Cereal Systems Initiative for South Asia (CSISA) Program, Spurring a Transformation in Agriculture through Remote Sensing (STARS), and Climate Services for Resilient Development (CSRD)

Timothy J. Krupnik, Andrew McDonald, and many, many others

Towards better integration of R4D for improved food production systems in the coastal zone of Bangladesh.

18-19 October 2016, Bangkok, Thailand
In this presentation

1. Background – why are we doing this work?

2. Evolution of the Cereal Systems Initiative for South Asia (CSISA) program and associated projects

3. CSISA Phase III in Bangladesh

4. CSISA-Mechanization and Irrigation (CSISA-MI)

5. Spurring a Transformation in Agriculture through Remote Sensing (STARS) project

6. The new Climate Services for Resilient Development (CSRD) project

7. Looking forward – avenues for enhanced collaboration
Each dot = 50,000 people living under $1 day$^{-1}$
Some constraints agricultural productivity in coastal Bangladesh

- **Resource degradation and lack of optimization**
  - But huge scope for improvements (MoA and FAO 2012)

  - **Poor coordination among research and development efforts**
    - Competition, duplication, taking stock of lessons learned, lack of communication

  - **Growing energy and production costs**
    - 500% fuel increase in last 15 years (BBS 2003)

  - **Climate change risks**
    - Extreme weather, increased salinity, drought risk, risk and adaptation bottlenecks

- **Low crop intensity**
  - Lower than remainder of country (MoA and FAO 2012)

- **Limited knowledge of and commercial access to innovative technologies and markets**
Putting Sustainable Intensification (SI) into practice in Bangladesh’s cereal systems

SI: “Producing more output from the same area of land while reducing negative environmental impacts and increasing contributions to natural capital and the flow of ecological services” (Pretty 2008)
Evolution of the CSISA program and associated projects

“Base-CSISA”
India, Nepal, BD, PK
(USAID-BFS and BMGF)
2009-2012

“CSISA Phase II”
India, Nepal, BD 2012
(USAID-BFS / BMGF)
2012-2015

“CSISA Phase III”
India, Nepal, BD
(USAID-BFS and BMGF)
2015-2020

“CSISA-Bangladesh”
(USAID-BD)
2010-2015

SRSPDS
(USAID-BD)
2012-2013

RVC
(USAID-BD)
2015-16

CSISA Nepal Program
(USAID-NP, DC)
2013-2018

CSISA-M.I.
(USAID-BD)
2013-2018

STARS
(BMGF)
2014-2016

CSRD
(USAID-DC E3)
2016-2019

WorldFish

CSRD
(USAID-DC E3)
2016-2019

IRRI
International Rice Research Institute

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Strengthening innovation systems through partnerships

- BARC
- BARI
- BRRI
- DAE
- BADC
- BMD
- SRDI
- BAU
- CEGIS
- IWM
- AFSIS
- BWDB
- WAGENINGEN Univ.
- FAO
- JUNATA ENGINEERING
- RFL
- ACI
- THE METAL LTD
- BSMRAU
- AIP/AIRN
- JCF
- ALIM INDUSTRIES
- CSIRO
- IPNI
- SDC
- BDS
- BIID
- WEP
- AEP
- BUET
- SRDI
- Georgia Tech Univ.
- iDE
- GJUS
- ICIMO
- Syngenta Foundation
**Phase I:**
‘Packing the technology pipeline’, demonstrations and training
(2009 – 2012)

**Phase II:**
Planning around common R4D impact pathways, support to intermediaries, continued demonstration and training
(2012 – 2015)

**Phase III:**
Specific, targeted research and scalable activities
(2015 – 2020)
CSISA Phase III in Bangladesh (2015-2020)

**GOALS:**

1. Widespread adoption of resource-conserving practices and services.
3. Generate and disseminate new knowledge on cropping system practices that can withstand climate change.
4. Improve the policy environment to facilitate the adoption of SI approaches.
5. Build strategic partnerships that sustain and enhance the scale of benefits accrued through improving cereal system productivity.
CSISA Phase III in Bangladesh

Catalyzing sustainable intensification at scale

**Theme 1**
Innovation towards impact
- Reducing risk for sustainable intensification
- Adding value to extension and agro-advisory systems

**Theme 2**
Systemic change towards impact (partnerships and scaling pathways)
- Inclusive growth around commercial pockets and neglected niches
- Participatory science and technology evaluations

**Theme 3**
Achieving impact at scale (mainstreaming)
- Growing the input and service economy
- Managing risk by coping with climate extremes
FOCUS ACTIVITIES:

1. Developing DSR service economy
2. Agronomic and variety recommendations to reduce the threat of wheat blast
3. Precision nutrient management and digital soil mapping
4. Healthy rice seedling awareness raising
5. Leveraging input dealers to deploy better-bet agronomic messaging
6. Rabi fallows development
7. Premium quality rice market linkages
8. NARES capacity building – focus on on-farm research methods and advanced statistics
9. Expanding integrated weed management in rice
10. Expanding commercial machinery supply chains for machinery in Rangpur district
11. Early wheat sowing to combat heat stress
Precision nutrient management (PNM) and digital soil mapping

Goals:
- Introduce and mainstream rapid spectral-based soil assessment methods to SRDI
- Update national databases and produce Bangladesh’s first digital soil map
- Assess methods to scale-out PNM approaches

Rabi season intensification

Master Plan for Agricultural Development in the Southern Region of Bangladesh
Targeting surface water irrigation in coastal Bangladesh

Krupnik et al. 2016 - Land Use Policy

43,271 km² study area: 125,000 ha suitable for decentralized *rabi* intensification + surface water irrigation

Remote sensing

Time Series EVI of field crops

Salinity Analysis
Targeting surface water irrigation in coastal Bangladesh

All data layers in open access in decision support tool format:
Science partnerships into impact

- Assisted USAID and BADC to mobilize a BDT $1.5 million investment for irrigation canal rehabilitation
- Locations result from remote sensing analysis
- 7 Upazillas in Barisal District – 72 km of canals rehabilitated
- Now used for *rabi* season irrigation
Wheat ($n = 513$)

Maize ($n = 550$)

Boro Rice ($n = 553$)
Targeting surface water irrigation in coastal Bangladesh

Maize ($n = 550$)  Wheat ($n = 513$)  Boro Rice ($n = 553$)

Krupnik et al. 2016 - Land Use Policy
Farmers’ perceptions drive adoption behavior – and are relevant for prioritizing interventions

Farmers’ motivations differ: typological analysis

Cognitive mapping:
Relationship and intervention scenario analysis

• Intervention scenario analysis
• Sequencing of interventions

Aravindakshan, Sharin et al. (PhD & MSc. research)
Wheat blast: Agronomy, surveillance, forecasting

- **2016: Asia’s first outbreak of** *Magnaporthe oryzae*, pathotype *Triticum*
- **15,000 HA (16% national area) affected with mean 25% yield losses**
- **Epidemiology and control largely unknown**

Source: Kevin Robson, BASF, 2014
Wheat blast: Agronomy, surveillance, forecasting

- **Agro-climatology, modeling and forecasting efforts (RS, Met., experimental data)**
- **Surveillance and alternate host surveys (2016/17)**
- **Large-scale awareness raising with national partners**
What constrains wheat production in coastal Bangladesh?

- What factors are most important in determining yield under late sowing?
- 422 wheat fields – researcher backed but farmer managed
Early wheat sowing to combat heat stress (and blast)

**Goal:** Move sowing 5+ days earlier

- Short duration rice
- Tillage options, including aggregating farmers' demand
- Genotype
- Mechanized rice harvest
- Drainage
- Credit
- Time- and environment-specific N rates

Data: R.K. Malik et al.

Krupnik et al. 2015 Field Crops Research

Ahmed et al. 2016 GFS conference
CSISA – Mechanization and Irrigation (2013-2018)
OVERCOMING THE ‘VALLEY OF DEATH’ IN GETTING INNOVATIONS TO SCALE

Figure 5. The “Valley of Death” between Public and Private Sector Development Activities

R&D Funding

Government funding

Private sector funding

Basic scientific research proven

Products demonstrated and scaled up
CONSUMPTION SPREADS FASTER TODAY
CSISA – Mechanization and Irrigation

- Consumer insights
- R 4 D
- Piloting & demo
- Commercialization

Technology adoption

Opportunity & constraints identified

Technology verification (NARES)

On-farm technology validation

Advertising
Block demos
Training
Business models implemented

Private sector investment expands

Spontaneous adoption

Trigger

Uptake

Sector Growth

~15%

Product diversification and new innovations
CSISA – Mechanization and Irrigation

SO1: Intensify cropping in S. Bangladesh through surface water irrigation

SO2: Boost broad-based access to agricultural mechanization services

SO3: Public-private partnerships to support mech. in S. Bangladesh
No more business as usual

- Public-private partnerships, concentration on local agricultural machinery service providers to reach scale
Axial flow pumps (AFPs) reduce energy requirements and costs for low-lift surface water irrigation

Krupnik et al. (2015) Irrigation and Drainage

Private sector partners invest to broadly commercialize domestically made pumps
Market intelligence:
PTOS performance under farmers’ mgt. (wheat)
Facilitating BARI, university student, and private sector collaboration

PTOS – Strip tillage blades

Towards Deshi axial flow pump design

3-D printing, modeling

Best impellers built by companies, tested and refined at BARI

Prototyping at Georgia Tech
CSISA – Mechanization and Irrigation

Achievements
• > $1.75 million of private sector investment
• 800 pumps, 550 PTOS and reapers sold
• Domestic pump production
• >29,000 + ha
• >1,200 service providers
• >40,000 + farmers serviced
Spurring a transformation in agriculture through remote sensing (STARS, 2014-2016)

- Application of remote (satellite) and proximal (drone) sensing to improve irrigation scheduling in southern Bangladesh
- Field-specific irrigation algorithm considering groundwater and salinity dynamics (wheat, maize, mung bean)
Spurring a transformation in agriculture through remote sensing (STARS)

- Program for Advanced Numerical Irrigation (PANI) conceptual proof of concept
Spurring a transformation in agriculture through remote sensing (STARS)

• Multi-scale assessment of surface water irrigation feasibility

Macro-scale (region)  Meso-scale (actionable)
Climate services for resilient development (CSRD, 2016-2019)
Climate services for resilient development (CSRD)

Objective 1: Impact-based national-scale decision tool platforms

Objective 2: Collaborative development and refinement of South Asian regional-scale agro-climate decision support tools

Objective: 3 Coordination of CSRD partners
Looking forward: Where do we need to go?

- Research for long-term time horizons (preparing for 2030)
- SWOT analysis for ag. R4D in coastal Bangladesh?
- Prioritize: Seek synergy, avoid duplication (and competition!)
- More integration with development partners
- Interdisciplinary integration with social scientists!
Thank you! Questions? t.krupnik@cgiar.org