

Learning and experiences
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BOOK: 3/10

PETRRA policy briefs

Poverty Elimination Through Rice
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PETRRA – an experiment in pro-poor agricultural research

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From technology to livelihoods

Alastair W. Orr, Fatima J. Seema, Shaila A. Nabi and Jakirul I. Peter

INTRODUCTION

Agriculture's role in eliminating poverty in Bangladesh has been challenged by the growth of the rural non-farm sector. This has led to claims that 'hands not land' provide the main pathway from poverty. According to this view, agriculture will continue to be important for food security, but it will no longer play the dynamic role it once did during the *green revolution*. Now that Bangladesh is self-sufficient in rice, other sectors of the economy will provide the engine of growth.

Agriculture's obituary seems premature, however. Evidence from Poverty Elimination Through Rice Research Assistance's (PETRRA) technology sub-projects (SPs) convincingly demonstrates that agriculture and particularly rice have

continue to play in eliminating rural poverty is easily overlooked.

This policy brief explores these wider dimensions of impact on livelihoods for four selected technology SPs. They were deliberately selected because they were technically successful, represented different types of technology and covered the different regions where PETRRA worked. The SPs and locations visited are given in Table 1.

The main questions addressed by this brief are:

- How has the new technology changed livelihoods among participating households and in the community as a whole?

Table 1. Sub-projects, locations and agencies for case studies

Sub-project	Lead agency	District visited	Local partner
Seed health	IRRI	Bogra	RDA
Integrated crop management (ICM)	BRRI	Thakurgaon	RDRS
Rice-duck	BRRI	Sylhet	FIVDB
Coastal water resources	BRRI	Khulna	HEED

lost none of their relevance in creating new economic opportunities for resource-poor households, and that they may have a much wider impact on livelihoods than simply improving crop yields or household food security. Unfortunately, the linkages between technology and livelihoods are not always captured in technical evaluations. As a result, the dynamic role that agriculture may

- How has the new technology changed livelihoods for women?
- How profitable and how appropriate has the new technology been for resource-poor farm households?

To answer these questions, we visited each SP and discussed these issues with participating households. We held meetings with mixed groups, with

separate groups of men and women, with farm households, and with local government representatives. We used mainly qualitative methods and the results are not a definitive 'livelihoods audit'. But they do capture the surprising range of impacts by what might appear to be narrow, 'technology' projects, which has implications for how agriculture might be used as an entry-point for programmes to eliminate rural poverty. Detailed results may be found in the original report (Orr, Seema, Arifa Nabi and Peter, 2004).

KEY LINKAGES

The impact of new technology is like throwing a stone into a pond. The immediate impact is felt at the household level, with changes in the use of resources, and in outcomes like food security or income. Other outcomes may be less easy to measure. Higher incomes may reduce vulnerability by improving the

spread out to include changes in assets, as households invest extra income, and in new livelihood strategies, as households change the way in which they use resources. But the ripples do not stop at the boundary of the household. They travel outwards to include changes in villages, in social relationships, or even in social norms, such as how women might behave. And they may travel even further, changing relationships with the Union, research institutions, and with private business.

Figure 1 shows a generalised picture of the type of livelihoods impact that were found in these four technology SPs. The concentric circles represent different types of impact. The different levels represent different parts of the sustainable livelihoods (SL) framework. Impact begins with outcomes, then moves to changes in capital assets, before moving to changes in livelihood strategies or the way that households make a living. Beyond the

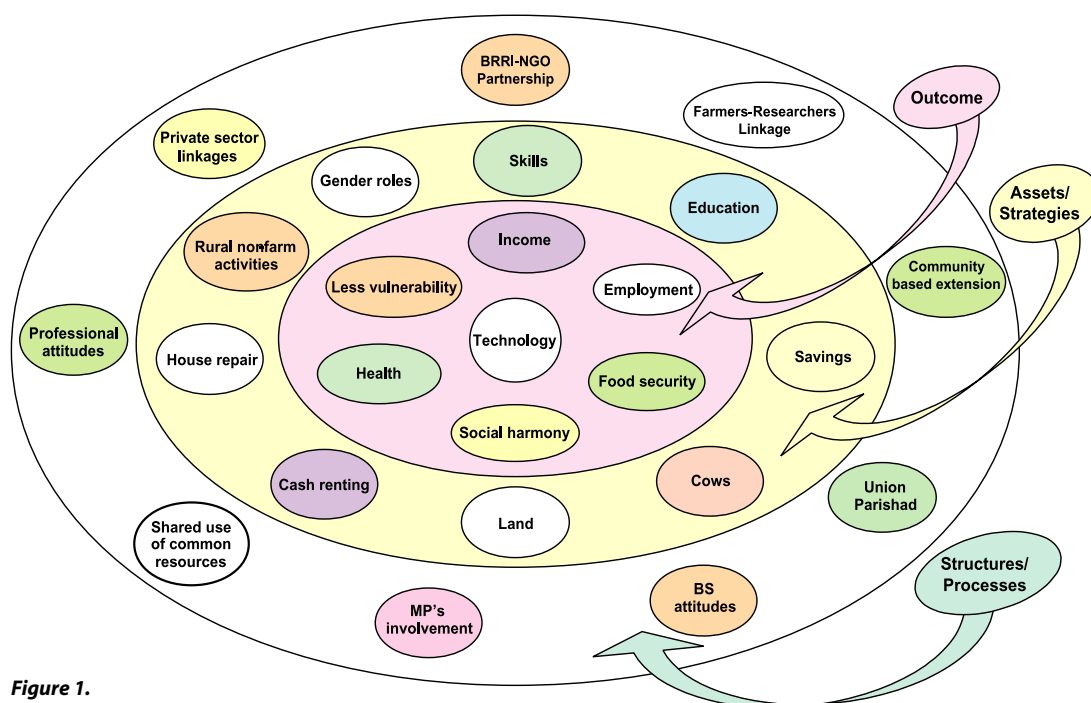


Figure 1.
From technology to livelihoods: a generalised model

household's ability to cope with a crisis, or result in better health, or give a new feeling of wellbeing and confidence. The ripples from new technology may also

household, impact then leads to changes in 'structures' or institutions (including social norms) and 'processes' or the way in which new technology reaches farmers.



LIVELIHOOD IMPACTS

Changes in outcomes

More income

New technology raised income significantly, especially if the cost of non-purchased inputs is excluded (Table 2). Income came not just from higher yields but from reduced expenditure on inputs.

sickness we can go to the specialist in Rangpur" (ICM).

Reduced vulnerability

"When we harvested only one crop we had to borrow money or rice from the wealthier families during the season" (coastal water).

"Duck rearing is a safety allowance for the household, if they need any cash money they can easily sell eggs or ducks" (rice-duck).

Table 2. Changes in income resulting from new technology

Sub-Project	New technology	Net returns over existing practice (cash-cost basis)	Unit
Seed health	Healthy rice seed	75	Tk./20 kg.
Seed health	MV boro with healthy seed	8,667	Tk./hectare
Seed health	MV t. aman with healthy seed	15,335	Tk./hectare
ICM	MV t. aman + rabi crop + boro	12,549	Tk./hectare
ICM	Improved irrigation	–	Tk./hectare
ICM	Supplementary irrigation for MV t. aman	11,675	Tk./hectare
Rice-duck	MV rice+ Khaki Campbell ducks	511	Tk./0.06 hectare*
Rice-duck	Rearing 30 ducks for sale	6,535	Tk./year
Coastal water	MV boro	11,105	Tk./hectare
Coastal water	MV t. aman	28,499	Tk./hectare

* Farmers reported this as the maximum feasible area of rice-duck that could be managed by one household

Improved food security

Higher income had an immediate impact on household food security, since income was made mostly in the form of rice. On average, new technology raised rice self-sufficiency by 1-2 months/year. Household case-studies sometimes showed increases of 3-6 months.

"We are able to eat enough three times a day" (ICM).

"She is with seed health about 7 seasons and 4 years ago she needed to purchase rice for 3-4 months. For the last 2 years they do not need to purchase any rice grain" (seed health).

Better health

"If village doctors are not able to identify our

"We used to sell right after harvest but now we can wait for prices to rise" (ICM).

Increased confidence and self-esteem

"We used to blame poor yields on bad luck (kopal kharap). Now we know it is knowledge



"Duck rearing is a safety allowance for the household, if they need any cash money they can easily sell eggs or ducks" (Rice-duck).



that makes production good or bad" (seed health).

"Before we weren't treated politely when we visited the house of a well-off person, who assumed we came to borrow something. Now they greet us, ask us to take a seat, and ask the purpose of our visit" (ICM).

"Before we weren't invited to the salish, and our word wasn't trusted. Now well-off people trust us as witnesses in village disputes" (ICM).

More harmony within the household

"When we used to fail to preserve good quality seeds, husbands used to quarrel with us asking why we failed".

"When you are poor, you don't want to consult with your wife or family members. 'Taka thakle, buddhee bhalo', so you feel like consulting others" (ICM).

Changes in assets

- Human capital increased through improved knowledge of MV rice cultivation, and new skills in seed-cleaning, duck-rearing, water management, and fertiliser use. Some skills were being transferred to other activities, for example, duck vaccine to poultry, and seed cleaning to maize;
- Physical capital increased as savings were invested in new assets. Replacing thatch with corrugated iron roofing saved the need for annual repairs;



"We used to sell right after harvest but now we can wait for prices to rise" (ICM).

"With the profits from rice sales he has managed to buy a con, tin sheets for his house, and hire a private tutor for his son who is studying in Class 5" (coastal water).

- Financial capital increased through the sale rice seed, seedlings, paddy, mustard, and eggs. This made it easier for households to save, buy clothes, invest in education for their children, get service loans from NGOs, or rent land for cash rather than crop-share.

"We can save some money from expenditures on food because of good production from rice" (ICM).

"Rice-duck has provided them with a little extra income, reducing the need for loans to educate his eldest daughter" (rice-duck).

"We were wearing short-length 'Tatial' sari which we purchased for Tk. 60, now we wear saris worth Tk. 200-300" (ICM).

- Natural capital increased, as households adopted higher-yielding MVs, used land in the dry season, introduced irrigation, and expanded the area they cultivated.

"This is the first time we are getting rice crop two times a year" (coastal water).

Changes in livelihood strategies

- Women's involvement in agriculture increased as they learnt new skills. They began to participate in field operations, sometimes for the first time. Women mentioned activities like preparing rice seedbeds, weeding, harvesting and carrying crops from the field, and finding feed for ducks.

"At first she felt shy to work in the rice fields. If her father or uncle saw her, she used to hide in the 'Tong' " (seed health).

- High-risk strategies were replaced by strategies with lower risks and higher returns.

"Sesame was risky to harvest compared to rice because it can be washed away during monsoon" (coastal water).



"We are not interested to sharecrop any more, we want to work with our own agricultural land" (ICM).

- Agriculture provided finance for seasonal, non-farm strategies.

"We are able to start small businesses like grocery shops, vegetable selling, selling molasses" (ICM).

Changes in structures

- The success of these projects reflected inclusion of all stakeholders. Projects were implemented mostly in partnerships with NGOs or local government. New linkages were created involving farmers, researchers, and local government representatives.

"In the first year, non-participating farmers protested against building embankment on canal. They thought their sesame crop would be damaged. The member of parliament (MP) made them understand and manage the problems. He also helped leasing-in the canal from local government" (coastal water).

"Now block supervisors come to us and even ask us for solutions" (seed health).

Changes in processes

- Changing attitudes among scientists. Farmers' views and knowledge helped adapt the new technology to make it more relevant and appropriate for their circumstances. For example, farmers showed seed health researchers that they could save labour by roguing only a part, rather than the whole field, and that beating rice stalks three times before threshing removed empty grains. Rice-duck farmers showed that ducks could be successfully reared using local resources, without the need for expensive feed.

"What I did in the last 12 years was meaningless. For the first time, I realise that I am doing research with farmers on their real life problems. I was a well-suited scientist and now my attitude is completely changed" (seed health).

"Before we were afraid of RDA. It is a well protected area and big officers may not talk with us. Now we are proud to talk to scientists" (seed health).

- Farmers learnt about the new technology through 'learning by doing' rather than formal training. This provided the basis for community based extension, with participants training their neighbours and farmers from other villages. Participants held field days to share knowledge with others.

"This training is more practical and real, we can practice it in our real life" (ICM).

"Training alone isn't enough to disseminate new technology. Demonstration, close linkage with researchers, and continuous learning is essential to disseminate and communicate any new technology" (union parishad [UP] chairman, seed health).



- Training women, not only in seed storage and crop processing, but in the whole range of new rice technology, including seedbed preparation, fertiliser use, and pest management. This allowed



them to share decisions about rice cultivation with their husbands and gave them confidence to work in the rice fields.

"If insects attack rice, women can identify the problem and inform their husbands to look for solutions" (ICM).

GENERAL CONCLUSIONS

While each project was different, they shared some common features, which provide useful lessons.

- What is most striking is the sheer scale of the livelihood gains. Agricultural technology – particularly new rice technology – can have a big impact in a very short time. To raise rice self-sufficiency by 3 months in just one year or just one season is no mean feat. It compares favourably with the smaller, more gradual impact of NGO micro-credit programmes. Agriculture's impact is high because:
 - Returns from land are higher than ones from micro-enterprise or wage labour, and rice can be grown in two seasons;
 - Payback period is short because one season is only for 3 months; and
 - Costs are low because technology builds on strengths and exploits unused resources (water, fallow land, household labour).
- Impact was significant not just because of its scale but because it involved rice. The centrality of rice makes it a strong entry point for changing livelihoods. Time and again, households told us that having more rice allowed them to buy more assets, eat better, be healthier, and also change their behaviour, quarreling less, being more willing to discuss problems, and a general increase in wellbeing and peace of mind. Increase in income for a poor household, and you will increase expenditure on rice. Increase in rice production, cash, time and energy are released for other activities;
- Income from new technology was reinvested in agriculture as well as non-farm assets and strategies. There was no fixed pattern of investment, which depended on household circumstances. But it was common to find households buying cows (which produce more assets in calves), buying inputs, renting more land, and switching from crop share contracts to mortgage or *khaikalashi*, which are more favourable for tenants. There was a noticeable preference for own cultivation over non-farm jobs like labouring or van-driving, which were low-paying, sometimes risky, and took husbands away from home. But households were also looking towards the future. And here they were making sacrifices for their children, investing in education and hiring private tutors to give them a better future. This included education for daughters, so that they might earn an income after marriage.

Another way that PETRRA's SPs made an impact on livelihoods was through the way they were implemented. This was particularly important for changes in structures and processes. Two examples stand out.

- Women received training in all aspects of new rice technology. Previously, women used to receive training only in activities for which they were



"If insects attack rice, women can identify the problem and inform their husbands to look for solutions" (ICM).



traditionally responsible like seed storage or crop processing. This reinforced existing gender roles and excluded women from many of their husband's decisions about agriculture. Training women has empowered them to share in decision-making and supervise hired labour. This has increased women's self-esteem and they have received respect from men. We noted a growing 'feminisation' of agriculture as women became more involved with field activities. Men appreciated this, because it saved hiring labour and freed their time for other productive activities. We also found that men whose wives worked in the fields were sometimes prepared to share childcare and some domestic tasks;

- Gender-awareness has replaced a naïve, unitary model of the farm household with one based on separate gender roles. This is useful for analysis. But it has also led to separate 'spheres of knowledge' when it comes to new technology. By treating women and men equally, as members of one household, PETRRA has given women access to knowledge that they were denied before. In operational terms, therefore, treating the household as a single unit has given women unlimited access to new knowledge, with remarkable results. This may have implications for choice of strategies, if women have different priorities from men. If women are more concerned to ensure that children are well-nourished, this could lead to greater emphasis on household food security rather than cash income;
- Local government can play a key role in scaling up and technology dissemination. UP chairmen are accountable to the electorate and have authority to initiate change. Their participation is essential for use of common property resources (coastal

water). They can 'broker' services for villagers from researchers and NGOs, and block supervisors more effectively if under local control. In working with local government, care will be needed so that the focus on the resource-poor is not lost;

- New technology in these four projects was knowledge-intensive. This knowledge was not easy to communicate through one-off 'demonstrations' or simple 'recommendations'. Farmers had to learn by doing. This required a new mode of working for scientists involving farmer participation, intensive training and close supervision. This required partnerships with local organisations that not only knew the target group (resource-poor farmers) but knew how to work with them and could incorporate training into their programmes;
- For the three partner NGOs – RDRS, HEED, and BDS – this was their first



"We can save some money from expenditures on food because of good production from rice" (ICM).



experience of working directly with rice. Their main activity was micro-credit for non-farm activities. Their involvement with agriculture was focused on homestead gardening. Now that they have seen the potential of new rice technology for their target group, they are keen to continue. This marks an important shift in their perception of agriculture as a pathway from poverty;

- PETRRA's ethos – people-focus, participatory, gender-aware, partnerships – has been a positive experience for rice scientists.

PETRRA's experience clearly shows that rice technology can have a much wider impact on livelihoods than might be suspected. This suggests that agriculture still has the potential to play a dynamic role in the elimination of rural poverty. Achieving this goal will require a national poverty strategy that makes full use not only of 'hands', but also 'land' and above all, 'heads'. But for agriculture to play this dynamic role effectively, PETRRA's legacy of value-based research – people-

focus, participatory, gender-aware, and partnerships – will be fundamental. And so will be the support of policy makers in reaffirming the power of new technology to transform livelihoods.



"Before we were afraid of RDA. It is a well protected area and big officers may not talk with us. Now we are proud to talk to scientists" (seed health).

This brief is the output of 4 case studies for seed health improvement, rice-duck farming, coastal water management and ICM technology sub-projects conducted for an understanding of impact from technology to livelihoods. The detailed case study reports are available in PETRRA website petrra.irri.org

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Technology, entitlements and freedom of choice

Abdul Bayes

Not long ago, the Nobel laureate in Economics, Amartya Sen, described development as expansion of the set of choices of the people. 'Beggars cannot be choosers' – goes the adage with the implications that at pitifully low levels of income, people have to prefer either 'this' or 'that' commodity bundle, but not both. Economists call it a 'corner' solution in an indifference curve analysis of consumers, generally taught in first year economics classes. But as the income goes up, people tend to have a choice among commodity bundles to saddle at a point where the budget line (a proxy for ability) is tangent to the indifference curve (a proxy for preference). Quite obviously, a tangent solution is preferable to a corner solution as far as consumer welfare is concerned.

'SHIP' technology

Technology adoption in agricultural practices could be one of the keys to raising income. The rise in income could alter the matrix of choices faced by the household or consumer. First, technology for the very poor enables entitlement by increasing the supply of food (for poor, production itself is entitlement as they consume what they produce) and then enhancement of entitlement could lead to a variety of choices that the poor could hardly think of in the pre-technology state.

To this effect, the impacts of the technology of the seed health improvement project (SHIP) is a case in point. In seven areas of Bangladesh: Chuadanga, Barisal, Rangpur, Bogra,

Habiganj, Gazipur and Rajshahi, 30 farmers from each area have received training on seed health management. The farmers and their spouses received training on 'why', 'how' and 'where' seeds should be kept safely for the sake of survival.

The project was in operation for four years and we wanted to obtain the reactions of farmers on the socio-economics of SHIP. We especially wanted to know-how their livelihoods were changing as a result of SHIP activities. Submitted below are some of the observations drawn from a few farmers who are very poor.

Case of an owner-tenant

Faruk Hossain (40) of Babuganj, Barisal has to feed a family of seven. He was working as a day labourer in addition to cultivating his meager amount of land. He has no education nor is his land endowment very high: only 60 decimals of owned land. He has to rent roughly 40 decimals from others to be on an even keel. Hossain and his wife took up the training with good spirit. During the last *aman* season, he cultivated BR11 to harvest home 14 *maunds* per *Jaistha* (20 decimals). Just four years ago, before there was any SHIP or associated training, Hossain used to get 8 *maunds* from the same amount of land. In the *boro* season, he cultivated *kajla* and harvested home 12 *maunds* compared to 10 *maunds* per *Jaistha* previously. The Faruk family also learnt how to use less fertiliser and pesticides.

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The increased yield from paddy and the sales of seeds that he recently embarked upon, seem to have altered the matrix of choices that he confronted in the past. Now the family has three meals a day. Four years ago, the family had only one rice-meal, sometimes just bread and at times were without food. "*Ekbon tin bela gorom bhat khai, agey ek bela ruti, onno bela na kbeye kataitam. Shoptabe duita murgi-o khai.*" (Now we have warm rice three times a day. Earlier, we used to have only one rice-meal and had to starve occasionally. We can also afford to have two chickens a week).

Faruk was a day labourer working in others' fields to supplement his farm income. "*Ekbon bhabchhi aar bodli khatbona. Nijer jomite kaj korbo. Amar foshol-e jotheshbo.*" (Now I am thinking of giving up working as a day labourer. Production from my own farm is enough to feed my family).

Faruk has understood the significance of education and therefore, devotes a part of the increased income on childrens' education. In the past, he could hardly afford to send the children to school despite the desire to do so.

Faruk has never used soap. Now the family uses two bars of *Lifebuoy* soap every month. Furthermore, the family has switched from eating *kajla* rice (relatively coarse rice) to BRRI dhan²⁹ (relatively fine quality rice).

Faruk now receives, after surrendering half of the produce for rent in land, about 1,100 kg. of rice a year. After meeting his family's need of about 1,000 kg., he sells the rest to the market. In addition, he also sells seeds to neighbours.

Thus, the training from SHIP increased the food entitlement of the household to which Faruk Hossain belongs. At the same time, the increased income and food security have altered the choices of the family. Earlier, the family could only have this or that. But now they can have this

and also that. "*agey pochbondi karey koi jantam na. Avabider abar pochbondi ki! Ekbon obostha besh bhalo. Majhe moidhey shad metai.*" (We had no choice in the past. Those in want, have no choice! Now conditions have improved and we try to fulfill some desires).

A tenant and a training

We now take up the case of a pure tenant. Abdul Kader of Sreepur village (under Gazipur district) lost his father in childhood and his grandfather deprived him of his due share of the inheritance. He has no education. Born landless, Abdul Kader has been striving hard for decades to feed seven members through renting out land. Though, his eldest son contributes Tk. 3,000 a month working as a carpenter, that is meagre as his household requires 3-3.5 kg. per day of rice just to survive. In the just finished *boro* season, he cultivated 4 *bighas* (1 *bigha* = 0.33 acre) of land and in the last *aman* season, 6 *bighas*. To repeat, all his cultivable lands were rented out to surrender 50% of the output to the owner. Like many others, Abdul Kader is a pure tenant in Sreepur village.

Kader reaped a harvest of 20 *maunds* per *bigha* of paddy from producing BRRI dhan²⁸. He and his wife made full use of the training on good quality seed. In the absence of such training, when they followed the traditional path of seed preservation, the yield was 17 *maunds* per *bigha*. In the *aman* season, he produced BR11 to harvest 16 *maunds* per *bigha* against 12 *maunds* per *bigha* in previous days. In those days, Kader and his wife used to keep seeds in a sack only to see that the seeds were spoiled due to air contamination. On many occasions, their seed beds were damaged (*jala mara gecbhe*) putting them in dire straits. They were heavily indebted to village *mohajons* and neighbours as they had taken a huge loan which could not be repaid.



Fatema Begum, Kader's wife says. *"For the last four years, we did not borrow money for cultivation. Before that, we borrowed money from 'mohajons', say Tk. 1,000 and had to pay Tk. 100 per month as additional."* During the last *boro* season, they sold seedlings worth Tk. 3,000, before which they had sold seedlings worth Tk. 1,400 and before that Tk. 1,200. The seedlings are bought not only by neighbours when theirs fail to grow, but also by villagers from far and wide.

However, in the last *boro* season, Kader's family got 80 *maunds* from four *bighas*. After surrendering half of the output, they brought home 40 *maunds* of paddy. There is also increased yield from BR11 and together they got 86 *maunds* of paddy in one year. After meeting household needs, this tenant family emerges as a surplus rice producer. A part of the excess is sent to the market to buy a *sari* for Fatema or to pay tuition fees for the daughter. Fatema, choked with emotion, while explaining that previously she could not provide education for her son due to poverty and never did she own two *saris*.

"I worked as a maid in somebody's house just three to four years back. Managing food for the family forced me to be a maid and my husband a 'muni' (year long labour in a household). Food shortage stays away these days due to the hard work we put in the fields."

"Ekkhuni cholen amar barit, bish-trish mon dhan achbei." (Accompany me to my house, you will find 20-30 *maunds* of paddy).

What are the basic differences in the Kader family that have emerged over the years? Fatema Begum replies supported by her husband and another pure tenant, Abdul Malek, *"Sir agey achhilam kamla maiya, ohon oichhi krishak maiya."* (Sir, I was a maid servant, now I am a farmer).

Second, *"ekhon ichha korle shoptabe dui-tin din machh khaite pari, agey ichha thakleo khaite*

pari nai." (Now, if we wish, we can eat fish twice a week, earlier could not despite the desire).

Third, *"agey amader graamey barga paoa jaitona karon foshol boitona abong amra khoroch korteo partamna. Ekhon bhalo foshol deikha malikera ghoore jomi deyar joinna. Ar amra chinta kortechhi aro barga nimu ki nimuna."* (In the past, there was a scarcity of rented land as crops failed and we, the poor, could hardly bear the costs of raising outputs. Now seeing the yield rate from good quality seeds, owners are running after us and asking us to till their land. We are thinking whether to rent in more or not).

The participants of SHIP in Sreepur village who are mostly poor, feel that the increased yield and the food security that resulted to a reduced quantity depend on NGOs. They believe they can save at least Tk. 300 per *bigha* from the economic use of seeds, seedlings and by very little use of insecticides. This has been supported by the judicious use of fertilisers. All of these developments came from the training on seed health. The cash cost needed to cultivate one *bigha* with BRRI dhan28 comes close to Tk. 300 implying that there is no need to search for credit sources.

Fatema Begum and Salma Khatun, both wives of pure tenant farmers always have smiles while talking. They visit fields occasionally just to see for themselves the output of the hard labour they put into seed health activities. *"Boroloker boura mathey jayna karon dorkar nai. Amra gorib. Goriber boura mathey na gele ki chole?"* (Wives of rich farmers do not visit fields as they do not need to. We are poor. We must visit fields).

I was told that their husbands now always discuss seeds and agricultural practices with them. They have moved from food deficit to food surplus households.



Seed and Eid

"Why do you laugh so much while talking"?- we asked them seeing their happy faces. *"Char bosor agey aile ai hashi debten na Sir. Goto char bochhor dhoira eid-eid bhab."* (You would not have noticed a smile on our faces had you visited us four years ago. For the last four years we have always been in a festive mood).

Light at the end of tunnel

There are, admittedly, many pro-poor projects in Bangladesh but nothing seems to sound more friendly to the poor than SHIP. Seed management had never been an important subject for discussions in the age-old cultural practices. But for decades, farmers have been robbed of 10% of the output due to low quality seed. Now the training from SHIP has enabled farmers to preserve seeds in a scientific manner. As a result, output has risen by 10-12 % per unit of land. For the resource-poor farmers, the increased yield meant a lot. First, it increased food security to the household. Second, it enabled quality seed for sales at 7-10% higher price than other sources of seeds

in the market. And finally, the resource savings, to the tune of Tk. 300-4,000 per 33 decimals on account of good management, paved ways for a better living. The choices made by the trained farmers, mostly poor ones, expanded. They have increased the quantity of food intake, are moving towards better quality food, better housing and clothing and most important of all, devoting a part of the increased income towards educating children. All these were mere dreams just four years ago.

From corner-to-center

Their production and food entitlement went up and, at the same time, their set of choices expanded. Within a span of four years, they moved away from a situation of 'corner' solution to a position of 'tagency' solution. They can now buy rice as well as non-rice commodities. Training that engaged both men and women helped raise output substantially to put the poorest of the poor in a village on an even keel. To me, some development as espoused by Amartya Sen seems to have happened in that village.

Suggested citation:

Bayes, A. 2007. Technology, entitlements and freedom of choice. In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA – an experiment in pro-poor agricultural research. Policy briefs no. 3.2. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.



Pathways from poverty: household level processes of graduation

Alastair W. Orr and B. Adolph

The Millennium Goal to halve extreme poverty worldwide by 2015 requires a better understanding of the possible exit routes from poverty. In Bangladesh, where poverty is falling slowly at only 1% a year, the need to accelerate graduation from poverty is acute. Yet while we know a lot about poverty itself and what keeps people poor, we know much less about movement out of poverty. What strategies do households use to graduate from poverty and what factors determine success?

One way of answering these questions is to survey the same households 'before' and 'after' they escaped poverty. A recent panel survey conducted by Bangladesh Institute of Development Studies (BIDS) has shown, for example, that households that graduated from poverty between 1988-2002 increased the share of income from non-farm sources, adopted modern rice varieties, and acquired more land (Sen, 2003). But this method also leaves some questions unanswered. Graduation is not just a point of arrival and departure, but a process. How did households identify strategies for graduation? How did they sequence these strategies? How did they cope with shocks? How did they succeed where others failed? Questions like these require a qualitative approach that explores the complexity of household decision making that successfully resulted in a pathway from poverty.

This policy brief outlines results from a qualitative study of how households graduate from poverty in Bangladesh. The study was led by the Natural Resources

Institute (NRI)-UK with local partnerships from BRRI, BARD, and RDA. Unlike the BIDS panel survey, the study was not designed to give results that were nationally representative or a firm basis for policy recommendations. Instead, the objective was to complement the quantitative data from the panel survey by providing insights on the process of graduation from inside the household.

Data and methods

Research was conducted in three villages (also surveyed by the panel survey) that were selected for differences in access to new rice technology, agro-ecosystem, and infrastructure (Table 1).

Table 1

District	Comilla	Bogra	Barisal
Village	Bhabanipur	Darikamari	Dariabad
Location	Rural	Peri-urban	Remote
Rice cropping pattern	aus - t. aman - boro	t. aman - boro	boro

Field research took one year and included site characterisation using participatory rural appraisal (PRA), participatory poverty assessment (PPA) to learn villagers' perceptions of poverty and poor groups, and detailed case studies of 30 households. Changes in poverty are based on villagers' own perceptions rather than on objective measures.

The poverty paradox

Slowly decreasing poverty...

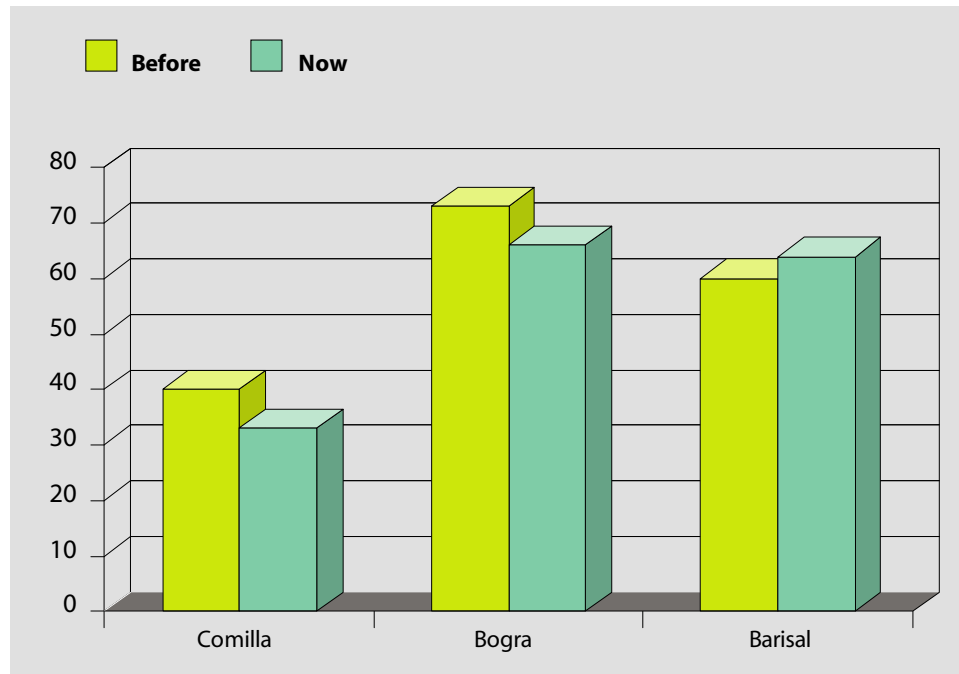
Households in the Comilla and Bogra villages reported a decrease in poverty

between 1988-2002, though the share of households who saw themselves as 'poor' remained high. The exception was in the Barisal village, where poverty slightly increased (Figure 1).

mobility among households that started poor. Figure 2 shows that:

- Graduation from poverty was not unusual or exceptional, with twice as

Figure 1. Changes in poverty, all households



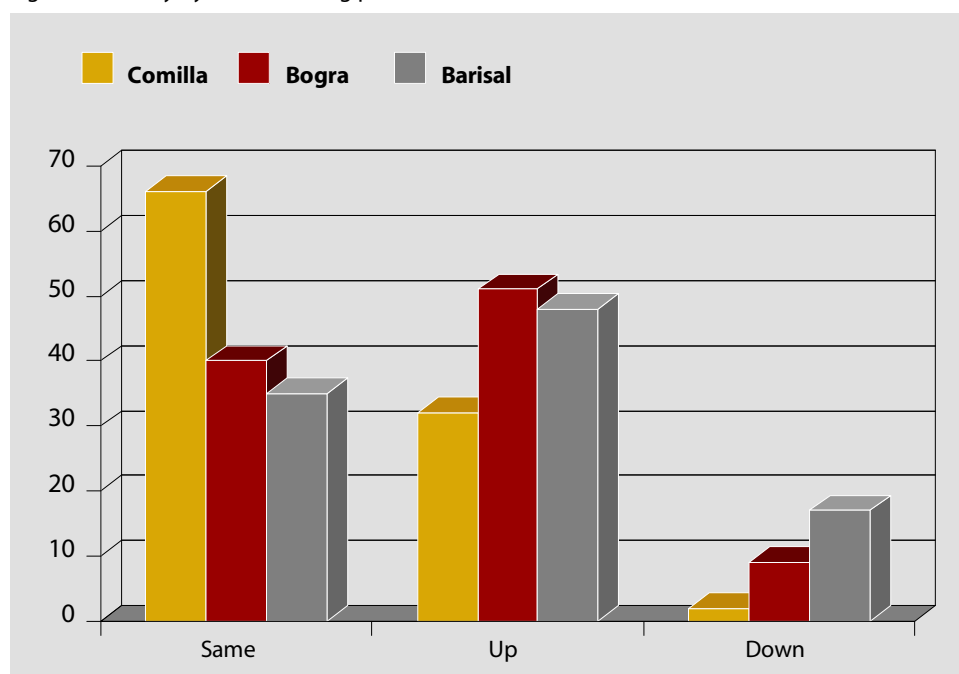
But high rates of graduation...

Contrasting with this slow decline in poverty was the high level of economic

many households moving out of poverty as becoming poorer.

- Graduation was widespread and was

Figure 2. Poverty dynamics among poor households



not confined to particular locations or rice ecosystems but occurred in all three villages.

The process of graduation

Case studies of households that graduated from poverty revealed certain common features. Figure 3 brings these features together in a schematic model of the process of graduation. Each component is illustrated by relevant quotations from household case studies.

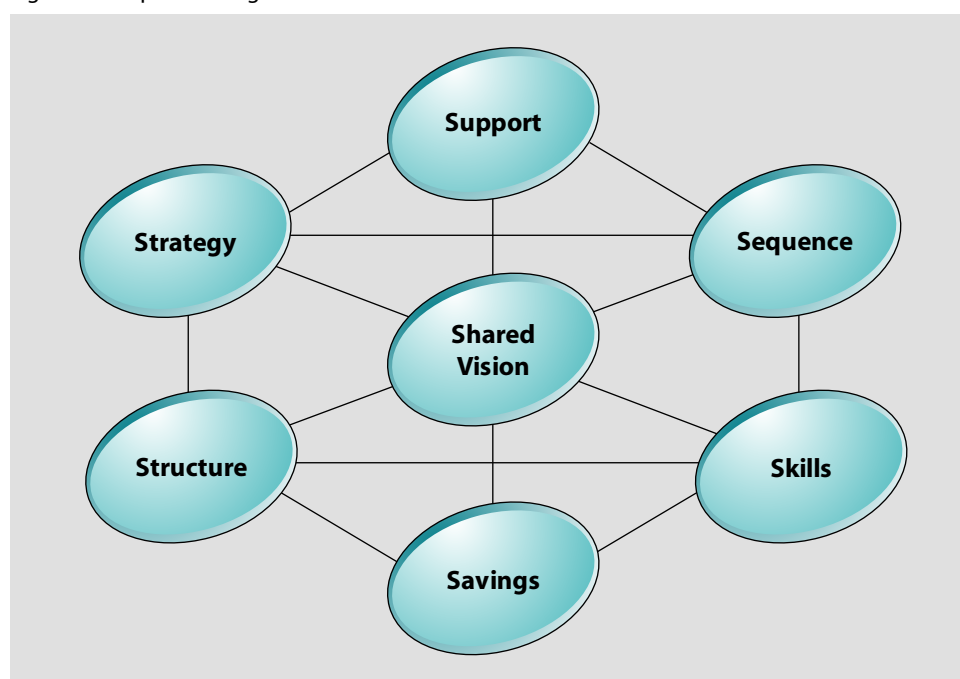
almost fainting from mental exhaustion to manage the money, Minara Begum proposed to receive money from the Grameen Bank."

"She earned about Tk. 250 per month through making bamboo crafts and would spend it for ensuring their children's education. She bore all the educational expenses of her children."

Structure

Household structure was important because separation from other family

Figure 3. The process of graduation



Shared vision

At the heart of the graduation process is the vision of a better future. This vision has to be shared by the household's key decision-makers for graduation to begin, let alone succeed. Partnership between husbands and wives is important in setting goals, agreeing on livelihood strategies, and on how much to save. Part of this vision is the recognition by both parties of women's productive role in generating income and savings.

"From the very beginning their motive was to save some money for doing something better."

"From 1996 onward when Nurul Islam was

members was often necessary for households to save. Otherwise, everything went to support the joint family. Among better-off households, however, a joint family structure was important because it allowed them to pool resources, reduce the need for external help, and reciprocate assistance from other family members.

"Harun Bepari would do everything jointly with his father and did not save anything of his own."

"From 1999-2000 Sarwar got financial support from his immediate younger brother Monir... because Sarwar maintained the whole of his family when his father died."



Support

Few households graduated without some form of external support. This took various forms. Business partnerships cut costs and shared risks. Patronage was important, where a family friend or wealthier relative helped secure a job for an elder son, provided a loan, or acted as a 'broker' in a business deal. Patronage was also important in helping households cope with shocks. Support also included access to credit from formal or informal sources.

"As he had no financial capital, he was the partner of another person."

"From a business source, Mr. Mannan became acquainted with... a big merchant whose nephew was a colonel in the army. He committed Mr Mannan to manage a job for his son Nannu in the Bangladesh Army..."

"He took a loan from one of his brothers-in-law for Tk. 80,000. He also took a loan of Tk. 100,000 from several of his relatives. By that loan Shahjahan sent his younger brother to the Middle-east."

Savings

Savings took different forms at different stages in the process of graduation. In the early stage, households saved through stinting or cutting household expenditure. They remembered this as a time of extreme hardship. Subsequently, households saved by minimising cash outlay, for example by avoiding the need to hire labour. In later stages, households took formal loans to finance lumpy investments, but for bigger and presumably more risky investments, households preferred to liquidate assets or borrow informally from friends and relatives.

"They minimised this deficit by taking one or two rice meals a day and sometimes borrowing rice from a neighbour.. He thought he would save money each year for his future."

"He irrigated his crops using tidewater from the

canal using khachi. He never hired labour. All intercultural operations were done by himself."

"They had an idea that they might get Tk. 30,000-35,000 selling the land and the next day Shamsul Haque went to the gram samity chairman and asked him for a Tk. 80,000 loan."

Skills

Graduating households acquired new skills through apprenticeships, watching others, or learning by doing.

"Nurul Islam had been working as the helper of a mason with full care from the very beginning and within 6-7 years he was able to learn almost all the works."

"When he had sold his shrimp to 'aratdar' (wholesalers), he observed and learnt how the wholesalers bought and processed and where they sold."

"In most of the cases, he repaired the rickshaw by himself with the help of a maker. In this way he learnt how to repair rickshaws, vans, and bicycles..."

Strategy

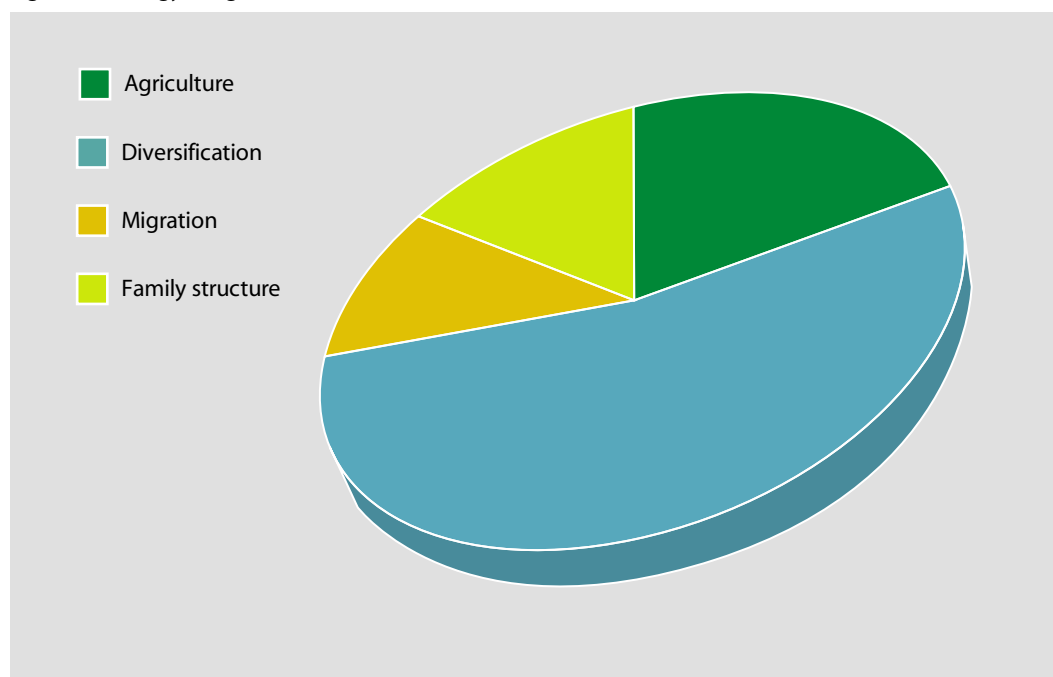
Figure 4 classifies the major livelihood strategies households used to graduate from poverty. One household might use several strategies. Non-farm activities were the most popular strategy, followed by agriculture and overseas migration. Villages differed in their choice of strategy, reflecting the mix of opportunity available in different locations and a 'snowballing' effect as households copied successful neighbours. Overseas migration was the most common strategy for graduation from poverty in the Comilla village, whereas in the peri-urban Bogra village non-farm activities (e.g, rickshaw pulling) were more common.

Sequence

Strategies usually followed a sequence. Households first tried to establish a food security platform, usually renting land and



Figure 4. Strategy for graduation



investing in new rice technology. Results from our mini-survey showed that graduation was associated with an increase of 2-3 months in the number of months that households ate their own rice. This was important for their peace of mind.

"He thought that if it could be possible to cultivate rice... he would not think about rice. As a result, it would be helpful for his future improvement."

"He was engaged in agriculture as a sharecropper to ensure food security all the year round so that he could be psychologically stable..."

Households selected livelihood strategies that simultaneously reduced the need for cash expenditure and also gave cash income (Figure 5). For example, buying draught animals was a good investment for a sharecropper because it saved the cost of hiring and also provided him with income when he hired them out to other farmers. Similarly, irrigation pumps and power tillers saved cash costs and earned income. Thus, livelihood strategies were carefully sequenced to ease cash flow.

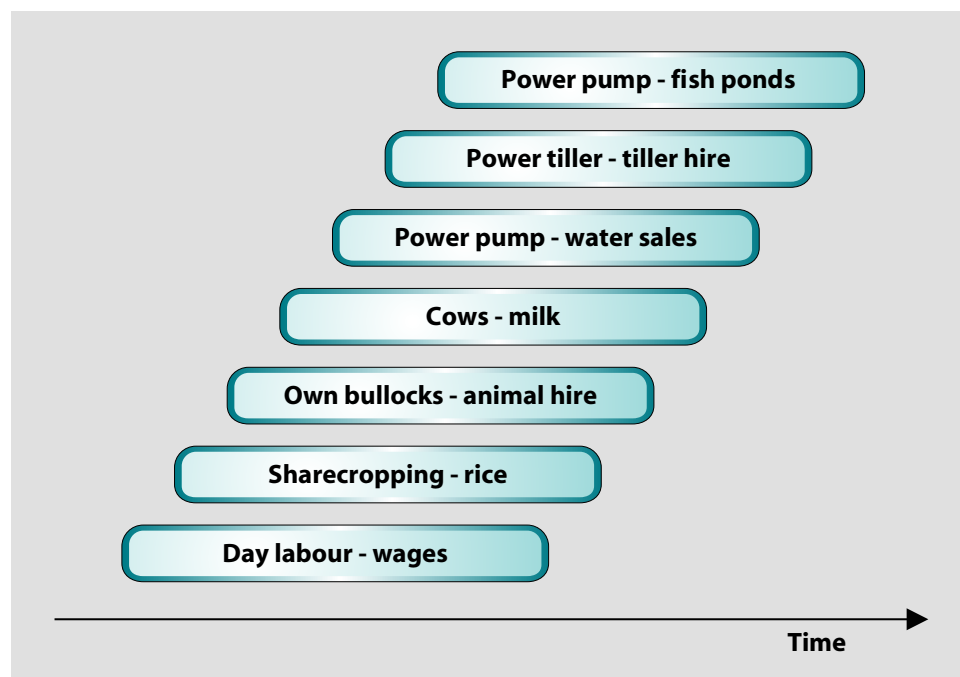
Implications for policy

Qualitative insights from three village studies cannot by themselves produce policy recommendations, but they may complement and reinforce policy recommendations derived from national survey data.

- Bangladesh's slow decline in poverty co-exists with surprisingly high rates of graduation from poverty. One in three households that started poor succeeded in moving out of poverty. Indeed, poor households were more likely to improve their position than get poorer. Furthermore, graduation was widespread and not confined to one location or rice environment. Thus, poverty is not inescapable, pathways from poverty exist, and policy has been effective in creating economic opportunities for graduation.
- Graduation can be accelerated by new policy measures, however. From our case study evidence, the process of graduation would have been easier if there were services providing micro-credit for agriculture (not just non-farm



Figure 5. Sequence



activities), advice for small businesses, technical advice on agricultural diversification, and on the marketing of high value crops. Hence, households need, not only new forms of credit but also access to knowledge and information.

- If opportunities for graduation exist, why do so many households remain poor? Qualitative research helps answer this question. Graduation from poverty is a multi-dimensional process, and does not depend on a single, decisive factor. Our schematic '7-S' model suggests that there is no magic bullet for success but that all components are equally important. We might even go further and say (borrowing from evolutionary biology) that success stems from avoiding many separate possible causes of failure. From this angle, helping households to graduate from poverty is not only about policy measures to provide opportunity, but about measures that help poor households overcome the shocks and stresses that prevent graduation.

Policies to create economic opportunity must be matched by policies that reduce vulnerability. Among our case studies, graduation was frequently frustrated by 'shocks'. These included the high cost of effective health care, lack of personal security and the danger of theft, and police corruption. Without effective health and legal systems, graduation from poverty was made more difficult. Policy measures to reduce the impact of these shocks would also reduce the number of 'tomorrow's poor' or those at risk of falling into poverty. In sum, accelerating poverty decline in Bangladesh requires a twin-track strategy that both promotes opportunities for graduation and reduces vulnerability.

- The primary pathway from poverty was through the rural non-farm sector, but this should not detract from the importance of agriculture for livelihoods. Household food security remained a key livelihood outcome, with graduating households investing in land and new rice technology. Indeed,



improved access to land was almost a litmus test for graduation. As wealthier households moved out of agriculture, space was created for poorer households to rent land. Households combined and sequenced livelihood strategies to mix the security associated with land and the disposable income from non-farm employment. Are we witnessing 'an agrarian revolution from below' as poor households move into the space vacated by middle and large farmers?

Changes in access to land are also changing the traditional client base for agricultural research and extension. Farming for these new entrants is combined with non-farm activities.



- 'Part-time' farmers have different needs from those for whom farming is a full-time occupation. They are more likely to be concerned with household food security than with crop diversification or commercialisation.

REFERENCE

Sen, B. 2002. Drivers of escape and descent: changing household fortunes in rural Bangladesh, *World Development*, 31 (3): 513-534.



Suggested citation:

Orr, A. W. and Adolph, B. 2007. Pathways from poverty: household level processes of graduation. In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA – an experiment in pro-poor agricultural research. Policy briefs no. 3.3. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 8 p.



Promoting rural non-farm economy: is Bangladesh doing enough?

Mahabub Hossain



This policy brief deals with the current status of rural non-farm (RNF) economy of Bangladesh. It documents the changes observed in the RNF sector. It also identifies the constraints for faster growth in this sector and suggests some policy measures for promoting it in Bangladesh. The background information for this policy brief is drawn from the official statistics published by the Bangladesh Bureau of Statistics and findings from a nationally representative household survey conducted by the Bangladesh Institute of Development Studies (BIDS) and the International Rice Research Institute (IRRI), henceforth called the BIDS-IRRI survey. The benchmark survey was conducted in 1987-'88 covering 1,245 households from 62 villages in 57 districts selected through a multi-stage random sampling method. The same households were surveyed during 2000-'01 period to assess the changes in rural economy during the 1987-'88 to 2000-'01 period. The 2000-'01 survey covers a sample of 1,880 households. Research findings were presented at a dialogue on 'Promoting rural non-farm economy: is Bangladesh doing enough?' The dialogue was organised by the Centre for Policy Dialogue (CPD) on July 18, 2002 at a hotel in Dhaka. Based on the research findings of the Dynamics of Livelihood Systems (DOLSys) sub-project, the DOLSys Team Leader Dr. Mahabub Hossain made a keynote presentation on the current status of RNF sector in Bangladesh. Professor M. A. Sattar

Mandal, former member of the Planning Commission and Dr. M. Asaduzzaman, research director at BIDS co-authored the other paper of this dialogue. Industries minister M. K. Anwar and former agriculture minister Begum Matia Chowdhury attended the dialogue as chief and special guest, respectively. Professor Rehman Sobhan, chairman of CPD, was the chair of this important dialogue. Inputs from the dialogue participants as well as from the research papers are included in this policy brief.

INTRODUCTION

Meeting the growing needs of generating productive employment for the ever increasing working age population in rural Bangladesh is a formidable challenge. The importance of RNF activities in generating employment and incomes during the process of economic development is widely recognised. In Bangladesh, RNF accounts for over 40% of rural employment. The RNF sector grew at 5% per annum between late eighties and mid nineties. In 1995-'96, it contributed 36% to the country's total gross domestic product (GDP) compared to about 31% by agriculture.

The RNF activities include activities outside agriculture that include livestock, fisheries and forestry. Non-farm activities can be classified into three categories: i) Mostly manual labour based; ii) Human capital based occupations; iii) Physical and human capital intensive activities. Mostly

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manual labour based activities include self-employed subsistence-oriented cottage industries, wage employment in rural business enterprises, transport operation, and construction labour. Human capital based occupations include salaried service in public and private organisations, teachers and imams, village doctors, and various types of personal services. Physical and human capital intensive activities include commercial type rural industries, including agro-processing, shop-keeping, peddling, petty trading, medium and large scale trading, and contractor services.

CHANGE IN THE RURAL ECONOMY

Agriculture performed relatively well in the 1990s. The growth of agricultural incomes is estimated at 3.5% in the 1990s compared to 2.6% over the 1974-'90 period. The acceleration of agricultural growth has contributed substantially to improved performance of the overall economy. The national income grew at 5.3% in the 1990s compared to 4.1% during the previous two decades.

The acceleration in the growth of agricultural incomes, was mainly on account of non-crop agricultural sectors particularly from livestock and fisheries

which experienced substantial increase in physical output, as well as an increase in relative prices compared to other agricultural produce. The fisheries income grew by 7.8% per year in the 1990s, compared to 2.3% during the previous two decades. The income from livestock activities picked up in the 1980s and continued to grow at a robust rate of 7.3% in the 1990s. Only the forestry sub-sector grew at a moderate rate of 3.8% per year. Thus, agriculture has become much more diversified than it was at independence. The share of livestock, fisheries and forestry in agricultural incomes was only 20% during 1973-'74; by 2000-'01 they contributed nearly 44% to agricultural incomes.

The official national income statistics in Bangladesh does not provide a rural-urban breakdown of employment incomes. So it is difficult to draw a reliable picture of nature, composition and growth of the rural non-farm sector in Bangladesh. The BIDS-IRRI sample household survey in 62 villages showed that the employment in the rural non-farm sector has increased by 4.5% per year while the number of workers employed in agriculture has declined by nearly 1.2% per year. In 2000-'01, 52% of the earning members of the households in Bangladesh reported RNF activities as



their primary occupation and another 14% as secondary occupations, which means that nearly two-thirds of the rural workers are involved in rural non-farm activities. Non-farm activities account for 52% of the income in rural Bangladesh. Over the 1987-'00 period the household income grew at 3.8% per year. Most of the growth came from the rural non-farm sector (mainly from services and trade and business and rural transport operations). The income from RNF activities increased at 6.8% per year compared to only 1.4% per year growth in agricultural incomes. As a result, the share of the non-farm sector in rural household income has been increasing very fast.

KEY DRIVERS OF RNF GROWTH

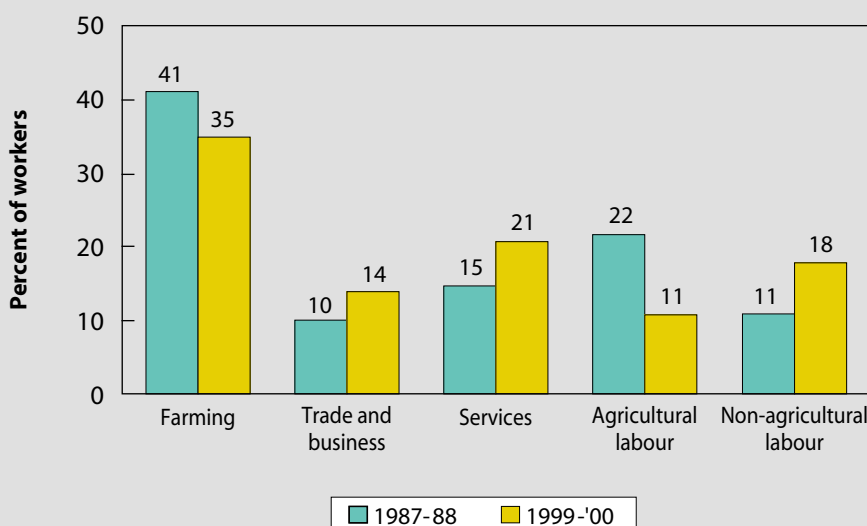
The macro economic drivers include large-scale liberalisation of market and trade regime, reduction of tariff and non-tariff barriers to trade and privatisation of agriculture i.e., input distribution, grain trade, etc. On the other hand the sectoral level drivers include rapid spread of irrigation technologies for rice production, increased mechanisation of tillage (15,000 power tillers and 200 tractors

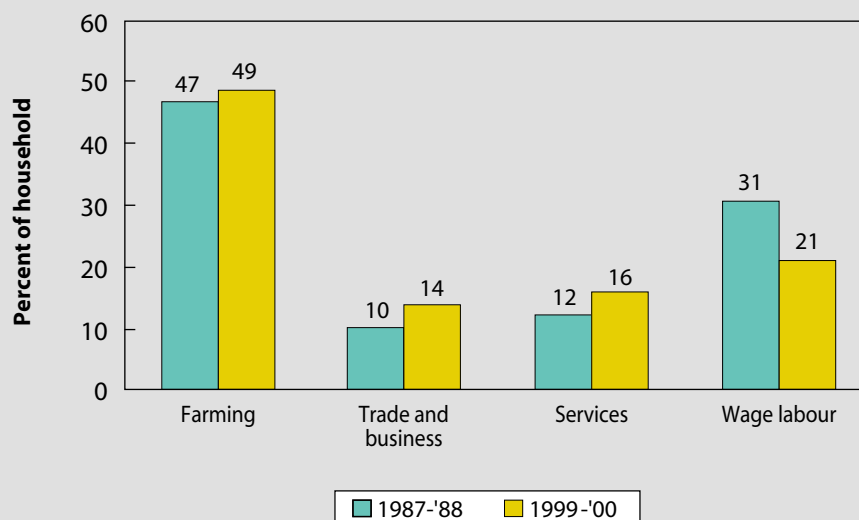
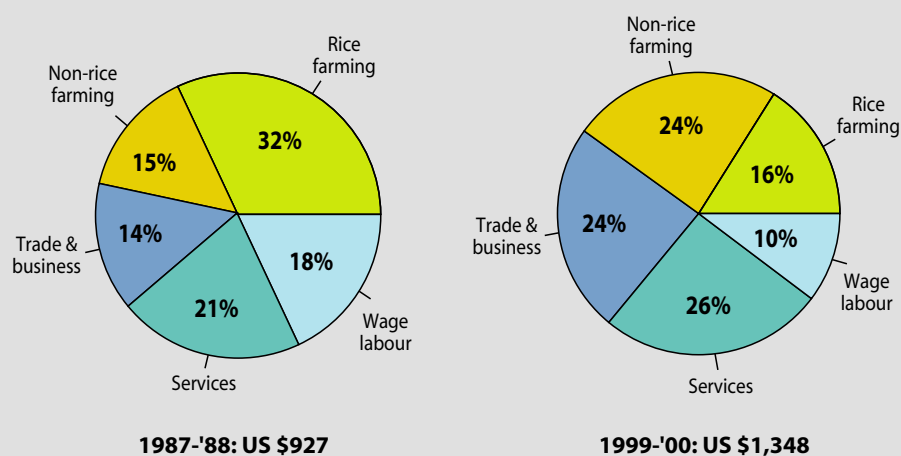
imported annually), growth of equipment manufacturing (numerous metal workshops/factory, income raised), support services for farm equipment (1.7 million owners/managers, 0.76 million operators of manual irrigation device, 0.16 million rural mechanics, created 11,000 full man-years of employment), increased trade in agricultural inputs (4,000 fertiliser dealers, numerous retail traders, etc.), increased cereal production and subsequent grain storing, trading, rice parboiling and milling etc. Agricultural diversification i.e., poultry, fisheries, plant nurseries, etc. (manufacturing and trading in poultry feeds, feeding and rearing equipment), rural transportation facilitated by rural infrastructures, rural electrification, rise in household income induced demand for new RNF products (house building, sanitation, carpentry, rural services, etc.) and remittances from outside the rural sector.

KEY CONSTRAINTS TO RNF SECTOR DEVELOPMENT

Three types of constraints, namely, market related constraints, physical constraints and policy constraints limit the

Livelihoods: Employment by occupation



Livelihoods: Major source of income**Composition of household income**

development of RNF sector. Market related constraints are lack of adequate demand for conventional RNF products, although there is a growing demand for new types of RNF goods and services. The physical constraints include lack of physical infrastructures, electricity, standard equipment and know-how. The policy constraints include inadequate

credit, irrational tax structure, bias against rural industrialisation. Pricing agricultural inputs/output and construction materials, airfreight charges for agricultural exportable items do affect RNF sector growth. The absence of business advisory services for RNF sector enterprises can be identified to be an institutional constraint to the growth of this sector.



STRATEGIES AND POLICIES FOR THE DEVELOPMENT OF RNF SECTOR

The government so far has created a number of institutions such as the Bangladesh Small and Cottage Industries Corporation (BSCIC), Handloom Board (HB) and Sericulture Board (SB), to cater to the needs of small scale and cottage industries, but they are inadequately backed by allocation of financial resources and appropriate management support to ensure sound institutional health. Therefore, to ensure sustained growth of the RNF sector there should be an Institutional home for RNF activities. There is a growing need of implementation of proposals of previous plans. The Second Five-Year Plan proposed the development of Rural Growth Centres in important market places. The industries that were selected to be promoted are manufacturing rural transport equipment and agricultural implements.

The Third Five-Year Plan proposed to set up Employment and Resource Centres at the upazila level for the promotion of rural non-farm employment. The centres would have training and demonstration units for the development of local crafts and new product lines. It also proposed to strengthen the technology development and extension work of the BSCIC, HB, SB and the Institute of Appropriate Technology (IAT). A national coordination council was to be established to formulate policies, coordinate the activities of various agencies engaged in the promotion and financing of rural enterprises and to review performance and achievements of such agencies.

The policies proposed in the Fourth Plan include: a) appropriate reform in exchange rates and tariff policies to remove the bias against rural industries; b) restructuring of the licensing system so that small scale and cottage enterprises can benefit from the

system; c) developing mechanisms for identification of real entrepreneurs and establishment of a system of supervised credit without collateral security; d) integrating credit with training and technology extension programme; and e) consolidating the operation of BSCIC so that the limited financial and managerial resources are not spread thinly over too many projects. The Fourth Plan recognised the role of GOs in the development of skills of the poor and other disadvantaged groups through motivation and training and proposed to encourage, coordinate and integrate non-governmental organisation (NGO) activities with public sector programmes for rural industries. There is a need for specific allocation for rural areas in normal development programmes such as secondary education, road and other transport network, rural electrification, infrastructure for telecommunication and information technology etc.

Special programmes should be launched such as vocational training for secondary school dropouts, storage and processing facilities for perishable products, a fleet of modern transport with refrigeration facilities.

The Bangladesh Agricultural Development Corporation (BADC) may also be reorganised for providing training on the operation and maintenance of agricultural and non-farm machinery particularly for the high school dropouts. BADC may also establish storage and processing facilities for perishable products, and invest in developing a fleet of modern transport with refrigeration facilities, the services of which may be rented-out to rural traders and entrepreneurs.

DIALOGUE OBSERVATIONS

The dialogue was participated by industries minister M. K. Anwar, former



agriculture minister Begum Matia Chowdhury, former finance minister Dr. M. Syeduzzaman, former advisor to the caretaker government Abdul Mueed Chowdhury, industries secretary Al Amin Chowdhury, Professor M. Muazzam Husain, former secretary Dr. Taufic-e-Elahi Chowdhury, Planning Commission member Professor Momtaz Uddin Ahmed, Dr. Sajjad Zahir, Dr. Hossain Zillur Rahman, Abdur Rob of Intermediate Technology Development Group (ITDG), Dr. Jahangir Alam of Bangladesh Agricultural Research Council (BARC) and others. Participants suggested that a study on demand for the products and services in the non-farm sector to analyse the absorptive capacity in the domestic market is essential.

The industries minister M. K. Anwar underscored the need for establishing linkages with the export markets for boosting the RNF sector. The former agriculture minister Begum Matia Chowdhury emphasised the need for graduating local farmers from subsistence level to a relatively better off level. She underscored the need for a concrete plan for developing the rural non-farm sector. She observed that female workers, in some cases, are exploited in the existing RNF sector. Former advisor to the caretaker government and present executive director of Bangladesh Rural Advancement Committee (BRAC) Abdul Mueed Chowdhury urged for empowering the local government bodies

instead of further extending the arms of the central government for promoting non-farm economy as well as for overall rural development. Professor Rehman Sobhan urged for expanding credit portfolios in the formal banking and NGO channels so that RNF sector can thrive at a proper pace.

CONCLUDING REMARKS

The improvement in the livelihood of the resource-poor households could be better achieved through faster growth in non-crop agriculture than for the crop sector, because the latter is much more land intensive than the former, and the land is so scarce and unequally distributed. The non-crop agriculture generates substantially higher value added in post-production (processing, storage and marketing) activities that can create opportunities for higher productive employment for the land-poor households. Exploitation of this potential will however require support from the public sector for creating an enabling environment; by developing rural infrastructures in the field of transport, power and communications; improving the quality and coverage of secondary and technical education; providing information on markets and facilities for training in entrepreneurship development as well as providing access to finance for resource-poor households.

Suggested citation:

Hossain, M., 2007. Promoting rural non-farm economy: is Bangladesh doing enough? Reprinted from CPD-IRRI policy brief series by Centre for Policy Dialogue. Series editor U. K. Deb. Dhaka, 2002. In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA – an experiment in pro-poor agricultural research. Policy briefs no. 3.4. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 6 p.



From technologies and enterprises to more sustainable livelihoods

David Gibbon

INTRODUCTION

Agriculture, technology transfer and resource-poor farmers

For many years, researchers, extensionists and rural development workers in Bangladesh have been trying to improve the productivity of small farm agricultural systems in developing countries by introducing new technologies, new crops and varieties and increasing inputs. Often this has been the introduction of single new varieties and technologies into complex systems. This approach has only been partly successful and in some cases the introduction of the new technology has only been successful during the life of the project in which it was introduced. The introduction has also been dependent on a large subsidy and support system which is not sustainable. Such an approach has often benefited larger farmers (those with more substantial resources of land and other assets) rather than poorer ones. The other important characteristic of past technological support from research was that the focus was almost entirely on male farmers by researchers who themselves were male. The areas of farm activity that were traditionally the domain of women-vegetables, homestead gardening, small livestock, post-harvest processing and small enterprises were given little attention.

The need for a new approach: systems, participation and livelihoods

In recent times, there has been a recognition that small farms are the base

for complex, integrated livelihood systems which are operated by farming families, the members of which have different roles and functions and also aspirations. Families survive through a range of activities, some on-farm and others off-farm and they might even have a significant income from a non-agricultural occupation. The participation of all the family members in the research and development process and this includes the design and implementation of new technical options- has been recognised as essential if these new ideas are to make a permanent difference to livelihoods.

Differentiation of farmers

Another important distinction which has been recognised by researchers is that all farmers and farms are not all the same and that poorer families, particularly those with minimal land, have great difficulties moving out of their situation of extreme poverty. Such families have different priorities and different potentials than families that have access to more resources and therefore the approach of research and development agencies needs to be different for them. In the Poverty Elimination Through Rice Research Assistance (PETRRA) sub-project (SP) the initial division of the farming communities into landless, marginal and small farms was to ensure that the different needs of these groups were addressed from an early point. It was recognised that the distinction between these categories on the basis of landholding was subject to some

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anomalies (e.g., some landless people might have had substantial off-farm employment which could have made them much better – off than another landless farmers who have no external employment). Despite this, by taking a large sample of study farms (20 landless, 20 marginal and 10 small farms in each of 5 sites across the country) it was assumed that the differentiation of farming families in this manner would highlight the distinctive nature of farming under different circumstances.

LIVELIHOODS: THE NEW FOCUS

The basis of livelihoods analysis is that farming families have five capital assets which are different for every farm. These are:

- Human: People have skills and knowledge which have been gained from many different sources- parents, schools and life experiences.
- Social: Societies are made up of people who interact in a variety of ways and the strength of a society may be judged from the types of interactions and institutions that people can build up over time. Social interactions may be weak or strong. In most of the study areas of the PETRRA SP, women's

cooperation was not strong before the project began.

- Physical: Families have houses, animal sheds, storage , equipment and tools which they build up over time. Many poorer families in Bangladesh have to renew much of this physical resource on a regular basis from renewable materials as they do not have the financial resources to purchase more durable materials.
- Natural: Farming families have access to more on less landholdings-homestead areas, land around this and land owned or rented or share-cropped in the vicinity. They have seeds, trees, crops and livestock which make up their natural resource base.
- Financial: Members of farming families have financial assets which are derived from earned income, sales of produce, gifts and savings and these are subject to fluctuations over time as a result of debts and other commitments.

All families are subject to a degree of risk and uncertainty because of their circumstances, either local or more regional. Floods, drought and death may bring a high degree of fluctuation into financial management as will poor production from natural resources in



poorer than average years' weather. Families survive by transforming their assets through their own strategies to produce desirable outcomes. Each family will have different strategies and the outcomes will be different for different categories of farms and for different individuals.

It is the recognition and understanding of all these factors by researchers and extensionists that has provided the background to the PETRRA livelihoods SP.

NEW TECHNOLOGIES AND ENTERPRISE SUPPORT

The project has offered to farmers a wide range of technologies: new crops, new crop varieties, vegetables which are adapted to a wide range of niche environments around the homestead (e.g., sunny places, shady places, over the roof, on deep beds), fruit trees, small livestock (chickens, goats, pigeons), large livestock (cattle), fish in ponds and tidal canals, composting, craft enterprise development (eg. stools, batik, sewing cloth). Each technology has been accompanied by training modules and by the promise of back up support (financial and technical). Farmers (both male and female) have been allowed to choose as many and which ever technology they wish to adopt and it has been remarkable how many women have become engaged in this process. They have been very keen to try out many homestead areas development options, vegetables, small stock and small enterprise (agricultural and non-agricultural) development. This has led to significant changes in livelihoods of families, circumstances, status of women and children in the family and in their communities. Marginal farmers seem to have been able to respond better to these initiatives more successfully than landless or small farmers.

LIVELIHOOD IMPACTS

The impact on livelihoods has been considerable. The new crops: high-yielding (HY) rice varieties, potatoes, okra, etc. have produced substantial yield increases over older varieties, a new range of vegetable crops are now grown alongside traditional vegetables and many new niches in the homestead are now utilised that were not previously used. Soils have been improved through the use of manure and compost which is now possible since the introduction of livestock on previously stockless farms. Farmers' skills and knowledge have increased dramatically, particularly with women who never had access to this kind of information before. With the management of livestock, the skills needed to vaccinate stock and to deworm cattle, have been acquired. An important area that has been particularly successful has been with vegetable production, the growing and exchange of plants and seeds and the development of a 'seed guardian culture' among many female farmers. Much knowledge has been gained through learning by doing and by exchanges of information between farmers and service providers.

LINKAGES, SYSTEMS AND SYNERGIES: CYCLING, DEPENDENCIES, EMERGENT PROPERTIES

From a farming systems perspective, the introduction of these many technologies has had some positive effects on the flows and linkages between components of the system. Livestock feeds are partly grown and also purchased, livestock produce waste which is transferred to the compost pit. The compost is then later spread on fields which maintains the fertility of the soil. Crop yields rise and produce greater physical surpluses which may be consumed, sold or used for fodder or fuel. Better fed family members are healthier and are able to work longer and



with greater energy than before. Many farm systems now exhibit what are known as emergent properties which are outputs over and above the sum of the outputs from the individual components. One emergent property would be the ability of the system (in its entirety) to increase its overall productivity on a sustained basis. Social status is raised within the community and wider linkages are developed which enhance income generating opportunities and sustainability of the livelihood.

LIVELIHOOD STRATEGIES: WOMEN'S ROLES – WORK LOAD, TRAINING, NUTRITION OF FAMILY INVESTMENTS

It is undoubtedly true that the work loads of women and children have increased as a result of taking on these new technologies. The farming families decided which and how many technologies they would adopt. One consequence of these changes has been an improvement in family food quantity



and quality and the generation of surpluses for gifts, exchanges and for sales. As a result, income has increased and the women in many villages have formed savings groups. Here, women contribute Tk. 10 a month and are eligible for loans for the purchase of livestock (for example) or in the investment of new non-agricultural enterprises.

STRUCTURES: NETWORKS AND SUPPORT MECHANISMS

These very significant changes have been brought about partly by the very considerable inputs which are received by farmers from the project. At some time in the future the project will phase out and by that time there have to be support mechanisms in place which will take the place of the roles which are currently being provided by the project. These include: seed supply, fodder for livestock, vaccination, deworming materials, spraying of fruit trees and access to fertiliser. At the moment these services are, at least in part, provided by the project but steps are being taken to ensure that farmers are aware of where and how to acquire these inputs. Such mechanisms already exist and it is simply a case of organising the access and delivery of these essential inputs at the appropriate time every year. Another area where growing networks are important is in marketing of surplus produce. For many of the newer crops, markets are only just developing and farmers are learning how and where to market the produce that they would like to sell. Currently buyers are beginning to visit villages in order to purchase produce directly and some farmers (husbands and sons) are marketing in local markets and towns.

These changes have resulted in women becoming more confident and empowered and they now know where to go to obtain services and inputs. They are therefore becoming more independent of the project in their success. These are positive changes in human and social capital.

Other important support mechanisms are the local service providers – extension services, both general and specific (e.g., livestock health, crop systems) – which are provided to help any local farmers. Local commercial interests are also part of the wider network to which farmers are beginning to be linked.



PROCESSES: SCIENTIST AND EXTENSIONIST CHANGES AND LEARNING, FARMER LEARNING, NETWORK LEARNING

One notable outcome from the project has been the learning processes of the natural scientists and extensionists who have participated. They were originally agricultural graduates who mainly dealt with male farmers and were only concerned with new rice varieties, alternative field crops and cropping systems. Since the project began they have been asked to work with all family members and to be highly flexible in developing those enterprises that interested farmers. By exposure to this wide range of options and in working with female farmers who have become highly motivated, professional staff have learned a great deal about the workings of complex farming systems which have many elements – homestead crops, trees and small stock, areas around the homestead, cropped land (owned, rented, share cropped) and non-agricultural enterprises. Their enthusiasm about the impact of the project is very evident and their relationship with all farmers, particularly women, has improved greatly. Their ability to communicate well in areas that hitherto had been considered very difficult and conservative (e.g., Noakhali) is very impressive.

SUSTAINABILITY: SUPPORT SYSTEMS AND ENVIRONMENTAL IMPLICATIONS

The longer term, sustainability of these changes is uncertain, but it is very evident that some form of support for some of

the current inputs might be necessary for a time. As was stated above, there is nothing here that should not already be part of the normal public sector research and development structure or of the local networks of business in the private sector. Perhaps the most important factor in the future would be the continuing contact and support from the core group of stakeholders who have been involved throughout.

In general, there are very few negative environmental impacts of the project inputs as the whole project relies on an ecological approach to developing farming systems. One practice that needs monitoring is the use of chemical sprays to 'protect' food crops in the homestead area. There does need to be a monitoring of these sprays and of spray operators who rarely wear protective clothing. Another practice would be the use of fertiliser used repeatedly over a long time without the combined use of compost or manure.

CONCLUSIONS

The general conclusion from this project is that it is possible to transform farm systems through comprehensive changes in the nature of technologies and of the strategies that are pursued by farming families. The lives of landless, marginal and small households can be transformed by putting together changes that will have a positive effect on family nutrition and food security, the production of surpluses for sale, the development of savings and investments, the acquisition of new knowledge and confidence.



Examples:

1. Barisal: Intensive vegetable production on *sorjon* beds system.
2. Faridpur: Homestead gardening (vegetables, climbers, small stock)
3. Rangpur: Multiple activities, surpluses, 3 womens clubs, investments
4. Rajshahi: Vegetables, small stock, crop diversification
5. Noakhali: Women, empowerment and seeds management, *rabi* cropping, non-farm enterprise development

This brief is based on the experience of the farmers' participatory research on integrated rice-based farming for improved livelihood for resource-poor farm households, PETRRA sub-project number SP 32 02.

The detailed case study reports are available in PETRRA website petrra.irri.org

Suggested citation:

Gibbon, D. 2007. From technologies and enterprises to more sustainable livelihoods. In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA – an experiment in pro-poor agricultural research. Policy briefs no. 3.5. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 6 p.



Mapping poverty for rural Bangladesh: implications for pro-poor development

S.P. Kam, Mahabub Hossain, Manik L. Bose, Tabmina Latiff, Abeed H. Chowdhury, S.G. Hussain and Mabbub Ahmed



The success of a pro-poor programme hinges first upon being able to determine who the poor are and where they are concentrated. Mapping where the poor are concentrated spatially helps to refine development strategies and priorities. This policy brief tries to identify target areas and priorities for agricultural research and development (R&D) interventions and poverty reduction programmes.

How precisely we manage to target areas for poverty alleviation depends on how finely we map poverty pockets. Then, how well we identify effective interventions to alleviate poverty depends on our understanding of which factors are most to blame for it. Researchers in the Social Sciences Division of the International Rice Research Institute (IRRI), in collaboration with the Bangladesh Agricultural Research Council (BARC), the Local Government Engineering Department (LGED) and the Bangladesh Bureau of Statistics (BBS) implemented a project to identify and map, at detailed spatial scales, where the most disadvantaged among the rural populations in Bangladesh are concentrated, and analysed factors contributing to the spatial concentration. A total of 425 rural upazilas (out of 464 upazilas) of Bangladesh were included in the poverty mapping study.

Findings of the study were discussed at the dialogue titled 'Mapping Poverty for rural Bangladesh: implications for pro-poor development', organised by the Centre for Policy Dialogue (CPD) with its chairman, Professor Rehman Sobhan in

the chair. The dialogue was organised as part of CPD's ongoing agricultural policy research and advocacy activities with IRRI under the Poverty Elimination Through Rice Research Assistance (PETRRA) project. Dr. Mahabub Hossain made the keynote presentation titled 'Geographical concentration of rural poverty in Bangladesh'. Inputs from the dialogue participants as well as from the research papers are included in this policy brief.

INTRODUCTION

Despite substantial improvements in overall poverty alleviation in Bangladesh over the past few decades, large inequities in living standards exist across geographical space as well as among socio-economic groups. As stated in the Interim Poverty Reduction Strategy Paper (I-PRSP) titled 'Bangladesh-national strategy for economic growth and poverty reduction', a key challenge in poverty reduction is to channel national resources to benefit those who are most needy, with minimum leakage. Mapping where the poor are concentrated would help measure the geographical inequality in well-being of the people. The more detailed the spatial scale for identifying pockets of poverty, the more precise would be the targeting of areas for programmes for poverty reduction. Here we report at detailed spatial scales (upazila), where the most disadvantaged among the rural populations in Bangladesh are concentrated, and factors contributing to the spatial concentration.

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METHODOLOGY

A conventional way to measure poverty is to establish a poverty line, defined as the threshold level of income needed to satisfy basic minimum food and non-food requirements, and determine the number of households (people) below that line as

the poverty measure must be sensitive to income transfers from the moderate to the extreme poor. It means that higher priority must be given to the improvement in the economic conditions of the extreme poor compared to the moderate poor. The SPGI satisfies this condition, and is used



a percent of the total households (population). This head count index (HCI) is a measure of the incidence of poverty. This measure is easily understood by the general public and hence is popular with policy makers and development practitioners. The limitation of the measure is that it is insensitive to changes in the level and distribution of income among the poor. The other measures of poverty commonly used to take into account the distribution issue are a) the poverty gap index (PGI) and b) the squared poverty gap index (SPGI). The PGI measures the average (of both poor and non-poor households) of the percent of income gap of the poor households from the poverty line, and is used as a measure of intensity of poverty. It measures the percent of total income needed to be transferred from the non-poor to poor households to lift the poor above the poverty line. However, if the society is averse to inequality in the distribution of income among the poor,

as a measure of the severity of poverty. For this study we measured and mapped the HCI and the SPGI.

Setting the poverty line income has been an issue of great controversy in Bangladesh. It has been the major source of discrepancies in the levels and trends of poverty estimated in various studies. The popular approach used by the poverty studies in Bangladesh is the 'cost of basic needs' method. This method takes a normative consumption bundle of food items recommended for the average Bangladeshi population that gives a per capita daily intake of 2,112 kcal. and 58 gm. of protein needed to maintain a healthy productive life (Muqtada, 1986). The required minimum expenditure of food items is estimated by using a set of prices for the specific food items for the reference period of the survey. It is then assumed that an additional 40% income is needed to meet the non-food basic needs. We used the same method for estimating



the poverty line. The prices for the food items are estimated from the 2000 HIES data on the quantity and value of foods consumed by rural households. The poverty line thus estimated was USD 168 per person per annum.

The study involved analysis of two sets of data: a) a nationally representative sample survey conducted by IRRI for policy analysis under the project entitled PETRRA – the survey covered 1,880 sample households from 62 randomly selected villages from 57 districts; and b) the 5% sample households covered under the 2001 population census for which the data have been released. The survey data was used to estimate a statistical model that relates income to the set of income determinants for which data were collected in the census. The parameter estimates from the model were then applied to the census data to predict income for about one million census households. The predicted income data were then used to estimate the poverty indices at the upazila level.

GEOGRAPHICAL CONCENTRATION OF POVERTY

The spatial variation in extent of poverty (HCI) is shown in Map 1. For most of the upazilas for the Chittagong Hill Tracts (CHT) region the estimates could not be made because of the small sample size, resulting in high standard errors of the estimate. The metropolitan thanas were also not included in the analysis. The HCI varied from 15% to 80% of the rural households across the 425 upazilas for which these estimates are statistically significant. The colours in the map represent the four quartiles of the upazilas ranked in order of the magnitude of the poverty incidence, with the red showing the top 25% of the upazilas with highest incidence of poverty (greater than 47%).

The areas with highest incidence of poverty are the depressed basins in Sunamganj, Habiganj and Netrokona districts; the north-western districts of Kurigram, Lalmonirhat, Nilphamari and Nawabganj; and Cox's Bazar and coastal islands of Bhola, Hatia and Sandeep. The areas with low levels of poverty are the greater Dhaka and Barisal regions, and Bogra, Pabna, and Jessore regions. The picture appears to be similar with regard to the severity of poverty.

FACTORS BEHIND GEOGRAPHICAL VARIATION IN POVERTY

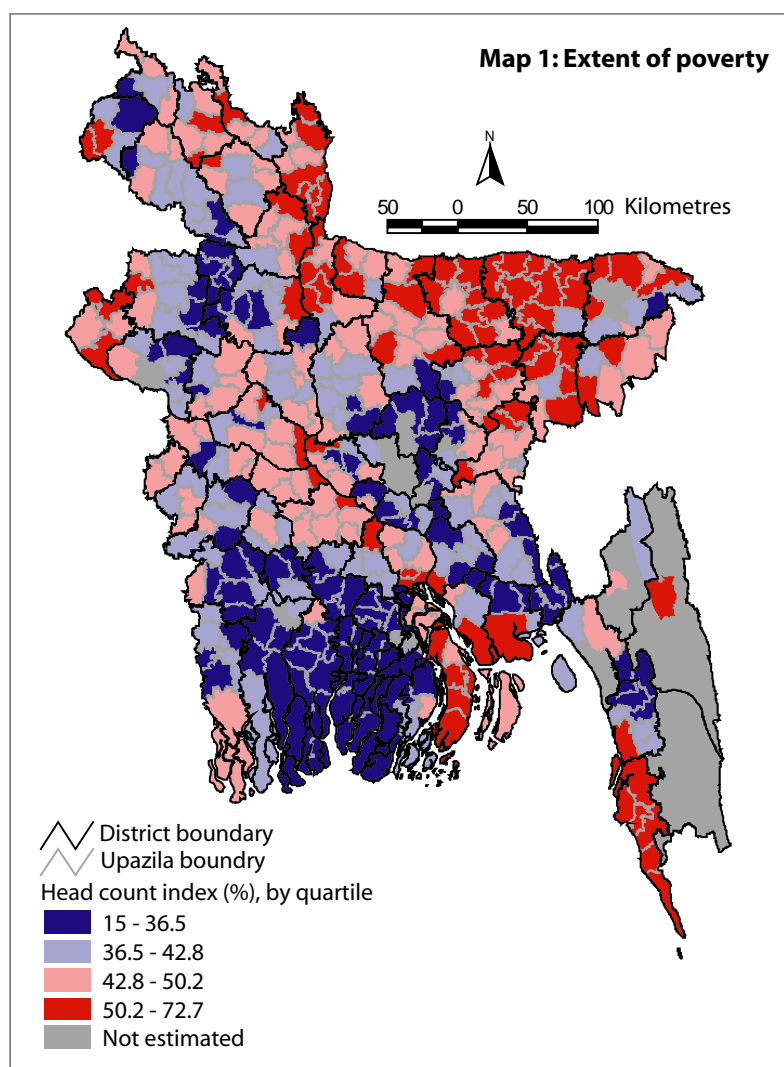
The study then analysed factors that contribute most to people's depressed state of well being using upazila level data on poverty and other variables. A multivariate regression model was used to explore the relationships between the poverty indices (i.e., HCI and SPGI) and a wide range of socioeconomic, agricultural, infrastructure and bio-physical factors. Landlessness, area under tenancy, income inequality and low land elevation contribute to the increase in poverty. On the other hand, access to communication infrastructure, coverage of irrigation, and clay loamy soil, education of adult members and rural electrification, have helped reduce poverty.

IMPLICATIONS FOR POLICY

Asset redistribution

The results suggest that income inequality and entitlement to land (land-ownership and tenancy) are major determinants of poverty. Given the same level of income, the higher the inequality in the distribution of income, the higher the incidence of poverty; and the higher the degree of landlessness, the higher the incidence of poverty in the upazilas. However, we did not find any clear





geographical pattern in the inequality in the distribution of income (Map 2). The 2001 census estimated that nearly 42% of the households do not own any cultivated land. The upazilas with highest concentration of landlessness are in the greater Sylhet, Chittagong and in the Khulna regions. The incidence of tenancy varies greatly across the region. Access to land through the tenancy market helps reduce poverty. The top quartile of the upazilas with regard to the incidence of tenancy are concentrated in the coastal region of Barisal, Noakhali and Chittagong, and also in the Nawabganj and Naogaon districts in the Rajshahi region.

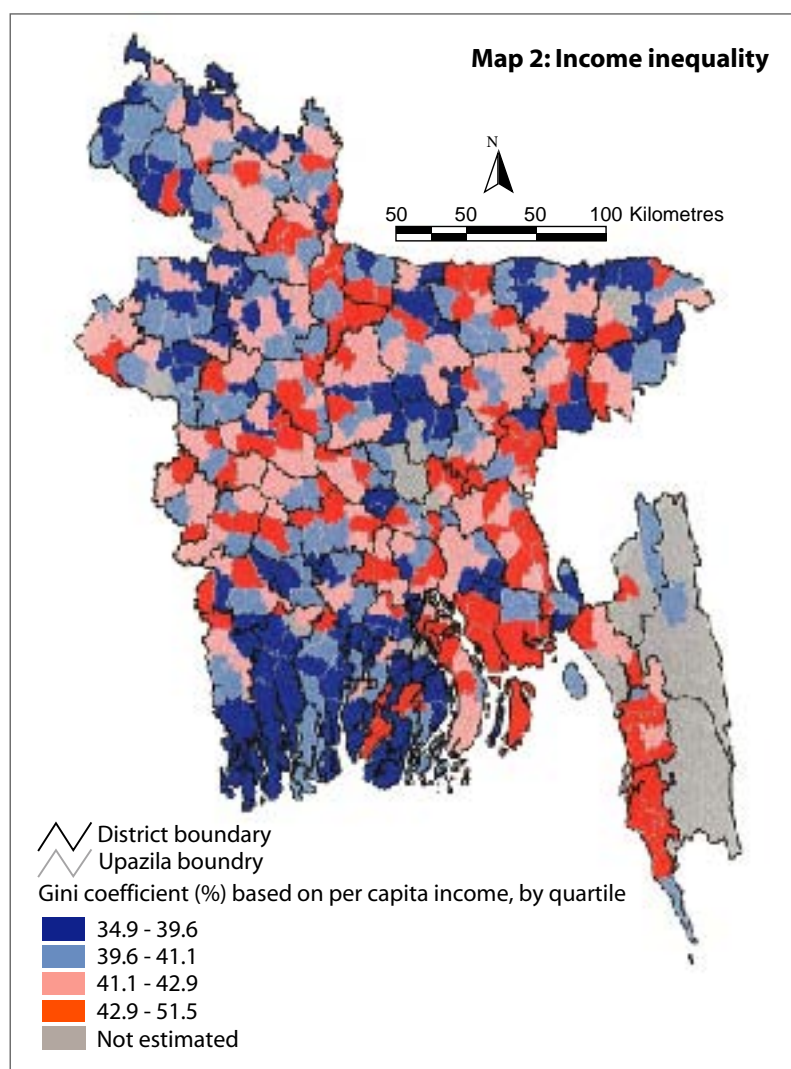
The above findings suggest that redistribution of land through land tenancy reforms would contribute to

poverty reduction. While such reforms are highly desirable, their feasibility is questionable given the already high population density in most areas of Bangladesh. Very little land would be available for redistribution, if the ceiling on land-ownership has to be kept at a viable level. However, the government can take up a programme for redistributing *khas* land for homesteads to those who do not own even homestead land. Measures can also be adopted to control absentee land-ownership and rents under fixed-rent tenancy which has been growing in importance.

Education and human capital formation

Close association of high incidence of poverty with low educational attainment





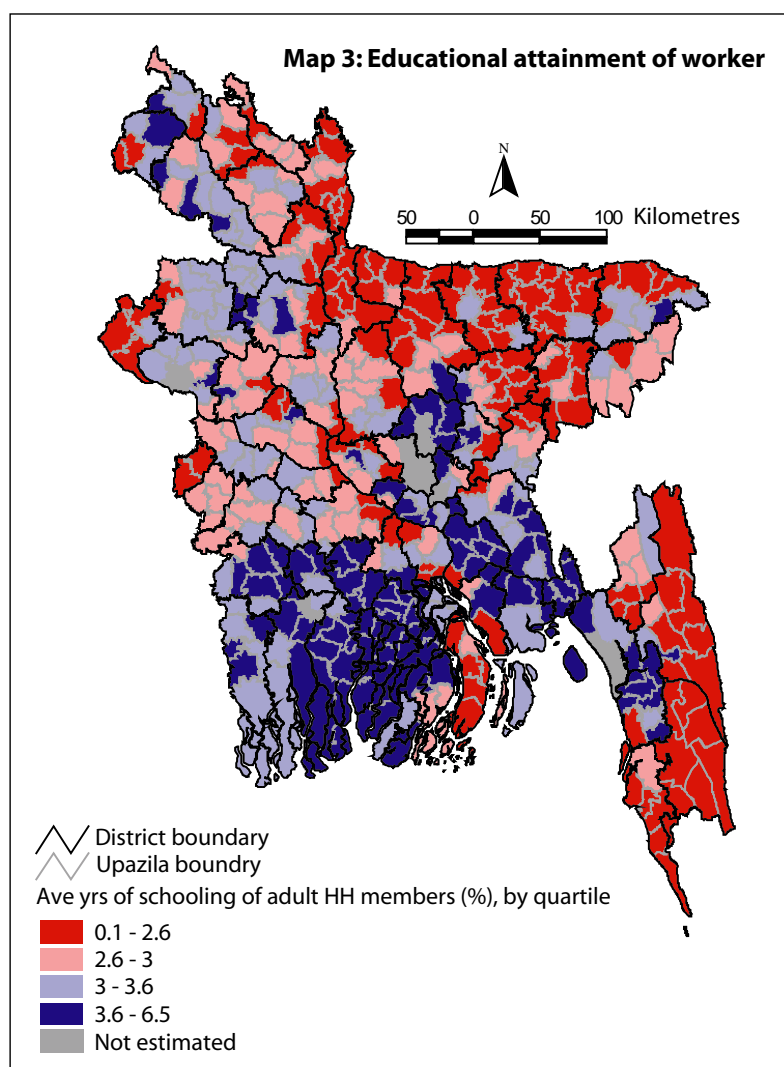
of the working age population was observed. This relationship is the strongest among all explanatory variables. The results suggest that improving human capital through providing education and training remain the most fundamental intervention to benefit the poorest of the rural poor in the medium and long term.

Map 3 shows the spatial distribution of educational attainment of the workers across upazilas. The average years of schooling of the workers at the upazila level vary from 0.1 year to 6.5 years. The upazilas with low levels of education are concentrated in the greater Sylhet, Mymensingh and the Rangpur regions, while those with relatively higher levels of education are concentrated in the greater Barisal, Noakhali and Comilla regions.

The Government of Bangladesh (GOB) has committed to achieving universal primary education and removing gender disparity in education by 2015 as targets for achieving the Millennium Development Goals (MDGs). There is a long way to go to reach the MDG of achieving universal primary education. The 2001 population census data show that nearly 30% of the children never attend school and the school participation rate is significantly higher in upazilas with lower incidence of poverty. The government needs to provide special incentives to poor households to induce them to send the children to schools, and to keep them till the secondary level to improve the human capital content.

That the incentives work is shown by the





higher participation of girls in the secondary school age group than boys, which is a positive impact of the government's policy of providing stipends to girls in the secondary schools.

Development of infrastructure

The positive impact of infrastructure on reduction of poverty is indicated by the highly statistically significant association of poverty with the coverage of irrigation, access to electricity and the accessibility of the villages to other infrastructures (upazila headquarters, educational institutions, health facilities etc.). The government has a major role to play in providing these infrastructure facilities. The extents of coverage of these infrastructures are still at a low level

in Bangladesh. During the 1990s Bangladesh made great progress in developing rural roads due to the impressive work of the LGED. The average travel time to access the main service facilities by road is estimated at 25 minutes. But for some upazilas the time is more than 4 hours. The upazilas with low levels of accessibility are in the CHT, Sunamganj, Netrokona and Kurigram districts in the north, and Patuakhali, Gopalganj and Bagerhat districts in the south-west. These areas should get priority in future transport infrastructure development projects.

Only 23% of the rural households have electricity connected. Obviously there is a long way to go for the government to provide people universal access to this



vital infrastructure that encourages private sector investment in agriculture and various non-farm activities, and contributes to changing the attitude of the people towards modernisation. The areas with very low coverage of electricity are Nilphamari, Kurigram districts, the greater Mymensingh and Sylhet region, CHT region, and Khulna region and the coastal islands.

Bangladesh has also made good progress in extending irrigation facilities since the early 1980s through private sector investment in shallow tubewells and power pumps. The area covered by tubewells and power pumps reached 4.1 million hectares in 2002, which is about 52% of the cultivated land. The coverage of modern irrigation facilities has expanded mostly to central and the north-western and south-western parts of the country. The coverage is still low in coastal areas, in the depressed basins in the Sylhet and Faridpur belt, and in the CHT region. For further expansion of irrigation, surface water development projects that help retain water accumulated during the monsoon season for use during the dry season will be required.

Agricultural development and technological needs

Few of the bio-physical variables have been found to correlate significantly with the poverty indices. The significant ones include the prevalence of low-lying land and vulnerability to deep flooding, flash-flooding and river erosion.

The dominant negative effects of depression areas and flood-related risks on poverty suggest that the extreme poor in these areas need to engage in non-farm income-generating activities and/or seeking alternative land uses that turn the constraints into opportunities, such as fisheries. For example, one major pocket

of high poverty incidence occurs in the *haur* (deeply-flooded) areas in north-eastern districts of Mymensingh and Sylhet. Farmers in some of these areas have shifted to planting high yielding *boro* rice by abandoning the low-yielding deep water *aman* rice traditionally grown in the area. Despite this, and the high migration of rural labour out of agriculture (particularly from Sylhet), this region remains among the poorest in Bangladesh. Agricultural interventions are still important, not only for increasing productivity of rice as the dominant crop, but also for diversifying production systems appropriate to the natural ecology to the area. The abundance of water and deep flooding provides opportunities for developing technologies for agriculture-aquaculture systems appropriate for poor rural communities, with accompanying policy, infrastructural and micro-credit support. Development of cold-tolerant shorter maturity *boro* rice varieties can help reduce risk from early flash-floods, and the vulnerability to livelihoods caused by this natural factor.

The significance of drought in explaining poverty over geographical space seems to be masked by massive expansion to shallow tubewells that can be used for supplementary irrigation. This, however, does not diminish the importance of developing drought-coping strategies for improving agricultural productivity in the low-rainfall regions. The high land areas are conducive for high-values upland crops. Expansion of irrigation can contribute to crop diversification and improved livelihoods of farmers in regions with large proportion of high-lands.

RECOMMENDATIONS

Based on the results of the poverty mapping study and discussions at the Dialogue, we recommend the following:



- The allocation under various safety-net programmes should be increased in upazilas with higher intensity of poverty.
- Government may take up a programme for redistributing *khas* land for homestead to those who do not own homestead land. Regulation of absentee land-ownership and terms of tenancy should be considered.
- As low enrollment and high drop-out rules are also linked with chronic poverty, the government should provide special incentives to poor households to encourage them to send their children to school and retain them upto at least secondary level.
- The upazilas with low levels of accessibility should get priority in future transport infrastructure development projects.
- Public investment for rural electrification should be accelerated.
- Surface water development projects will be required for expansion of irrigation in coastal areas and the depressed basins in the Sylhet and Faridpur belt, and in the CHT regions.
- Technologies for agriculture-aquaculture systems appropriate for poor rural communities should be developed. The dissemination of these technologies should be supported by appropriate policies for storage, transportation, marketing and credit support.
- Research for improved technologies for escaping flash-floods and droughts should be supported for the very low-lying and upland areas.

Suggested citation:

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Nature and impacts of women's participation in economic activities in rural Bangladesh

Mahabub Hossain, Thelma R. Paris, Manik L. Bose and Alamgir Chowdhury



This policy brief is prepared on the basis of a study conducted by the Bangladesh Institute of Development Studies (BIDS) in collaboration with the International Rice Research Institute (IRRI) and from inputs of a dialogue on 'Women's contribution to rural economic activities: making the invisible visible', which was jointly organised by the Centre for Policy Dialogue (CPD) and IRRI and was held on April 22, 2004 at the BRAC Centre Inn Auditorium, Dhaka. The study was based on a two-period survey of a nationally representative sample of 62 villages from 57 districts. The sample was drawn in 1987 through using a multistage (union-village-households) random sampling method. IRRI revisited the villages again in 2000 and collected data from a random sample drawn on the basis of 'wealth-ranking' of households in the villages, including households which were selected in the 1987 benchmark. This policy brief deals with the nature and impact of women's participation in the economic activities in rural Bangladesh and makes some recommendations in this regard. Fazle Hasan Abed, chairman of the Bangladesh Rural Advancement Committee (BRAC) chaired the dialogue, and the minister in charge of agriculture, M. K. Anwar was the chief guest. The state minister of agriculture, Fakhrul Islam Alamgir and the agriculture secretary of Awami League (AL) M. A. Razzaque attended the dialogue as special guests. The dialogue was attended by eminent researchers on gender issues and women activists. The technical

background paper was presented by Dr. Thelma R. Paris, the Gender Specialist of IRRI and Dr. Mahabub Hossain, the Head of IRRI's Social Sciences Division.

INTRODUCTION

Credible documentation of women's participation in economic activities is problematic particularly for women belonging to farm households. Women's work outside the labour market has often been overlooked and excluded from economic analyses. In recent years, empirical research have tried to document the extent of women's involvement in specific tasks, and their contribution to national income, but the controversy regarding the complexity of women's work and the interconnectedness between different types of functions remain. The role of women's work for empowerment of women, income generation and poverty reduction continues to be an important area of investigation in Bangladesh. It is recognised that women work more hours than men particularly in low-income households, more in agricultural than in non-agricultural economic activities, and more as unpaid family labourers than as managers. Even if they do most of the work, men mostly control their decisionmaking power and ownership of household resources. Institutional services for development target only men. Even when women are targeted such as in a micro-credit programme, women are often used as a front and men keep control over managing the resources.

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It is acknowledged that women are a disadvantaged group in acquiring knowledge in on-farm and non-farm production systems and technologies from the service sectors. They are disadvantaged because traditional culture and social norms confer power and privilege to men. However, some recent studies have observed that women from poor households have challenged the traditional norms and coming out of home to sell labour as field workers in agriculture and as construction labour, due to extreme poverty and food deficiency.

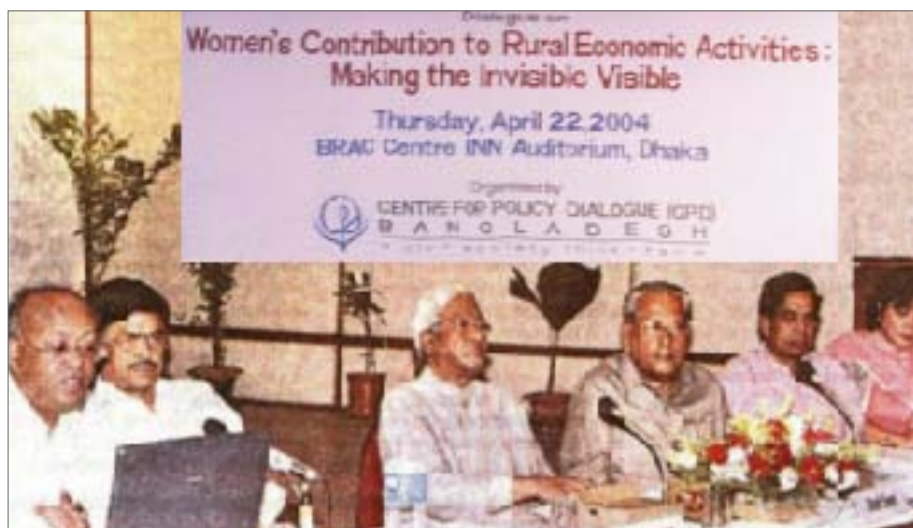
NATURE OF WOMEN'S PARTICIPATION IN ECONOMIC ACTIVITIES AND IN LABOUR MARKET

The study shows powerful social norms in Bangladesh tend to deter females' mobility into the public domain and confine them to low productive household activities that generally carry low returns. Setting aside the cultural constraint on mobility, women's involvement in the labour market is also constrained by the 'imposed' primary responsibilities for household tasks and childcare. Other two important factors that influence women's involvement in the labour market are location and

proximity. Most women's activities and income are dominated by male lineage. In addition, there are some cultural and religious barriers in different locations that do not allow female workers to participate in field work even on their own farm or for income from outside work.

However, as male members leave the household in search of non-farm jobs, the women tend to take over some of their economic functions. Due to the changes in pattern of market participation of women in various economic activities, the share in paid hours for cultivation increased but declined in post-harvest work. This indicates the increasing participation of women as wage labourers. The time spent by female unpaid labour also declined in post-harvest work due to the introduction of commercial mills for paddy which has reduced women's labour in dehussing paddy processing, with the use of *dhaki*. Female family members benefit from labour saving technologies because of the reduction in time, drudgery and work burden.

Regarding women's participation in economic activities, Table 1 shows that in 2000 total working time in economic activities was 7.81 hour per day for



women and 8.07 hours for men. The situation was opposite in 1987 when women worked for 9.00 hours a day compared to 8.55 hours for men. The change in labour time during the 1987-2000 indicates that both men and women have reduced their work effort, which could be a positive impact of the improvement in economic conditions and the enjoyment of leisure. Part of the reduction in women's labour was due to an increased tendency of sharing the domestic household work with the husband. The other contributory factors are: a) replacement of the traditional back-breaking homestead based processing technologies (such as rice milling by *dheki* and pit looms) by relatively advanced commercial technologies (such as rice huller and the semi-automated looms); and b) improvement in the quality of housing that requires less time for maintaining cleanliness. Most of the reduction in women's work effort is on account of domestic labour.

but have increased the labour supply to nonagriculture by 42%. The reverse is the case for women who have withdrawn some labour from non-agriculture, but increased the labour supply to agricultural activities. The study shows only 23% of the total labour for women was on account of economic activities, compared to 83% for men.

Only 6% of the women allocated more than 6 hours a day and hence can be considered fully employed in economic pursuits. It appears that women allocate time to economic activities in their spare time after providing domestic labour and hence are only marginally involved in economic activities. Thus, almost 57% of the women are under-employed if economic activities are counted. Among men, 59% were fully employed, and 28% under-employed. Women from households who considered themselves as very poor worked for 161 days a year compared to 122 days for the poor, and 115 days for those who considered

Table 1. Time allocation (hours/day) for adult population by type of activity

Type of activity	Male population		Female population	
	1987	2000	1987	2000
Economic labour	7.57	6.73	1.86	1.79
Agriculture	5.29	3.50	1.37	1.41
Non-agriculture	2.28	3.23	0.49	0.38
Domestic labour	0.98	1.34	7.14	6.02
Total labour (average/day)	8.55	8.07	9.00	7.81

Source: IRRI-BIDS household survey

In 2000, women spent on average of 1.79 hours per day (equivalent to 82 standard eight-hour days in a year) on economic activities compared to 6.73 hours (307 days per year) for men. During 1987-2000 there was only a marginal reduction (4%) in economic labour for women, but a substantial reduction (11%) for men. An important point to note is a redistribution of economic labour between agriculture and non-agricultural activities for men. Men have reduced the labour supply to agriculture by one-third over this period,

themselves as self-sufficient but vulnerable to economic shocks. However, women from economically solvent groups were engaged more in economic activities, presumably because the educated women who are employed in full-time services mostly belong to this group. Again, the larger the size of the land holdings the higher the participation in economic activities. Women's participation might increase if the labour market becomes compact leading to an increase in the wage rate. There was substantial gender





disparity in the wage rate. In 2000, women received on average about 30% less wage than men. In specific activities the gender disparity in the wage rate was even more pronounced. For example, in agriculture women received about 42% lower wage than men compared to 24% in non-agriculture. Illiterate females received about half of the wage as opposed to their male counterparts in 2000, while it was much lower in 1987. The findings indicate that the higher the level of education of household head and spouse, the lower the male-female disparity in earning.

WOMEN'S PERCEPTIONS OF CHANGES IN LIVING AND WORK ENVIRONMENT

Focus group discussions (FGDs) revealed that the level of living of the poor women has improved but not so for the women from the non-poor households. Below are women's perceptions of changes in their work environments over the last 10 years.

- Greater contribution in economic activities not only within the homesteads but also outside. More poor

women are now employed outside the villages in fieldwork for crop cultivation. The social norms are weakening partly because of the mobilisation of women by non-governmental organisations (NGOs) for organising economic activities with micro-credit;

- Increase in cultivation of vegetables. At present the women are more involved in growing vegetables than men. NGOs often work with men in supplying improved seeds and extending the knowledge on improved management practices;
- Reduction in participation in paddy husking and other low-productive cottage industries. Women's labour in paddy husking has almost been eliminated due to the introduction of commercial rice mills in almost every village. Some poor women now find employment in rice mills for drying paddy and managing rice byproducts;
- Increasing commercialisation of poultry farming and goat rearing. Poultry farming has become an attractive enterprise and men also participate in this activity. The selling of the poultry



birds and eggs is an important source of cash for meeting daily expenses, and sale of goats helps overcoming financial crisis;

- Reduction in labour allocation for animal husbandry. The spread of power tillers and threshing machines substantially reduced women's activities for feeding and caring cattle;
- Emerging enterprise such as tailoring. In the past only men earned income through tailoring. At present, more women are purchasing sewing machines by taking loans (money) from different NGO *samities* (societies). This has helped empower women to engage in a business enterprise and earn cash incomes;
- Changing role of women in economic activities. Migration of men to urban areas and abroad in search of better earning jobs is on the increase. There is also an increasing trend of mobility from farm to non-farm jobs within rural areas with improvement of roads and development of growth centres. In response, women's roles are beginning to shift from being unpaid family workers to de facto farm managers in cases when men are absent;
- Changing attitude towards girls' education. More mothers now want their daughters to go to school. They realise the value of education as a step out of poverty and tedious long hours of work for home maintenance. It was stimulated by the government's provision of a stipend for girls enrolled in Secondary schools;
- More self-confidence and recognition. Unlike earlier times when women were afraid to talk to strangers and express themselves in public, more women now are outspoken and confident to share their feelings, sentiments and ideas in public; and
- Men allocating time for child care.

Husbands particularly from non-poor households allocate some time to take care of children although it still remains the major task for the wives.

WOMEN'S PERCEPTIONS REGARDING THEIR SOCIAL STATUS

- Lack of empowerment. In the situation described above, the wife thinks that she does not have any value in the family and the society. She is often reprimanded on very trivial matters and some of them are even beaten by their husband and in-laws;
- Perceived traditional gender roles. Activities done outside the homestead are supposed to be done by men and the homestead activities should be done by the women. When men return from work, women should attend to their needs; and
- Changing attitudes of women about themselves. That women are considered to be of less value which is a traditional attitude in the Bangladeshi rural society. At present the young women consider themselves to be equal to men. They are now aware of their rights by virtue of attending various meetings organised by NGOs, and the exposure of the outside world due to the spread of television.

IMPACT ON WOMEN'S EMPOWERMENT

To quantify women's empowerment, Women Empowerment Index (WEI) was developed considering 'participation' in decision making as the proxy of 'empowerment' in the field of agricultural and non-agricultural sectors in rural areas. Except for post-harvest work, for crop agricultural decision, the results of WEI shows that about 23% to 34% of male heads took sole decisions, otherwise the



decision was made after joint discussions with other members. An exception is with regard to cash management where about 84% of women take decisions by themselves in the absence of their husbands. Presumably, other male or female agents dominating the leadership of the households, and obviously the presence of adult males, usually dominate decision making in most of the household and its economic activities in Bengali culture. There are few women in all categories of households who are reported to take decision and leadership even in the presence of their husbands.

A multiple regression analysis shows that the most important factors influencing women's empowerment is the size of land ownership and the tenure status of the household. The women belonging to the tenant households appeared to be more empowered compared to that of women in the owner operated farms. Also, the older women are more empowered than the younger women, as indicated by the positive coefficient of the age of the spouse. The higher the levels of education of the household members the more empowered are the women members of the households. After controlling the effects of other variables influencing empowerment, women's economic involvements seem to have a significant impact on women's empowerment. The influence is however weak compared to some other variables.

MAINSTREAMING WOMEN IN RURAL DEVELOPMENT: IDEAS OF WOMEN

Women's opinion about their needs and opportunities in performing their economic activities and the government's role in improving their social and economic status are:

- Need to have formal and 'hands-on' training on seed management including seed production, drying and preservation;

- Need to have access to new seeds (rice, vegetables) as well as seedlings for homestead forestry which they can sell;
- Need access to new seeds, tube wells and training on improved methods of vegetable growing as well as improved marketing facilities to sell vegetables;
- Need access to vaccine within the village to reduce poultry mortality and also training on how to raise improved breeds of poultry including formulation of local feeds. Need capital to increase the number of poultry birds and train some women as veterinary service providers;
- Increase supply of credit and larger size of loans for cattle fattening. Government programme for the production of animal fodder within the homestead and in the field;
- Formation of cooperative of those engaged in handicrafts production for organising small scale marketing, and providing them access to credit and training on financial management and improved technology;
- Almost every household has a pond/ditch that can be used for fish culture. It would save the cost of fish consumption in the family and help earn an income. More effective programme for culture fishery should be promoted;
- Need to train women to improve the quality of garments making and organise marketing of household based garments products; and
- Since women's participation in fieldwork is increasing, their technical knowledge can be enhanced through training in improved farming methods. The demand for their specialised skills can increase if their quality of work and efficiency is improved.



RECOMMENDATIONS

- All government development programmes must target women as equal partners with men. Indeed, government assistance should be channeled through women for reaching the entire household effectively;
- Increasing roles of women in field activities aside from homestead activities should be addressed and mainstreamed in on-going and future research and also extension programmes. Success stories of the PETRRA project have shown that women can be empowered by giving them equal access as given to men in training and extension programmes;
- Knowledge is power. Although women's roles are confined within the homestead, they should also be provided with technical knowledge and skills on crop management and production;
- Programmes that combine technical with organisational and leadership skills are effective in terms of building social capital. Thus, research and development workers should facilitate the formation of women's groups to sustain adoption of different income generating activities. Women should be trained as female agricultural extension workers at the local level;
- Money is power. Agricultural credit should be channeled through women to empower them and to ensure best use of credit. The pilot project on family approach to extension should be replicated nationwide; and
- A policy is only good when it is implemented. It is useful for an organisation to complement a policy on gender with a gender strategy outlining the approach to implementation as well as a gender action plan. To implement the organisation's commitment to gender equality, additional technical advice or expertise is needed. An effective strategy for mainstreaming is to ensure that gender sensitivity is included as a criterion in the development agenda. A strong monitoring and evaluation (M&E) mechanism should be developed to ensure that all women benefit from the various development efforts made.



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Rice seed delivery system and seed policy in Bangladesh

Mahabub Hossain, Aldas Janaiah, A. M. Muazzam Husain and Firdousi Naber



This policy brief is prepared on the basis of a study conducted by the International Rice Research Institute (IRRI) in collaboration with the Bangladesh Rural Advancement Committee (BRAC) and from the inputs of a dialogue on 'Rice seed delivery system and seed policy' held on January 8, 2002 at Centre on Integrated Rural Development for Asia and the Pacific (CIRDAP) auditorium. The dialogue was jointly organised by the Centre for Policy Dialogue (CPD) and IRRI. The study was based on data collected through formal and informal discussions/interviews with the key participants of 19 organisations/ agencies representing the public and private sector seed agencies, non-governmental organisation (NGOs) and farmers' associations and a sample survey of farm households. The policy brief deals with the status, effectiveness and constraints of the existing rice seed delivery system in Bangladesh. It provides insight into the adequacy of institutional linkages and policy conditions of the current seed delivery system. The public sector is performing a wide range of roles from the development of a modern variety (MV) to the final distribution of seeds to the farmers. Lack of incentives for plant breeders and absence of an inter-institutional coordination are likely to constrain the development and promotion of new modern varieties, and may limit the expansion of the rice seed market. The private sector and NGOs are expanding their roles with increasing

supplies of quality rice seeds for the newly released varieties. Some suggestions are provided to take advantage from the emerging public-private interface and adequacy of policy environment for further development of the rice seed delivery system.

IMPORTANCE OF SEED SYSTEM

Seed delivery system in general and the rice seed delivery system in particular is very important for agricultural development in Bangladesh. Continuous saving of seeds from own harvest as seed for sowing in a subsequent period without proper cleaning, seriously affects the seed health and lowers crop yields. Different country experiences show that the average paddy yields tend to be relatively high in those countries/regions where seed replacement rate is high. In Andhra Pradesh of India where the rice seed industry is highly developed, farmers procure 46% of the seed from the market every season. In Vietnam, 60% of the farmers change their seeds of MVs every year/season. Most of the rice farmers in Thailand change their varieties (seeds) every 3 to 5 years. Farmer participatory experiments carried out in the Philippines and Bangladesh show that good quality seed can increase rice yield by 8% to 10%. It is estimated that Bangladesh can produce an additional 2.1 million metric tons of rice annually worth US Dollars 420 million by ensuring quality seeds. However, this would require an efficient

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seed delivery system with active collaboration of private and public sectors, and farmers' organisations.

THE SEED DELIVERY SYSTEM

In Bangladesh, the public sector meets only 5% to 6% of the total rice seed demand of 0.8 million tons every year. Bangladesh Agricultural Development Corporation (BADC) is the major supplier of seed and has the mandate to produce and supply quality seeds of notified crops (rice, wheat, potato, jute and sugarcane). Private sector participation which is a relatively new development is mainly confined to the marketing of hybrid seeds of vegetables, corn, oilseeds and fruits, and more recently, hybrid rice seeds, which are imported. The 1998 Seed Policy of the Government of Bangladesh (GOB) has made provisions for active participation of private sector and NGOs. Since then, there has been a visible shift in the seed delivery structure with considerable participation by the private sector and the NGOs. An ideal seed system in Bangladesh ought to serve the farmers with five key roles i.e., adequate supply of quality seeds of modern varieties at affordable prices in the right time. An ideal seed system needs supportive institutional and policy conditions for

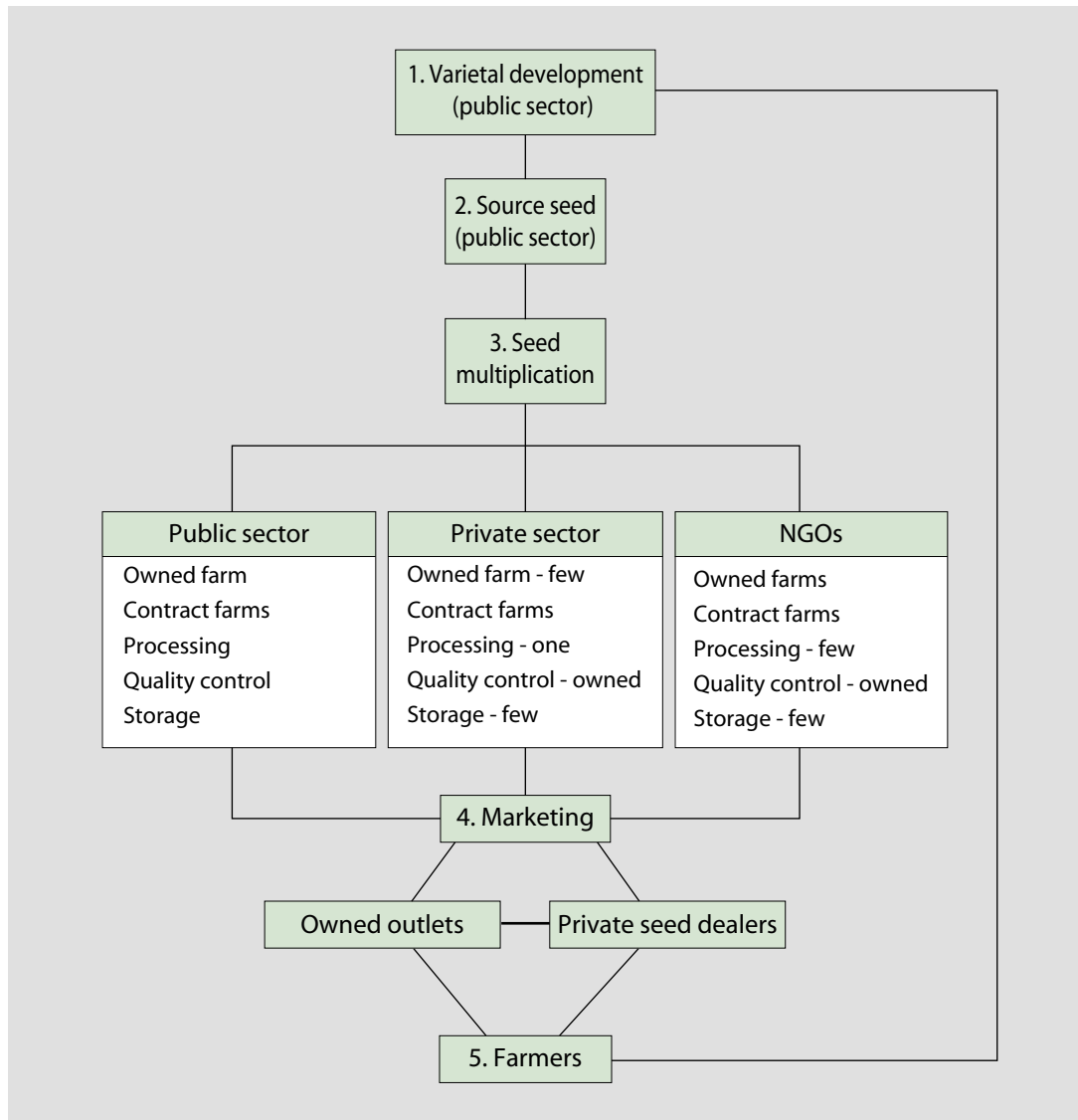
active participation of all key entities and for strengthening the public-private interface to play their basic roles in an efficient way. There are four basic elements of the seed system, namely, production and import of improved varieties, quality control of seed, production and marketing of improved seeds and improvement in the quality of seed kept by farmers. The structure of the seed delivery system in Bangladesh is shown in Figure 1.

VARIETY DEVELOPMENT AND PROMOTION

The Bangladesh Rice Research Institute (BRRI) and the Bangladesh Institute of Nuclear Agriculture (BINA) are responsible for variety development and promotion. In addition, agricultural universities are also engaged in plant breeding research. BRRI, BINA and agricultural universities are under three different ministries and institutional coordination and cooperation among these institutes are relatively weak. A lot of activities are involved in the process of development of a new variety. The activities include preservation of genetic resources and improvement of the variety by tapping on useful traits. Breeders combined the traditional land races with that of the enhanced germplasm to



Figure 1. The structure of seed delivery system



increase yield, improve quality, reduce growth duration and incorporate resistance to insects, diseases and water and soil related stresses. It takes about 15-16 years from initiation of variety development process to cultivation in the farmers' field of the identified new line due to a complex process of variety release and seed multiplication.

Until 2001, BRRI has developed 40 varieties including one hybrid; BINA and Bangladesh Agricultural University (BAU) have developed 6 and 2 rice varieties, respectively. There is an increasing trend towards production of new varieties. BRRI released 9 varieties in the 1970s (1970-79), 13 varieties in the 1980s (1980-

89) and 16 varieties in the 1990s (1990-99). Three varieties (BR-1, BR-3 and BR-8) released in the 1970s, 3 varieties (BR-11, BR-14, BR-16) released in the 1980s and 2 varieties (BRRI dhan28 and BRRI dhan29) released in the 1990s have become popular with farmers. The crosses used in the popular varieties contain advanced genetic materials developed by IRRI and other national systems.

PRODUCTION AND DISTRIBUTION OF SEEDS

BRRI and BINA are involved in supply of source seeds (breeder's seed). There is a



lack of involvement of universities in this process. The demand for breeder's seed is growing rapidly for rice since the 1990s. There is inadequate capacity utilisation in the production of breeder's seed. The availability of suitable land area for production of breeder's seed does not appear to be a constraint for major research and development (R&D) institutions. Lack of adequate infrastructure (processing and storage facilities), incentives and support staff may however constrain the increased production of breeder's seed in the public sector and R&D institutions such as BRRI, BAU and BINA.

BADC is the main agency in charge of production of foundation seed (FS). They have a fairly large infrastructure with 26 seed farms in different parts of the country with 1,800 hectares of land and producing 1,063 tons of foundation seed in 1999-2000. They have built up a network of contract seed growers and have a good infrastructure of quality control of seeds. The private sector and NGOs are now coming forward for production of foundation seed. Several NGOs have signed a Memorandum of Understanding (MOU) with BRRI to have access to breeder's seed for production of foundation seed and certified seed. They have started production of some foundation seeds but have limited facilities. They use contract growers for production of the certified seed.

A few special projects implemented under the public sector are being implemented to develop the entrepreneurship in the seed business and to expand the seed market. These are: i) The Food and Agriculture Organisation (FAO)-United Nations Development Programme (UNDP)-sponsored seed project implemented by the Department of Agricultural Extension (DAE) in 1998 promotes seed production activity by entrepreneurial farmers; ii) the BADC has

been implementing since 1997 Bangladesh-German Seed Project (BGSP), sponsored by the German government; and iii) a 'special seed uptake programme' was initiated by IRRI under the PETRRA project, sponsored by the Department of International Development (DFID) of UK. Farmers under the special seed projects of DAE and BADC produced about 16,000 tons of certified seeds of rice in 2000 and distributed them to other farmers. This informal flow of certified seeds is not included in the official statistics on the seed replacement rate. If we consider both formal sale of BADC seeds (about 14,000 tons) and the informal flow of certified seeds (16,000 tons), seed replacement rate would be about 9% of the total modern variety seeds planted by farmers.

SEED MARKETING

BADC has an extensive marketing network which includes 22 regional and 42 district level sales centres and 36 sale outlets at the upazila level which are located all over the country. In addition, BADC has about 1,300 licensed seed dealers for marketing the certified seed of BADC throughout the country. Registered private seed dealers, and NGOs can buy certified seeds from BADC outlets and sell with the BADC brand name through their networks.

DEMAND FOR SEED AND ROLE OF THE MARKET

Bangladesh has a potential rice seed market of Tk. 1,650 crores (i.e., US Dollars 290 million) with an annual demand for 786 thousand tons of rice seed. The potential market of seed is about two-third of the fertiliser market.

Effectiveness of the seed delivery system depends on the extent of incentives



provided to key participants (like plant breeders, private seed companies, seed dealers, etc.) in the seed market. Lack of incentives for the production of breeder seed and the regulation in the pricing of BADC seed are the key constraint to the expansion of the seed market. It is observed that the private seed dealers get only Tk. 1.00-1.50 per kg. for marketing of the BADC rice seeds, which is much lower than the margin in the marketing of seeds supplied by other agencies. There is no price control on the selling of privately produced seeds (either private companies or NGOs). The selling price of private sector paddy seed was 50% higher than the price of the BADC seed. The NGOs and the private seed firms offer higher margins for the private seed dealers compared to that offered by the BADC.

On an average, the net return in the business of the production of rice seed for the NGOs (BRAC) and the private seed companies was about Tk. 1.62 and 1.84 per kg., respectively. The margin is lower than the margin in the business of marketing hybrid seeds of vegetables, maize, pulses, etc. So in order to induce the private sector to expand the business of production of certified rice seeds, the companies should be allowed to charge a price for rice seeds at a rate that generates profits comparable to other businesses. The competition of the private sector with BADC is not fair because BADC receives a subsidy from the government for its operations.

BOTTLENECKS AND CONSTRAINTS

Major constraints to expand the seed market are as follows:

- Release of varieties that often are not superior to the popular varieties currently grown by farmers;
- Inadequate participation of farmers in variety testing;

- Lack of inter-institutional coordination/network for development and promotion of new varieties through better utilisation of available germplasm across R&D institutions;
- Complex and lengthy procedures for a variety testing and release;
- No special incentives for plant breeders to produce enough breeder seeds;
- Inadequate manpower and modern infrastructure for testing seed quality;
- Regulation on pricing of seeds by the public sector; and
- Lack of farmers' protection against unfair seed business.

RECOMMENDATIONS

In view of the above, we recommend the following to improve the efficiency and effectiveness of the seed delivery system.

- Initiation of an inter-institutional coordination and networking research for the variety testing and release in line with what is currently in operation in India;
- Reviewing of the variety release process to shorten the breeding cycles and also ensuring more participation of farmers in the varietal evaluation programmes;
- Strengthening the infrastructure (modern processing and storage, and additional manpower) for breeder seed production to meet the growing demand;
- Provision of financial incentives to breeders for the promotion of breeder's seed production;
- Introducing 'minikit/block demonstrations' immediately after the release of new MVs as a parallel activity to breeder seed production to help familiarise the farmers with new MVs;
- Relaxation of restrictive policies on



pricing of seed to provide adequate incentives to the various market participants; and

prevent entry of potentially damaging new diseases.

- Strengthening the regulatory mechanism for imported seeds to

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Rice research and poverty alleviation in Bangladesh

Mahabub Hossain



This policy brief deals with the links between rice research and the poverty vulnerability situation in Bangladesh. Rice research has contributed to poverty alleviation in Bangladesh through direct and indirect ways. Owner and tenant farmers benefited from higher productivity and lower unit cost of production and incomes obtained from the adoption of modern varieties (MVs). The landless labourers benefited from increased employment opportunity in rice cultivation and in the processing, trade and transport of rice and agricultural inputs. This is the direct pathway. On the other hand, increased rice productivity helped to reduce the price of rice relative to other commodities. Lower prices of rice indirectly helped to reduce poverty as nearly 40% of expenditures of the poorest 60% of the population go to rice. In the long run, poverty alleviation requires a structural transformation of the economy away from agriculture towards non-farm activities (industry and services). Increased productivity in rice helped facilitate this process of structural transformation by releasing resources for diversification into more productive and profitable non-crop and non-farm activities.

INTRODUCTION

Rice is our staple food. It provides nearly 48% of rural employment, about two-thirds of total calorie supply, and about one-half of the total protein intake of an average person in the country. The rice sector contributes one-half of the

agricultural gross domestic product (GDP) and one-sixth of the national income in Bangladesh. About 75% of the total cropped area and more than 80% of the total irrigated area is planted to rice. Almost all of the 13 million farm families grow rice. Thus, rice plays a vital role in the livelihood of the people.

Poverty is widespread in Bangladesh. Poverty is usually measured with reference to a threshold level of income or expenditure (called poverty line) needed to meet the food and non-food basic needs for a person to maintain a healthy and productive life. These measures are called 'income poverty'. Now-a-days there is an agreement between social scientists and policy makers that low levels of education and health are of concern in their own right. The recent World Bank report on poverty broadens the notion of poverty to include vulnerability and exposure to risk. The report states, 'to be poor is to be hungry, to lack shelter and clothing, to be sick and not cared for, to be illiterate and not schooled' (World Bank, 2001). Most of the studies on poverty in Bangladesh have focused mainly on income measures. Considering the minimum required calorie intake (2,122 kcal. per day), 44% of the country's population live in poverty. The pertinent question is, 'how does rice research alleviate poverty?' The following discussions elaborate on the process of poverty alleviation through rice research.

The background information for this policy brief is drawn from the official statistics published by the Bangladesh

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Bureau of Statistics, and findings from two nationally representative household surveys carried out in 1987-'88 and 2000-'01. The Bangladesh Institute of Development Studies (BIDS) and the International Rice Research Institute (IRRI) conducted the benchmark survey in 1987-'88 while the survey in 2000-'01 was carried out by IRRI under Poverty Elimination Through Rice Research Assistance (PETRRA) project. The benchmark survey covered 1,245

Chuadanga and Rangpur. The Bangladesh Institute of Nuclear Agriculture (BINA) is also responsible for rice variety development using advanced tools such as mutation breeding. In addition, agricultural universities are also engaged in plant breeding research. As of 2001, BRRI has developed 39 improved varieties and 1 hybrid; BINA has developed 6 improved varieties and Bangladesh Agricultural University (BAU) has developed 2 improved varieties. There



households from 62 villages in 57 districts selected through a multi-stage random sampling method, covering all agro-ecological zones of Bangladesh. The same households were surveyed during 2000-'01 period to assess the changes in rural economy during the 1987-'88 to 2000-'01 period. The 2000-'01 survey covers a sample of 1,880 households. These two surveys are henceforth called the BIDS-IRRI survey.

RICE RESEARCH IN BANGLADESH

The Bangladesh Rice Research Institute (BRRI) at Gazipur has the mandate to conduct rice research. Today, BRRI conducts rice research in its nine research stations located in Gazipur (headquarters), Comilla, Habiganj, Sonagazi, Barisal, Rajshahi, Bhanga,

is an increasing trend towards production of improved varieties. BRRI released 9 varieties in the 1970s (1970-'79), 13 varieties in the 1980s (1980-'89) and 16 varieties in the 1990s (1990-'99). Rice scientists also developed improved, soil and water management practices, incorporated resistance against major insects and diseases, and improved farm machinery.

TRENDS IN FOODGRAIN PRODUCTION

Although the area under rice has remained stagnant at around 10 to 10.5 million ha, rice production (in paddy units) has increased from 16 million tons before independence to 38 million tons in 2000-'01. It implies a rate of growth 2.6% per year, much faster than the growth of



population. Development and diffusion of high-yielding rice varieties supported by the development of minor irrigation through shallow tube wells and power pumps has been the main engine of this growth. More than half of the land is now irrigated and over 65% of the rice area has been covered by the high yielding varieties.

Rice price has not increased as per the price of other commodities. The real price of rice has gone down and that has been one of the mechanisms through which we have been able to reduce the poverty in the country, particularly for the landless in rural areas and the urban poor who are living in urban areas, have benefited tremendously. More than 60% of their budget is spent on food. Compared to the upper income group, the lower income group has benefited from low price of rice.

There has also been a respectable increase in the production of wheat. Wheat production increased from 0.14 million tons in 1976 to 1.4 million tons in 1984, but remained stagnant at that level during the next decade. Wheat production continued to grow again in late 1990s in response to favourable prices, reaching a production level of nearly 1.8 million tons.

The rapid expansion of wheat and the dry season *boro* rice was however achieved partly through reduction in the area under jute, sugarcane, pulses and oilseeds. As a result Bangladesh had to spend scarce foreign exchange on the import of non-cereal food products in increasing amounts. The reduction in the availability of pulses, which are important sources of protein and micronutrients, has adversely affected balanced nutrition, particularly for the poor. Among other food crops the growth was respectable only for potatoes and vegetables. The vegetable production picked up particularly after the 1998 floods stimulated by the distribution of

vegetable seeds as part of the postflood agricultural rehabilitation programme.

STRUCTURAL TRANSFORMATION OF RURAL ECONOMY

The growth in farmers' income has however been much lower than the growth in crop output due to a) substantially higher requirement of modern inputs (water, fertilisers and pesticides) in cultivation of MVs; b) an increase in wage rates faster than price of agricultural produce, as the agricultural labour market has become tight with the expansion of the rural non-farm sector and rapid rural-urban migration of population; and c) a long term decline in the price of rice adjusted for inflation.

The growth of agricultural productivity has however promoted a healthy development in the rural non-farm sector by triggering what economists call 'backward and forward linkages'. Agricultural growth has generated opportunities for employment and income in the rural non-farm sector through its effects on a) the demand for irrigation equipment and chemical fertilisers produced and transacted in the non-farm sectors; b) the demand for services for processing, storage and marketing of additional agricultural produce; and c) the demand for trade, transport, construction, education and health care services, as farm households spend a larger proportion of additional incomes for purchasing non-farm goods and services.

The BIDS-IRRI study reports that the employment in the rural nonfarm sector has increased by 4.5% per year while the number of workers employed in agriculture has declined by nearly 1.2% per year. While the agricultural income grew at 1.4% per year during the 1987-'01 period, the household income grew at 3.8% per year mainly due to a robust



7% growth in income from rural non-farm activities. Most of the growth originated from services, trade, business and rural transport operations.

REDUCTION OF POVERTY AND VULNERABILITY

An accurate assessment of the trend in alleviation of income poverty is difficult, in spite of a large number of studies conducted for Bangladesh on the subject. The household expenditure survey (HES), conducted by the Bangladesh Bureau of Statistics, reports the incidence of poverty and income inequality through periodic generation of household level data. They have changed the method of data collection and the measurement of poverty line overtime. Thus, while making a judgment about poverty trend in Bangladesh, one needs to be cautious about the interpretation of the information.

According to the World Bank estimate based on the HES data, nearly 40% of the rural population in Bangladesh lived below the poverty line in 1995-'96. A study by Ahmad and Hossain estimated that the number of poor households in rural Bangladesh remained almost stagnant at 75% during 1963-'64 to 1973-'74. According to the Bangladesh Bureau of Statistics (BBS), the poverty ratio for rural areas declined from 74% in 1981-'82 to 48% in 1988-'89. The dramatic improvement in the poverty situation in the 1980s, as shown by the official figures, was however highly debated in the literature and was partly attributed to the change in the data collection method in the 1983-'84 HES. During 1983-'84 to 1989-'90, there was a decline in poverty ratio from 57% to 48% for rural areas and 50% to 44% for urban areas. It is now widely recognised that the poverty ratio has been declining by 1% per year which is very slow considering that over 40% of

the rural population are still poor. The slow progress in poverty reduction in spite of the acceleration of economic growth in the 1990s is attributed to growing inequality in the distribution of income for both rural and urban areas.

There are indications that Bangladesh has made moderate progress in other dimensions of poverty also. According to the World Bank, the primary school enrolment ratio has improved from 60% to 75%, and the infant mortality rate declined from 132 to 73 per thousand live births during the 1980-'97 period. The access of the population to safe drinking water has increased from 40% to 84%, and to improved sanitation from 4% to 35%. The most impressive progress has been made in population control. The number of births per woman has declined from 6.1 to 3.1. The preliminary findings from the 2001 population census show a decline in population growth from 2.2% in the 1980s to 1.5% in the 1990s. Household level large scale sample surveys support the findings of improved literacy and school participation rates, and show that the gender disparity in the school participation rate has almost disappeared for primary level, and has turned in favour of girls at the secondary level. The school participation at both secondary and tertiary levels, however, still remains low.

People have become more resilient to natural disasters because of the change in the seasonal composition of food production. The area under pre-monsoon *aus* rice, which was highly susceptible to droughts, has declined by nearly two million ha; the area has been diverted to growing dry season high-yielding and relatively safe *boro* rice or highly profitable vegetables and fruits. The risk of the loss of *aman* rice from droughts has also been reduced due to large scale expansion of the shallow tube-wells which could be used for supplementary irrigation. The area under deep-water broadcast *aman* rice has declined from 2.2 to 0.7 million



hectare, substantially reducing the loss in rice output from abnormal floods. In the deeply flooded area farmers now keep the land fallow during the monsoon season and grow *boro* rice with irrigation during the dry season. The *boro* area has expanded from 0.5 to 4.0 million hectare over the last three decades, which together with wheat brings nearly 55% of the cereal harvest during the May-June period. So the losses in the rice output from floods or droughts could be recovered within a few months. Earlier, farmers had to wait for the next *aman* harvest to recover the loss. With the year round production of rice, the seasonality in employment and income for the landless workers is now much less pronounced than it was in the 1970s or 1980s.

In Bangladesh poverty is concentrated mostly in households who do not have assets (resource-poor). Manual labour is the only resource available to poor households. The BIDS-IRRI study estimated that 43% of the rural households were poor. The study found that most of the households engaged in agricultural wage labour and transport operations were extreme or moderate poor, and households engaged in trade or business and services were non-poor. The incidence of poverty was 80% among households with no cultivated land, 60% among those holding up to 0.2 hectare, and almost none among households owning more than 1.0 hectare. Households who were unable to provide three meals a day to their members were reported at 40% among those with no cultivated land, 26% among those with up to 0.2 hectare and very little among households owning over 0.4 hectare.

ROLE OF RICE RESEARCH IN POVERTY ALLEVIATION

Rice research aims to increase the productivity of land resources through the development and promotion of high

yielding varieties. As producer, owner and tenant farmers benefit from higher productivity and higher profits but the landless labourers benefit from increased employment opportunity. Rice production is an economic activity based on land. In Bangladesh almost one-third of the households do not own any cultivable land and another 17% own only up to 0.2 hectare. How can rice research improve the livelihood of the people of these bottom 50% of the households who do not own any land and constitute the vast majority of the poor?

One can argue that agriculture generates wage employment for the landless households as medium and large farmers hire labour for conducting farm operations. But since the proportion of medium and large farmers is very small the agricultural labour market can generate employment for only a small fraction of the vast landless and marginal land owning households in the country. The BIDS-IRRI household survey found that only 22% of rural workers had agricultural wage labour as primary occupation in 1987-'88, and their number declined to 12% by 2000. Agricultural wage income accounted for 11% of the rural household incomes in 1987-'88; it declined to only 4% in 2000. When the modern high-yielding varieties (HYV) were introduced the demand for hired labour increased substantially. But overtime the labour use in rice cultivation has declined with the spread of agricultural mechanisation in land preparation, irrigation and post-harvest processing. Even full employment in agricultural labour market cannot provide a poverty escaping income level at the prevailing agricultural wage of about one dollar per day.

It is the expansion of the non-farm sector that has been contributing to the increase in incomes of the households who are poorly endowed with assets. Many landless households have migrated to



rural towns and cities and found jobs as transport operators or construction labourers. The impressive development in the rural road network in the 1990s coupled with the increase in marketed surplus rice, vegetables and fruits have created employment opportunities in transport operation and petty trading. This is the main reason why the supply of agricultural labour has declined in recent years and farmers have been complaining regarding the scarcity of agricultural labour. The increase in the number of shallow tubewells, pumps, power tillers, rickshaws and rickshaw vans have created jobs in operation, repair and maintenance. Last but not least, many marginal land owning households with some skills for utilising capital have been able to generate self-employment in livestock and poultry raising, petty trading and various kinds of personal services with the vast increase in micro-credit supplied by the NGOs.

Agricultural research in general and rice research in particular has however contributed to poverty reduction of the landless households in an indirect way. Agriculture produces food for the people. The increase in the supply of food faster than demand has helped keep food prices within affordable limits of low-income people, and thereby has contributed to achieving food security. The amount of food the poor can access from the market with their limited income depends on the price of food. The rural landless and the urban labouring class spend two-thirds of their income on staple food and one-third on rice, compared to 44% and 10% respectively for the top 10% in the income scale. So a reduction in the price of rice relative to the industrial products benefits the poor relatively more than the non-poor households. In Bangladesh the poverty situation deteriorated in the early 1970s mainly due to the decline in the per capita availability of rice. The soaring price of rice caused tremendous hardship to the landless, marginal farmers and

artisans in the rural areas; and to industrial labourers, transport and construction workers in urban areas.

Since the mid-1980s food grain prices have increased at a much slower rate than the general price index, due to favourable growth in agriculture in general and rice production in particular. The large farmers have been hurt by the decline in the real rice price, but the landless have gained. An agricultural wage-labourer could buy 2.8 kg. of rice with their daily wage in 1987-'88. The rice-equivalent wage was 5.7 kg. in 2000, an increase of 5.8% per year during 1987-'00. Thus, the main role played by rice farmers in poverty alleviation lies in maintaining the supply of food at least at a rate at which the demand has been growing, thereby keeping the rice prices stable and within affordable limits of low-income households.

CHALLENGES AND OPPORTUNITIES

The major obstacle to poverty reduction in Bangladesh is its overpopulation in relation to natural resources. Fortunately, Bangladesh has started making respectable progress in population control, particularly since the mid-1980s. The population growth has declined from 2.8% per annum at independence, to 2.2% in the 1980s, to 1.5% in the 1990s. However, we should not be complacent. The population is still growing by two million every year, and may increase by another 30 million over the next 20 years. It will not be easy to provide food and employment for the additional people and the labour force. As the population has started declining, the proportion of population in the working age group will continue to grow for some time, putting additional challenges for policy makers for generating productive employment.

Bangladesh has almost exhausted the potential for increasing rice supplies with



existing technology and in the process has over-exploited the fertility of the soil and ground water resources. MVs have been adopted on lands that have access to irrigation. The arable land has been declining to accommodate increasing demand for housing, commercial and infrastructure development. There is little scope for further expansion of irrigation infrastructure. Without further increase in the productivity of the irrigated land, and development of appropriate varieties for the flood-prone, drought-prone and submergence prone environments, and dissemination of improved crop management technologies for reducing the yield gap, it would be difficult to maintain the demand-supply balance for rice, and sustain the food grain self-sufficiency achieved only recently. So the public sector investment for research and development, and for harnessing of modern science and technology for increasing the productivity of natural resources must continue.

The strategy of poverty reduction by keeping food grain prices low may not work in the future due to the growing urbanisation and spatial separation between the producers and the consumers of food. So far the vast majority of the population lived in rural areas. Subsistence was the main driving force behind the growth in food production, as the farm household had to produce food to feed its own members. Urbanisation is however growing fast and soon most of the increase in population will be located in urban areas. Farmers may not produce surplus food for the urban population

unless the price of inputs and outputs provide adequate incentives. Profitability, rather than subsistence will increasingly become a more important motive for sustaining the growth in food grain production.

It was noted earlier that the respectable growth in the production of cereals – rice and wheat – has been achieved at the cost of many minor crops. The pattern of growth of the crop sector has affected not only the relative prices of different food items but also the nutritional balance in food intake. The composition of the food basket shows that the consumption of cereals has reached a level much higher than the minimum nutritional requirement, there is a marginal deficit for tubers and vegetables and fish, but substantial deficits for pulses, oilseeds and livestock products. Thus, crop and agricultural diversification must be given priority in agricultural development strategy to achieve balanced nutrition.

Since most of the land and other agricultural resources are tied in rice cultivation, agricultural diversification cannot be achieved unless resources are released from rice cultivation. Thus, further growth in rice productivity is needed so that rice needs can be met with less land, less labour and less water. Agricultural research must be done while keeping in view the needs of the system, rather than individual crops. This will require stronger coordination among different research institutes, and greater interaction between researchers and farmers for assessing the technology needs.



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Liberalisation of the crop sector: can Bangladesh withstand regional competition?

Mahabub Hossain and Uttam K. Deb



This policy brief is based on the keynote presentation and discussion held at the dialogue 'Liberalisation of the crop sector: can Bangladesh withstand regional competition?' held on January 8, 2003 at BRAC Centre Inn Conference Room, Dhaka. Bangladesh is gradually integrating itself within the global economy and liberalising its crop sector in the world economy. A comparative picture of the cost of production and prices of major crops are presented in this brief. Trade policies pursued by India in recent years are also highlighted. Analyses revealed that per tonne cost of production for many crops in Bangladesh is higher than other countries of the region. The farmgate price as well as the margin (price over variable cost) for the rice farmer is substantially higher in Bangladesh and India compared to Thailand and Vietnam. For the majority of the agricultural products, unit costs and prices are higher in Bangladesh than in India. Only for jute and pulses (lentil), are the Indian unit costs and prices comparable with Bangladesh. The main reason behind the higher cost of rice production in Bangladesh is the high cost of irrigation. It is also observed that in recent years India is exporting rice and wheat at half of their economic cost. Under these circumstances, Bangladesh must take a pragmatic approach in her trade policy so that the interests of both the producers and consumers can be maintained through a fair price. This brief suggests some of the required policies.

CROP SECTOR: IMPORTANCE AND CONCERNS

The crop sector is of strategic importance to Bangladesh, as in most other low income countries. It is the source of staple food for 130 million people and the major means of livelihood of 13 million farm households in the country. In 2000-'01 the crop and horticulture sector contributed US\$ 8,450 million to the economy, accounting for 18% of the gross domestic product (GDP) at current market prices. According to the report of the Household Income and Expenditure Survey 2000 conducted by the Bangladesh Bureau of Statistics (BBS), consumers spent nearly US\$ 9.8 billion on the crop sector output, which comprises 25% of the private sector consumption expenditure in Bangladesh. Crop production activities generated 2,065 million person days, equivalent to full-time yearly employment of 7.9 million people in the labour force. The average import of the crop sector output for the 1998-'00 period is estimated at US\$ 1.2 billion, about 24% of the export earnings of the country. So any change in the domestic production and import for the sector following the liberalisation of trade, would make a large impact on producers' and consumers' welfare, government's revenue earnings, the balance of trade and the rural sector employment situations.

A major issue concerned with the crop

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sector is the inflexibility of resources tied up in production activities. Land is the dominant factor of production. Because of specific agro-ecological situations that determine the suitability of land for the production of different crops, land cannot be easily shifted from one crop to another without some loss in yield. For example rice is the only crop that can be

Another important issue regarding the trade and price policy in the crop sector is the balancing of interests for the producers and consumers. The crop sector is the source of production of staple food. Too much protection of the sector will raise food prices out of line in the international market that will benefit farmers at the cost of consumers, and



grown in low-lying land that remains submerged with water during the monsoon season. So, whatever the price of rice, the farmer has no alternative but to grow *aman* rice during the wet season, while they can choose among alternative crops during the dry season depending on the relative productivity and profitability. The crop sector is also the 'employer of last resort' and the main source of livelihood for the illiterate and low-educated people who do not have alternative employment opportunities. A reduction in price and the profitability for the crop sector activities may not necessarily lead to reallocation of labour to more productive activities outside the sector; an argument made by proponents of free trade. Under Bangladesh conditions, it may lead to lower earnings for the farmers and a lower wage rate for agricultural labourers, thereby worsening the poverty situation in the country.

vice-versa. A major concern for the government is maintaining stability in food prices, since price instability affects the food security of the poor. The bottom 40% of the rural households in the per capita income scale spends nearly 52% of their budget on the crop sector output and 35% on rice and wheat alone. The corresponding numbers for the urban areas are 42% and 25% respectively. The top 10% of the households in the income scale allocate 18% and 13% of their budget on crop sector output. Thus maintaining the price of the crop sector products at an affordable level is a major element in the strategy for poverty alleviation.

Trade policies that allow consumers to access food from the lowest cost source in the international market is thus important for the welfare of low income consumers, but it is equally important to protect them from large fluctuations in



the prices of staple food in the world market. It is also important to maintain an incentive price for farmers to sustain the long-term growth in the production of staple food, and the balance between the demand and supply for maintaining the stability in prices in the domestic market. A fair price for farm products is also important for poverty alleviation, since two-thirds of the farmers operate a holding size of less than one hectare, which is incapable of generating even a poverty level income.

UNIT COST OF PRODUCTION AND PRICES

We have carried out a comparative analysis of the costs of production of rice in Bangladesh, India, Thailand and Vietnam. In the cost estimation we have computed only variable costs of production (all material inputs, irrigation charges and machine rental) and imputed the value of family labour and family supplied animal power. We have not considered the rental value of land and the depreciation of other fixed assets because of the problem of comparing these values across countries. We noted that the Indian data show that the costs on land and other fixed assets may account for an additional 60% of the costs.

For rice, the variable cost of production per unit of output is the lowest for Punjab in India followed by Vietnam and Thailand. For Bangladesh the cost of production is higher in the cultivation of *boro* rice than in *aman* rice. However, the cost for Bangladesh is lower than that in the neighbouring Indian state of West Bengal. Comparison with Punjab and Andhra Pradesh is however more appropriate since most of the marketable surplus of rice in India is generated in those two States. Compared to Thailand, which is the largest rice exporter in the

world market, the cost of production in Bangladesh is 62% higher for the dry season crop (*boro*) and 18% higher for the wet season (*aman*).

The farmgate price as well as the margin for the farmer (price over variable cost) is however substantially higher in Bangladesh and India compared to Thailand and Vietnam. Thai farmers can offer rice at a lower margin to consumers because of the substantially larger size of farm compared to other rice growing countries in Asia. The average farm size in Thailand is over 5 hectares, compared to 0.68 hectare in Bangladesh. Thus, even with a lower margin per unit of output Thai farms could have substantially higher household incomes than Bangladeshi farmers. The farmgate price is 50% higher in Bangladesh compared to Vietnam and Thailand, and 15% to 20% higher than the Indian States of Punjab and Andhra Pradesh.

For wheat, India (Punjab) is in a superior position compared to Bangladesh. The variable unit cost of production is about 129% higher in Bangladesh compared to the Indian State of Punjab, and the domestic market price is higher by about 14%. The Commission of Agricultural Costs and Prices (CACP) in India however, reports that the economic cost of the procurement of wheat by the Food Corporation of India (FCI) is higher than the world market price. Thus, at current prices, Bangladesh cannot withstand competition from imported wheat from the world market.

For sugarcane, Bangladesh's position is similar to wheat. The unit cost of production is almost double in Bangladesh compared to India (Maharashtra).

For rape seeds and mustard, India's (Rajasthan) position once again is better compared to Bangladesh. India's unit cost of production and farmgate price is about



23% and 13% respectively, lower than those for Bangladesh. India is a major importer of edible oil, as is Bangladesh. The domestic price of oil is determined more by the world market price and the rate of import duty, than by the domestic cost of production.

Only for pulses (lentil) are the Indian unit cost and prices comparable with Bangladesh. So is the case with jute.

The above information indicates that Bangladesh will not be able to compete in the world market for rice and other crops at the prevailing costs and market prices. Considering the transport cost and trade margin, Bangladesh may be able to withstand competition in rice from imports from India, but may not be able to do so from rice imports from Thailand and Vietnam.

FACTORS BEHIND THE DIFFERENCE IN UNIT COSTS

What are the reasons for the relatively high unit cost of production in Bangladesh for most of the crops? The most important factor is obviously the agro-ecological conditions and the development of irrigation infrastructure that determine the suitability of land for growing a particular crop. The other is the extent of adoption of improved production technologies. These two factors determine the level of crop yield. For high-yielding variety (HYV) rice, the yield in Bangladesh is comparable to other countries in the region. But there is potential for increasing the yield in the *aman* season and thereby further reducing the unit cost. For all other crops, Bangladesh has a lower yield compared to that for the highest yielding state in India. The difference is large for wheat and sugarcane.

The other source of the difference in cost is the price of inputs. The price of urea is

about one-third lower in India, but is comparable in Thailand and Vietnam compared to Bangladesh. The difference in the price of fertiliser would not however make a large difference in unit cost of production, since chemical fertilisers account for only 15% of the total variable costs.

There is a large difference in the cost of labour across countries. The wage rate varies from US\$ 5.2 in Thailand to about US\$ 1.2 in Bangladesh. The higher wage rate however does not necessarily lead to higher cost of production since the farmer adopts mechanisation in response to the scarcity of labour. The Thai farmers now utilise only 6 to 8 days of labour per hectare in rice cultivation, compared to about 140 days in Bangladesh, and 80 days in Vietnam. Indeed, the substitution of agricultural machinery for human labour and animal draft power contributes to a reduction in unit cost of production. In Thailand and Indian Punjab, where the extent of mechanisation is high, the cost of production on account of power is the lowest.

The cost of irrigation is the major contributing factor behind the high cost of rice cultivation in Bangladesh, particularly for *boro* rice. Irrigation accounts for 28% of the variable costs of rice cultivation, compared to 13% in Punjab, 8% in Thailand and 6% in Vietnam. The low cost of irrigation in other countries is mostly due to the subsidised supply of electricity (India) and the subsidised public sector investments in the construction, operation and maintenance of large-scale irrigation projects. In Indian Punjab electricity is provided free for tube well irrigation and the farmer is also provided free water from irrigation canals. In Bangladesh the major source of irrigation is the privately owned shallow tube wells and power pumps, mostly run by diesel. Diesel has now become a major agricultural input in the cultivation of *boro* rice, and the cost of



boro cultivation is very sensitive to the price of diesel.

COMPARATIVE ADVANTAGE IN CROP PRODUCTION

Whether a country can take advantage of new trading opportunities under the World Trade Organisation (WTO) would depend on its comparative advantage. In most developing countries, social or economic profitability deviates from private profitability because of distortions in the input and output markets, the import and export duties and the valuation of the domestic currency. Comparative advantage in the production of a given crop is measured by imputing the value of production at the border price (world market price adjusted for transport cost and trade margins) and comparing it with the social and opportunity cost of producing, processing, transporting, handling and marketing an incremental unit of the commodity. If the opportunity cost is less than the border price, the country has a comparative advantage in producing that crop.

The most recent study (Shahabuddin, et al 2002) estimated the comparative advantage of various crops in Bangladesh for different ecologies and irrigation systems using recent input-output prices, market distortions and production coefficients show that:

- At export parity price Bangladesh has comparative advantage in the production of *aman* rice, jute and vegetables. Bangladesh can gain from the increase in production of these crops provided that the surplus production can be exported in the world market;
- At import parity price Bangladesh has comparative advantage in the production of *boro* rice, potato, lentil and onion. Bangladesh will not be able to compete in the export market for

these commodities. Because of the transport cost and trading margin, the cost of importing these commodities into Bangladesh would be higher than the opportunity cost of producing them within the country; and

- Bangladesh does not have comparative advantage in the production of wheat, oil seeds, sugarcane and spices. The country will gain by importing these commodities, if the resources tied in the production of these commodities can be diverted to the production of other crops.

TRADE POLICY IN INDIA

A review of India's trade policy suggests three main points:

- India has turned backwards from the policy of liberalisation initiated in the early 1990s. External trade has been brought back under the state trading agencies from private traders;
- For staple grains India follows a policy of subsidised exports and a highly restrictive import policy; and
- For pulse and oilseeds for which the demand exceeds supply, India has followed a liberal import policy, although in recent years the import duty has been raised substantially.

The Indian government followed a liberal import policy of edible oils in the 1990s. As a result the import of edible oils has increased substantially. But the policy has been reversed since 1999 when a 15% duty was imposed. In the budget of 2001-'02, the rate of duty on crude oils was raised from the range of 35-50% to a uniform 75%, and on refined oils from the range of 45-65% to 75-85%. The lower rate of 45% applies to soybean oil on account of the WTO binding.

India has also provided a large amount of export subsidy for rice and wheat during



the last two years. In order to push rice exports, the Government of India (GOI) took a decision to release stocks from the Food Corporation of India (FCI) to private exporters at a subsidised rate of US\$ 127 per tonne (milled rice) while the economic cost is US\$ 253. The FCI was permitted to export wheat at the highly subsidised rate of US\$ 90 per tonne, which was half the economic cost of wheat (US\$ 183) to FCI (GOI, 2002). This policy has exposed the Bangladeshi rice and wheat market to dumping by Indian exporters. Thus, natural comparative advantage of other countries to produce rice and wheat at a lower cost added with subsidised export from India explain to a large extent the fact of importing rice and wheat after attaining self sufficiency in foodgrain production. In recent years, export of rice from Bangladesh has also increased.

IMPLICATIONS FOR BANGLADESH'S TRADE POLICY

Findings of this study have important implications for trade policy of Bangladesh.

- Studies on comparative advantage for the crop sector activities in Bangladesh show that Bangladesh does not have comparative advantage in the production of wheat, sugarcane, rape seed and mustard, chilies and certain pulses. Bangladesh may allow unrestricted import of those commodities for the benefit of the consumers;
- Although Bangladesh has a comparative advantage in the production of HYV rice, the unit cost of production is relatively higher than the rice exporting countries in the region. India now promotes export of rice and wheat under special incentives given to the exporters that subsidises almost half of the economic cost. The government

should take appropriate measures to protect the Bangladeshi farmers from dumping of Indian rice in the domestic market. These may include an increase in tariff rate within the bound rate. However, an increase in tariff rate should not be very high since it protects the farmers at the cost of consumers and consumption of poor household decreases when rice price is increased. Bangladesh may also increase regulatory duty and may even consider imposition of anti-dumping duty;

- A major factor behind the high unit cost of production of HYV rice in Bangladesh is the cost of irrigation compared to the other countries in the region. As mentioned earlier, Bangladeshi farmers have to spend about US\$ 51 in irrigating one hectare land whereas the irrigation costs are about US\$ 32 in Punjab, India and US\$ 18 in Thailand and US\$ 26 in Vietnam. India provides a heavy subsidy for electricity that lowers the cost of irrigation. In other countries, the government subsidises large scale public sector irrigation projects. The recent (January 2003) price hike of diesel will surely increase the cost of irrigation. Considering these realities, Bangladesh should provide a subsidy for diesel to reduce the cost of ground water irrigation and pursue a stable price of diesel. If the international price is up, the price should remain as it is and the government should take back the money during a slump in the international market. Bangladesh should also pursue a policy of rapid expansion of rural electrification to facilitate electricity connection to irrigation and thereby reduce the cost of irrigation;
- Rice production drastically falls in Bangladesh during periods of natural disasters and the supply of rice becomes scarce leading to an abnormal rise in prices, which affects the



livelihood of the rural landless and marginal farmers. The government allows import by the private sector to cope with the situation. The government should follow a policy of a variable tariff rate in the annual budget on the basis of the assessment of the previous *aman* and *boro* harvest, and the prevailing world market prices;

- India is now importing foodgrain through the state trading agency FCI. Considering the past experience of

state trading agencies, Bangladesh should not follow the path of India for food grain imports. Rather the government should regularly monitor the export/import situation and should regulate trade through flexible tariff rates and L/C margin.

REFERENCE

- GOI. 2002. Reports of the Commission for Agricultural Costs and Prices (CACP) for the crops sown during 2001-'02 season. New Delhi: Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.
- GOI. 1998. Reports of the CACP sown during 1998-'99 season. New Delhi: Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.
- Hossain, M. and Deb, U. K. 2003. Trade liberalisation and the crop sector in Bangladesh. CPD occasional paper 23. Dhaka, Bangladesh: Centre for Policy Dialogue (CPD).
- Shahabuddin, Q., Hossain, M., Mustafi, B. A. A. and Narciso, C. 2002. Assessment of comparative advantage in rice cultivation in Bangladesh. In: Sombilla, M., Hossain, M. and Hardy, B., editors. Developments in the asian rice economy. Proceedings of the international workshop on medium and long-term prospects of rice supply and demand in the 21st century, December 3-5, 2001, Los Baños, Philippines. Los Baños (Philippines): International Rice Research Institute (IRRI). p. 369-384.



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Biotechnology for rice improvement

M. Hossain, A. M. Muazzam Husain and S. K. Datta



This policy brief deals with issues related to biotechnology for rice improvement in Bangladesh. It focuses on the potential benefits and risks of rice biotechnology research and genetically engineered (GE) varieties to be developed from such research. It provides information on rice biotechnology products in the pipeline, and makes a critical assessment of the potential benefits and risks of biotechnology in the Bangladesh context. Findings of a survey on knowledge, perceptions and attitudes of civil society in Bangladesh to identify the constraints to adoption of rice biotechnology in Bangladesh are also reported.

This policy brief is based on the output of the dialogue on 'Sustaining agricultural growth in bangladesh: should we go for biotechnology for rice improvement?' The Centre for Policy Dialogue (CPD)-IRRI collaborative activities on agricultural policy research and advocacy. Professor Rehman Sobhan, chairman of CPD, moderated the dialogue. Dr. Mahabub Hossain, Professor A. M. Muazzam Husain and Dr. S. K. Datta presented the keynote paper titled, 'Rice biotechnology: opportunity, perceived risks and potential benefits to Bangladesh'. The minister for agriculture, M. K. Anwar and state minister for agriculture Mirza Fakhrul Islam Alamgir attended the dialogue. Participants of the dialogue debated the relevant issues. Inputs from the deliberations of the dialogue participants, as well as from the research papers are included in this policy brief.

INTRODUCTION

Scientific revolution in molecular biology over the last two decades has led to rapid progress in understanding the genetic basis of living organisms, and the ability to develop processes and products useful to food security, nutrition and human health. In agriculture, there is increasing use of biotechnology for genetic mapping and marker assisted selection (MAS) to aid more precise, time saving and cost effective development of new strains of improved crops, animal and aquatic species. This development is encouraging, particularly for developing countries since conventional breeding that has contributed to the green revolution, no longer provides further breakthroughs in shifting the yield potential, solving the complex problems of durable resistance of the plant to insect and disease pressure and tolerance to climatic stresses such as drought, submergence, salinity, heat and cold. A particularly appealing feature of biotechnology is the opportunity to address health problems through improved crops and other agricultural products.

Development of agricultural biotechnology is perceived by many as posing considerable risks to human health and the environment. The current debate is focused on the initial applications of such biotechnology in developed countries where food safety rather than food security is a major concern. At present there is little commercial utilisation of results from modern biotechnology research in developing countries, except for cotton and maize, whereas soyabean

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which has benefited most from this technology, is grown in the United States. The potential contributions of biotechnology to enhanced food and nutrition security and poverty reduction have received little attention in developing countries, beyond blanket statements of support or opposition.

A debate based on the best available empirical evidence relevant for poor people in developing countries is needed to identify most appropriate ways that molecular biology based research might contribute to achieving and sustaining food and nutrition security. Food insecurity mal and undernutrition result in serious public health problems and lost human potential in many developing countries. In contrast, in most developed countries the population has reached a stationary state, and in many the absolute decline in population is causing concerns. So increased food production is no longer an issue. The developed country consumers have enough income to afford a diversified diet needed for balanced nutrition. They are more concerned with safe and healthy food and hence with the perceived risks of genetically modified organisms (GMO). So the trade-off between the benefits and risks would vary from country to country. Public policy regarding biotechnology and GMOs must take into account the individual country context rather than being influenced by the debate in the developed countries.

PROGRESS IN BIOTECHNOLOGY RESEARCH FOR RICE

Weeds, brown plant hopper (BPH), yellow stem borer, sheath blight and bacterial blight are common pests causing substantial yield loss for rice. Biotechnologists have been able to develop methods to transfer bacillus thuringiensis (Bt) and chitinase genes to enhance resistance of rice against these

insects and pathogens. Research is going on in the private sector on developing herbicide resistant seeds to reduce yield loss from weeds.

Vitamin-A deficiency affects some 400 million people worldwide, leaving them vulnerable to infections and blindness. Iron deficiency affects 3.7 billion people, particularly women, leading to high maternal deaths and infant mortality. Developing micronutrient dense rices, with higher amounts of iron, zinc and Vitamin-A, can have tremendous impact on the health of low income people. Conventional breeding when combined with biotechnology can provide very powerful tools to achieve this goal.

In the initial years, rice biotechnology research was located in the laboratories of developed countries outside Asia. The big multinational companies who invested heavily in upstream research on biotechnology have back tracked in recent years. They assess rice biotechnology research for Asia no longer economically profitable because of the predominance of small and marginal farmers and the high transaction costs of enforcing intellectual property rights under weak judicial systems.

Within Asia, most of the biotechnology research is now confined in the public sector laboratories in Japan, South Korea, India and China, Philippines and the International Rice Research Institute (IRRI). IRRI accounts for only a small share of the Asian biotechnology research, but it plays a catalytic role in promoting downstream biotechnology research in developing countries by mobilising financial support and providing training to National Agricultural Research System (NARS) scientists through the Asian Rice Biotechnology Network (ARBN).

Progress has been made in herbicide tolerance and insect and disease



resistance. This will benefit farmers in irrigated ecosystems by stabilising yields at high levels and increasing profits due to reduced yield losses and lower application of pesticides. Some progress has also been made in developing submergence tolerance and in incorporating iron and Vitamin-A in rice. These traits have been transformed mostly in Japonica varieties, which are grown in temperate zones in East Asia. Scientists from IRRI and selected NARS are now working for transferring these genes in popularly grown indica varieties. Major products which are available but undergoing tests on biosafety and health effects are Bt rice for stem borer and sheath blight resistance, iron and Vitamin-A enriched rice.

POTENTIAL BENEFITS: THE BANGLADESH CONTEXT

Policy makers in Bangladesh must not be complacent with the past achievement in meeting the food needs of the people. Food security will remain a major concern so long as population continues to increase. Indeed, Bangladesh must increase production of rice by 300,000 tons every year to meet the needs of the growing population. Bangladesh must exploit all scientific opportunities for shifting the yield frontier and reducing the yield gaps for sustaining growth in rice production. Application of modern biotechnology tools provides Bangladesh such an opportunity. Use of molecular biology tools and molecular markers have made it possible to map and tag quantitative trait loci (QTL) that affect characters such as yield, quality and tolerance to submergence and drought stresses and problem soils. The gene for submergence tolerance (SUB1) has already been identified, which if incorporated into the popularly grown modern varieties such as BR-11 and *Swarna* (Indian variety grown widely in the

border belt), can help reduce yield losses and the cost of repeated transplanting of rice in the wet season in low-lying areas. IRRI Scientists have been collaborating with Dhaka University (DU) and Bangladesh Rice Research Institute (BRRI) for developing high-yielding (HY) salt tolerant varieties applying biotechnology tools, which if successful can help expand the area under modern varieties in the coastal region. The Bt rice has been proved effective in controlling stem borers and chitinase genes for sheath blight disease and is now being considered for release in China and being field tested in India. Resistance against these pests has been found difficult to incorporate in high yielding varieties through conventional breeding. If the Bt rice is widely adopted, farmers will be able to save the yield losses from stem borers and at the same time reduce pesticide use that will have a positive effect on human health and the environment.

Even more important for Bangladesh is the potential benefit of GE rice in addressing major health issues. The level of micro-nutrient induced malnutrition in Bangladesh remains one of the highest in the world. Nearly 60% of the children under age five are underweight and more than half are stunted. Almost half of the children suffer from chronic energy deficit and more than 70% of pregnant women suffer from anaemia due to iron deficiency. In rural areas where three-fourths of the population live, malnutrition is high due to lack of knowledge regarding (or financial capacity to afford) a balanced diet or the economic capacity to purchase supplemental iron and Vitamin-A. Since the poor consume nearly 150 to 170 kg. of rice per year, incorporation of a small amount of iron and Vitamin-A in rice can go a long way in meeting the deficiency of these critical micro-nutrients. Rice scientists have already incorporated iron in rice varieties using genetic engineering, which are



currently being evaluated for bioavailability and food safety concerns. Genes controlling beta-carotene have already been incorporated into IR-64, the most widely grown rice variety in the world and also in Brri dhan29, the most widely grown *boro* rice variety in Bangladesh. Adoption of these varieties in Bangladesh after proper evaluation of the food safety and environmental effects and economic viability, may contribute substantially to improved nutrition and human health.

PERCEIVED RISKS OF BIOTECHNOLOGY

As with any science and technology, biotechnology can bring with it both benefits and risks. It is the risk of agricultural biotechnology that has received widespread publicity in the media and there are issues of serious controversy in Europe. Many non-governmental organisations (NGOs) are particularly vocal about the effect of genetic modification of crops on the environment and human health. In the public debate biotechnology has become synonymous with GMOs, although they are only one of the many products of biotechnology. The potential risks are the same in Bangladesh as in other countries of the world.

The risks associated with modern biotechnology fall into four categories: food safety, environmental, ethical and socioeconomic. Some of these concerns relate to potential risks inherent in any innovations and can be described as technology inherent. Others are related more to value systems or cultural practices and can be described as technology transcending. Scientists have been designing ways of minimising potential risks associated with biotechnology and generating information for the consumers on negative side effects

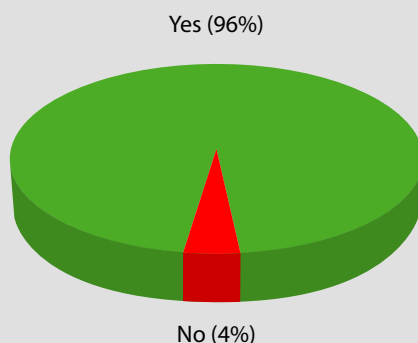
before recommending their release to farmers for adoption. Many Asian governments have started having regulations in place by enacting biosafety rules. Enforcement of related laws and safety procedures will minimise the risk of biotechnology products to human and environmental health.

PERCEPTIONS AND ATTITUDE OF BANGLADESH CIVIL SOCIETY

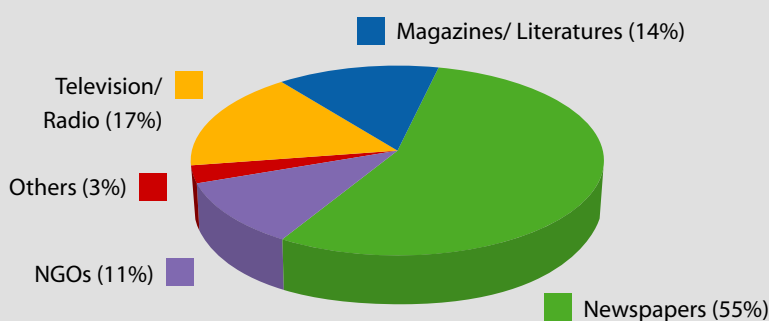
Given the debate on the perceived risks and benefits of biotechnology in the developed country, it is useful to study the exposure to Bangladesh civil society groups to the debate and their attitude and perceptions regarding rice biotechnology research in the Bangladesh context. The study is important because the civil society groups mould public opinion and any negative opinion may stand in the way of releasing the products however beneficial they might be to rice producers and consumers. The Bangladesh Rural Advancement Committee (BRAC) implemented the study by sending questionnaires by post to agricultural researchers and educationists, NGO representatives, mid to high level government officials and eminent professionals. Nearly 300 questionnaires were returned.

About 96% of the respondents reported that they have heard of 'biotechnology' while 56% reported they have heard of GMOs with 86% among them correctly defined the GMO as genetically modified organism. Only 40% of the respondents reported hearing the word 'Frankenstein food', the slang version of GMO used by its critics. The major sources of information on biotechnology were newspapers (55%), magazines and literature (14%) and television/radio (17%). NGOs were a relatively minor source of information regarding biotechnology and GMOs (11%) which





Have you heard of biotechnology?



Sources of information on biotechnology

indicates that in Bangladesh NGOs are yet to play a significant role in negative advocacy on biotechnology.

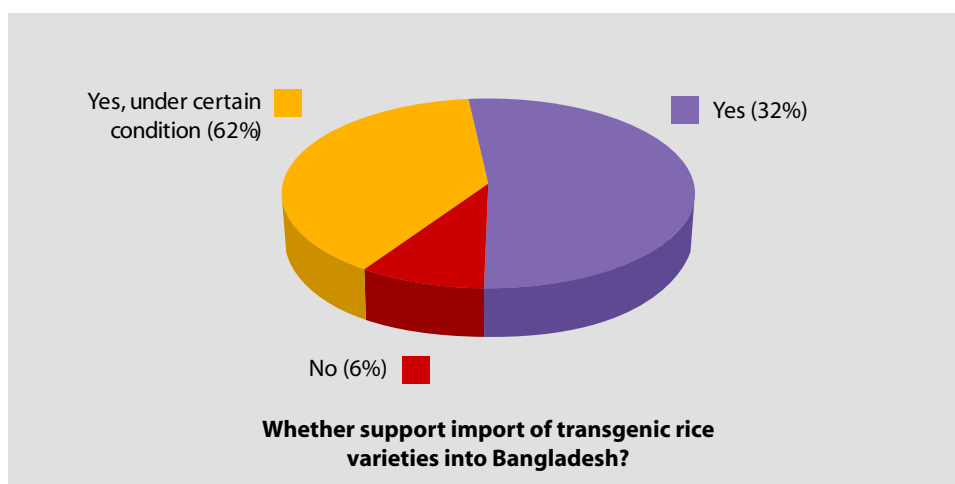
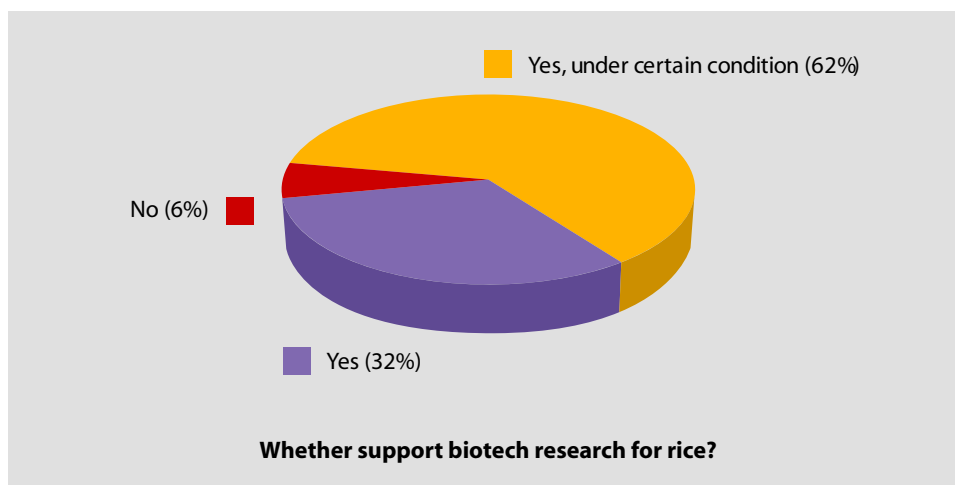
The perceptions regarding negative effects of biotechnology were 'adverse effects on human health' (46%), 'threats to biodiversity and ecology' (19%), 'hazardous change in the environment' (16%), 'farmers will face seed related problems' (11%), 'may change human gene and behaviour' (11%) and 'unethical science' (6%). Thus the food safety concern is predominant in the mind of the respondents as opposed to environmental or ethical concerns. There is also some concern regarding socioeconomic equity as expressed by the response to farmers' access to seeds.

In response to the question, 'whether support biotech research for rice?' a third

of the respondents answered positively, and nearly 60% answered 'yes, under certain conditions'. The conditions in order of priority were 'if environment and health impact are assessed before releasing the products' (89%), 'if the products provide substantial health benefits' (58%), 'if the products contribute to reduction in pesticide use' (57%) and 'if research is done under the public sector and the products are provided free of charge to the farmers' (36%). The unequivocal positive support for biotech research was less among NGO respondents (13%) and high for respondents from agricultural research and educational institutions (41%).

In response to the question, 'whether support import of transgenic rice varieties into Bangladesh?' 52% of the respondents answered positively and





another 39%, under certain conditions. The positive response (including the conditional positive) was 96% for respondents from the agricultural research and educational institutions and 89% for the NGO and other civil society groups. The major conditions for support were stated as, 'if food safety and environmental impact are assessed', 'if field testing is done under biosafety regulations'.

Among the respondents 28% agreed that iron deficiency is a very serious health problem in Bangladesh, and another 54% as a serious health problem. Vitamin-A deficiency was considered a very serious problem by 31% of the respondents and a serious problem by another 54%. Thus, an overwhelming majority consider them as major health issues for Bangladesh. 80% of the respondents supported field testing of iron-enriched rice in

Bangladesh. The support was also very high among the NGO (74%) and other civil society groups (78%). 82% of the respondents supported field testing of Vitamin-A enriched rice in Bangladesh.

In brief, Bangladesh civil society is quite aware of biotechnology and GMOs with a fairly good knowledge and understanding of the potential benefits and risks. A large majority supports biotech research on rice and import of GMOs, if their food safety and environmental effects are properly assessed and the field testing is done and supervised under proper biosafety regulations.

CONCLUDING REMARKS

For addressing the issues of food insecurity and poverty biotechnology



research must focus on the problems of small farmers and poor consumers and on problems that the conventional plant breeding has found it difficult to address. Private sector research is unlikely to take on such a focus, given the lack of markets that ensures adequate returns to investment. Without a stronger public sector role a form of 'scientific apartheid' and 'technology divide' may develop, in which cutting edge science becomes oriented exclusively toward developed countries serving the interests of large scale farmers.

The Government of Bangladesh (GOB) must take a stand on biotechnology research and import of GMOs, and have a proper policy in place. The majority of

Bangladesh civil society would not be hostile to biotech research and GMOs, if regulated under international standards of biosafety. The government has already developed biosafety regulations which may need to be ratified by the Parliament. The implementation mechanism has also to be put in place so that public and private sector research organisations can start testing the GE products in Bangladesh. The government should also be proactive in adjusting the education and research infrastructure, for bringing the benefits of this cutting edge agricultural science to the doorsteps of poor farmers and consumers in Bangladesh.



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Enhancing rural livelihoods need not cost the earth

Charlie Riches

INTRODUCTION

Rice production in Bangladesh has risen three-fold since the 1960's. Over 65% of the area planted to rice in the country is now under high-yielding varieties (HYVs) and more than half the cultivated land is now irrigated. The increased yields have benefited both consumers and resource-poor producers. However, the adoption of HYVs has been accompanied by widespread use of inorganic fertilisers and pesticides. There are now concerns that degradation of the soil and the toxicity of pesticides in the environment could threaten the sustainability of the productivity gains.

As they have come to rely increasingly on inorganic fertilisers and pesticides to deliver increased productivity, farmers themselves have observed changes in the environment around them. In meetings held during the preparation of this policy brief, farmers explained that they link reduced earthworm activity to continuous application of fertiliser and observe that soils are now 'harder', possibly due to declining organic matter content with intensive production of HYV rice. Indeed, average soil organic matter content at 0-15cm below the soil surface declined by 11% from 1967 to 1995, while deficiencies in secondary and micro-nutrients, in addition to the nitrogen that is most frequently applied to rice, are increasingly common. Despite a four-fold increase in the national sales of fertiliser between 1980 and 2000, soil fertility has become depleted as agriculture has intensified, in the absence of proper

replenishment with balanced fertilisation and organic recycling.

Farmers have also noticed greater pest occurrence in the dense rice canopies associated with excessive fertiliser use. Insecticide use in Bangladesh is low compared to elsewhere in Asia, being about one third of the amount applied per hectare to rice in India. However, recent surveys indicate the use of at least one application of insecticide in every rice crop by more than 80% of rice growers. After they have been spraying, farmers regularly observe the death of earthworms, beneficial insects, fish, frogs, snakes and small rodents, and themselves experience nausea and headaches.

During 2000, Poverty Elimination Through Rice Research Assistance (PETRRA) undertook stakeholder consultations in nine areas of Bangladesh, to understand and prioritise the rice production issues of resource-poor households. Of the issues raised in these consultations, three themes emerged that were particularly related to resource use and the environment:

- Crop losses to pests and damage to the environment and human health caused by regular use of insecticides;
- Lack of knowledge on fertiliser management linked to a perceived decline in soil fertility, despite regular use of what were considered to be excessive doses of fertiliser; and
- Problems of timely access to irrigation of *boro* rice linked to increased abstraction and in coastal areas a lack of

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technology for intensification of cropping on seasonally saline soils.

Several PETRRA sub-projects (SPs) responded to this demand by evaluating and promoting innovative technologies. As the PETRRA policy brief 'From technology to livelihoods' makes it clear, the impacts of these technologies extend far beyond improvements in rice yield, farm income, and food security. Adoption of successful technologies has also led to reduced financial vulnerability, increased accumulation of assets and changing livelihoods for poor households.

But is the adoption of these pro-poor technologies compatible with care for the environment? To find out, environmental issues were explored with farmers and project staff in six selected PETRRA SPs (listed in Table 1), in 5 diverse agro-ecological zones. From the start, emphasis within PETRRA has been on low-cost technology that increases farmers' yields through a more efficient use of resources. The establishment of a healthy crop, avoiding excess use of fertiliser or insecticide and efficient use of water have been guiding principles. This policy brief examines the environmental impacts of selected rice production practices evaluated by PETRRA SPs. It does so by addressing two key questions:

- Do farmers associate environmental

impacts with changes in rice production practices? and

- What are the impacts of wider adoption of the new technology on the agri-environment?

'BUILDING BLOCK' TECHNOLOGIES

The experiences of farmers and researchers on the PETRRA SPs demonstrate that environmental impacts associated with intensification can be slowed or even reversed. PETRRA's work suggests that three key practices provide the 'building blocks' for rationalising resource use:

Planting healthy seed

Use of healthy farm-saved seed results in vigorous, pest and disease tolerant crops, allowing farmers to reduce pesticide use by 50% on average and completely on some farms.

"A weak baby needs expensive medicine but a healthy baby will be free of disease and strong, and so needs less care and expenditure" (seed health project farmer).

Doing without insecticides

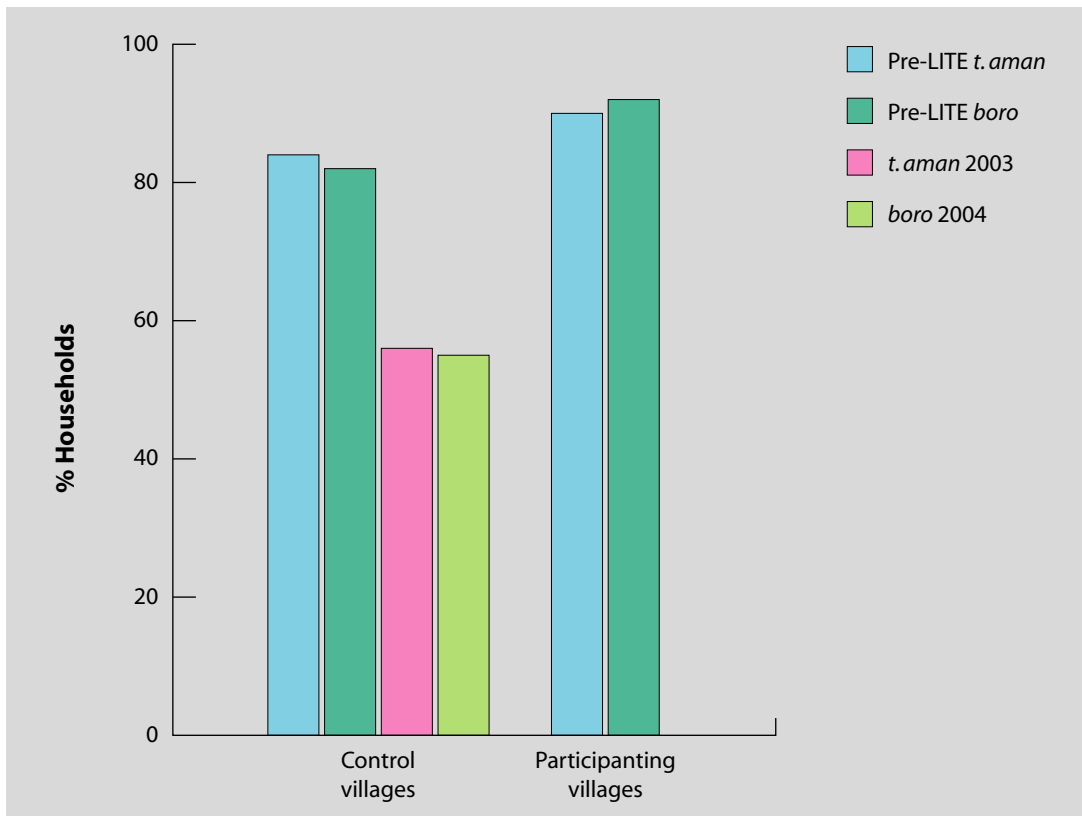
Insecticide use costs farmers on average almost Tk. 2,000 per hectare each year.

The belief is widespread that preventative, prophylactic applications of

Table 1. Selected PETRRA sub-projects

Sub-project	Implementing agencies	Districts visited
Seed health	BRRI-IRRI	Gazipur
Livelihood improvement through ecology (LITE)	BRRI, IRRI, DCPUK, AID-Comilla	Rangpur
Rice-duck	BRRI, FIVDB	Sylhet
Site specific nutrient management (SSNM)	BRRI, RDRS	Thakurgaon
Integrated crop management (ICM)	BRRI, RDRS	Thakurgaon
Coastal water resources	BRRI, HEED	Khulna





Proportion of farmers using insecticide in participating and neighbouring villages after two years of LITE sub-project activities in Comilla and Rangpur

insecticides are needed to protect the crop. In intensive rice growing areas one to two sprays are common in *aman*, while two applications of granular carbofuran followed by one spray of liquid insecticide are used in *boro*. But in 324 field trials conducted by livelihood improvement through ecology (LITE) project farmers in both *aman* and *boro*, insecticide use provided no yield benefit whatsoever. Sweep nets and other methods of control known collectively as integrated pest management (IPM) were used instead of insecticide with no observed increase in pest damage. Following the LITE recommendations, saves, on average, more than a litre of insecticide per hectare each year, safeguarding soil fauna, beneficial insects and aquatic life.

Nutrient management based on crop requirements

Using readings from a leaf colour chart (LCC) (see Picture 1) to schedule urea

applications has increased rice yields by an average of 270 kg. per hectare, reduced urea application by 23 kg. per hectare and increased household rice provision by one month. Farmers have also observed fewer pests as the rice canopy is less dense in

Box 1. Hazards to health from pesticides

Registered Insecticides used in rice in Bangladesh are classified by the World Health Organisation as 'highly' or 'moderately'

harmful to human health. Other damaging products, although now banned, are still sold cheaply in some areas. Farmers have little knowledge of their effects. Users are exposed to toxicity hazards during handling, mixing and spraying. The only precaution taken by most farmers is to cover their nose and mouth with a cloth when spraying. Studies elsewhere in Asia indicate that this practice actually concentrates a film of chemical which is then inhaled from the cloth. In areas where LITE has been active, farmers are ceasing the routine use of insecticides, ending their exposure to health risks.



rice managed this way. Emphasis on split applications of urea for top-dressing when indicated by the chart, instead of the larger less frequent applications that are commonly used, will also reduce losses to ground water by leaching.

"Before we learnt about the LCC, we applied fertiliser by guessing." (SSNM project farmer).

Picture 1



An alternative approach, in which the application of a balanced fertiliser is based on the results of soil tests, has also resulted in yield benefits and reduced fertiliser use. Integrated pest management (ICM) project farmers previously applied up to 40% more urea than the dose required by the crop. Farmers report a 25% increase in yields with more judicious fertiliser management, for an outlay of just Tk. 20 per year on a test kit covering Nitrogen, Potassium and Phosphorus.

PUTTING INTEGRATION INTO PRACTICE

These individual building block technologies can be combined in an ICM approach that saves input costs, increases yields and delivers environmental benefits. Three PETRRA SPs examined this approach in different areas of the country.

ICM

ICM project participants experimented

with a combination of technologies. In addition to applying fertiliser on the basis of soil test kit results rather than traditional wisdom, they tested use of the green manure *dhaincha* (*Sesbania* sp.) or the pulse *mug dal* (mung bean), in the fallow period before *aman*. They observed that rice following these legumes needed less fertiliser and saw more earthworms and millipedes as the increase in organic matter improved the soil condition.

"After growing mug dal the soil changes colour" (ICM project farmer).

Output in the dry season with less water has been achieved by increased efficiency of water use and crop diversification. Savings in the cost of diesel used for pumping have been achieved through a 40% reduction in transmission losses of irrigation water by building concrete aprons around shallow tube wells, by manual compaction of earth canals, or by delivering water to nearby plots through flexible piping. Pressure on water resources has also been reduced by growing wheat, potato or mustard, crops that require less irrigation than *boro* rice in the *rabi* season. These are important lessons for more efficient and equitable use of ground water resources in the future.

Intensification on coastal saline soils

Farmers in the coastal zone are restricted by soil and water salinity to a single crop of *aman* rice, followed by sesame. But by storing fresh river water in existing drainage canals before the end of the rains, the coastal water SP has developed a new source of irrigation for *boro* rice, demonstrating the potential for rice double cropping on an estimated one million hectare of coastal land. In this zone, farmers grow low-yielding traditional varieties with little fertiliser and rarely apply pesticides. In the 2002 *aman* season substantial losses were caused by pests in farmers' crops. By using sweep



Table 2. Environmental benefits associated with PETRRA technologies

Technology options	Benefits
Healthy seed	<ul style="list-style-type: none"> • The foundation of a healthy, pest and disease tolerant crop. • Compatible with IPM, so contributes to reduced or eliminated insecticide use.
Insecticide-free production and IPM	<ul style="list-style-type: none"> • Saving of 1.03 l insecticide per hectare per year in the <i>aman-boro</i> system with no yield penalty. • Safeguards soil fauna, aquatic life and human health.
Efficient nutrient management	
Leaf colour chart (LCC)	<ul style="list-style-type: none"> • Lower doses of nitrogen reduces losses by leaching to ground water. • Reduction in insecticide use in healthy crop canopy.
Soil test kit	<ul style="list-style-type: none"> • Balanced application of nutrients to degraded soil. • Up to 40% reduction in use of urea compared to farmer practice but 1 ton per hectare increase in <i>boro</i> yield.
Green manure crops	<ul style="list-style-type: none"> • Increased soil organic matter and reduced urea application to subsequent crop.
Efficient use of water resources	
Improved canal construction	<ul style="list-style-type: none"> • 40% reduction in water losses from canals and reduced use of diesel for pumping.
Diversification by planting potatoes, wheat and mustard in <i>Rabi</i> season	<ul style="list-style-type: none"> • Spreads demand for irrigation water across seasons.
Conservation of 'sweet' canal water to irrigate saline coastal soil	<ul style="list-style-type: none"> • Introduction of <i>boro</i> rice without increasing soil salinity.
Organic farming with rice and ducks	<ul style="list-style-type: none"> • 20% yield increase with NO fertiliser and NO pesticide. • Safeguards soil fauna, aquatic life and human health. • Increases soil organic matter.

nets, light traps and bird perches in an IPM approach in HYV rice they were able to harvest two and half times more than usually produced from local varieties. Flood protection schemes built in the early 1970's prevent the annual addition of silt that once enriched the soil. Applying fertiliser based on soil test results can also contribute to sustained productivity, whilst avoiding over use. Weeds growing in the *boro* season provide a welcome source of non-saline fodder for livestock at a time of the year when good quality grazing is in short supply. Intensification without increasing soil salinity or use of insecticides therefore promises a better future for coastal zone households.

Organic farming with ducks

Keeping ducklings foraging for weeds and insects in rice allows farmers with ready access to cow dung or compost to produce rice without fertiliser or

pesticides. 'Rice-duck' plots are not weeded and savings in production costs over an average of 30% for conventional rice management, while yields are 20% higher. Researchers have recorded significant reductions in the populations of key pests, including brown plant hopper and rice bug, in this system. In Sylhet, individual farmers are already managing up to 0.4 hectare using the rice-duck system and observing healthy rice crops, with increased root growth, greater organic matter in the soil and a healthier, pesticide free environment.

LIVELIHOOD GAINS WITHOUT ENVIRONMENTAL DAMAGE

PETRRA SPs have demonstrated practical technologies that allow farmers to use fertilisers and irrigation water more effectively and to end prophylactic applications of insecticides. The evidence shows that by exploiting these



opportunities farmers can increase their yields as well as reduce inputs. This is of particular importance to the poorest farmers, who often cultivate under share-cropping and other tenancy arrangements and who therefore need to maximise yield in order to harvest sufficient rice to cover rent and household needs.

Farmers regularly observe the effects of poorly managed fertiliser and pesticide use in their environment. Their experience suggests that in addition

to productivity benefits, the new technologies promoted by PETRRA SPs deliver healthier crops and soils, and are kinder to aquatic life and human health – clearly a win-win situation. The demand for knowledge in the farming community about the cost-effective use of inputs is strong. The support of policy makers will be crucial if that demand is to be met with widespread dissemination of information about these successful technologies.

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