing enough?", Centre for Policy Dialogue, July 18, 2002, Dhaka.
- Mahtab F U 1989. Policies and strategies for agricultural mechanization in Bangladesh. A report submitted to Bangladesh Agricultural Research Council, Dhaka and sponsored by RNAM, ESCAP.
- Mandal M A S and Asaduzzaman M 2002. Rural non-farm economy in Bangladesh: Characteristics and Issues for development. BIDS-DFID Workshop paper, 22-23 January.
- Miah T H 2000. Impact of Power Tiller Utilization on Crop Yield, Income and Employment of Farmers in Rural Bangladesh. in Mandal (ed.) *Changing Rural Economy of Bangladesh*, Mousshumi Printers.
- MOA 2006a. Actionable Policy Brief and Resource Implications; Agriculture Sector Review (crop sub-sector) Volume I. Ministry of Agriculture, Government of Bangladesh, Dhaka
- MOA 2006b. Action Plan for Implementing the Actionable Policy Brief in Bangladesh; Agriculture Sector Review (crop sub-sector), Volume II, Ministry of Agriculture, Government of Bangladesh, Dhaka.
- Sarker R I 1997. Agricultural mechanization in Bangladesh: selection of technology. Proceedings of the Joint International Conference of Agricultural Engineering & Technology. Vol. 1, Dhaka.
- Turton Cate and Rita Afsar 2002. Livelihood and Farm Power- The REFPI Experience. The IDL Group, P.O. Box 20. Somerset, TA 18 7YW, UK.