Bangladesh Rice Value Chain Analysis and Recommendations

July 2013
Executive Summary (1/3)

- To achieve self-sufficiency in rice by 2025, Bangladesh must produce an additional 9 million MT of rice per year. This requires nationwide improvement in yields of 2.4% CAGR (36% increase by 2025):
  - Expected population growth requires 5.3 million MT more rice
  - Latent demand for rice from country’s undernourished requires 3.7 million MT more rice
  - Environmental and ecological factors likely to reduce the size of available arable land by more than 10% by 2025
  - Yields must increase from approx 3 MT / ha to 4 MT / ha (milled rice)
  - Prior improvements that have driven growth (high yielding seeds and irrigation expansion) are reaching potential requiring new interventions to maintain growth

- Rice is one of the important industries and the predominant agricultural crop in Bangladesh:
  - 85% of gross cropped area is dedicated to rice
  - 66 million people (43% of population) are involved in agriculture – all of whom plant rice in at least one season (often two)
  - Rice contributes 8-10% of Bangladesh’s GDP
  - Estimated 11% of annual budget (123 billion BDT or 1.6 billion USD) supports rice production

- There is a strong demand for rice throughout Bangladesh, with a discernible shift towards better quality rice in the last 10-15 years:
  - Rice represents 63% and 71% of the average daily calorie intake for urban and rural populations respectively
  - As of 2009, medium grade rice has the largest market share (40%) followed by coarse rice (lowest quality, 32%) and fine rice (highest quality – 28%). The fastest growing market is fine rice with market share increasing by 5% CAGR, and its price premium over coarse rice has risen from 25% to 40% since 1999
  - Increased supply of finer, better quality is rice driven by the rise of an auto-milling industry which exhibits greater quality control – any intervention targeting quality improvements to increase farmer income should involve auto-millers

- Rice producers can be segmented into three broad categories:
  - Stressed area farmers (5M households, 8400 BDT or 107 USD / ha / season income, 1-3 MT rice / ha / season yield, ~0.5ha landholding) are farmers in zones affected by flood, drought, cold or salinity, produce low yields and account for 30% of rice production
  - Surplus farmers (7M households, 17700 BDT or 224 USD / ha / season income, 3-5MT rice / ha / season yield, ~0.8ha landholding) are in relatively favorable conditions, producing crops for consumption as well as commercial sale, have greater production due to higher cropping intensity (1.9 crops per year) accounting for 60% of rice production
  - Aromatic rice farmers (1M households, 37000 BDT or 468 USD / ha / season, 2.0MT rice / ha / season, ~1.4ha landholding) produce aromatic rice (cash crop) for domestic consumption and export, accounting for 10% of rice production

- For stressed area farmers key constraints are seeds (~20% yield; ~100% income uplift if resolved), agronomic practices (~30% yield, ~110% income uplift if resolved) and infrastructure – land (~30% yield and/or extra cropping season, 150% income uplift if resolved):
  - Seeds: Limited production and distribution of stress-tolerant varieties (primarily at research stage). Farmers continue to use local varieties with low yield because of limited availability of stress tolerant varieties.
  - Agronomic Practices: Farmers continue to practice traditional farming methods with limited information regarding scientific methods of farming, limited information about stress tolerant varieties, limited or no emphasis on soil management degrading land quality
  - Infrastructure (land): Due to salinity, drought and flood, land quality and availability is a critical challenge that is set to worsen
Executive Summary (2/3)

• For surplus farmers key constraints are seeds (~20% yield; 115% income uplift if resolved), mechanization/labor (~5% yield, %150 income uplift if resolved), agronomic practices (~20% yield; 40% income uplift if resolved) and market access (50% income uplift if resolved)
  - Seeds: Quality of seeds supplied by Bangladesh Agriculture Development Corporation (BADC), the dominant HYV supplier (>70% share) is often compromised
  - Mechanization / labor: Limited use of high horsepower machinery and rising cost of labor contributes to high production costs, depressing farmer incomes
  - Agronomic Practices: Injudicious use of fertilizers/pesticides combined with intensive farming, limited information about modern farming practices and limited emphasis on soil quality management contribute to poor agronomic practices
  - Market Access: Farmers in surplus areas are forced to sell their produce immediately after harvest due to lack of physical and financial holding capacity, when prices are relatively low. Farmers have limited bargaining power when negotiating with traders/millers who have storage capacity. Added complexity is competition with cheap PDS rice from India which keeps prices depressed.

• For aromatic farmers key constraints are seeds (25% yield; 50% income uplift if resolved), mechanization/labor (5% yield; 35% income uplift if resolved), agronomic practices (20% yield; 25% income uplift if resolved) and market access (35% income uplift if resolved)
  - Seeds: Typically of low quality due to poor seed management practices, exacerbated by large informal sector which supplies aromatic rice seed
  - Mechanization / labor: Limited use of high horsepower machinery and high cost of labor in these relatively prosperous areas leads to higher cost of production
  - Agronomic Practices: Farmers undertake practices that do not support optimum aroma and fineness of rice, along with injudicious use of inputs and poor cultivation techniques
  - Market Access: While price of aromatic rice is almost 2X-3X the price of non-aromatic rice, farmers only receive 50% of retail price.

• Government spends an estimated 123B taka (1.6B USD) supporting rice production
• Government intervention in value chain limited to inputs. Key policy constraints concern seeds and agronomic practices:
  - Seeds: Government intervention across seed value chain crowds out private sector:
    ▶ Government-run Bangladesh Rice Research Institute (BRRI) is the only body authorized to produce new varieties of seeds –private sector research can only be performed in conjunction with BRRI, and seeds must then be certification by government run Seed Certification Agency (SCA)
    ▶ Private sector has production disadvantage vs. government run, tax payer-subsidized production facilities.
    ▶ High subsidies (~40-50%) on government-provided high-yielding varieties (HYV). Private sector cannot compete on price and has limited incentive to invest and scale up production and distribution, especially to harder-to-reach rural areas.
    ▶ These factors incentivize private sector to sell HYV seeds at foundation stage only resulting in sub-optimal multiplication rate
  - Agronomic Practices: Govt has developed Package of Practices (PoPs) for various agro-climatic conditions but not widely adopted due to limited reach of govt extension system
Based on these constraints, 4 key intervention priorities emerge:

- **Improve the availability and adoption of improved seeds** for all segments;
- **Improve availability and cost of mechanized technology** for surplus and aromatic farmers
- **Enhance market access and increase share of profit pool** for surplus and aromatic farmers
- **Improve agronomic practices** for all segments

These constraints can be addressed via an integrated intervention program focusing on:

**A. Seed use and availability (stressed – 2100 BDT / 27 USD / ha income uplift; surplus – 7300 BDT / 92 USD / ha income uplift):**
- Enhance supply of quality seeds (HYV and hybrid), through large scale commercialization of private sector seeds focusing on:
  - Supporting private sector to increase capacity
  - Supporting methods for private sector to signal quality of product e.g. branded, tamper-proof packaging
  - Exploring options with government to provide HYV seed subsidies to private sector (or directly to farmers)
- Assist private seed companies in providing seed-related extension services to farmers
- Work with BRRI, SCA, BADC and other government agencies/private companies to enhance supply of quality seeds, particularly in stressed areas such as fast tracking the uptake of stress tolerant varieties and examining methods to improve the efficiency and effectiveness of seed certification, multiplication and distribution systems

**B. Mechanization service provider model (surplus – 7700 BDT / 98 USD / ha income uplift; aromatic – 12800 BDT / 161 USD income uplift)**
- Link entrepreneurial farmers to equipment manufacturers and provide them with training, support and access to credit so that they can purchase equipment (focus on tractors, transplanters and harvesters) and rent it out to others
- Support equipment companies to offer mechanization services directly

**C. Contract farming model for market access, agronomic practices and seeds* (surplus – 16300 BDT / 207 USD income uplift; aromatic – 45000 BDT / 573 USD income uplift)**
- Support the establishment of contract farming model between private sector millers/retailers and farmers where farmer agrees to supply paddy to millers in exchange for support and education in proper agronomic practices including appropriate use of fertilizer and pesticides, supply of quality seeds and assistance to improve organic matter content of land

**D. Extension support program to improve agronomic practices (stressed – 6100 BDT / 78 USD income uplift; surplus – 6000 BDT / 75USD income uplift; aromatic – 9700 BDT / 123 USD income uplift)**
- Develop program to improve the agronomic practices of farmers across Bangladesh with focuses on fertilizer use, pesticide use and land regeneration
- Leverage existing projects infrastructure including, robust project management methodology and reach (potential partners include CSISA, STRASA, BRAC or DAE)

If executed effectively, these initiatives could improve yields by 40-50% and raise incomes by ~100-220% for up to 13M farmer households

* Aromatic only
Agenda

Project approach

Supply-demand dynamics

Value chain & constraints

Policy context & challenges

Prioritized interventions
### Approach: A 3-step approach followed

<table>
<thead>
<tr>
<th></th>
<th>November 2012</th>
<th>December 2012</th>
<th>January/February 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key activities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Diagnostic** | • Understand **overall market context**  
  - Supply-demand dynamics  
  - Policy context  
  • **In-depth snapshot** of Bangladesh **rice value chain**  
  - Farmer behaviour and segmentation  
  - Revenue & profit build-ups  
  - Value chain inefficiencies | • Develop **interventions** to address key constraints  
  • **Prioritize interventions** based on impact and ability to implement  
  - Yield and income increase  
  - # farmers impacted  
  - Feasibility | • Test and refine intervention hypotheses with **key stakeholders**  
  - Validate interest and feasibility  
  - Refine based on feedback |
| **Intervention design** | | | |
| **Validation & synthesis** | | | |
| **Key sources (see next slide for detail)** | • Stakeholder/expert interviews  
  • Fieldwork across 3 districts  
  • Secondary research | • Stakeholder/expert interviews | • Revisit key stakeholders |
| **Outcomes** | • **Key constraints** across rice value chain in Bangladesh | • Prioritized set of **interventions**  
  • Preliminary **implementation plan** | • Final, validated set of recommendations |
## Approach: Wide range of stakeholders consulted

### Stakeholder Interviews
- **Government**
  - Additional director, Field Service Wing, Dept of Agricultural Extension
  - Director General, Seed Wing, Ministry of Agriculture,
  - Director General, Bangladesh Rice Research Institute
  - Executive Officer, Bangladesh Fertiliser Association
- **Private sector**
  - Mechanization providers (eg: ACI, Motors Corona)
  - Input providers (Eg: ACI Seed, Lal Teer, Supreme Seeds, Bayer)
  - Retailers (Eg: PRAN)
  - Fertilizer importers (South Bengal Fertiliser mills)
  - Large millers (Rashid Automatic Rice Mills Ltd, Saha Group)
  - Banks (Eastern Bank)
- **NGOs**
  - PKSF, RDRS, BRAC
- **International bodies**
  - Focal point, Agriculture and Natural Resources, ADB
  - Representative for Bangladesh, IRRI

### Fieldwork
- **89 farmers** across three districts
  - Barisal, Dinajpur and Sylhet
- **120+ other value chain players**
  - Traders, millers, wholesalers, retailers
- **Field teams** of various private/NGO players/Department of Extension

### Secondary Sources
- Bangladesh Bureau of Statistics
- World Bank
- Bangladesh Rice Research Institute
- IRRI
- Ministry of Agriculture
- Bangladesh Fertiliser Association
- Ministry of Finance
- Bangladesh Institute of Development Studies
- CSISA
- Academic papers
Agenda

Project approach

Supply-demand dynamics

Value chain & constraints

Policy context & challenges

Prioritized interventions
The Bangladesh rice industry has seen substantial growth over the last 40 years with GoB reporting near self-sufficiency

- Rice production has increased substantially over last 40 years (243% absolute growth, 2.4% CAGR)
- All rice produced is consumed within Bangladesh (ban on exports^)
- Rice imports by govt typically small relative to production
- Reported self-sufficiency rate is typically ~99% except when natural disasters affect production
- Actual self-sufficiency likely lower with estimated ~2 Million MT imported by private sector

Self Sufficiency Rate  98.8% 99.7% 99.5% 92.7%

* Unless otherwise indicated all figures pertaining to rice in this document represent milled rice or milled rice equivalent.
^ Bangladesh occasionally allows a small amount of aromatic rice to be exported depending on food security of country
Self sufficiency rate = Actual rice production / Actual rice consumption. Shortfall in rice production met by imports (~0.6 MT in FY12)
Source: Bangladesh Bureau of Statistics
The main drivers of demand have been population growth and since 1995, increased per capita consumption of food insecure rice.

RICE DEMAND DRIVEN BY POPULATION GROWTH...

95% correlation with rice consumption

... AND GREATER PER CAPITA CONSUMPTION OF FOOD INSECURE

+ 48%

Coincides with significant reductions in poverty* and undernourishment^ suggesting increased per capita demand driven by food insecure

N.B. As of 2012, 40% of Bangladesh remains food insecure despite progress made since 1995**

* % of population below poverty line fell from 50% in 1996 to 32% in 2010; ^ the prevalence of malnourished children under 5 – an indicator of overall food security – fell from 69% in 1995 to 43% in 2007 (more recent data unavailable)


Source: World Bank Data Bank
While rice is an important source of calories for all Bangladeshis, greater urbanization has a slight dampening effect on demand.

### RICE IS THE PRIMARY CALORIE SOURCE – BUT LESS IMPORTANT IN URBAN AREAS

- Rice comprises a very significant proportion of all calories consumed - 63% and 71% of the total daily calorie intake for urban and rural populations respectively.
- Urban per capita rice consumption is 20kg less per year compared to rural per capita rice consumption.
- Lower urban rice consumption is driven by diet diversification with urban population consuming more edible oils, fats, fruit, meat, eggs and fish*

### GREATER URBANIZATION HAS DAMPENED DEMAND GROWTH

*Urban and rural population per capita daily total calorie intake similar (2194 kCal for urban, 2253 kCal for rural)

Rice demand within Bangladesh is expected to continue to grow with additional 9 million MT required by 2025.

~29% DEMAND GROWTH BY 2025

Based on 174kg per capita annual consumption + additional 12% for seed, feed and wastage.

DRIVEN BY POPULATION GROWTH...

- Pop. to grow by ~28M by 2025
- Assuming constant consumption of ~174kg per annum, additional ~5.5M MT of rice will be required by 2025
- However, increasing urbanization likely to reduce this figure by ~0.3 million MT (urban consumption lower than rural)

...AND LATENT DEMAND BEING MET

<table>
<thead>
<tr>
<th>Group</th>
<th>Latent demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely food insecure (26% of population)</td>
<td>~2.9 million MT (assumes additional 600 cal / 150 gm rice per day) + wastage</td>
</tr>
<tr>
<td>Food insecure (14% of population)</td>
<td>~0.8 million MT (assumes additional 200 cal / 75 gm rice per day) + wastage</td>
</tr>
</tbody>
</table>

Note: Latent demand segments are defined as: Extremely food insecure population consumes less than 1,800 kcal per day (less than 75% of the recommended minimum intake); Food insecure farmers consume between 1,800 kcal and 2,400 kcal per day. Feed, Seed and Wastage Value from “Rice Figures Mismatch”, The Daily Star, 21 Jan 2013 Source: World Bank, World Development Indicators Databank;
Consumer preferences in both rural and urban markets are shifting towards finer rice - an indicator of quality in Bangladesh

- While there are many elements that determine quality (such as taste, translucency, broken rice content etc...) “the most widespread distinction [of quality] used in Bangladesh relates to the shape and size of the kernel” Minten et al. (2011)
- Other indicators of quality are either subjective (flavour) or difficult to measure in Bangladesh (e.g. color, brokenness)
- From a price perspective, fine commands a premium over medium, which commands a premium over coarse – suggesting size is an indicator of quality and value
- Beyond grain size*, fine, and to some extent medium rice tend to have superior characteristics such as being unbroken, free from dust, free from bad odours and in the case of fine aromatic rice, possessing a fragrant aroma (due to higher prevalence and better quality control of auto-milling in medium and fine rice - see next slide)
- The increase in market share of quality medium and fine rice reflects a shift in consumer preferences enabled by rising wealth**

* Rice is graded on width of the grain and labelled as Coarse (>2mm), Medium (1.7mm-2mm) and Fine (<1.7mm); ^ data on aromatic rice market share across time and by urban / rural unavailable; **GNI per capita (PPP) doubled from $840 to $1700 between 1999 and 2009
Source: Minten, Murshid and Reardon (2011), “The quiet revolution in agrifood value chains in Asia: The case of increasing quality rice in Bangladesh”, IFPRI Discussion Paper 01141 – figures represent sales share of each quality category of rural on-market wholesalers and urban wholesalers (p7 Table 4.2). They have been combined by weighting each share by relative population size to determine contribution to overall demand
The rise of automatic and semiautomatic milling has contributed to the supply of finer, better quality rice

% Share of auto and semi-auto millers in rice market by quality – comparison between 1999 and 2009

• Since 1999, automatic and semiautomatic milling in general, has increased across Bangladesh at the expense of smaller millers

• Evidence suggests that auto and semiautomatic millers are a significant factor in the growing supply of finer, better quality rice:
  - There is a stronger positive correlation between increase in market share of auto / semiauto-millers and fineness of rice
  - Auto and semi-auto millers have better facilities compared to small, traditional mills and as such are more likely to produce rice that is unbroken, free from dust, free from bad odours
  - Auto and semi-auto-millers are using techniques such as double milling to ‘upgrade’ low / medium paddy to medium / fine rice taking advantage of the premium fine and medium rice command over coarse

Source: Minten, Murshid and Reardon (2011), “The quiet revolution in agrifood value chains in Asia: The case of increasing quality rice in Bangladesh”, IFPRI Discussion Paper 01141; Team analysis
Farmer incomes could be significantly enhanced by producing finer, higher quality rice in cooperation with auto-millers

<table>
<thead>
<tr>
<th>BOTH MEDIUM AND FINE RICE</th>
<th>MAJORİTY OF PREMIUM BYPASSES</th>
<th>FARMER – CAPTURED BY MILLERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMAND PREMIUM OVER COARSE</td>
<td>% Price premium over coarse rice (3 year moving average)</td>
<td>Value of fine rice price premium to each segment (2009)</td>
</tr>
</tbody>
</table>

• While fine prices are significantly greater than coarse, farmers have lowered incentive to produce finer, better quality paddy since they capture only 3.7 BDT / kg (21%) of the price premium

• Millers capture the greatest share of the premium, partially due to value added during milling process (e.g. double milling of medium paddy to fine rice, superior quality control)

• Opportunity for farmers and millers to cooperate to produce finer, better quality rice with mutual benefit to both parties (e.g. miller does not need to double mill, farmer receives greater share of premium)

• There is emerging interest in BR50 – a fine (aromatic) rice variety grown in the Boro season, particularly in south of Bangladesh. Any expansion of aromatic rice will require support to farmers, and the establishment of links to markets.

Source: Minten, Murshid and Reardon (2011), “The quiet revolution in agrifood value chains in Asia: The case of increasing quality rice in Bangladesh”, IFPRI Discussion Paper 01141; Team analysis
There are three rice growing seasons in Bangladesh - 55% of rice is grown in the Boro (winter) season

<table>
<thead>
<tr>
<th>Winter</th>
<th>Summer</th>
<th>Monsoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec</td>
<td>Jan</td>
<td>Feb</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Boro**
- Sowing
- Growth
- Harvest

**Aus**
- Sowing
- Growth
- Harvest

**Aman**
- Harvest

<table>
<thead>
<tr>
<th>BORO</th>
<th>AUS</th>
<th>AMAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>55% of national production</td>
<td>10% of national production</td>
<td>35% of national production</td>
</tr>
<tr>
<td>42% of gross cropped area</td>
<td>9% of gross cropped area</td>
<td>49% of gross cropped area</td>
</tr>
<tr>
<td>Irrigation fed</td>
<td>Partially-irrigation fed</td>
<td>Rain-fed</td>
</tr>
<tr>
<td>Typically grown using high yielding seeds (~95% of all boro) with the remainder, local varieties</td>
<td>Approximately 50:50 split between local and high yielding varieties</td>
<td>Only season that supports aromatic rice</td>
</tr>
</tbody>
</table>

Source: Bangladesh Bureau of Statistics, Team analysis
Bangladesh food security has been significantly enhanced due to HYVs and irrigation expansion driving growth of Boro crop.

- The growth in food production has been due to large increase of Boro crop since 1970.
- This is driven by widespread irrigation improvements which allowed rice to be planted in dry winter months, effectively increasing the amount of arable land.
- The other improvement has been the introduction of High Yielding Varieties (HYV) which has significantly improved yields.

Source: Bangladesh Bureau of Statistics, Team analysis
However, current adverse and worsening environmental situation is constraining supply of land...

• Note: Total cropped area includes double and triple cropping of same patch of land. 1.1% reduction assumed to be proportionally distributed across single, double and triple cropping.
... which could be even worse if climate change effects become significant

<table>
<thead>
<tr>
<th>Top10 Countries Most Vulnerable to Climate Change Floods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bangladesh</td>
</tr>
<tr>
<td>2. China</td>
</tr>
<tr>
<td>3. India</td>
</tr>
<tr>
<td>4. Cambodia</td>
</tr>
<tr>
<td>5. Mozambique</td>
</tr>
<tr>
<td>6. Laos</td>
</tr>
<tr>
<td>7. Pakistan</td>
</tr>
<tr>
<td>8. Sri Lanka</td>
</tr>
<tr>
<td>9. Thailand</td>
</tr>
<tr>
<td>10. Vietnam</td>
</tr>
</tbody>
</table>

**THE COUNTRY MOST VULNERABLE TO CLIMATE CHANGE INDUCED FLOODING**

**RISING RIVER AND SEA LEVELS COULD IMPACT 4-9* MILLION HA**

<table>
<thead>
<tr>
<th>Flood Prone Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity of blue indicates flood vulnerability</td>
</tr>
</tbody>
</table>

“Increasing glacial melt from the Himalayan ranges as a result of rising global temperatures is set to swell the Ganges and Brahmaputra rivers and their hundreds of tributaries, flooding 30-70 percent of the country each year as the water makes its way to the Bay of Bengal in the south, where the coast is also vulnerable to flooding from rising sea levels”

IRIN – Twelve Countries on Climate Change Hit List, 2009

- Note: *Based on assumption that floods impact 30-70% of entire country
- IRIN – Twelve Countries on Climate Change Hit List
Rice yields will need to increase by 36% (2.4% CAGR) to ~4 MT/ha to meet demand

- 36% productivity improvement required from 2012 to 2025
- This translates to 2.4% CAGR yield improvement
- This is similar to the long run yield improvement of Bangladesh rice production (~2.6% CAGR since 1972)
- Improvements that have supported growth in production are reaching potential and experiencing diminishing marginal returns – e.g. introduction of extant high-yielding seeds, increased irrigation.
- Continued innovation and improvements required to sustain growth over next ~12 years

Note: Demand projections based on annual per capita intake of rice of 180 (160) kg for rural (urban); population growth 1.3% p.a. and
Increase in average yield will require wide-reaching interventions that could impact 43% of the population.

| 43% OF POPULATION ARE INVOLVED IN AGRICULTURE | ALL FARMERS GROW RICE IN AT LEAST ONE OF THE THREE SEASONS EACH YEAR |

• Note: Rice cropping patterns represent planting patterns across 3 seasons; Labels do not imply order, e.g. Rice-Other could be a rice crop followed by a vegetable crop or vice-versa.
Due to the ubiquity of rice production, any interventions would have a significant impact on poverty reduction.

**ONE OF THE HIGHEST POVERTY LEVELS IN ASIA**

% of Population below respective national poverty line

<table>
<thead>
<tr>
<th>Country</th>
<th>% of Population</th>
<th>Poverty Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myanmar</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Cambodia</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Laos</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Nepal</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Bhutan</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**RICE IS THE PRIMARY PRODUCE OF FARMING HOUSEHOLDS IN BANGLADESH**

Bangladesh Gross Cropped Area by crop (2005-06, Million ha)

Note: Poverty Line is separately determined by each nation and as such, denotes what is considered poverty for a given country’s specific circumstances. Strict absolute wealth comparisons across nations are not possible.

Source: World Bank, Data Bank; Cropping area by crop from Ministry of Agriculture
Agenda

Project approach

Supply-demand dynamics

Value chain & constraints

Policy context & challenges

Prioritized interventions
Rice producers can be categorized into 3 segments: Stressed, Surplus and Aromatic - stressed area farmers much worse off

<table>
<thead>
<tr>
<th></th>
<th>STRESSED</th>
<th>SURPLUS</th>
<th>AROMATIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yield</strong></td>
<td>• 1-3 MT per Ha*</td>
<td>• 3-4 MT per Ha*</td>
<td>• ~2 MT/ha* (local, aromatic rice variety)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• 3-4 MT/ha* (HYV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cropping system</strong></td>
<td>• Often only one crop, Boro, can be planted though in NW can be affected by cold. Flooding, and drought affects Aman planting</td>
<td>• Two crops planted annually</td>
<td>• 1 aromatic crop in aman season (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• 1 non-aromatic crop in boro season</td>
</tr>
<tr>
<td><strong>Subsistence vs. commercial</strong></td>
<td>• Largely subsistence</td>
<td>• Largely commercial</td>
<td>• Commercial (both cropping seasons)</td>
</tr>
<tr>
<td><strong>Price of paddy</strong></td>
<td>• ~BDT15/Kg (HYV)</td>
<td>• ~BDT15/Kg (HYV)</td>
<td>• ~BDT 30/Kg for Aromatic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ~BDT 15/Kg for HYV</td>
</tr>
<tr>
<td><strong>Value chain linkages</strong></td>
<td>• Weak forward linkages due to limited marketable surplus</td>
<td>• Moderate forward linkages due to a large number of mills though automatic mills percentage is not high</td>
<td>• Strong forward linkages due to large, modern milling industry in area</td>
</tr>
<tr>
<td></td>
<td>• Backward linkages low due to reuse of seeds (local variety) and low inputs used</td>
<td>• Use of quality inputs, certified seeds moderate</td>
<td>• Use of quality input (input requirement is low due to use of local variety)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Seed market unorganized due to use of local variety</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td>• Poor. Weak road linkage and power facilities</td>
<td>• Moderate. Roads moderate and power facilities poor</td>
<td>• High. Good road linkage and moderate power facilities</td>
</tr>
<tr>
<td><strong>Geographical constraints</strong></td>
<td>• Yield and cropping intensity limited by soil quality and climatic conditions</td>
<td>• Covers most of Bangladesh</td>
<td>• Can only be grown in certain highland areas in the North West of country</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Has small amounts of stress</td>
<td></td>
</tr>
<tr>
<td><strong>% of rice produced</strong></td>
<td>• ~30%</td>
<td>• ~60%</td>
<td>• ~10%</td>
</tr>
</tbody>
</table>

*Milled Rice Yield not Paddy Source: Team analysis
(1) BRRI has also developed an aromatic rice variety, BR50, that grows in the boro season – current uptake is small but increasing
Stressed rice farmers are typically in areas near sea and rivers, Aromatic farmers in north-west with the rest as Surplus farmers

- **Stressed Rice Farmers**: predominant in areas with any climatic stress such as flooding, drought, cold or salinity which decreases yield and/or cropping intensity*
- **Surplus Farmers**: have high HYV usage with high cropping intensity (average of ~1.9). Boro (winter) crop is planted along with the Aman (monsoon) crop
- **Aromatic Farmers**: produce high value aromatic rice in the Aman season

*Ratio between gross cropped area and net sown area (1.0 = land is planted with one crop in the year)

Note: Segmentation done from a point of view of intervention priority. For example, while “Aromatic” areas have both Surplus as well as Aromatic farmers, Aromatic based interventions should be the focus in these areas

Source: IRRI, Primary interviews; Team analysis

Note: 1) Districts do not solely contain only one type of farmer. 2) Districts in NW also prone to cold stress
The common constraints are seeds and agronomic practices – other constraints are particular to a given rice segment

### Summary of Value Chain Constraints

<table>
<thead>
<tr>
<th></th>
<th>Seeds</th>
<th>Agronomic practices</th>
<th>Mechanization / labor</th>
<th>Market access</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stressed</strong></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>*</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Surplus</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Aromatic</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Other areas of value chain analysed include:

- Fertilizer
- Pesticide
- Irrigation
- Access to Credit
- Post-harvest practices
- Milling

See individual segment chapters for detail

- **Seeds** – constraints are unique to each segment though can be broadly characterized by lack of quality and / or appropriateness of seed variety depressing potential yields

- **Agronomic Practices** – agronomic practices are sub-optimal across country with farmers practicing traditional farming methods with lower yields combined with injudicious use of inputs which does not support long term sustainability of soil - particularly problematic in stressed areas

- **Mechanization / labor** – while mechanization rate in Bangladesh is high it is geared towards low horsepower machinery (power-tillers). Labor costs are high and increasing – significant potential to improve farmer net income by increasing tractor and harvester use

- **Market Access** – Complex market access environment characterized by lack of financial and physical holding capacity which forces farmers to sell at harvest time, depressing farm-gate prices

- **Infrastructure** – land quality, characterized by low organic matter content, is very poor in stressed areas, arising from floods, drought and salinity - results in poor yields

*While not a priority constraint currently, market access could be a foreseeable issue within stressed areas given current lack of large scale commercial milling capacity. However, the milling industry in Bangladesh is dynamic and responsive enough to fill the gap as stressed area farmers develop marketable surplus*
Agenda

Project approach

Supply-demand dynamics

**Value chain & constraints**

- Stressed farmers
- Surplus farmers
- Aromatic farmers

Policy context & challenges

Prioritized interventions
Average stressed area farmer earns USD 106 per hectare representing a margin of 13.9%

**Stressed Farmers**

Avg. yield: ~2.5* per ha (milled rice)
Avg. land holding: 0.49 ha

Would increase to 58.3 USD without diesel subsidy

Represents ~13.9% margin

Figures taken via field interviews with stressed area farmers in Barisal district. N=13. Labor costs are calculated as simple average between our analysis and estimated labor costs from boro season in USAID, “The Status of Food Security in the Feed the Future Zone and Other Regions of Bangladesh”, April 2013 Analysis assumes all rice sold. Does not include opportunity cost of family labor. Taken an exchange rate of 78.9877 BDT to 1 USD (2012 average exchange rate) *Yield figure from field visits (3.2MT/ha) adjusted downwards to account for bias from small sample size. Source: Team analysis, field interviews
For these farmers, key constraints are seeds, agronomic practices and infrastructure

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Severity</th>
<th>Issues</th>
<th>Est. yield impact if resolved</th>
<th>Est. income impact if resolved^</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeds</td>
<td></td>
<td>• Limited production and distribution of stress-tolerant varieties (mainly at research stage).</td>
<td>~20%</td>
<td>~100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Farmers continue to use local varieties with low yield because of limited availability of stress tolerant varieties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertilizer</td>
<td></td>
<td>• Government has stabilized supply and is looking to correct usage imbalances (has reduced price differential between urea and non-urea)</td>
<td>~10%</td>
<td>~30%</td>
</tr>
<tr>
<td>Pesticides/ herbicides</td>
<td></td>
<td>• Government involvement is limited with minimal monitoring of quality</td>
<td>~5%</td>
<td>~20%</td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td>• Government provides subsidies on diesel for irrigation – risk that farm economics would deteriorate if subsidies removed</td>
<td>~12.5%</td>
<td>~120%</td>
</tr>
<tr>
<td>Access to credit</td>
<td></td>
<td>• Majority of farmers do not use loans for inputs (farmer access to credit is limited in BD)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Access to credit not preventing farmers from improving practices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agronomic practices</td>
<td></td>
<td>• Farmers continue to practice traditional farming methods with limited information regarding scientific methods of farming, limited information about stress tolerant varieties, limited or no emphasis on soil management degrading land quality</td>
<td>~30%</td>
<td>~110%</td>
</tr>
<tr>
<td>Mechanisation/ labor</td>
<td></td>
<td>• Limited mechanization and rising labor costs impacting farmer incomes;</td>
<td>~5%</td>
<td>~20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Stressed farmers typically have small land sizes so problem is less acute than for surplus and aromatic farmers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-harvest</td>
<td></td>
<td>• Lack of proper storage facilities at farm level leads to wastage and reduction in quality</td>
<td>~5%</td>
<td>~5%</td>
</tr>
<tr>
<td>Market access</td>
<td></td>
<td>• Farmers are primarily subsistence and consume most of their produce</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Milling</td>
<td></td>
<td>• Sufficient milling capacity in stressed areas</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Infrastructure</td>
<td></td>
<td>• Due to salinity, cold, flood and drought, land quality and availability is a critical challenge for farmers that is set to worsen</td>
<td>~30%*</td>
<td>~150%</td>
</tr>
</tbody>
</table>

^Some farmers who could plant another her crop due to improved agronomic practices and seed availability will increase production by >100% ^from rice farming. Source: Team analysis
These have high impact and are relatively easy to address, except land quality.

Difficult to address fully but has significant long term impact on income across a large section of farmers who are most in need.

Priorities

Source: Team analysis
### Seeds: Negligible production of stress-tolerant varieties in Bangladesh

**KEY ISSUES ARE SEED AVAILABILITY AND APPROPRIATENESS OF VARIETIES GROWN**

<table>
<thead>
<tr>
<th>Issues</th>
<th>Severity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Not an issue</td>
<td>While some stress-tolerant seeds have reached farmers, supply has yet to meet demand due to low commercial production and distribution.</td>
</tr>
<tr>
<td>Affordability</td>
<td>Not an issue</td>
<td>Availability of quality seed is also an issue — farmers often face adulterated seed, mixed varieties or diseased product.</td>
</tr>
<tr>
<td>Awareness</td>
<td>Not an issue</td>
<td><strong>Subsidized seed distribution</strong> (subsidy of ~40%) by the BADC ensures that seeds, when available would be affordable.</td>
</tr>
<tr>
<td>Appropriateness</td>
<td>Not an issue</td>
<td>Information/exposure regarding performance of stress tolerant varieties. Handling of seeds is an issue as some farmers fail to ensure quality seeds for next crop.</td>
</tr>
</tbody>
</table>

- **Issues**

  - **Availability**
  - **Affordability**
  - **Awareness**
  - **Appropriateness**

- **Severity**

  - Not an issue
  - Sig. issue

### SEED NON-AVAILABILITY LEADS TO A DRASTIC DROP IN YIELDS FOR FARMERS

- **Description**

  - There are **number of varieties for various types of stress**
    - **Salinity**: BRRI 47, 52, 53, 61, 62
    - **Drought**: BRRI 56, 57, 33, 42, 43
    - **Flood**: BRRI dhan 51, BRRI dhan 52
    - **Cold**: Currently under research with South Korean partnership
  - However, varieties exist largely at the research stage, with demand greater than supply
  - There is **limited commercial production and distribution** of these stress-tolerant varieties

**Limited efforts on adoption/distribution of stress-tolerant varieties forces farmers to grow low-yielding local varieties and prevents them from utilising all rice growing seasons**

Source: Primary interviews; Team analysis; BRRI
Agronomic Practices: Outdated agronomic practices impacting soil quality

BANGLADESHI FARMERS HAVE POOR AGRONOMIC PRACTICES

- Agronomic practices are outdated as farmers still practice traditional farming methods
  - Basic practices such as line planting and spraying pesticide away from the wind are largely unknown
  - Limited use of most appropriate, stress-tolerant varieties of seed
  - Improper understanding of how to best apply fertilizer, pesticide and herbicide leading to over and under use of recommended inputs
  - Limited emphasis on soil management techniques perpetuating already challenging environmental conditions
  - Lack of knowledge about seedbed preparation including timely planting of healthy seedlings

“Organic matter (OM) status of Bangladesh soil is one of the lowest in the world. The average OM content of Bangladesh soils is less than 1%, ranging between 0.05 and 0.9% in most cases.”

National Encyclopedia of Bangladesh^

EXACERBATED BY LACK OF GOVERNMENT EXTENSION SERVICES

“The government tells us nothing about pesticides. We know what to put because the shopkeeper tells us and from what we see other farmers doing”

Badal Das, rice farmer, Barisal

Note: * Government has recently corrected over-subsidization of urea to promote balanced use of fertilizer.
Source: Bangladesh Fertiliser Association; Primary interviews; Team analysis ^available at Banglapedia.org
Infrastructure: Land quality poor and set to decline further

LAND QUALITY UNDER SEVERE STRESS DUE TO VARIOUS FACTORS

SITUATION TO DETERIORATE FURTHER IN THE COMING YEARS

- Flood, drought and salinity are already taking a huge toll on soil quality
- Climatic factors are expected to make the situation worse in the near future.

Bangladesh is categorized as the world’s most vulnerable nation to climate change by the World Bank

- Salinity:
  - Both water and soil salinity along the coast will be increased with the rise in sea level, destroying normal characteristics of coastal soil and water
  - A World Bank study suggests that increased salinity alone from a 0.3 metre sea level rise will cause a net reduction of 0.5 million metric tons of rice production

- Flooding/drought: Damming rivers in India and deforestation in Nepal and changing rainfall patterns as a result of climate change have made floods as well as droughts more frequent

Note: There is overlap between flood, drought and saline affected areas. Flood Affected includes severe as well as moderate flooding
Agenda

Project approach

Supply-demand dynamics

Value chain & constraints
  Stressed farmers
  **Surplus farmers**
  Aromatic farmers

Policy context & challenges

Prioritized interventions
Surplus farmers make ~USD 224 per hectare with labor representing the largest cost component

**Surplus Farmers**
- Avg. yield: ~3.9T per ha (milled rice)
- Avg. land holding: 0.78 ha

\[ \text{Repre} \text{s} \text{en} \sim 24.8\% \text{ margin} \]

The difference between stressed and surplus farmgate prices per Ha is due to yield variations NOT price

Would increase to 58.3 USD without diesel subsidy

Note: Figures taken via field interviews with surplus farmers in Sylhet district. N=15 except for labor costs. Labor costs are calculated as simple average between our analysis and estimated labor costs from boro season in USAID, “The Status of Food Security in the Feed the Future Zone and Other Regions of Bangladesh”, April 2013. Analysis assumes all rice sold. Does not take into account opportunity cost of family labor. Taken an exchange rate of 78.9877 BDT to 1 USD (2012 average exchange rate)

Source: Team analysis, field interviews
For these farmers, key constraints are seeds, agronomic practices, mechanization and market access

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Severity</th>
<th>Issues</th>
<th>Est. yield impact if resolved</th>
<th>Est. income impact if resolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeds</td>
<td>1a</td>
<td>• Quality of seeds supplied by BADC, the dominant HYV supplier (&gt;70% share) is often sub-standard</td>
<td>~20%</td>
<td>~115%</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>1b</td>
<td>• Government has stabilized supply and is looking to correct usage imbalances (has reduced price differential between urea and non-urea)</td>
<td>~5%</td>
<td>~30%</td>
</tr>
<tr>
<td>Pesticides/herbicides</td>
<td>1c</td>
<td>• Government involvement is limited with minimal monitoring of quality</td>
<td>~5%</td>
<td>~40%</td>
</tr>
<tr>
<td>Irrigation</td>
<td>1d</td>
<td>• Irrigation coverage is reasonably good in this area, though the cost of subsidization of diesel for irrigation pumps is large</td>
<td>~5%</td>
<td>~35%</td>
</tr>
</tbody>
</table>
| Access to credit    | 1e       | • Farmers do not need to take out large loans for paddy cultivation (sometimes only for mechanization)  
                          • Adequate access to credit via government, private and microfinance institutions | n/a                          | n/a                           |
| Agronomic practices | 2a       | • Injudicious use of fertilizers/pesticides combined with intensive farming, limited information about modern farming practices and limited emphasis on soil quality management | ~20%                         | ~40%                          |
| Mechanisation/labor | 2b       | • Limited use of high horsepower machinery and rising cost of labor contribute to high production costs | ~5%                          | ~150%                         |
| Post-harvest        | 3        | • Lack of proper storage facilities at farm level leads to wastage and reduction in quality, | ~5%                          | ~5%                           |
| Market access       | 4        | • Farmers in surplus areas are forced to sell their produce immediately after harvest due to lack of financial and physical storing capacity. Added complexity is competition with cheap PDS rice from India which keeps prices depressed.  
                          • Farmers have limited bargaining power when negotiating with traders/millers who have storage capacity | n/a                          | ~50%                          |
| Milling             | 5        | • Milling is a dynamic segment with significant investments in this area and replacement of traditional mills with automated mills increasing | n/a                          | n/a                           |
| Infrastructure      | 6        | • Relatively better roads and power in surplus rice growing areas                            | n/a                          | n/a                           |

Source: Team analysis
These four constraints have significant income impact and relatively high addressability, particularly seeds + mechanization

Source: Primary interviews; Team analysis
**Seeds: BADC seed quality is an issue; government subsidies crowd out private players**

### LOW SEED QUALITY AND POOR SEED MANAGEMENT MAIN ISSUES

<table>
<thead>
<tr>
<th>Issues</th>
<th>Severity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td><img src="https://via.placeholder.com/15" alt="Not an issue" /></td>
<td>BADC has a vast network but quality supply is often limited, gap between demand and supply</td>
</tr>
<tr>
<td>Affordability</td>
<td><img src="https://via.placeholder.com/15" alt="Not an issue" /></td>
<td>Subsidized seed distribution by the BADC ensures that low price seeds available</td>
</tr>
<tr>
<td>Awareness</td>
<td><img src="https://via.placeholder.com/15" alt="Not an issue" /></td>
<td>Farmers have low awareness with respect to handling and storing seeds</td>
</tr>
<tr>
<td>Appropriateness</td>
<td><img src="https://via.placeholder.com/15" alt="Not an issue" /></td>
<td>BADC is supplying appropriate varieties</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Issues</th>
<th>Severity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td><img src="https://via.placeholder.com/15" alt="Not an issue" /></td>
<td>BADC has a vast network but quality supply is often limited, gap between demand and supply</td>
</tr>
<tr>
<td>Affordability</td>
<td><img src="https://via.placeholder.com/15" alt="Not an issue" /></td>
<td>Subsidized seed distribution by the BADC ensures that low price seeds available</td>
</tr>
<tr>
<td>Awareness</td>
<td><img src="https://via.placeholder.com/15" alt="Not an issue" /></td>
<td>Farmers have low awareness with respect to handling and storing seeds</td>
</tr>
<tr>
<td>Appropriateness</td>
<td><img src="https://via.placeholder.com/15" alt="Not an issue" /></td>
<td>BADC is supplying appropriate varieties</td>
</tr>
</tbody>
</table>

### ORGANIZED PRIV. SECTOR PRODUCES BETTER SEEDS BUT OUTPRICED BY GOVT.

- BADC seeds dominate the HYV space as a result of its low prices (BDT 35/kg versus BDT ~50-70/kg for private players)
- Seed quality is an issue
  - Quality control in BADC’s supply chain needs to be tightened
- Selected private players produce seeds of higher quality but due to subsidies, the BADC prices organized private players out of the market
- Farmers often reuse seeds (low replacement rate)
  - This leads to a fall in seed quality as seed management practises are poor
- Private companies play a major role in Hybrid seeds
  - BADC has almost no role in this sector currently
  - Evidence that seed companies willing to fill gaps in market where government intervention is low

---

**Note:** Organized private sector refers to medium to large scale commercial entities as opposed to small, community-based seed growers

Source: Primary interviews; Team analysis
Agronomic Practices: Improper of use of inputs, intensive farming practices the biggest concern amongst surplus farmers

SURPLUS FARMERS USE INPUTS INAPPROPRIATELY

- **Intensive farming practices**, exacerbated by high cropping intensity, leads to poor soil quality
  - Unbalanced fertilizer use driven by heavy subsidy of urea relative to other fertilizers (e.g. P and K) leads to long term soil damage and lower yields*
  - **Pesticide overuse is an issue** as well especially in the Boro crop - according to a recent survey of 820 Boro (winter rice) growers more than 47% of farmers in Bangladesh use more pesticides than needed
  - Long term soil management techniques rarely applied by surplus farmers

AGRONOMIC PRACTICES PERPETUATING POOR SOIL CONDITIONS

“Organic matter (OM) status of Bangladesh soil is one of the lowest in the world. The average OM content of Bangladesh soils is less than 1%, ranging between 0.05 and 0.9% in most cases.”

National Encyclopedia of Bangladesh^ ^

EXACERBATED BY INEFFECTIVE GOVERNMENT EXTENSION SERVICES

“Some areas of the opportunities for improvement that we have identified (include):

- **Inadequate commitment and effort on the part of the DAE management committee member necessary for fulfilling its crucial role in establishing and implementing a strategy to achieve the national policy**
- Lack of incentives for efficient extension workers
- Lack of expertise and institutions to prepare extension material for users”

World Bank Country Paper on Bangladesh Extension Systems***

Note: * Government has recently corrected over-subsidization of urea to promote balanced use of fertilizer.
Source: Primary interviews; Team analysis ^Available at Banglapedia.org; **Robinson et al (2007), “Motivations behind farmers’ pesticides use in Bangladesh rice farming”, *Agriculture and Human Values, 24; ***World Bank, (2003), *Existing Extension System: Strengths, Weaknesses and Proposed Reforms in Bangladesh* – while somewhat dated, the findings in this report are corroborated by a more recent report, Karim et al. (Dec 2009), *Study of the Implementation Status and Effectiveness of New Agricultural Extension Policy for Technology Adoption* which shows the limited understanding of national extension policy by officers in DAE
Mechanization/labor: Outside of power tillers, mechanization in Bangladesh is low which in turn lowers farmer incomes

EXCEPT POWER TILLERS, BANGLADESH MECHANIZATION LEVELS ARE LOW...

...LEADING TO HIGH LABOR EXPENSES FOR THE FARMER

% of farmers using machines for land preparation

Labor is 52% of cost

Note: Labor does not include family labor
Source: Primary Interviews, ACI Motors, Lit Search; Field Data; USAID, “The Status of Food Security in the Feed the Future Zone and Other Regions of Bangladesh”, April 2013
Mechanization/labor: Mechanization would result in significant cost savings, though these have not been popularized.

- Mechanization can also lead to **higher yields** (through timely and more accurate agronomic practices) and less **wastage**
- **Tractors and power tillers** are already being run on a **service provider model** by local entrepreneurs and with the assistance of NGOs such as CSISA, though overall penetration needs to be increased.
- Machinery seller **Corona is piloting a nationwide paddy harvesting service model**, where their combine harvesters harvest paddy for a fixed fee per acre. The company hopes to make it into a full fledged business.

Note: The above analysis assumes that power tillers, tractors, and transplanters are rented on per hectare basis; Manual labor Costs include opportunity costs of family labor. Source: Primary Interviews, ACI Motors.
### Market Access: Farmers only receive a small proportion of revenues and profits because farmers tend to sell at harvest

<table>
<thead>
<tr>
<th><strong>FARMGATE PRICES ONLY</strong></th>
<th><strong>FARMERS GARNER ONLY</strong></th>
<th><strong>HIGH PRODUCTION, BULK SELLING DEPRESS PRICES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>~60% OF RETAIL PRICES</td>
<td>24% OF THE PROFIT POOL</td>
<td>• Low farmgate prices of paddy are driving down farmer margins</td>
</tr>
</tbody>
</table>

- **High paddy production** over the past three years (as a result of an absence of major natural calamities) has depressed prices
- Farmers **bulk sell paddy at harvest** leads to a sharp drop in farmgate prices
  - Harvest prices range between 55-70% of peak prices
  - This is primarily because **farmers lack financial and physical holding capacity** to store paddy
  - However, farmers not necessarily guaranteed higher prices by waiting due to the risk of illegally imported **cheap Indian rice**, often pilfered from the Public Distribution System, flooding market and depressing prices
- Evidence that millers add value by double milling poor quality paddy, to refine and reduce width of grain thereby producing superior rice

*One quintal rice equivalent refers to either 1 quintal of rice or 1.5 quintal of paddy

Source: Field Data, Primary interviews, Team analysis
Agenda

Project approach

Supply-demand dynamics

**Value chain & constraints**
- Stressed farmers
- Surplus farmers
- Aromatic farmers

Policy context & challenges

Prioritized interventions
Average aromatic farmer makes ~USD 470 per hectare representing a margin of ~40%

Aromatic Farmers
Avg. yield: ~2.0T per ha (milled rice)
Avg. land holding: 1.37 ha

Represents ~35% margin

While aromatic rice is more profitable than non-aromatic rice, due to environmental factors it can only be grown in certain regions in the country’s north west – difficult to expand across Bangladesh

Note: Figures taken via field interviews with aromatic farmers in Dinajpur district. N=32. Analysis assumes all rice sold. Does not take into account opportunity cost of family labor. Taken an exchange rate of 78.9877 BDT to 1 USD (2012 average exchange rate)
Source: Team analysis, field interviews
For these farmers, key constraints are seeds, agronomic practices, mechanization and market access

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Severity</th>
<th>Issues</th>
<th>Est. yield impact if resolved*</th>
<th>Est. income impact if resolved^</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeds</td>
<td>1a</td>
<td>• Typically of low quality mainly due to poor seed management practices</td>
<td>~ 25%</td>
<td>~50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Vast majority of seeds supplied through informal sector or are re-used seeds of local varieties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertilizer</td>
<td>1b</td>
<td>• Government has stabilized supply and is looking to correct usage imbalances (has reduced price differential between urea and non-urea)</td>
<td>~ 5%</td>
<td>~10%</td>
</tr>
<tr>
<td>Pesticides/herbicides</td>
<td>1c</td>
<td>• Government involvement is limited with minimal monitoring of quality</td>
<td>~ 5%</td>
<td>~10%</td>
</tr>
<tr>
<td>Irrigation</td>
<td>1d</td>
<td>• Aromatic rice is grown in monsoon with minimal need for irrigation</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Access to credit</td>
<td>1e</td>
<td>• Credit is sufficiently supplied by government and microfinance sector</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Agronomic practices</td>
<td>2a</td>
<td>• Farmers do undertake practices that do not support optimum aroma and fineness of rice, incl. Overuse of inputs and poor cultivation techniques</td>
<td>~ 20%</td>
<td>~25%</td>
</tr>
<tr>
<td>Mechanisation/labor</td>
<td>2b</td>
<td>• Limited use of high horsepower machinery with relatively high cost of labor in these prosperous areas leads to higher cost production impacting farmer incomes</td>
<td>~ 5%</td>
<td>~35%</td>
</tr>
<tr>
<td>Post-harvest</td>
<td>3</td>
<td>• Lack of proper storage facilities at farm level leads to wastage and reduction in quality</td>
<td>~ 5%</td>
<td>~10%</td>
</tr>
<tr>
<td>Market access</td>
<td>4</td>
<td>• While price of aromatic rice is almost 2X-3X the price of coarse/fine rice, farmers only capture &lt;50% of retail price. Aromatic rice does not have a differentiated market channel</td>
<td>n/a</td>
<td>~35%</td>
</tr>
<tr>
<td>Milling</td>
<td>5</td>
<td>• Sufficient milling capacity in aromatic farming areas</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Smallholder rice farmers cannot access large auto-millers due to size restrictions while traditional milling leads to large % of broken rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td>6</td>
<td>• Relatively better roads and power in aromatic rice growing areas</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Post-harvest storage sometimes an issue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Team analysis
These four constraints have significant income impact and relatively high addressability

Source: Team analysis
Seeds: Production and distribution is unorganized leading to unavailability of quality seeds

**KEY ISSUES ARE SEED SUPPLY AND SEED MANAGEMENT PRACTICES**

<table>
<thead>
<tr>
<th>Issues</th>
<th>Severity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>![Green Circle]</td>
<td>• No certified seed available for most aromatic varieties (certified seeds exist for modern varieties, not local varieties)</td>
</tr>
<tr>
<td>Affordability</td>
<td>![Green Circle]</td>
<td>• Seeds affordability is not a problem given relatively higher price of paddy as compared to non-aromatic rice</td>
</tr>
<tr>
<td>Awareness</td>
<td>![Green Circle]</td>
<td>• Seed management/storage can be improved significantly</td>
</tr>
<tr>
<td>Appropriateness</td>
<td>![Green Circle]</td>
<td>• Farmers use the appropriate variety to grow aromatic rice</td>
</tr>
</tbody>
</table>

**ISSUE PRECIPITATED BY LACK OF ORGANIZED PLAYERS IN THE SECTOR**

- Aromatic rice seeds have no organized industry behind it
- The government does not produce nor distribute aromatic rice seeds - their focus is on non-aromatic rice
- Not economical for private players to distribute major varieties of aromatic rice seed due to repeatable use of local varieties
- Consequently, farmers have to depend on recycling their own seeds or buying from unorganized seed vendors
- As a result of poor seed management practices at the local level seed quality is a significant issue

Source: Primary interviews; Team analysis
Agronomic Practices: Outdated agronomic practices, improper use of inputs affecting soil quality

AROMATIC FARMERS HAVE POOR AGRONOMIC PRACTICES...

- Farmers undertake practices that do not support optimum fineness and aroma of rice:
  - Aromatic rice does not require large amounts of fertilizer and pesticide due to the hardy nature of the local variety. However, increasing (improper) use of chemical fertilizer and pesticides is impacting rice quality
  - Poor cultivation techniques, such as sowing of aromatic and coarse rice on same plot of land, decreases quality due to cross pollination
  - Poor harvesting and post-harvesting practices impact final quality of rice

...EXACERBATED BY DETERIORATING SOIL CONDITIONS

“The concentration of organic materials… has deteriorated significantly in the Barind Tract, Madhupur Tract, Himalayan Foothill areas, the floodplains of Tista, Karatoya, and Bangali, and in the hilly Northeast region”

(regions mentioned include areas where aromatic rice is grown)

WORSENED BY INEFFECTIVE GOVERNMENT EXTENSION SERVICES

“The DAE officers rarely come to our village. Even when they come it's not useful; they don't teach anything or hold camps. For information on fertilizer use we go to the person who sells us the fertilizer. He knows how it's to be applied”

Aman Uddin, Rice Farmer, Dinajpur

Note: * Government has recently corrected over-subsidization of urea to promote balanced use of fertilizer.
^ From DFID, 2002, Fine and Aromatic Rice Sector
Source: Bangladesh Fertiliser Association; Primary interviews; Team analysis ^available at Banglapedia.org
Mechanization/labor: Outside of power tillers, mechanization in Bangladesh is low which in turn lowers farmer incomes

EXCEPT POWER TILLERS, BANGLADESH MECHANIZATION LEVELS ARE LOW...

...LEADING TO HIGH LABOR EXPENSES FOR THE FARMER

% of farmers using machines for land preparation

Labor is 52% of total costs

Note: Labor does not include family labor
Source: Primary Interviews, ACI Motors, Lit Search; Field Data; USAID, “The Status of Food Security in the Feed the Future Zone and Other Regions of Bangladesh”, April 2013
### Mechanization/Labor: Mechanization would result in significant cost savings, though these have not been popularized

<table>
<thead>
<tr>
<th>LAND PREPARATION</th>
<th>TRANSPLANTING</th>
<th>HARVESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Cost</td>
<td>Cost</td>
</tr>
</tbody>
</table>

- Mechanization can also lead to **higher yields** (through timely and more accurate agronomic practices) and less **wastage**
- **Tractors and power tillers** are already being run on a **service provider** model by local entrepreneurs and with the assistance of NGOs such as CSISA, though overall penetration needs to be increased
- Machinery seller **Corona** is piloting a **nationwide paddy harvesting service model**, where their combine harvesters harvest paddy for a fixed fee per acre. The company hopes to make it into a full fledged business
- In the long term, mechanization in aromatic areas could also focus on improving postharvest aspects such as upgrading milling-machinery.

Note: The above analysis assumes that power tillers, tractors, and transplanters are rented on per hectare basis; Manual labor Costs include opportunity costs of family labor.
Source: Primary Interviews, ACI Motors
Market Access: Farmers only receive a small proportion of revenues and profits

FARMGATE PRICES ONLY ~45% OF RETAIL PRICES

FARMERS GARNER ONLY 15% OF THE PROFIT POOL

*One quintal rice equivalent refers to either 1 quintal of rice or 1.5 quintal of paddy; All figures are for BR-34 variety
Source: Raha and Akbar, 2010, “Aromatic Rice Marketing in Bangladesh: An Empirical Study”, Economic Affairs, Vol 55-1, values have been adjusted upwards to better reflect current market prices
Agenda

Project approach

Supply-demand dynamics

Value chain & constraints

Policy context & challenges

Prioritized interventions
Bangladesh contributes 11% of budget (BDT 123B / USD 1.6B) towards rice production, primarily through MoA activity

- **Ministry of Agriculture** directs 75B taka towards rice production via:
  - Seed research and production
  - Extension services
  - Fertilizer subsidy
  - Minor irrigation
  - Overall management of sector

- **Ministry of Energy and Mineral Resources** provides a 36% subsidy on the market price of diesel – estimated contribution towards rice is 37B taka
  - Diesel is used to power irrigation pumps for rice and other crops in boro season
  - Subsidy includes 5BDT/L direct cash payment to farmers and 28.4BDT/L subsidy to all consumers
  - Based on total requirement of 1.1B liters across Bangladesh

- **Ministry of Water Resources** contributes 11B taka to support irrigation infrastructure

Note: Detailed information on budget use is unavailable from Bangladesh Ministry of Finance beyond allocations to different ministries. Figures are estimated based on % of rice grown relative to other crops except for diesel subsidy; Ministry of Agriculture expenditure is 93B taka – 75B taka represents estimated share for rice; Water Resources budget is 23B taka, 11B represents estimated share for rice.

Source: Ministry of Finance; Revised Budget FY12; Bangladesh Institute of Development Studies, *A Citizens’ Guide to Energy Subsidies in Bangladesh*, 2012
Government intervention is primarily focused on inputs, with limited activity in other parts of the value chain.

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>PRODUCTION</th>
<th>POST-HARVEST</th>
<th>MARKETING</th>
<th>PROCESSING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seeds</strong></td>
<td><strong>Agronomic practices</strong></td>
<td><strong>Post-harvest practices</strong></td>
<td><strong>Market access</strong></td>
<td><strong>Milling</strong></td>
</tr>
<tr>
<td>1a Ministry of Agriculture</td>
<td>2a Ministry of Agriculture</td>
<td>3a Ministry of Agriculture</td>
<td>4a Ministry of Food (limited procurement)</td>
<td>5a Limited government intervention</td>
</tr>
<tr>
<td>1b BD Rice Research Institute</td>
<td>2aBD Agricultural Development Corp.</td>
<td>3a Dept. of Agricultural Extension</td>
<td>4b Some subsidies to millers</td>
<td></td>
</tr>
<tr>
<td>1c BD Agricultural Development Corp.</td>
<td>2b BD Fertiliser Association</td>
<td>3b BD Agricultural Development Corp.</td>
<td>5b None</td>
<td></td>
</tr>
<tr>
<td>1d BD Institute of Agricultural Research</td>
<td>2bBD Institute of Nuclear Agriculture</td>
<td>3bNat. Agricultural Research System</td>
<td>5bMinistry of Planning</td>
<td></td>
</tr>
<tr>
<td>1e Nat. Agricultural Research System</td>
<td>2bBangladesh Krishi Bank</td>
<td>3bMinistry of Local Government Division and Rural Development</td>
<td>5bMinistry of Industries</td>
<td></td>
</tr>
<tr>
<td>1f BD Institute of Nuclear Agriculture</td>
<td>2bRajshahi Krishi Unnayan Bank</td>
<td>3bMinistry of Local Government Division and Rural Development</td>
<td>5bMinistry of Local Government Division and Rural Development</td>
<td></td>
</tr>
</tbody>
</table>

**Infrastructure**
- Ministry of Planning
- Ministry of Local Government Division and Rural Development

Source: Respective ministry and department websites, Input, Subsidies and Farmer Incentives, Bangladesh Institute of Development Studies, 2009
For farmers, key policy constraints concern seeds and agronomic practices

<table>
<thead>
<tr>
<th>Area</th>
<th>Current Policy and Government Execution</th>
<th>Adverse Policy Impact</th>
<th>Ability to Change Govt Policy</th>
</tr>
</thead>
</table>
| Seeds | • Government run BRRI and Seed Certification Agencies are the only bodies authorized to produce and certify new varieties of seed varieties respectively  
• Private sector has production disadvantage vis. government run production facilities  
• High subsidies (~40-50%) on government provided high-yielding varieties (HYV), - private sector cannot compete on price and has limited incentive to invest and scale up production | ![Very Adverse](https://example.com) | ![Very Difficult](https://example.com) |
| Fertilizer | • Government fixes price of all fertilizers + controls supply and distribution network  
• Government has stabilized supply and is looking to correct usage imbalances (has reduced price differential between urea and non-urea) | ![Neutral](https://example.com) | ![Neutral](https://example.com) |
| Pesticides/ herbicides | • Government involvement is limited with minimal monitoring of quality | ![Neutral](https://example.com) | ![Neutral](https://example.com) |
| Irrigation | • Government provides significant subsidies on diesel for irrigation – likely to reduce subsidy amount in future due to high cost but will highly impact stressed area farmers | ![Neutral](https://example.com) | ![Neutral](https://example.com) |
| Access to credit | • Coverage of formal agri-credit by banks/NGOs/MFIs moderate | ![Neutral](https://example.com) | ![Neutral](https://example.com) |
| Agronomic practices | • Govt has developed PoPs for various agro-climatic conditions but not widely adopted due to limited reach and effectiveness of govt extension machinery | ![Very Adverse](https://example.com) | ![Very Difficult](https://example.com) |
| Level of mechanization/ labor | • Government supports mechanization through subsidy though credit access via banks is a major challenge | ![Neutral](https://example.com) | ![Neutral](https://example.com) |
| Post-harvest | • Limited govt involvement / support for initiatives regarding storage | ![Neutral](https://example.com) | ![Neutral](https://example.com) |
| Market access | • Limited procurement of rice that does not support prices | ![Neutral](https://example.com) | ![Neutral](https://example.com) |
| Milling | • Some subsidies provided to millers | ![Neutral](https://example.com) | ![Neutral](https://example.com) |
| Infra-structure | • Govt recently announced intention to develop road, power and railway infrastructure under PPP model | ![Neutral](https://example.com) | ![Neutral](https://example.com) |

Source: Team analysis
Seeds: Government intervention across seed value chain crowds out private sector in HYV market

**GOVT. MONOPOLY LIMITS SPACE FOR PRIVATE R&D**

- Bangladesh Rice Research Institute has monopoly on breeder seed production in Bangladesh, though often works with other partners to develop seeds (e.g. IRRI, STRASA)
- Limited space for private sector innovation
- Private / NGO R&D is possible but must go through government for production which is a long process with uncertain compensation for private sector IP
- All breeder seeds must be certified by Seed Certification Agency for release to farmers
- ‘Bottleneck’ occurs at the beginning of the seed value chain limiting supply (though CSISA-BD is currently examining ways to overcome this)

**SUBSIDIES DO NOT INCENTIVIZE ORGANIZED PRIVATE SECTOR TO PRODUCE HYV SEEDS ON A LARGE SCALE**

- Government does not sell foundation seeds (instead multiplies to 3rd generation)
- Private sector is therefore incentivized to play in foundation seed market which results in severe sub-optimal multiplication rate

**Research and Development (1st gen - Breeder Seeds)**

**Production (2nd gen – Foundation Seeds)**

1 Breeder Seed => 150 Foundation Seeds

- Govt is allocated disproportionate share of breeder seeds – private sector with large unmet demand*

**Distribution and Sale (2nd gen - Foundation Seeds)**

- BADC seeds are heavily subsidized – the organized private sector cannot compete in the certified seed market without scale and the government is not inclined to reduce subsidies or apply subsidies equally to private sector
- Organized private sector has limited incentive to invest in infrastructure required to generate 3rd generation seeds given govt. price and production advantage resulting in severely limited volume of truthfully labelled seeds in the market

**Production (3rd gen – Certified Seeds / TLS^)**

1 Foundation Seed => 150 Certified / TLS Seeds

- Private sector has limited infrastructure for processing and storage of seeds to 3rd generation while BADC has large (tax payer subsidized) production facilities
- Certification is a lengthy process undertaken by government – alternative to certification, TLS^, is possible but faces quality perception challenges from consumers - private sector needs to overcome this perception to be successful in HYV market

**Distribution and Sale (3rd gen - Certified Seeds / TLS)**

- Government does not sell foundation seeds (instead multiplies to 3rd generation)
- Private sector is therefore incentivized to play in foundation seed market which results in severe sub-optimal multiplication rate

Note: *Share of breeder seeds given to government vis-a-vis private sector / NGOs is 40% to 60% - though private sector demand is significant and remains largely unmet. ^TLS = Truthfully Labelled Seed is technically 3rd generation seed that is not certified. In practice, it is often mixed with local non HYV varieties

Source: Value Chain Analysis on Rice Seeds – CSISA Report 2010; Team field observations
Agronomic Practices: While formal programs to improve agronomics are in place, effectiveness and impact are limited

DAE IS NOTIONALLY RESPONSIBLE FOR PROVIDING AGRONOMIC EXTENSION

DEPARTMENT OF AGRICULTURAL EXTENSION MISSION

“Provide efficient and effective needs based extension services to all categories of farmers to enable them to optimize their use of resources, in order to promote sustainable agriculture and socio-economic development”

REPORTS INDICATE EFFECTIVENESS AND IMPACT ARE LIMITED...

• By The Department’s own admission, achievement of strategic plan to meet mission (1999-2002) was not satisfactorily achieved with a summary of progress stating:
  “The DAE management committee has not led in its crucial role in establishing and implementing a strategy to achieve the DAE mission”

  driven by lack of coordination, ownership of strategy, monitoring, and effective management.

... BACKED UP BY EVIDENCE FROM THE FIELD

“The DAE officers rarely come to our village. Even when they come it's not useful; they don't teach anything or hold camps. For information on fertilizer use we go to the person who sells us the fertilizer. He knows how it’s to be applied”

Aman Uddin, Rice Farmer, Dinajpur

• Evidence from field work indicates that effectiveness and impact of agronomic practices improvement programs are limited:
  - Farmers utilize incorrect amounts of fertilizer, and in proportions that do not support sustained use of land
  - Use of pesticide is not optimal
  - Traditional agronomic practices still in place
  - Lack of soil management

Source: Draft National Agricultural Extension Policy (2002-2006), DAE – while the data is dated, there has been no progress report on the Department’s 2002-2006 strategic plan, nor a strategic plan for subsequent (and more recent) years
Agenda

Project approach

Supply-demand dynamics

Value chain & constraints

Policy context & challenges

Prioritized interventions
Given the nature of the constraints, we recommend working with the private / NGO sector with some govt. assistance

### Key value chain constraints

- **Seeds – for all three farmers**: Lack of availability for Aromatic and Stress. Low quality for Surplus
- **Market Access – for Aromatic and Surplus farmers**: Farmers often receive a low share of profits
- **Mechanization – for Aromatic and Surplus farmers**: Level of basic farm mechanization low; continued pressure on labor prices
- **Infrastructure (Land) – for Stressed farmers**: Land quality deteriorating at a significant rate
- **Agronomic practices – for all farmers**: Farmers engage in sub-optimal agronomic practices

### Interventions

#### A Seed use and availability (surplus and stressed)
- Enhance supply of quality seeds, through large scale commercialization of private sector produced seeds focusing on:
  - Supporting private sector to increase capacity
  - Supporting methods for private sector to signal quality of product e.g. branded, tamper proof packaging
  - Exploring options with government to provide HYV seed subsidies to private sector (or directly to farmers)
- Assist private seed companies in providing seed related extension services to farmers
- Work with BRRI, BADC and other government agencies/private companies to enhance supply of quality seeds, particularly in stressed areas such as fast-tracking the uptake of stress tolerant varieties and examining methods to improve the efficiency and effectiveness of seed multiplication and distribution systems

#### B Mechanization service provider model (surplus and aromatic)
- Link entrepreneurial farmers to equipment manufacturers and provide them with training, support and access to credit so that they can purchase equipment (focus on tractors, transplanters and harvesters) and rent it out to others
- Encourage equipment companies to offer mechanization services directly

#### C Contract farming model (surplus and aromatic)
- Support the establishment of contract farming model between private sector millers and farmers where:
  - Farmer agrees to supply paddy to millers at market rates
  - Millers provide support and education in proper agronomic practices including appropriate use of fertilizer, and pesticides as well as helping to improve organic matter content of land

#### D Extension support program (all segments with focus on stressed)
- Develop program to improve the agronomic practices of farmers across Bangladesh with focuses on land regeneration, seedling mgmt and efficient use of fertilizer and water
- Leverage existing projects infrastructure including, robust project management methodology and reach (potential partners include CSISA, STRASA, BRAC or DAE)

### Key policy & govt. constraints

- **Seeds**: Regulation and subsidies limit incentives for private sector participation across seed value chain
- **Agronomic Practices**: Reach and quality of govt. extension services poor

Source: Team analysis
This set of interventions will address all key constraints identified

|-------|------------|-----------------------|------------|-----------------|---------------------|------------|--------------|---------|---------------|--------|

| Key policy constraint? | ✓ | | | ✓ |  |  |  | |  | | |
| Key VC Constraint – Stressed | ✓ | | | ✓ | ✓ | |  |  |  |  | ✓ |
| Key VC constraint – Aromatic | ✓ | | | ✓ | ✓ | ✓ |  |  |  |  |  |
| Key VC constraint – Surplus | ✓ | | | ✓ | ✓ | ✓ |  |  |  |  |  |

Seed use and availability: A
Contract farming model: B
Mechanization service provider model: C
Extension support program: D

Degree to which constraint addressed for affected segments

- [ ] Fully addressed
- [ ] Partially addressed

Source: Team analysis
The intervention on seeds needs to focus on commercialization, extension and research in partnership with relevant players

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Segment</th>
<th>Description</th>
<th>Potential Partners</th>
</tr>
</thead>
</table>
| **Commercialization** | Surplus       | - Partner with private seed companies to improve distribution of quality seeds at affordable rates and at commercial scale  
- In HYV market selected private seed companies have comparative advantage on quality which is attractive to surplus sectors, though are heavily disadvantaged on price due to subsidies on govt-supplied seed  
- In HYV market, donors could assist private seed companies to explore options for commercially viable models in the Bangladeshi context* including:  
  - Work with government to improve incentives and remove obstacles to private sector participation (such as equal subsidies for private sector seed)  
  - Assisting in bearing initial risk to ‘scale up’ production to commercially viable quantities  
  - Increasing awareness of quality advantage and assist in developing methods to signal quality (branded tamper proof packaging) amongst target market  
- The aim would be to ensure the private sector grows its market share to a level which would make this initiative self-sustaining                                                                                                     | Lal Teer, ACI, Supreme Seeds, BADC                      |
| **Extension / Distribution** | Surplus / Stressed | - Extension services would promote a higher seed replacement rate (SRR) and better seed storage  
- Seed companies could leverage extensive distribution network and community presence to push extension services - A higher SRR would help promote their business, so this model would be self sustaining after the pilot stage  
- Work with government to improve seed distribution efficiency and strengthen quality control along supply chain                                                                                                                                                                                                    | BRRI, BINA, IRRI, STRASA                                  |
| **Research**        | Stressed      | - A number of stress tolerant varieties exist at the conceptual stage but need further trails and testing at the field stage  
- Donors could push field trials and fast track the uptake of stress tolerant varieties                                                                                                                                                                                                                                                                                  | BRRI, BINA, IRRI, STRASA                                  |
Organized private seed companies require capacity building interventions to assist in commercialization

**SEED COMPANIES CURRENTLY HAVE A SMALL PRESENCE IN BANGLADESH**

- Total seed volume sold: ~140,000 MT per annum (2012)
- Of this, organized seed companies have only 6% of the market share, 72% is with the BADC and the rest (23%) with unorganized, small scale players
- **Cost is a major constraint for the organized private players.** BADC uses government subsidies to out-price organized seed players whose prices are 50-100% higher than the BADC’s
- Private sector has high average fixed costs per seed as a result of their smaller volumes
- Private expansion is restricted by high costs for storage and processing policy

**DONORS CAN HELP SEED COS. BUILD CAPACITY FOR LARGE VOLUMES**

- Donors can work with government to help organized private seed companies to **achieve scale** in multiplying and distributing quality seeds at affordable rates
- Donors could provide advocacy, technical assistance and loan guarantees needed to help private seed companies **build capacity** with investment in storage and processing facilities
  - High volumes would facilitate lower seed prices and improve financial viability of seed companies

**ONCE SCALED UP, SEED COMPANIES COULD COMPETE OR WORK WITH GOVT**

**Option 1 – Compete:**
- In the current market environment, a private seed company with ~15-20% of the market could manage to offer quality seeds at BDT 40 per kilo, which is only BDT 5 above BADC’s price^.
- If the quality was sufficiently superior to government provided seed then private sector could maintain a sustainable market share

**Option 2 – Work as agent of Government:**
- Once scale is achieved, private seed companies could work with government to act as seed multipliers at the breeder and foundation seed stage
- Government could provide fee-for-service to private seed companies, with strict standards on quality

---

**Tulachan et al., 2012, Value Chain Analysis of Rice Seeds in Bangladesh: A case of three southern districts,**
Source: Primary Interviews, Team analysis, Lit Search. ^discussions with private seed companies
Additionally donors can assist in areas that allows private sector to signal quality of product

THERE IS DEMAND FOR QUALITY SEED IN A COMPROMISED HYV SEED MARKET

- **BADC seed quality is an issue** – TLS seeds have variable quality due to:
  - Poor seed management practices and lack of proper infrastructure
  - Mixing with counterfeit seed
  - Lack of large scale certification and testing techniques preventing all 3rd generation seed from being certified

DONORS CAN HELP SEED COS. DEVELOP METHODS TO SIGNAL QUALITY

- Donors can assist private seed companies to develop **supply chain integrity technology** and ways to **signal quality of product**:
  - Discussions with private seed companies in Bangladesh indicate support for development of methods to ensure seeds on the shelf are free from counterfeit seeds and are of high quality
  - Funding R&D to develop tamper proof (branded) and/or tamper evident packages along with supporting packaging infrastructure is one low-cost method
  - Assisting in raising awareness of quality amongst target market, potentially via dealers and demonstrations is another which could easily be tied into extension services (see next slide)

• Evidence exists that farmers are **willing to pay premium** for quality seed:
  - Foundation seed (typically high quality control) sells for significant premium over TLS seed. Price of foundation seed is 55BDT / kg as opposed to TLS which is 35BDT/kg - 57% premium

Source: Photo of seed infested with fungal growth is from Tulachan et al, 2012, *Value chain analysis of rice seeds in Bangladesh, A case of three southern districts*
Seed companies could also assist with seed related extension services to increase exposure – dealers are natural intermediary

- **Seed companies:**
  - Provide training on optimal seed use (for farmers) and handling (for farmers and dealers)
  - Supply quality rice seeds to dealers

- **Dealers:**
  - Recommend appropriate seeds based on farmer characteristics
  - Assist farmers in trailing new seed varieties*
  - Assist farmers in proper seed handling / storage

- **RICE SEED DEALERS**

- **RICE FARMERS**

---

*Tulachan et al., 2012, *Value Chain Analysis of Rice Seeds in Bangladesh: A case of three southern districts* provide several case studies of dealers gaining both trust and market share after providing high quality seed to farmers. Occasionally these seeds were initially provided on a trial basis, where payment was only provided to the dealer if the seeds performed well.

---

**Description of Model**

- Providing training to dealers is a low cost and effective way of reaching many individuals
- Dealers typically have strong networks within local communities
- Anecdotal evidence that farmers, especially in stressed zones, rely heavily on seed dealers for information and are willing to trust those that provide high quality seed*
- However, not all dealers have the necessary training to provide seed related advice – real possibility to improve use of stress tolerant, HYV and hybrid seed varieties as well as seed handling / storage through education of dealers
- Value proposition for seed producer is increased exposure of brand and products, wider distribution and greater seed replacement rate
- Value proposition for rice seed dealers is increased knowledge, creating a differentiated competitive advantage vis-à-vis other dealers
- Value proposition for rice farmer is information, more appropriate seeds and higher yields
- Conflict of interest is a concern (e.g. dealers recommending inappropriate seeds for financial gain) but is mitigated by the fact that dealers have to engage farmers over multiple seasons – those that provide improper advice likely to lose market share over multiple seasons
- Other potential intermediaries could be local NGOs, input dealers and farmer groups (if present)
There are several avenues that donors could explore with government to improve seed availability and quality.

**IMPROVE INCENTIVES FOR THE PRIVATE SECTOR**
- Government could provide an equal playing field for government supplied seeds vs. private sector seeds:
  - Provide subsidies to non-government supplied seeds
  - Provide subsidies directly to farmers to purchase seeds
- This would incentivize the private sector to produce HYV seed on a large scale
- An additional advantage would be that private sector would be incentivized to stop selling foundation seeds, thereby improving multiplication rate
- Additionally, donors could work with government to improve incentives to introduce new HYV / hybrid seed varieties to Bangladesh
- Finally, donors could lobby for changes:
  - allowing private sector the right to commercialize varieties with their own variety names
  - strengthening capacity and practices of seed certification agency to improve and hasten seed certification standards and monitoring

**EXAMINE EFFICIENCY OF DISTRIBUTION**
- Due to poor post-harvest practices (handling and storage) and problems with quality control, BADC seeds supplied to farmer are often sub-standard
- Donors could work with the government to identify areas for improvement and assist with implementing recommendations
- The BADC has a large distribution network and if successful any recommendations would have wide-reaching impact

**FAST TRACK PROD. OF STRESS TOLERANT SEEDS**
- There are several seed varieties currently at research stage which produce yields of 4-5 MT / ha in drought, flood and saline conditions (see appendix)
- Donors could explore the specific constraints preventing transition from research to production stage and assist government in fast-tracking
- Farmers have preference for short growth varieties – researchers should take into account this trait when producing new stress tolerant seeds

Source: Team Analysis

* There is already significant donor activity in upstream R&D in South Asia e.g. CSISA, STRASA, Green Super Rice. Given this activity the analysis presented in this document does not place a large focus on additional support of seed R&D. That said, any interventions targeting seed R&D in Bangladesh should look to leverage the structures of these existing programs.
Service provider models run by entrepreneurs or equipment companies can deliver mechanization solutions to smallholders.

**SERVICE PROVIDER MODELS EFFECTIVE FOR SMALLHOLDER FARMERS**

- **Entrepreneurial service provider model**
  - Larger, progressive farmers buy equipment and rent it out to others.

- **Equipment company-owned service provider model**
  - Large equipment companies offer mechanization services via self-owned machines and own human resources.

**OPPORTUNITY FOR PRIVATE EQUIPMENT PLAYERS TO SELL EQUIPMENT AND START TO OFFER SERVICES**

- Opportunity to create specific service provider module/package and market it to entrepreneurial farmers.
  - Clear articulation of economics.
  - Provide corporate support for shared functions like marketing, R&D, maintenance, business training and technical support.
  - Assist with credit linkages.

- Opportunity to create a new business by selling mechanization services.
  - Significant latent demand for mechanization.
  - Provides a solution to the biggest bottleneck of mechanization, equipment credit, since equipment providers (such as ACI Motors or Corona) would buy machines outright or be able to access credit relatively easily and more cheaply compared to farmers.

A donor could bring together consortium of private equipment players to promote service provider models through their distribution network and/or push mechanization services of their own.

Source: Primary interviews; Lit. Search
Economics are attractive for a service provider

Represents an RoI of 16% on original tractor cost

Would be 49% lower (118k) without diesel subsidy

<table>
<thead>
<tr>
<th>Key Figures*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of tractor</td>
<td>50 HP tractor with tillage implantation and trolley</td>
</tr>
<tr>
<td>Price of tractor (BDT)</td>
<td>1,47,000</td>
</tr>
<tr>
<td>Payback Period (years)</td>
<td>10</td>
</tr>
<tr>
<td>Per-acre Rental Fee (BDT)</td>
<td>1,000</td>
</tr>
<tr>
<td>Number of days used per year</td>
<td>60</td>
</tr>
</tbody>
</table>

Note: Whole tractor assumed to be taken as a loan @ 15% per annum. “labor’ includes driver and helper wages. Per day cultivation assumed to be 15 acres. Diesel cost taken at BDT 75/litre.

* Estimates for number of days used and payback period are conservative

Source: Primary Interviews, ACI Motors data
A contract model could alleviate agronomic practice and market access issues while ensuring supply of quality paddy for millers.

**MILLER POV**

- Supply inputs such as seed, fertilizer, and pesticides at cost
- Assist farmers in choosing most marketable varieties of rice
- Provide training in appropriate sustained use of inputs
- Assist in regeneration of organic matter of land
- Agree to multi-year / multi-season engagement (subject to farmers providing sufficient paddy each year)
- Assist in appropriate post-harvest practices and seed management
- Offer a premium on market prices to farmers at harvest time through potential linkages with mechanization
- Using relationship managers employed at the community level, oversee program management (distribute inputs, aggregate paddy etc.) – typically relationship manager is a ‘lead farmer’ from the area

**FARMER POV**

- Supply paddy to millers at end of harvest
- Enter into relationship-based incentive model rather than contract to supply paddy (i.e. NOT based on contractual obligation)
- Receive training, extension services and cheaper inputs so long as paddy is supplied to millers
- Paid a premium on market price by miller

Farmer incentivized to regularly supply quality paddy to miller over the short and long term in return for a premium on market price.

---

**Sources:**

- PRAN has expressed willingness to explore large scale contract farming model with donors.
- This is based on a functioning model for aromatic rice in Bangladesh initiated by PRAN.
This model is based on a successful existing arrangement in the aromatic rice sector – however current scale is small

PRAN Agri Hub (located at the village level)

PRAN Agro Products Limited (Agri producer for PRAN retail)

Private Company

Retailer

Contract Farmer

Premium Aromatic variety paddy at 5-15% of market premium

Inputs: Seeds, fertilizer, pesticide, and equipment at cost price

Extension at no cost

Milled Rice for distribution

Buying Model

- No water tight contract between Contract Farmer and PRAN
- Instead, to limit side selling, PRAN buys paddy at a small premium above market price (5-15%)
  - Premium justified by superior quality that PRAN receives
- Farmers free to not sell to PRAN for a particular year. However, in case of a farmer repeatedly not selling his paddy to PRAN, he is eased out of the Contract Farming programme
- Uses a ‘Lead Farmer Model’ to manage farmers. Lead Farmer acts a reseller of PRAN’s inputs to the other farmers and also aggregates paddy for PRAN from other farmers. PRAN gives a certain minimum buying guarantee to the Lead Farmer which is decided on the basis of the amount of seeds that are distributed. Lead farmers gets a margin on whatever (inputs, paddy) goes via him
- Lead Farmer has anything between 500-4K farmers under him.

PRAN works with ~8K rice contract farmers. Currently only does Aromatic Rice

Source: Field visit to PRAN’s Chinigora (a type of aromatic rice) Contract Growing facility in Natore, Bangladesh (Jan 2013)
The proposed model has numerous benefits for both miller and farmer, but is not without challenges

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Miller</th>
<th>Farmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduced costs to produce medium and fine rice (less need to double mill inferior paddy)</td>
<td>• Access to cheaper inputs (miller can purchase inputs at a lower average price due to economies of scale)</td>
<td></td>
</tr>
<tr>
<td>• Greater certainty of paddy supply</td>
<td>• Access to training and guidance on most marketable varieties of rice</td>
<td></td>
</tr>
<tr>
<td>• Greater quality control</td>
<td>• Guaranteed avenue for selling paddy but does not lock farmer contractually to one buyer</td>
<td></td>
</tr>
<tr>
<td>• Improved ability to plan for capacity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Miller</th>
<th>Farmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Non-trivial investment and ongoing costs required to implement</td>
<td>• Risk that miller obtains undue influence over farmer practices (i.e. farmer loses autonomy)</td>
<td></td>
</tr>
<tr>
<td>• Not a true contract model in that supply is not guaranteed nor enforceable by law</td>
<td>• Risk that miller uses influence to offer lower than market price</td>
<td></td>
</tr>
<tr>
<td>• Side selling by farmers to other brokers and traders is a risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• In non-aromatic rice, much rice is grown for home consumption with a small surplus – model will need to cover a large area to produce commercial volumes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Critical Success Factors</th>
<th>Miller</th>
<th>Farmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Multi-year / multi-season engagement ensures farmers’ incentive to “cheat” (i.e. supply paddy to another miller) is lowered</td>
<td>• Costs of inputs must be as low as possible, and offset by improved returns on yield</td>
<td></td>
</tr>
<tr>
<td>• Relationship / community based model is critical to help ensure agreements are met</td>
<td>• Relationship / community based model is critical to help ensure agreements are met</td>
<td></td>
</tr>
</tbody>
</table>
In the Bangladesh context, contract farming is more feasible relative to other methods of improving market access.

<table>
<thead>
<tr>
<th>Description</th>
<th>Feasibility Assessment</th>
<th>HIGH</th>
</tr>
</thead>
</table>
| 'Contract' Farming | Establish arrangements between miller and farmer where former supplies inputs and extension in return for paddy supply – relationship based rather than true contract model | Contract farming already established in Bangladesh, albeit on a small scale  
Clear economic incentive for milling industry to procure finer, quality paddy – higher market prices and lower costs  
Clear economic incentive for farmers to enter agreement – higher farm-gate prices, lower inputs and better extension  
Milling industry is rapidly expanding and has financial capacity to support contract farming |

| Farmer Collective | Group multiple farmers under a joint enterprise to boost bargaining power, share knowledge and improve market access | MODERATE  
Bangladesh does not have a history of large scale agricultural collectives and no major collective in rice  
Establishment of collective from scratch has significant challenges:  
Mobilization of numerous farmers in certain areas difficult  
Governance structures are difficult to establish and prone to corruption  
Careful management of stakeholders in existing supply chain (intermediaries) required (they may oppose initiatives)  
Once established likely to have positive impact on farmer market access but likely to require long lead time |

| Commodity Exchange | Establish a formal, transparent market for exchanging commodities | LOW  
Bangladesh has no commodity exchange and only two stock exchanges (small by global standards)  
Establishment of commodity exchange requires level of sophistication, financial infrastructure and market knowledge – rare in Bangladesh and costly to source  
Will require farmers to improve knowledge of financial markets and utilize brokers for access  
Uncertain whether minimum transaction size requirements will suit smallholder farmers – i.e. may not solve market access problem |

**RECOMMENDED**
An extension support program, in partnership with NGO, govt., and private sector could target agronomic practices

DONORS TO SPONSOR + OVERSEE PROJECT TO IMPROVE AGRONOMIC PRACTICES

- Project aim would be to improve agronomic practices of farmers with focus on:
  - Enhance soil quality for long term sustainability e.g. via composting
  - Planting practices and seed / seedling education
  - Judicious use of fertilizer, pesticide and water
  - Education on post-harvest practices
  - Long term sustainability of practices

- Project would also focus on **improving overall farm and business management** of farmers so that farmers can make their own decisions regarding how to best allocate resources to maximize income

- The project would:
  - Cover all of Bangladesh with a focus on stressed area farmers
  - Utilize demonstrations, trials, education workshops
  - Leverage latest innovations in low-cost, scalable extension services, potentially through use of ICT and online material
  - Leverage local experts to garner on-the-ground community credibility
  - Have a 3-5 year timeframe

- Donors well placed to ensure rigorous project methodology utilized
- Long term financial sustainability of program is challenging, though program aims would also include:
  - Inculcating best practice amongst farmers particularly focusing on ensuring they maintain land quality
  - Up-skilling of employees of DAE to ensure continuation of extension services provision
  - Mechanism to ensure DAE, NGO and private sector share best practices in providing extension services

POTENTIAL PARTNERS AVAILABLE TO EXECUTE

**Government Partners**
- Department of Agricultural Extension is the natural government partner with 10,280 supervisors overseeing extension services
  - Government involvement is crucial as they will be the long term custodians of extension services
  - Unfortunately they have a limited track record of providing extension services that result in sustained change

**Local Governments** of various districts

**NGO / Non-govt. / Private Sector Partners**
- CSISA is undertaking research to improve cereal productivity and farm income in South Asia – potential to expand scope to implementation of research
- BRAC has 250 agriculturists and 8,903 agriculture extension workers across Bangladesh focusing on proper use of HYV seeds – potential to expand to other inputs and general agronomic practices
- Village level farmer groups are a good way to distribute extension information – high trust among farmers
- Private sector players such as millers, seed distributors, input suppliers and community level advisors
- NGO / non-govt. partners have significant in-country experience and agricultural expertise, utilize robust project practices and could readily partner with donors

Source: Respective websites of CSISA, STRASA and BRAC, DAE Strategic Plan (2002-2006)
In the long run this program with the other interventions would form a coherent support system for Bangladeshi farmers

<table>
<thead>
<tr>
<th>Sector</th>
<th>Areas of Responsibility</th>
<th>Critical Success Factors</th>
</tr>
</thead>
</table>
| **Extension Support Program** | • Manage and deliver extension services  
• Fund and deliver necessary inputs to support extension services  
• Engage with NGO and private sector for assistance | • Up-skill DAE management and staff during program  
• Continuous up-skilling of DAE upon program completion |
| Non-Govt. Sector            | • Provide selected support to DAE to ensure sharing of best practice and continual up-skilling  
• Continue to provide selected extension services based on NGO mandate / vision | • Clear and enunciated social value proposition to maintain support of farmers and DAE |
| Private Sector              | • Provide extension services in areas relevant to entity e.g. agronomic practices by millers, seed practices by seed companies / dealers | • Identifiable commercial value proposition to maintain support of farmers |

Source: Team Analysis
Interventions can be tailored to support empowerment of women

**OPPORTUNITIES TO EMPOWER WOMEN**

**Seed use and availability**
- Train women to deliver seed care and provide seed advice
- Encourage private sector and government seed companies to employ women in distribution network

**Mechanization Service Provider Model**
- Ensure women are enabled to act as mechanization service providers
- Provide training to women to use mechanized technology
- Provide job placement services for women displaced by increased mechanization (women most likely to be displace by greater mechanization)

**Contract Farming**
- Pilot programs where contract farming arrangements are established directly with women or women groups
- Employ women as relationship managers between farmers and millers

**Extension Services**
- Expand ‘info-lady’ model where women are trained to deliver extension services to women farmers
If executed and scaled effectively, interventions could have a sig. productivity & income impact on ~13M households

<table>
<thead>
<tr>
<th>STRESSED</th>
<th>SURPLUS</th>
<th>AROMATIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.75X baseline</td>
<td>2X baseline</td>
<td>2X baseline</td>
</tr>
</tbody>
</table>

Source: Team Analysis, Primary Analysis
Phased intervention approach will allow donors to target the “low hanging fruit” first and provide time to build partners for the contract farming intervention and extension services support.

- **Start immediately (1-3 years)**:
  - Seed use and availability (A)
  - Contract Farming model (B)
  - Mechanization service provider model (C)

- **Build and scale (4-6 years)**:
  - Extension Services Support (D)

- **Longer-term (7-10 years)**

*Source: Team Analysis*
Next Steps (1/2)

Seed Use and Availability

• Contact / meet with BRRI, BADC, BINA, IRRI and STRASA to:
  - Determine current state of research program regarding stress tolerant varieties and identify specific constraints to fast-tracking of production for most promising varieties
  - Identify specific constraints and challenges of enhancing quality of seeds supplied by BADC including supply chain efficiency
  - Determine feasibility of altering seed subsidy policy to incentivize private sector participation

• Contact leading seed companies (Lal-Teer, Supreme Seeds and ACI) to discuss proposal including detailed requirements and constraints associated with partnering with donors and government for commercialization

• Prepare RFP seeking business plans from seed companies for increasing production of HYV seed and providing seed related extension services to farmers in surplus areas. Responses to RFP must include at the very least:
  - market entry strategy including targets / forecasts of market share
  - expected investment and ongoing costs required to scale up production and distribution
  - projections of expected retail price of HYV that could realistically be provided to market and comparisons to government provided seeds
  - expected NPV of plan, including scenarios analysis and market share required to ‘break even’
  - Details on type of extension services to be provided, reach, methodology (e.g. use of dealers as intermediaries), revenue and cost impact
  - Risks and mitigating actions to successful completion

Mechanization Service Provider Model

• Contact ACI Motors and Corona to discuss mechanization service provider model in greater specificity including sounding out potential challenges

• If necessary engage financial service providers to assist in credit provision (vendors likely to require assistance with this)

• Leverage experts / existing models of vehicle financing (e.g. Car financing)

• Consult with existing entrepreneurs already providing services
### Contract Farming Model
- Contact PRAN to determine what specifically would be required to scale up current model in aromatic rice sector
- Contact millers to discuss proposal including detailed requirements and constraints associated with partnering with donors to assist in developing contract farming model
- Prepare an EOI seeking interest in setting up a contract farming model for non-aromatic rice including broad model parameters as outlined on slide 68. Responses to EOI must include:
  - Expected methodology and logistical arrangements required to implement model
  - Type of services to be provided and expected reach
  - Expected investment and ongoing costs of model
  - Expected high level qualitative and quantitative benefits to miller and farmer of model
  - Risks and mitigating to successful implementation

### Extension Support Program
- Contact and meet with DAE to propose partnership model with NGOs to boost extension services across the country
- Ascertain at a high level current state of extension services provided by DAE and gaps in service provision
- Prepare RFP seeking partners for extension support program including aims (see slide 65), scope (all Bangladesh but focus on stressed areas / farmers), time frame (2-5 years). RFP responses must include:
  - Overarching plan for providing extension services including, but not limited to new techniques using ICT to deliver extension services at scale
  - Pipeline of innovative extension services to pilot (e.g. Digital Green, Grameen Community Knowledge Workers)
  - Understanding of services provided by DAE and gaps in service provision (full diagnostic to be included as part of the program)
  - Type of services to be provided, reach, and methodology
  - Investment and ongoing costs required
  - Expected qualitative and quantitative benefits of providing extension services
  - How proposed method will meet program aims
  - Role of government in program including how responsibility will transfer to government at program close (government role not essential in program but preferred) and plans to up-skill government staff, if applicable
  - Plans for ensuring long term sustainability of program, if possible
  - Risks and mitigating actions to successful implementation
The Ministry of Agriculture has primary responsibility for supporting rice in Bangladesh with assistance from selected ministries

<table>
<thead>
<tr>
<th>Ministry of Agriculture</th>
<th>Ministry of Water Resources</th>
<th>Ministry of Energy and Mineral Resources</th>
<th>Ministry of Industries</th>
<th>Ministry of Food and Disaster Mgmt</th>
<th>Ministry of Commerce</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Consists of 18 agencies, the most important for rice are:</td>
<td>• Responsibilities:</td>
<td>• Formulates policies and regulations for the management of water resources</td>
<td>• Determines subsidies on diesel fuel – the primary source of energy for irrigation systems</td>
<td>• Promotes rural industrialization</td>
<td>• Responsible for development and regulation of trade and commerce related policies for Bangladesh</td>
</tr>
<tr>
<td>- Department of Agricultural Extension</td>
<td>- Providing extension services to farmers to increase productivity</td>
<td>• Implements development projects related to flood control, drainage and irrigation</td>
<td>• Regulates many industrial inputs to rice production including fertilizer</td>
<td>• Responsible for building foodstock through procurement or import</td>
<td>• Has exempted agricultural inputs (fertilizers, seeds) from import duties and taxes</td>
</tr>
<tr>
<td>- Seed Certification Agency</td>
<td>- Certifying and controlling quality of seed development and expanding seed industry</td>
<td></td>
<td>• Establishes a food distribution network</td>
<td>• Focuses on ensuring poor and deprived have access to food via safety net</td>
<td></td>
</tr>
<tr>
<td>- Bangladesh Agricultural Development Corporation</td>
<td>- Monitoring minor irrigation</td>
<td></td>
<td>• Responsible for ensuring consumer price of grain is stable</td>
<td>• Responsible for ensuring consumer price of grain is stable</td>
<td></td>
</tr>
<tr>
<td>- Bangladesh Rice Research Institute</td>
<td>- Conducting rice related research including R&amp;D in seed development and agronomic practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Direct support of rice production
Indirect support of rice production

Source: Respective Ministry Websites
There are at least 9 varieties of stress related seeds in the research stage that could be fast-tracked to production.

### Stressed Related Seeds at Research Stage

<table>
<thead>
<tr>
<th>Variety</th>
<th>Name</th>
<th>Yield (Mt / ha)</th>
<th>Planting Duration (Days)</th>
<th>Season</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Saline Resistant</strong></td>
<td>BR23</td>
<td>4.0</td>
<td>150</td>
<td>Aman</td>
<td>Can tolerate moderate to strong saline conditions (8 dS / m)</td>
</tr>
<tr>
<td></td>
<td>BRRI dhan 40</td>
<td>5.0</td>
<td>144</td>
<td>Aman</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRRI dhan 41</td>
<td>5.0</td>
<td>144</td>
<td>Aman</td>
<td></td>
</tr>
<tr>
<td><strong>Flood Resistant</strong></td>
<td>BRRI dhan 51</td>
<td>4.0-5.0</td>
<td>-</td>
<td>Aman</td>
<td>Can tolerate 10-16 days submergence</td>
</tr>
<tr>
<td></td>
<td>BRRI dhan 52</td>
<td>3.5-4.0</td>
<td>-</td>
<td>Aman</td>
<td>Can tolerate 10-14 days submergence</td>
</tr>
<tr>
<td><strong>Drought Resistant</strong></td>
<td>BR33</td>
<td>4.5</td>
<td>118</td>
<td>Aman</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BR39</td>
<td>4.5</td>
<td>122</td>
<td>Aman</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BR11 (ck)</td>
<td>5.0</td>
<td>130</td>
<td>Aman</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRRI dhan32 (ck)</td>
<td>6.0</td>
<td>145</td>
<td>Aman</td>
<td></td>
</tr>
</tbody>
</table>

Source: “Bangladesh Perspectives on HYV production for food security and experience-sharing on adoption of hybrid rice”, Massuduzzam, Regional Seminar on Rice Production and Mechanization, 11-12 Dec 2011