Marginality Hotspots with Agricultural Potentials in Bangladesh: Technology Innovations, Barriers and Willingness to Pay of Poor Smallholders

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Abstract

Following marginality approach developed at ZEF, Bonn we identified five marginal sub-districts in Bangladesh i.e. underperforming areas since in such areas yield gaps (potential minus actual yields) are high and productivity gains (of main staple crops) are likely to be achieved. Then we conducted qualitative and quantitative sample survey of 313 poor Smallholders and used livelihood assets and need assessment, Principal component analysis (PCA), logit regression model and cluster analysis to draw the conclusion. Results suggest that only cereal based growth productivity program could not improve food and livelihood security of the poor SHs in the study areas and thus we find that intensive crop system, hybrid seeds, water management technologies, non-crop farming, non-farm enterprise/business, etc. are the suggested potential technology innovations. However, there is very limited availability of extension services among the poor SHs in the study areas and thus despite being poor, the poor SHs have high willingness to pay for extension services, say, awareness and motivation building for increasing agricultural intensification, knowledge service for crop related agricultural production and agriculture related business. Regression results show that household head education, length of the permanent residency in the locality, land ownership, farm size, availability of seeds, having fair price, geographical locations are important determinants for willingness to pay for agricultural extension services. We finally suggest that creating an agricultural technology cum business promoter at the village level address the generalized barriers for the poor SHs for adopting those technology innovations, that is, low level of motivation for the poor SHs, lack of appropriate information, technical knowledge and extension/rural business services/networking, lack of credit and liquid money, etc.

Key Words: Marginality hotspot, technology, willingness to pay, poor smallholder

JEL Code: Q160,

Introduction

Although Bangladesh made some remarkable achievements in reducing poverty and in improving social and economic outcomes in recent decades, about one-third of the rural population still lives below the upper poverty line most of whom depend on agriculture as their primary source of income. Compared to favorable areas, the quite dismal picture prevails among the marginal areas in Bangladesh. One of the reasons for their poverty is the low

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productivity that results from sub-optimal use of inputs and other technologies in agriculture. To foster agricultural productivity and rural growth in those lagging regions, technology innovations have to reach to all strata of the poor among small farming communities, hereinafter, we term poor small holders (SHs), in rural Bangladesh. For that purpose, technology opportunities need to be brought together with systematic and location-specific actions related to technology needs, agricultural systems, ecological resources and poverty characteristics to overcome the barriers that economic, social, ecological and cultural conditions can create. As a first step of an ex-ante assessment of technology innovations for inclusive growth in agriculture (TIGA) project at the Center for Development Research (ZEF), Bonn in collaboration with BRAC and partners in India, Ethiopia and Ghana, we followed the mapping approach and identified underperforming areas, hereinafter, we term as marginality hotspots with agricultural potentials. Those areas are underperforming areas, i.e. rural areas in which the prevalence of poverty and other dimensions of marginality are high and agricultural potential is also high since in such areas yield gaps (potential minus actual yields) are high and productivity gains (of main staple crops) are likely to be achieved (Malek, Hossain, Saha and Gatesweiler 2013). The marginality mapping presented in their analyses attempted to identify areas with high prevalence of societal and spatial marginality-– based on proxies for marginality dimensions representing different spheres of life—and high (un/der utilized) agricultural (cereal) potentials. The overlap between the marginality hotspots and the high (un/der utilized) agricultural potentials shows that *Rajibpur (Kurigram), Dowarabazar (Sunamgonj), Porsha (Naogaon), Damurhuda (Chuadanga), Hizla (Barisal), Mehendigonj (Barisal), Bauphal (Patuakhali) and Bhandaria (Pirojpur)* are the marginal areas where most productivity gains could be achieved.

As the next step of the ex-ante assessment of technology innovations for inclusive growth in agriculture, those identified marginality hotspots with agricultural potentials could be used in combination with other instruments in order to improve targeting and priority setting for agricultural growth productivity program. Thus, this paper aims to address following research questions:

1) Why the agricultural potentials in those areas are not yet exploited? 2) Who are the poor small holders (SHs)? Which income strata and segments of the rural poor (by agro - ecological and socio-economic clusters) live in those areas? 3) What are the strategic options already available for each segment? And 4) which segments of poor SHs could be eligible for any agricultural (crop) productivity program? 5) What are the technology innovations that accrues economic benefits for each segment of the poor? 6) What is the status of extension services in those areas to adopt those technologies? Are the poor SHs are still willing to pay for these services?

To address those research questions, we followed the conceptual framework and theory of change for TIGA projectwhich is elaborated in section II. Then selection of study areas, sample for the assessment and survey methodology are discussed. Results with analytical techniques are elaborated in Section IV. Final section V concludes the study.

Conceptual Framework and Methods for Analyses

With reference to the conceptual framework and theory of change as developed for TIGA project, once the marginality hotspots with agricultural potentials are identified, then the poor SHs (to be eligible population for any agricultural growth productivity program) are identified in those areas and stratification according to income criteria is carried out, e.g. subjacent poor are those with incomes between 1.25 and 1 $/day, medial poor: 1 and .75 $/day and ultra-poor: below .75 $/day[1]. Those stratifications of the poor SHs are validated by participatory wealth ranking and/or self-reported perceptions. At this stage, the poor SHs from each stratum are allocated to five broad strategic options (Figure 1):

A. agricultural intensification through improving current farming system performance by means of innovations (yet to be identified),

B. agricultural diversification through changing current farming system and shift to another,

C. income diversification through progressing along the value chain, for example by shifting from being farmer to working as agro-dealer, or diversifying income from the non-agricultural sector (say, by non-farm wage employment or migrating in other areas/abroad), etc.

D. leaving the agricultural sector completely

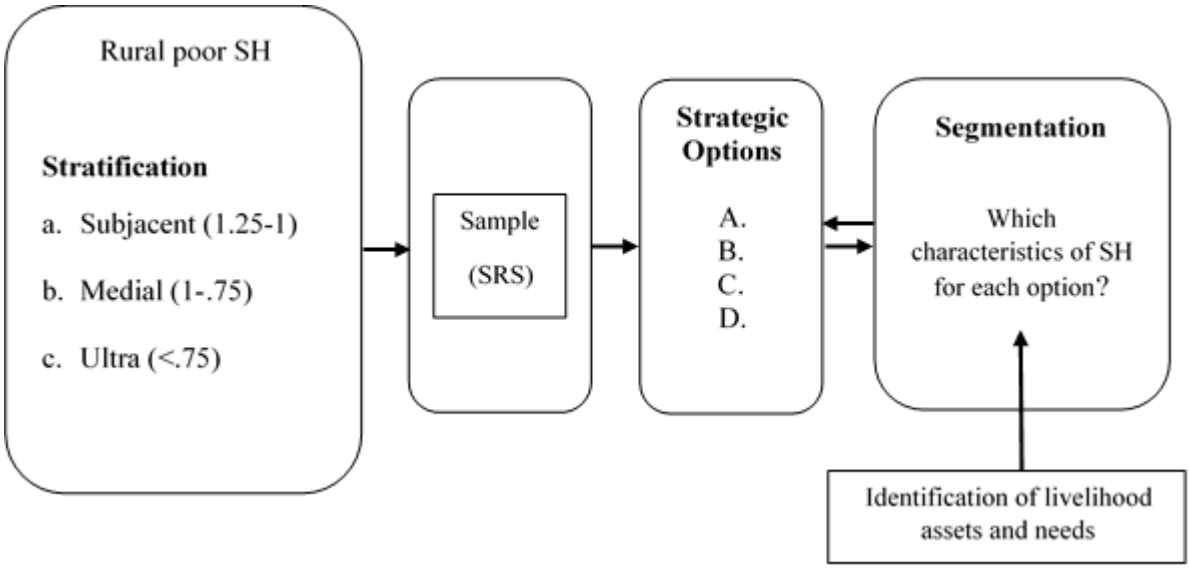

Figure 1 From stratification to segmentation

This allocation of poor SHs from different strata is carried out in parallel with the livelihood assets and need assessment. As it is widely recognized that development strategies for sustainable intensification in marginality potentials with agricultural potentials need a careful adjustment of resource use at field farm- household and village level looking for a portfolio of activities and technologies that guarantee input efficiency and labor productivity

[1] This stratification needs to be adjusted to national poverty lines in each study country.

(Ruben, Pender and Kuyvenhoven 2007). The sustainable livelihoods framework (SLF) developed by DFID (2008) is used to improve our understanding of livelihoods of the poor SHs. Our livelihoods analyses try to develop a full understanding of all dimensions including the vulnerability context, the aim is to identify those capital assets, trends, shocks and aspects of seasonality that are of particular importance to livelihoods of the poor SHs. Effort can then be concentrated on understanding the impact of these factors and how negative aspects can be minimized. A need assessment can in addition identify demands, wants and requirements for improving the quality of current livelihoods. Such needs can be discrepancies between current and needed or desired conditions of SHs and they are assessed to ensure that technological innovations which are economically possible also match the wants and aspirations of the poor – an important aspect which is also captured by allocating the surveyed SHs to the strategic options.

Then allocating the poor SHs to the different strategic options are done in a participatory manner and supported by agronomic calculation based on household data from the livelihood assets and needs assessment to ensure that the options are realistic (no wish lists) and economically viable for each of the actors from different strata. Trade-offs may need to be made between subjective and rational choices. The SHs allocated to different strategic options come from different strata. By means of their characteristics the segments are defined for each strategic option. Segmentation is necessary to identify suitable technology innovations – innovations which match the characteristics of each segment and thereby contribute to achieving the overall goal of increasing productivity. For example, all SHs allocated to option A own land, or lease land or are sharecroppers and each belong to a different income category. Land and income (e.g.) define different segments which can be defined by additional characteristics, such as family members, level of education and social status. After this step in the assessment we know which strategic options are available for which strata of the poor and which characteristics the poor have in each option category (segment). Finally, poor SHs from different strata are segmented to the strategic options stemmed from all-inclusive assessment on household attributes and cluster analysis are used for this purpose. Some systematic tabulation of perception study and expert opinions have been used for identifying technology innovations. Economic benefits of some selected technology innovations following economic surplus model have also been estimated In our study we asked farmers that whether different types of extension services are available in their localities or not. Moreover they were asked to report their accessibility to this extension services and their willingness to pay for agricultural extension services of those familiar and unfamiliar technologies. Based on that a logit model was used to examine factors influences famers willingness to pay for different agricultural extension.

Demand for private extension services can be revealed by the willingness to pay (WTP) of farmers. A number of causes are working behind the demand for extension services. For effective management of farm practice, it is necessary for a farmer to have skills as well as knowledge about technical information which comes from different agricultural extension services. In last four decades various donors spent a huge amount of money for enlightening

agricultural extension services through public sectors. (Anderson & Feder, 2004, Overseas Development Institute, 1994; World Bank, 2006, Islam *et al.*, 2011, Uddin and Qijie, 2012). Different governments, including Government of Bangladesh, and multiple development organizations around the world offer agricultural extension services for free. Nowadays farmers are willing to receive extension services from private services. Copious literatures, in recent time, incorporate a variety of variables that might influence WTP for different agricultural services. Falola et al. 2012 found stock size, nature of production, level of education and age of the farmers are the significant causes to shake willingness of Nigerian Fish farmers to pay for extension services. In another literature Falola et al. got household heads educational level, access to extension services and farm income are the key items for determining willingness to take agricultural insurance. Mwaura et al. 2010 listed sex, age, education level, regions of residence and preferred means to receive the services as key factors for WTP of Uganda's farmers who are involved in crop production and animal husbandry. Socioeconomic characters such as age, gender, income; market characteristics such as availability and prices of agricultural extension services etc. controls purchase behavior of farmers. Experiences and attitudes towards different technologies help farmers to choose those for their practical use (Aryal et al. 2009). Available roads and easy access to that also influence WTP. On the contrary to this, Lack of familiarity of new or existing technologies hinder the WTP for agricultural extension for those particular technologies (Cohen and Zilberman, 1997).

A logit model also called as multiple logistic regression where the dependent variable Y is binary or dichotomous and can take values of 1 and 0 for willing to pay or not, respectively. The conditional mean represents the expected value of the response variable Y, given the value of the independent variable x is denoted as P(Y| x). In linear regression it is possible for P(Y |x) to take any values ($-\infty$; ∞), but with dichotomous response variable the conditional mean is bounded between 0 and 1, i.e. [0 ≤ P(Y |x) ≤ 1].

The conditional mean P(Y|x) is denoted as Z(x) can be calculated as

$$Z(x) = \frac{e^{\beta_0 + \beta_1 x_1 + \ldots\ldots + \beta_k x_k}}{1 + e^{\beta_0 + \beta_1 x_1 + \ldots\ldots + \beta_k x_k}}$$

The logit transformation of Z(x) is defined in terms of Z(x):

$$g(x) = \ln\left\{\frac{Z(x)}{1 - Z(x)}\right\}, \text{ logit model;} \qquad \text{where } \left\{\frac{Z(x)}{1 - Z(x)}\right\} \text{ is odds ratio}$$

Systematic component of the multiple logistic regression is a linear predictor with more than 1 variable $\alpha + \beta_1 x_1 + \ldots\ldots + \beta_k x_k$. For the logit of Z($x$) logistic regression model has linear form: g(x) = logit $\{\pi(x)\} = \alpha + \beta_1 x_1 + \ldots\ldots + \beta_k x_k$.

Selection of Study Areas, Sample for the Assessment and Survey Methodology

The marginal areas identified for the assessment are usually bypassed by the policy makers due to generalized convention about the Agro-Ecological Zones (AEZ) as a whole and receive less attention (Malek, Hossain, Saha and Getzweiler 2013). Therefore, marginal (or

less favored areas or laggard) regions especially in poor developing countries and emerging economies in Sub-Saharan Africa and South Asia are recently gaining much attention in the development literature (Conway 1999; Fan &Hazell 2000; Pinstrup-Anderson &Pandya-Lorch 1994; Ruben, Pender &Kuyvenhoven 2007; Pender 2007; Reardon et al. 2012). As mentioned earlier, the first step towards designing systematic interventions is to identify underperforming areas, i.e. rural areas in which the prevalence of poverty and other dimensions of marginality are high and agricultural potential is also high since in such areas yield gaps (potential minus actual yields) are high and productivity gains (of main staple crops) are likely to be achieved. The identification has been done with high prevalence of societal and spatial marginality– based on proxies for marginality dimensions representing different spheres of life and an overlapping high (un/der utilized) agricultural (cereal) potentials. The available secondary data and household survey data from various sources have been used for the exercise. Fig:2 show that Rajibpur (Kurigram), Dowarabazar(Sunamgonj), Porsha(Naogaon), Damurhuda(Chuadanga), Bhandaria(Pirojpur),

Figure 2 Map of study areas-overlap of marginality hotspot and agricultural potential in Bangladesh

Hizla (Barisal), Mehendigonj(Barisal) and Bauphal(Patuakhali) are the marginal sub-districts where most productivity gains can be achieved through suitable agricultural technology intervention. These areas are in different Agro-ecological Zones (AEZs) - most of which are agro-ecologically fragile/unfavorable. Among them, Patuakhali, Pirojpur and Barisal are in Coastal region, Kurigram is in Northern Char region, Sunamgong in Haor region and Naogaon is in Drought prone areas. Only Chuadanga, among these seven districts, is not in agro-ecologically vulnerable region but in food in-secured region (HKI & JPGSPH 2011). Another point to note is that 4 out of these 8 sub-districts are adjacent to Indian boundaries, whereas the other 4 sub-districts are located in the coastal region.

Thus, among those eight sub-districts the first four sub-districts represent different regions while the last four sub-districts represent the similar regions (coastal belt) and among these four sub-districts, Bhandaria (Pirojpur) would be comparatively less difficult to reach with some agricultural technology interventions. Thus, we selected the following five sub-districts for the study sites for our ex-ante assessment: Rajibpur (Kurigram), Dowarabazar(Sunamgonj), Porsha(Naogaon), Damurhuda(Chuadanga) and Bhandaria(Pirojpur).

Then we, the research team, visited the localities, understood the situation, and prepared the list of all marginal villages. Finally, we randomly selected 16 marginal villages for the detail quantitative sample survey. Prior to conducting in-depth quantitative sample survey, we conducted qualitative survey in 5 villages (1 village/sub-district) - this included several PRA methods (social and resource mapping, participatory wealth ranking, in-depth interview, focus group discussion, etc.) for livelihood assets and needs assessment. Those qualitative data are analyzed through contents analysis- this helps to identify the issues for detail quantitative investigation. At the beginning of quantitative sample survey, we first conducted household

census (5,855 households) in all 16 villages containing few basic information mainly related with household assets targeting to identify the poor SHs (study population) for the assessment. For this, we analyzed the census data and developed a wealth index[1] calculated from principal component analysis (PCA) factor scores and found 862 poor SHs[2] (study population) for the assessment. From those study population, following proportionate random sampling a sample of the poor SHs (357) were drawn for in-depth quantitative sample household survey.

<Table 1>

Results and Discussion

Bio-Physical Conditions for the Poor Shs in the Marginal Sub-Districts in Bangladesh: Why the Potentials Are Not Yet Exploited?

While the national average for cropping intensity is about 180, it is only 144 for the study sample in those five sub-districts- it is extremely low for some sub-districts (say, Rajibpur under Charland, Dowarabazar under Haor basin, etc.) - the rice yield rates in those areas are also very low (Table 2-4). While the major crop season in the so-called typical favorable areas in Bangladesh is dry season (high yielding) irrigated rice, *Aman* (wet-season) rice (moderate yielding) season is the major crop season for three of the five sub-districts. Our results clearly indicate the availability of unused potentials for the cereal crops. If we see the major livelihood opportunities (by seeing the household members engagement/income share to household total income) in a favorable rural area, non-farm business, non-farm wage employment, remittances from abroad and high yielding crops and non-crop farming are the dominant livelihood options (Malek and Usami 2010); however, cereal (predominantly rice) farming and low productive agricultural day laboring are the major livelihood options in these sub-districts. The poor SHs in these areas are not being able to exploit the opportunities of high yielding cereal and non-cereal based farming, non-crop farming, non-farm business activities, non-farm wage employment and international migration- these realities came from both qualitative investigation and sample survey. These are not only due to their adverse geographical location but also for their poor capital bases and un-availability of innovative development interventions

[1]Wealth Index is an indicator of the level of wealth which is consistent with expenditure and income measures (Rutstein, 1999). Wealth index has been constructed based on the census data on household assets (ownership of durable goods such as TV, bicycle etc. and landholdings) and quality of life indicators (say, water supply and sanitation facilities). A single wealth index has been done based on following equation (Balen et al, 2010):

$Ai = \gamma\hat{}1\alpha i1 + \ldots + \gamma\hat{}n\alpha in$

Where, Aiis the standardized wealth index score forith households; $\alpha in = (xin - \bar{x}n)/SDn$; $\gamma\hat{}n$=Weight (factor score); xin=nth asset for household I; $\bar{x}n$=Mean of nth asset for all households; SDn = Standard deviation for nth asset for all households

[2]Poor small holders: Though we considered 2.47 acre of farm size as the highest ceiling, the avaraze farm size of our sample is the avaraze farm size of our sample is 0.53 acre of which 60.78% functionally landless (<0.50 acre) farm households, 28.85% marginal farm households (0.51-1.00 acre) and10.36% small farm households (1.01-2.50 acres).

in the locality that will be explained more in latter section. The qualitative investigations suggest that the poor SHs in the marginality hotspots are vulnerable due to their agro-ecological vulnerability- almost all five areas face, to some extent, natural calamities (say, flood, drought, salinity by tidal flow, etc.) that discourage farmers from thinking innovative process and technology useful for agricultural production for their livelihoods. The poor SHs in all areas (except Damurhuda) are usually less motivated for agricultural intensification and also lack in agricultural knowledge. Almost all areas face water management and irrigation problem with varying level of severity. They are also constrained to their limited connectivity with the main growth centers, poor physical, irrigation and extension/communication infrastructure, power shortages, etc.

<Table 2>

<Table 3>

<Table 4>

Number and Characteristics of the Poor at Each Poverty Strata

National sources (BBS 2010) shows that the population under upper poverty line regardless farming involvement in those five sub-districts varies from 34-59% except Dowarabazar (haor area) where the figure is nearly to national averages (31%). Results

from TIGA Bangladesh household census 2013 conducted in 16 villages of 5 marginal sub-districts shows that about 3,135 (54% of total households-5,855) households are the SHs- of them about 862 households (27% of SHs and 15% of total) are the poor SHs who could be eligible for any agricultural productivity improvement program in the marginal sub-districts. From this study population, the sample of 357 SHs has been drawn for the detail investigation. Then, the sample households have been stratified by quantitative income criteria and validated by participatory wealth ranking and self-reported perceptions. For income criteria, we use both US dollar classification and PPP dollar classification and find US dollar classification (e.g. subjacent poor are those with incomes btw 1.25 and 1 $/day, medial poor: 1 and .75 $/day and ultra-poor: below .75 $/day) is more consistent with self-reported perception (Table). Table 5 suggest that about the 12.32% sample belongs to non-poor category as of US dollar income criteria (that is equivalent to 8.4% as of self-reported perception) and thus the latter analyses are centered on these poor sample (313 poor SHs). It is also found that the number of subjacent poor is almost similar in both USD income criteria and self-reported perception, but it varies significantly for medial and ultra-poor households. Our qualitative participatory wealth ranking exercise also shows that the majority of the households in the sample should be in the ultra-poor category. Thus, we followed the latter analyses based on the USD income classification. Sub-district wise distribution (Table 6) shows that the number of subjacent and medial poor SHs does not differ significantly but the number of ultra-poor SHs are comparatively high in

Porsha and Rajibpur than other three sub-districts. Though overall economic condition in Damurhuda is much better compared to that at Dowarabazar, the similar number of ultra-poor SHs in those two sub-districts may be because of the fact that at Damurhuda the poor SHs are more marginalized compared to the better off households. The latter section will give us more explanation about those facts.

<Table 5>

<Table 6>

Poor Shs Livelihood Capitals as Per Stratification

Table 7 shows that the poor SHs capital bases are very poor but these capitals quantitively don‘t differ significantly to different strata (subjacent, medial and ultra poor) . However, qualitative investigations suggest that the majority of the community defined ultra-poor categories are differentiated from medial to subjacent poor in terms of landholdings/access to farm land, livelihood engagement, technology adoption, credit accessibility, using cell- phone, motivation and communication/networking skills, physical fitness, etc (Annex 1). Poor SHs are also insecure and vulnerable.

Poor Shs' Livelihood Opportunities and Income Pattern across Poverty Strata

The poor SHs and their households' working members' include farming, non-agricultural enterprises, wage employment in the locality and migration. Rice during Boro and Aman season is common cereal crops for all strata of SHs in marginal areas. Additionally, the subjacent poor SHs in the *Charland* produce a limited scale of maize and wheat while the poor SHs produce maize in food in-secured zone produces in larger scale and wheat in drought prone areas of *barind tract* areas in limited scale. Other crops that the SHs produce are jute, sweet potato, pulses, spices, sugarcane, mung bean, a several types of vegetables, etc.Most of the poor SHs are related with non-crop farming include poultry and cattle rearing beef fattening, goat rearing, fruit gardening, commercial fishing, and plantation. Poultry is common non-crop practice among the SHs and the purpose of this practice is both consumption and commercial purpose. Fishing is mostly done by poor SHs who are living in the coastal belt areas. Poor SHs are engaged with non-agricultural enterprise/businesses like renting tractor and spray machine, working in grocery and sweet shop, local transport driver (*korimon*) etc.The wage employment opportunities for poor SHs available in areas are day laboring (agricultural day laborer, work in break field), mason, rickshaw pulling, wood cutter, etc. In-country migration is familiar among the poor SHs.

<Table 7>

<Table 8>

In a particular time of a year they migrate from their own area to different areas for earning additional income for their livelihoods and purchasing agricultural inputs. While Rajibpur and Porsha SHs' households' members don't migrate to other countries, the members from other three sub-districts migrate in other countries esp. in the Middle East and south-east Asia (Malaysia) in limited scale.

The sample for this study was drawn from the poor SHs population and thus their income is naturally very low compared to national rural average and also national poor households' rural average. As shown in qualitative investigation, their income is contributed mainly from farm and nonfarm day laborers' income and cereal crop farming income (Table 8). The income differences are observed along the different strata of the poor SHs. While ultra-poor SHs income are differentiated from medial and subjacent poor mainly by cereal crop and day-laborers income and also partly by non-cereal crop income; but the subjacent poor SHs income are differentiated also from business income. That means, medial poor and subjacent poor SHs compared to ultra-poor SHs are taking some advantages of livelihood opportunities other than cereal based farming. However, compared to livelihood opportunities available in a typical advanced rural location, the income sources for the poor SHs are limited only among low productive nature of activities. Thus, it is evident that the poor SHs in those areas are marginalized not only in the national context but also within the community.

Segmentation of Poor Shs: Findings from Cluster Analysis

To suggest which types of agricultural growth productivity program seem most promising for the poor SHs for their agriculture and livelihood improvement in the marginality hotspots with agricultural potentials in Bangladesh, we used cluster analysis to group the poor SHs according to appropriate dimensions leading to different strategic options. For this purpose, Cluster analysis (a major technique for classifying data) is used. Cluster analysis assigns observations to groups (clusters) so that observations within each group are similar to one another with respect to variables or attributes of interest and each group stands apart from one another. In other words, it divides the observations into homogeneous and distinct groups. This is achieved by assigning all similar observations according to the degree of proximity (closeness) among the cluster elements by calculating the shortest possible distance between observations referred to as the Euclidean distance[1]. Through the focus group interviews and

[1] The Euclidean distance between observations $\{X_{1i}, X_{2i}, \dots, X_{ki}\}$ and $\{X_{1j}, X_{2j}, \dots, X_{kj}\}$is estimated as:

$$D(i,j) = \sqrt{(X_{1i} - X_{1j})^2 + (X_{2i} - X_{2j})^2 + \cdots (X_{ki} - X_{kj})^2} \quad (5)$$

Observations with the closest distance are then grouped into one cluster. Allocating the farmers to the different strategic options are done using both hierarchal and k-means cluster analysis. At first, cluster analyses are performed using a sequence of a common hierarchal and exchange algorithm using variables and attributes containing both dichotomous and categorical values. A cluster dendogram (cluster tree) reveals the appropriate number of clusters (in our case: 5 clusters). Then we used K-means clustering which aims to partition 313 observations into 5 clusters in which each observation belongs to the cluster with the nearest mean. K-means cluster analysis is a well-accepted exploratory statistical technique in social science research that creates

key informant discussions, the respondents are characterized into five strategic groups that has been used for the cluster analyses (Table 9). Our analyses show that the clusters are homogeneous in a sense that those are mostly male headed, family size not so high, schooling years very low, similar non-land agricultural productive assets, low per capita income, salaried and remittance income insignificant, all clusters receive some social safety nets, all clusters take some loan. On the other hand, ownership to the land, farm size, cropping intensity, agricultural crop sales, household durables, cereals income, other crops income, business income, day laborers income, household savings, cereals' technology adoption, access to the agricultural market, etc. play decisive role to make the cluster distinct from one another. Thus, among the five groups of the poor SHs, *non-cereal and non crop farming with day laboering* and *day laboring with business* could be appropriate strategic options for two groups and the other three appropriate strategic options could be farming (crop and non-crop) *with day laboring*, *cereal crops*, and *business with cereal crops*. The meanings of these results are: say, 1) For productivity growth program towards indivdual the poor SHs, day—laboring can't be any strategic option though the poor SHs naturally takes it as a survival strategy; 2) Among the poor SHs, though about 97.78% households cultivate cereals accruing major of their housold income share they are living under poverty line, they need alternative options that could increase their income and livelihood security. Thus, only cereal based productuivity program could not improve food and livelihood security of the poor SHs and the growth productivity program should be designed in a way that the SHs could have the opportunity to explore their human capability in farming (cereal and non-cereal crops and non-crop farming) and business that create backword and forward linkages with those farming in the locality. Therefore, we should extend our focus of technology innovations from crop techoniology to non-crop farming and non-farm business thatt could better link the SHs with the market.

<Table9>

<Table 10>

Technology Innovations for the Poor Small Holders and the Barriers: Beyond Crop Technology Innovations

Initially we focused cereal crop technology innovations- latter it expanded from cereal crop to all crops, non-crop framing and non-farm innovations required for poor SHs growth productivity program in the selected areas. For identifying technology innovations, we did not follow the traditional pipe-line approach- that is, scientists develop technology and then it is given to the extension agents for adoption to the farmers. Rather we took a bottom-up approach that match available technologies with the needs, aspirations and potentials of the poor SHs

natural, internally similar groups from rating scale questionnaire data. The statistical program identifies the centroid for each cluster by running the algorithm until a stable solution with minimum variability within each cluster and maximum variability between each cluster results.

and the projected costs (barriers) i.e, the matching available technology innovations usually require enabling conditions to work for the poor SHs. In our approach, the focus of the innovation packages should be related with current farming practices and cropping technology use of the SHs covering all stages of production (say, pre-production, production, harvesting, processing and marketing) - it could be newly introduced goods and services for most of the farmers but should be readily available in the locality (say, despite having exploitable potentials some areas/farmers are adopting some tech innovations, others are not; in the similar context some farmers are getting very good returns close to exploitable potentials yields from those innovations, others are getting very less; etc.).

<Table 11>

Following literature/document review, consultation with the scientists both at national and regional level and local level extension workers/officials both at GOs and NGOs, we prepared a lists of more than 50 technology innovations (Table 14) and conducted a perception study. Perception study addressed several key questions: 1) whether the SHs are aware of this technology innovation? 2) How many SHs of the awaked SHs are currently using it? 3) Which technologies (for the awaked farmers) are most important?

Poor SHs perception about those technologies (following frequencies and percentages of their responses) can be grouped in several ways: 1) all three indicators- say, awareness, adoption and further importance of some technologies among the poor SHs are very high, for example, power tiller/tractor, machine for pesticide use, seed plantation in line with definite spacing, etc.- that means though these technologies are intensively adopted but still their necessity prevails 2) for some technologies awareness and importance are high but adoption is not high- say, rice mill (diesel driven), shallow tube well (STW), rice mill (electricity driven), etc. -adoption of second group of technologies need to increase significantly. 3) For some technologies, all awareness, adoption and importance are low- most of these technologies are recently developed in the research station but the farmers in those areas are not quite aware of their importance. At the second stage, mainly with the third group of technologies we consulted with BRAC in-house technology experts/practitioners knowledgeable about those technologies and those study areas and found some technologies could be useful, say, short duration *aman* rice verities, hybrid maize and stress tolerant wheat varieties, handy kit for using guti urea, etc. At the final stage, we again validate our study results with the local level stakeholders, say, extension workers (both public and NGOs), input dealers, processors, model farmers, poor SHs, etc. and made the lists of technology innovations for future growth productivity program (Table 11).Among the selected technology innovations, we estimated economic benefits using standard economic surplus model (Norton and Dey; 1993, Alston et al. 1995 and Napasintuwong, O., and G. Traxler. 2009). In our approach we considered a closed economy framework with supply elasticity 0.28 and demand elasticity -0.62 for hybrid rice and with supply elasticity 7.6 and demand elasticity -0.62 hybrid maize for eligible farmers. At present current yield of the marginal area is about 4.8 ton/hac. If farmers can operate according their capacity it would be 8 ton/hac whereas experts opinion (with the soil condition and weather

conditions) is it can be reached to 10 ton/hac. If famers of the five sub-districts adopts in larger area, that will benefits them more. We treat competitive price is a constant factor economic surplus of producers (Poor SHs, Model farmers, and Experts trained farmers) will increase (yield increase and unit price reduction for producing) for the time period 2014 to 2017. Ex-ante estimation of hybrid rice technology accrues significant benefits in terms of economic surplus for the eligible poor SHs in marginal sub-districts with agricultural potentials.

Though the selected technology innovations seem to accrue economic benefits, we need to address the barriers that hinder the adoption of technology innovations in the selected study areas. As mentioned at Section 4.1, due to some adverse bio-physical conditions, it may be difficult to exploit potentials of those selected technology innovations in those areas; however, there are some general barriers, for example, less availability of quality seeds for improved cereal varieties, lack of credit/capital for renting the agricultural land in and establishing agri-business, labor shortages and lack of labor saving agricultural machineries and machineries services, influence of middleman for marketing SHs' produces, less use of mobile phone technology in agricultural knowledge dissemination and technology business promotion that hinder the adoption of crop technology innovations in marginal areas in Bangladesh. In our paper we will particularly focus on the extension services that the poor SHs barely necessitate for adopting those technology innovations.

Willingness to pay of the poor SHs for extension services

As elaborated earlier, in this paper we have focused on agricultural extension services: (1) Awareness and motivation building for increasing agricultural intensification, (2) extension services crop related agricultural production and (3) suggestions on agriculture related business/institutions management and maintaining liaison with related persons. And we found that a substantial farmers are willing to pay (stated willingness) for these services.

<Table 12>

In case of availability of extension services, these marginal areas are in a deprived situation. Only 17% of the poor SHs are getting 'awareness and motivation building for increasing agricultural intensification' and 'crop related agricultural production'. Whereas 3% are obtaining 'suggestions on agriculture related business/institutions management and maintaining liaison with related persons' in different means. Considering different upazilas, farmers of Damurhuda and Porsha are more aware of availability of these services compared to other three upazilas. As the availability of these extension services are low these areas, use of these services are also limited. Likewise availability table, uses of these services are very low in Dowarabazar, Rjibpur and Porsha than that of other two upazilas. Among these five upazilas availability and use of these technology are crucially inadequate in dowarabazar. If we follow farmer eagerness to pay for extension services, there exists a huge demand for payable extension services. Broadly 74% and 68% SHs would like to spend their wealth for 'awareness and motivation building for increasing agricultural intensification' and 'crop

related agricultural production' respectively. And 40% are agree for paying third one. Since availability and use of these services are limited, SHs who responded of Rjibpur, Dowarabazar and Porsha are agree to pay for first services. Similarity is also visible in other two services.

In our study, 50% poor SHs' head are age of 40 years or less, 30% are 41-55 years and rest of the farmers more than 55 years. 97% of them are male. About 64% household heads have no literacy. And those have schooling 34% of them are grade five or less. Most of these poor small holders (71%) resides in there localities over 99 years. And 87% household heads have experience in agriculture more than 10 year. Most of them are functionally landless. Only 49% SHs have their own land. Others continue their farming taking land from others by leasing, mortgage or rent in and even those own a small amount of land also take lands in different means. 38% SHs are involved with different NGO including BRAC. And only 23% SHs have practices of saving behaviors while 47% are taking loans from both formal and informal sectors. Among these households only 20% have access to electricity.

In our study we asked farmers that whether different types of extension services are available in their localities or not. Moreover they were asked to report their accessibility to this extension services and their willingness to pay for agricultural extension services of those familiar and unfamiliar technologies. Based on that a logit model was used to examine factors influence famers' willingness to pay for different agricultural extension.

<Table 13>

For extension service entitled 'Awareness and motivation building for increasing agricultural intensification' two different logit regression models have been executed. In one model (model1) we have incorporated all variable except location dummy (study Upazilas) that might have influences on the extension services, while another model (model2) includes location dummy too. In model1, the strongest positive influences of household farm size on WTP for this particular service. Famers who are more educated would like to buy the services. The model also depicts who could manage good seeds and got fair price for their production in last year do not like to spend money for the extension service. However, in model2 interestingly we found areas significantly influence willingness to pay. Among the five upazilas farmers of Rajibpur, Porsha, Dowarabazar are more keen to occupy their wealth for availing the stated extension service.

For crop related agricultural production, (model3) availability of good seeds, irrigation water and fair prices in last year agricultural productions decrease WTP for this extension service. But In Model4, Farmers of Rajibpur, Porsha and Dowarabazar are significantly want to pay for crop related agricultural service because their crop production hampers due to this. Access to irrigation water and loan taking decreases WTP for the service.

Model5 and Model6 are logit regression outputs of extension service: Suggestions on agriculture related business/institutions management and maintaining liaison with related persons. In model5, as the year of living in their localities increases, WTP decreases. Here like model1 and Model3, significantly as the potentiality of getting price fair price and manage

good seed goes up, WTP goes down. Similarly, this is true for loan taker and farmers who managed irrigation properly last year. Interestingly, Model6 shows like model2 and Model4, areas are crucial for WTP. And aging farm size matters. So farmers of those areas are lack behind average production are more WTP for these extension services.

Conclusion

Under a collaborative project entitled " Technology assessment and farm household segmentation for inclusive poverty reduction and sustainable productivity growth in agriculture (TIGA) " conducted by Center for Development Research (ZEF), Bonn in four partner countries of South Asia and Sub-Saharan Africa, this paper discusses the results generated from Bangladesh country study. Following marginality approach developed at ZEF, Bonn we identified five marginal sub-districts in Bangladesh i.e. underperforming areas i.e. in which the prevalence of poverty and other socio-economic dimensions of marginality are high and agricultural potential is also high since in such areas yield gaps (potential minus actual yields) are high and productivity gains (of main staple crops) are likely to be achieved. Thereafter we conducted a household census of 5,855 households in 16 marginal villages from those five sub-districts and drew a sample of 357 poor SHs for in-depth quantitative sample survey. Some qualitative surveys (focus group discussions, in-depth interviews, etc.) were also conducted. Then we developed the analytical methodology to create a thorough understanding of the interactions between technology needs, farming systems, ecological resources and poverty characteristics in the different strata of the poor small holders (SHs), and to link these insights with technology assessments in order to guide action to overcome current barriers to technology access and adoption under the common approach for technology innovations for inclusive growth in agriculture developed at ZEF jointly with the partners. Results suggest that five marginal sub-districts with agricultural potentials are very different from each other. Sufficient potentials available in those sub-districts and enough scope for exploiting the potentials for ensuring farm intensification and livelihood diversification. The adverse agro-ecological vulnerability- almost all five areas facing, to some extent, natural calamities (say, flood, drought, salinity by tidal flow, etc.), discourage poor SHs from thinking innovative process and technology useful for agricultural intensification and livelihoods. Poor SHs' income mainly accrues from cereal crops income and low productive non-farm sources (say, agricultural day laboring) and their capital bases are very poor that don't differ significantly to different strata quantitatively though qualitatively some differences among the capital bases are observed. Cluster analysis gives meaningful segmentation of the poor SHs- development strategies should focus on three pathways: agricultural intensification, income diversification and agricultural diversification based on options available for the SHs in the localities. Cereal based technology under agricultural innovations could be part of the solution- but that could be integrated with other income diversification and agricultural diversification strategies. Intensive crop system, hybrid seeds, water management technologies, non-crop farming, non-farm enterprise/business, etc. are the suggested potential technology innovations for the study areas. The technology innovations could be promoted through introducing strategic

development program that includes promotion of crop and non-crop farming production and related (backward and forward) non-farm business in the localities. However, there is very limited availability of extension services among the poor SHs in the study areas and thus despite being poor the poor SHs have high willingness to pay for extension services, say, awareness and motivation building for increasing agricultural intensification, knowledge service for crop related agricultural production and agriculture related business. Regression results show that household head education, length of the permanent residency in the locality, land ownership, farm size, availability of seeds, having fair price, geographical locations are important determinants for willingness to pay for such agricultural extension services. We finally suggest that creating an agricultural technology cum business promoter at the village level address the generalized barriers for the poor SHs for adopting those technology innovations, that is, low level of motivation for the poor SHs, lack of appropriate information, technical knowledge and extension/rural business services/networking, lack of credit and liquid money, etc.

References

Adato, M., Meinzen-Dick, R. (2002) Assessing the impact of agricultural research on poverty using the sustainable livelihoods framework. IntlFood Policy Research Institute.

Alston, J.M., Norton, G.W., Pardey, P.G., (1995). Since Under Scarcity: Principles andPractice for Agricultural Research.Evaluation and Priority Setting. Cornell University Press, Ithaca, NY. p. 237.

Anderson, J. R., Feder, G., (2004). Agricultural extension: Good intentions and hard realities. World Bank.Research Observer 19 (1), 41–60.

Aryal, K. P., Chaudhary, P., Pandit, S., Sharma, G., (2009). Consumers' willingness to pay for organic products: a case from Kathmandu valley. Journal of Agriculture and Environment, 10, 15-26.

Carney, D., (1998). Sustainable rural livelihoods: what contribution can we make? Papers presented at the Department for International Development's Natural Resources Advisers' Conference. Department for International Development (DFID).

Cohen, D. R., Zilberman, D., (1997). Actual versus stated willingness to pay: A comment. Journal of Agricultural and Resource Economics. 376-381.

Conway, G., (1999). The Doubly Green Revolution: Food for All in the Twenty-First Century. Ithaca, NY. Cornell University Press.

Department for International Development (DFID). (1998). Sustainable livelihood Guidance Sheets. http://www.eldis.org/vfile/upload/1/document/0901/section2.pdf

Fan, S., Hazell, P., (2000). Should Developing Countries Invest More in Less-Favoured Areas? An Empirical Analysis of Rural India. Economic and Political Weekly Vol. 35, No. 17, 1455-1464.

Falola, A., Banjoko, I. K., Ukpebor, P. O., (2012). "Willingness-to-Pay for Agricultural Extension Services by Fish Farmers in Nigeria: A Case Study of Kwara State, Nigeria." Journal of Sustainable Development in Africa 14.5, 197-207.

Ganesh-Kumar, A., Prasad, S. K., Pullabhotla, H. (2012). Supply and Demand for Cereals in Bangladesh (No. 01186). Discussion Paper.

Helen Keller International (HKI) & James P Grant School of Public Health (JPGSPH).(2011). State of food Security and Nutrition in Bangladesh, 2010. Dhaka, BD: HKI & JPJSPH.

Islam, M.M., Gray, D.I., Reid, J.I., Kelly, T.C., Kemp, P.D., (2011). Beyond Recurrent Costs: An

Institutional Analysis of the Unsustainability of Donor-Supported Reforms in Agricultural Extension .Journal of International Agricultural Extension Education 18(3), 5-18.

Malek, M. A.,Gatzweiler, F. W., (2014). Identifying technology innovations for marginalized smallholders-A conceptual approach. Paper to be presented for an organized parallel (special) session for TIGA results under Institutional Innovations and Development of Markets for Agricultural Services sub-theme at 8th ASAE Conference to be held in Dhaka dated 15-17 Oct 2014

Malek, M. A., Hossain, M. A., Saha, R., Gatzweiler, F.W., (2013). Mapping marginality hotspots and agricultural potentials in Bangladesh. Working Paper 114. Bonn: Center for Development Research (ZEF).

Malek M. A., Usami. K.,2010.Do the Non-farm Incomes really matter for Poverty among Small Households in Rural Bangladesh? A Case of Advanced Villages.Journal of Development and Agricultural Economics. Vol. 2(7):250–267.

Mwaura, F., Muwanika, F. R., Okoboi, G., (2010). Willingness to pay for extension services in Uganda among farmers involved in crop and animal husbandry. In African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference.

Napasintuwong, O., Traxler, G., (2009). Ex-ante impact assessment of GM papaya adoption in Thailand.

Norton, G., Dey, M., (1993). Analysis of Agricultural Research Priorities in Bangladesh. BARC, ISNAR. p. 300.

OECD (Organization for Economic Co-operation and Development). (2001). Poverty Reduction, The DAC Guidelines, OECD, Paris.

Pinstrup-Andersen, P., Pandya-Lorch, R., (1994). Alleviating poverty, intensifying agriculture, and effectively managing natural resources (Vol. 1). Intl Food Policy Res Inst.Washington, DC.

Pender, J., (2007).Agricultural Technology Choices for Poor Farmers in Less-Favored Areas of South and East Asia. International Food Policy Research Institute. Washington, DC. http://www.ifpri.org/sites/default/files/publications/ifpridp00709.pdf.

Ruben, R., Pender, J., & Kuyvenhoven, A., (2007). Sustainable poverty reduction in less-favoured areas. Eds., CABI.

Reardon, T., Chen, K. Z., Minten, B., Adriano, L., (2012). The quiet revolution in staple food value chains: Enter the dragon, the elephant, and the tiger. ADB and IFPRI. Available at http://www.indiaenvironmentportal.org.in/files/file/quiet-revolution-staple-food-value-chains.pdf

World Bank (2006) Sourcebbok: Agricultural Investment. Module 3 –Investments in Agricultural Extension and Information Services. World Bank, Washington, DC. Available at: http://go.worldbank.org/3CO4VK9ON0 (assessed 31 August 2012)

Yaseen, M. R., Dronne, Y. V. E. S., Ahmad, I. R. F. A. N. 2011. Estimates of Supply Response of Major Crops in Bangladesh. Bangladesh Development Studies. 34(4), 55-64.

Tables

Table 1 Selection of sample survey households (poor SHs) from the selected villages

Sub-districts	Total study population	Under poverty line				Poorest 10%		
		Total population calculated as per HIES[1] 2010 poverty line	Cut off point wealth Index	Poor SHs-study population	Sample poor SHs	Total	Cut - off index	Non-farm HHs
Damurhuda	1428	39%(557)	.568	302 (54%)	**125**	102	-1.49	64 (63%)
Rajibpur	1299	59%(766)	.162	163 (21%)	**67**	130	-2.74	79 (61%)
Dowarabazar	899	29%(261)	-1.46	89 (34%)	**37**	90	-2.23	55 (61%)
Porsha	1021	49%(500)	-.467	188 (37%)	**78**	102	-1.86	99 (97%)
Bhandaria	1208	34%(411)	-1.27	120 (29%)	**50**	121	-2.11	88 (73%)
Total	5855	50%(2945)		862 (29%)	**357**[2]	545		385 (71%)

Source: Authors estimation from TIGA Bangladesh Household Census 2013

Table 2 Farm size, cropped area and cropping intensity of the poor SHs in marginal sub-districts of Bangladesh: 2013

Sub-districts	HHs Farm size (acre)	Cropped area (acre)	Cropping intensity
Damurhuda	0.58	0.94	159.40
Rajibpur	0.56	0.57	100.61
Dowarabazar	0.79	0.95	121.99
Porsha	0.63	0.97	156.10
Vandaria	0.93	1.49	163.57
Total	0.66	0.96	144.03

Source: TIGA Bangladesh Baseline Survey 2013

Table 3 Cropped area of poor SHs in marginal sub-districts of Bangladesh: 2012-13 (N=313)

Sub-districts	All cereals	Rice	Maize	Wheat	Other crops	Total
			(acre/household)			
Damurhuda	0.81	0.64	0.14	0.02	0.14	0.94
Rajibpur	0.30	0.30	0.00	0.00	0.27	0.57
Dowarabazar	0.87	0.87	0.00	0.00	0.08	0.95
Porsha	0.95	0.89	0.01	0.05	0.02	0.97
Vandaria	1.45	1.43	0.00	0.00	0.06	1.50
Total	0.83	0.76	0.05	0.02	0.12	0.96

Source: TIGA Bangladesh Baseline Survey 2013

Table 4 Yield rate of major cereals of poor SHs in marginal sub-districts in Bangladesh (N=313)

Sub-districts	Rice	Maize	Maize
		(ton/hectare)	
Damurhuda	4.50	8.87	2.93
Rajibpur	2.79	-	-
Dowarabazar	3.42	-	-
Porsha	5.15	-	3.16
Vandaria	2.67	-	-
Total	4.01	-	-

Source: TIGA Bangladesh Baseline Survey 2013

[1]Bangladesh Household income and expenditure survey
[2]at 4% error and 95% CI

Table 5 Stratifications of poor SHs in marginal sub-districts in Bangladesh (N=357)

Household status	**Self-reported perceptions** (percent)	**As of US $ (@ 80.00 BDT)**	**As of PPP $(@33.53)**
Non poor	8.4	12.32	63.02
Subjacent poor	20.17	13.73	11.2
Medial poor	55.18	17.93	8.4
Ultra-poor	16.25	57.7	18.77
Total	100	100	100

Source: TIGA Bangladesh Baseline Survey 2013

Table 6 Distribution of poor SHs by poverty status among marginal sub-districts (as of US $ classification) (N=313)

Sub-districts	**Ultra-poor**	**Medial poor**	**Subjacent poor**	All sample
		(percent)		
Damurhuda	63	23	15	36
Rajibpur	71	17	15	19
Dowarabazar	63	17	20	11
Porsha	72	20	8	20
Vandaria	58	21	23	14
Total	66	20	15	100

Source: TIGA Bangladesh Baseline Survey 2013

Table 7 Descriptive statistics for poor SHs five capitals in marginal sub-districts in Bangladesh (N=313)

Variables	**Ultra poor (N=206)**	**Medial Poor (60)**	**Subjacent poor (47)**	**1 vs 2**		**1vs 3**		**2 vs 3**	
Human capital	**Mean**	**Mean**	**Mean**	**Diff**	**P-value**	**Diff**	**P-value**	**Diff**	**P-value**
Members schooling years	2.4	2.7	3.0	-0.3	0.7	-0.6	0.2	-0.3	1.0
Household head schooling years	1.5	1.8	2.0	-0.3	1.0	-0.6	0.6	-0.2	1.0
Financial C									
Total Income (BDT)	40700	77931	102152	-37231	0.0	-61451	0.0	-24220	0.0
Loan (BDT)	6253.4	5599.2	6166.3	654.3	1.0	87.1	1.0	-567.2	1.0
Savings (BDT)	2294.4	2581.7	4871.3	-287.3	1.0	-2576.9	0.2	-2289.6	0.4
Natural capital									
Farm size	62.1	68.9	77.2	-6.7	1.0	-15.1	0.2	-8.4	1.0
Physical C									
Total Physical assets (BDT)	60059.4	64810.4	61914.6	-4751.0	1.0	-1855.3	1.0	2895.7	1.0
Farm productive assets	20977.8	20905.8	22288.3	72.0	1.0	-1310.5	1.0	-1382.5	1.0
Non-farm productive assets	5017.2	2433.3	3483.2	2583.9	0.2	1534.0	1.0	-1049.9	1.0

Source: TIGA Bangladesh Baseline Survey 2013

Table 8 Poor small holders' pattern of income from different sources (N=313) as of US$ classification (BDT)

Variables	Ultra poor (N=206	Medial Poor (60)	Subjacent poor(47)	1 vs 2		1vs 3		2 vs 3	
		BDT		Diff	P-value	Diff	P-value	Diff	P-value
Farm income	13635.1	26916.8	27196.3	-13281	0	-13561	0	-279	1
Cereals	9439.3	18286.1	16758.4	-8846.7	0	-7319.0	0	1527.6	1
Non-cereal crops	1885.8	3447.1	5255.9	-1561.1	0.51	-3370	0.02	-1808.8	0.7
Non-crop farming	2309.7	5183.5	5181.9	-2873.8	0.24	-2872.1	0.33	1.6	1
Non-farm income	27065	51014	74956	-23949	0	-47890	0	-23941	0
Business	2094.66	1833.33	11085.11	261.33	1	-8990.45	0	-9251.7	0
Home based non-farm activities	7.1	19.1	42.5	-12.0	1	-35.4	0.3	-23.3	1

Source: TIGA Bangladesh Baseline Survey 2013

Table 9 Segmentation of the poor SHs in marginal sub-districts in Bangladesh 2012-13 (N=313): Results of cluster analysis

Clusters	Freq. (%)	Characteristics	Strategic options
1	36 (11.5)	Farm size medium, CI low, moderate ownership of land, everybody sales their produces, non-land physical assets and household durables high, cereals income medium, Other crops income high, business and day laborers income medium, savings low, cereals' technology adoption low, access to the cereals' inputs/markets low	Non-cereal crops and day laboring
2	107 (34.2)	Zero ownership to the land but farm size high (good access to the tenancy market), CI low, about 75% sales theirs produces, non-land physical assets low and household durables are medium, cereals income high, other crops income moderate, no business income but day laborers income high, savings medium, cereals' technology adoption medium, access to the cereals' inputs/markets medium	Both cereal and non-cereal crops and day laboring
3	98 (31.3)	Farm size high, CI high, high ownership to the land, almost everybody sales their produces, non-land physical assets and household durables high, cereals income high, other crops, business and day laborers income medium, savings low, cereals' technology adoption high, access to the cereals' inputs/markets high	Cereal crops
4	33 (10.5)	Farm size low, CI low, low ownership to the land, about 23% sales their produces, non-land physical assets and household durables low, crop incomes low, business income moderate but day laborers income high, savings low, cereals' technology adoption medium, access to the cereals' inputs medium but output market low	Day laboring, business
5	39 (12.5)	Farm size medium, CI medium, low ownership to the land, about 62% sales their produces, non-land physical assets and household durables medium, cereals incomes medium but other crops income low, business income high but day laborers income low, savings high, cereals' technology adoption medium, access to the cereals' inputs medium but output market medium	Business and cereal crops
Total	313		

Table 10 Distribution of strategic options for the poor SHs in marginal sub-districts in Bangladesh (N=313)

Strategic options	Upazila					All
	Damurhuda	Rajibpur	Dowarabazar	Porsha	Vhandaria	
			(Percentage)			%
SO1: Non-cereal crops and day laboring	6.2	37.2	2.86	7.81	2.33	11.5
SO2: Both cereal and non-cereal crops and day laboring	25	37.2	34.3	29.6	60.4	34.9
SO3: Cereal crops	50.8	10.17	20	40.6	4.65	31.3
SO4: Day laboring, business	4.4	8.47	28.5	9.38	16.28	10.5
SO5: Business and cereal crops	13.3	6.78	14.2	12.5	16.28	12.4
Total	100	100	100	100	100	100

Source: TIGA Bangladesh Baseline Survey 2013

Table 11 Suggested technology innovations for marginal areas in Bangladesh

Theme	All locations	Rajibpur	Dowarabazar	Porsha	Damurhuda	Bhandaria
Intensive crop system technologies		Maize+chili, Chili+vegetable,		Wheat/rice+orchard	Maize+chili+vegetable, maize+ sugarcane+chili	Group based fish + poultry + vegetable farming
Seed Technology	Hybrid and short duration rice varieties, quality seeds	Hybrid maize and stress tolerant wheat varieties	Quality seed esp for Flash flood tolerant rice varieties	Maize and stress tolerant wheat varieties through shifting from *Boro* rice. aman rice (Drought tolerant short duration)	Maize and hybrid vegetables	Hybrid rice varieties, saline resistant rice varieties, sun flower, hybrid vegetable seeds
Technology related with water management and irrigation	Water management/saving practice	Improved *fita* pipe	STW, LLP, rubber dam	Pond digging or re-excavation	STW, AWD	Low lift pump, STW, rubber dam
Mechanical Innovations	Power tiller, power tiller operated seeder, thresher	Power tiller, thresher	Power tiller, thresher, rice miller	Power tiller, thresher, rice miller	Handy USG (Guti urea) applicator, power tiller, power tiller operated seeder, thresher	Power tiller (rental cost is high for cultivation), handy USG (Guti urea) applicator, power tiller, power tiller operated seeder, thresher
Non-crop innovations (non-crop farming, non-farm enterprise/business, migration)	Business/enterprise: seasonal crop(to sell surplus at reasonable price thereby instigating others), livestock and poultry rearing, seed business (distribution channel and awareness building), extension service	Business/enterprise: seasonal crop, livestock and poultry rearing, fishing, boat, rice milling; seed business	-Extension service -Seed distribution channel with awareness building -Seasonal crop business (say, creating forward linkage for duck/fish/crop sto sell surplus)	Business/enterprise: Mango cultivation/orchard, water harvesting/mini-pond digging/re-excavation;	Business/enterprise: seasonal crop/vegetables business, beef fattening, poultry, small scale fruit gardening, goat farming, power tiller and threshing service; agro-machineries,	-Extension service (to make people aware of potentials in the area) -Commercial enterprises for sunflower production with backward and forward linkage -Business for seasonal vegetables, -Fishing + poultry, livestock and poultry, agro-machineries

Source: TIGA Bangladesh qualitative survey 2013

Table 12 Availability, Use, and Willingness to Pay for Extension Services

Items			Awareness and motivation building for increasing agricultural intensification	crop related agricultural production	Suggestions on agriculture related business/institutions management and maintaining liaison with related persons
Availability of extension services in study area	All Sample	Response	313	313	313
		Yes (%)	54(17)	53(17)	3(.95)
	Rajibpur	Response	59	59	59
		Yes (%)	4(7)	1(2)	0
	Dowarabazar	Response	35	35	35
		Yes (%)	0	0	0
	Porsha	Response	64	64	64
		Yes (%)	18(28)	13(20)	1(2)
	Damurhuda	Response	112	112	112
		Yes (%)	10(9)	19(17)	2(1)
	Vandaria	Response	43	43	43
		Yes (%)	22(51)	20(46)	0
Use of extension services with in twelve month (2012-2013)	All Sample	Response	54	53	3
		Yes (%)	25(46)	24(45)	1(33)
	Rajibpur	Response	4	1	0
		Yes (%)	3(75)	0	0
	Dowarabazar	Response	0	0	0
		Yes (%)	0	0	0
	Porsha	Response	18	13	1
		Yes (%)	1(6)	2(15)	0
	Damurhuda	Response	10	19	2
		Yes (%)	8(80)	13(68)	1(50)
	Vandaria	Response	22	0	0
		Yes (%)	13(59)	0	0
Agree to pay for similar extension services in future	All Sample	Response	313	313	313
		Yes (%)	231(74)	212(68)	124(40)
	Rajibpur	Response	59	59	59
		Yes (%)	58(98)	54(92)	47(77)
	Dowarabazar	Response	35	35	35
		Yes (%)	34(97)	27(77)	20(57)
	Porsha	Response	64	64	64
		Yes (%)	53(83)	53(83)	31(48)
	Damurhuda	Response	112	112	112
		Yes (%)	52(46)	48(43)	20(18)
	Vandaria	Response	43	43	43
		Yes (%)	34(79)	30(70)	6(14)

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Table 13Logit Regression Analysis of Willingness to Pay for Agricultural Extension Services

VARIABLES	*Awareness and motivation building for increasing agricultural intensification*		*crop related agricultural production*		*Suggestions on agriculture related business/institutions management and maintaining liaison with related persons*	
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Household head age	-0.00934	-0.0200	-0.00815	-0.0175	-0.0189	-0.0121
Year of schooling HH	0.175**	0.115	-0.0162	-0.0597	-0.0404	-0.0411
HH head's gender	-2.307*	-1.853	-0.464	-0.0343	-0.442	0.0753
HH's year of residence	-0.0106**	0.00534	-0.00405	0.00583	-0.0114***	-0.00158
Year of Ag. production	0.00131	0.00122	-0.00521	-0.00285	0.0228	0.0170
Land (decimal)	0.576	0.850*	0.0364	0.302	0.0395	0.0284
Land from others	0.661	1.075**	-0.00893	0.465	0.409	0.693
HH business	0.293	0.415	0.481	0.615	0.181	0.270
Ultra-poor household	0.808	0.802	0.438	0.364	-0.282	-0.208
Marginal poor HH	0.152	0.416	-0.0745	0.0240	-0.378	-0.269
HH total income	3.59e-06	6.04e-07	-2.64e-06	-3.48e-06	-1.17e-06	5.39e-07
HH farm size	0.0125***	0.00997**	0.00433	0.00226	0.00656**	0.00673*
Agro production asset	-4.94e-06	-1.11e-06	-3.33e-07	5.76e-07	-7.54e-06	-6.03e-06
Non ag. prod asset	-1.60e-05	-2.14e-05	8.97e-06	9.46e-06	2.09e-05	2.44e-05
dum2	-0.0828	0.139	0.162	0.364	-0.236	0.0630
dum3	0.630	0.775	-0.0289	0.126	0.0258	0.486
Managed good seed	-1.452***	-0.605	-1.170**	-0.407	-1.950***	-0.945**
Got fare price	-1.149***	-0.631	-0.765**	-0.553	-0.803***	-0.666*
NGO membership	0.152	0.459	0.119	0.346	-0.346	-0.158
Savings	0.739*	0.552	0.801**	0.487	0.194	0.165
Sanitary latrine	-0.166	-0.230	-0.0961	-0.181	-0.0764	-0.0870
Electricity	-0.529	-0.173	-0.457	-0.106	-0.452	-0.192
Migration of HH	-	-	0.573	1.018	0.175	0.210
Wage employment	0.122	0.284	0.295	0.373	-0.492	-0.489
Lone	-0.681	-0.666	-0.673*	-0.756*	-0.565	-0.455
Managed irrigation	-0.381	-0.211	-0.698**	-0.893*	0.216	-0.487
dum_rajibpur		4.026***		2.303***		1.890***
dum_dowarabazar		3.395***		1.281**		0.788

VARIABLES	*Awareness and motivation building for increasing agricultural intensification*		*crop related agricultural production*		*Suggestions on agriculture related business/institutions management and maintaining liaison with related persons*	
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
dum_porsha		1.741***		2.066***		1.395***
dum_vandaria		1.087		0.628		-1.275*
Constant	4.667***	0.456	3.519**	0.617	3.750**	0.430
Observations	313	313	313	313	313	313

Note: With ***, **, * corresponding to significance levels of 0.001, 0.05, 0.01 respectivel