



Scoping Studies for the Capacity Development of Agricultural Innovation Systems (CDAIS): Bangladesh Country Report

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We have attempted to capture and convey the views and perceptions of many of agricultural innovation stakeholders in this report. The authors alone accept responsibility for any shortcomings, omissions or errors.

Executive Summary

As the first task of the EC-funded project 'Capacity Development for Agricultural Innovation Systems' (CDAIS), a scoping study was undertaken in Bangladesh during September 2015 with the main purpose of mapping and characterising key stakeholders, projects, programmes, policies and existing coordination mechanisms related to agricultural innovation systems development at national or sub-national level. A further task was to identify those engaged in capacity development for AIS and potential champions in AIS or CD for AIS as well as potential organisations/teams with which the CDAIS project could work during project implementation in Bangladesh. Service provider organisations that could provide training in capacity development were explored. The study involved a review of relevant documents to assess the institutional and policy context. The authors then met with as many stakeholders involved in agricultural innovation systems (AIS) as time allowed. To this was added information about the main stakeholders and the linkages between them, obtained from web-based material. A further purpose of the scoping study was to identify and briefly characterise a series of ten to twelve on-going innovation partnerships (or value chains or themes) at national or sub-national level. These were presented at the Inception Workshop in December 2015 for consideration, development and prioritisation by project stakeholders with the aim of identifying two to three innovation partnerships/value chains for the CD for AIS interventions in Years 2-4.

The Capacity Development for Agricultural Innovation Systems (CDAIS) Project will contribute to more efficient and sustainable agricultural innovation systems by identifying challenges and solutions, with multi-stakeholder interaction, and addressing capacity development in support of agricultural innovation. CDAIS project activities will focus on capacity development at three levels: individual, organisational and the enabling environment. It will address the four capacities required which support an effective agricultural innovation system – the capacity to navigate complexity, for collaboration, for reflection and learning and to engage in strategic and political process.

The agricultural innovation systems concept was not familiar to many of the people interviewed; although we appreciate the scoping study was not exhaustive. However, project documents consulted subsequently indicate that many organisations have been exposed to new approaches to research and extension. There have been research projects in the last 15 years, which have stressed farmer-focus and poverty elimination in their approaches. One of the first of the large donor-funded projects that involved many of the stakeholders consulted for this scoping study - BARC, BRRI, RDA and DAE as well as many NGOs – was the Poverty Elimination Through Rice Research Project (PETRRR). PETRRR fostered the concept of demand-driven research. The concept of participation is well known and referred to, particularly by NGOs. Most of the agricultural research institutes refer to links to farmers (via technology centres, field days and training) but top-down linear, technology-transfer approaches are often cited in conversation.

In stakeholder presentations, their organisational brochures and website material very limited mention is made of collaboration with other research institutes and stakeholders. From this, it would appear there is limited communication and coordination between research organisations, the private sector and extension providers to maximise resources and impact of results for farmers. However, strong *ad hoc* links (institutional; personal) exist between NARS, DAE, RDA, NGOs, Universities and private companies via MoU, involvement in large projects, training and sponsorship. The documentation for the second phase of the National Agricultural Technologies program (NATP-2), 2015-2021 highlights the need address key constraints for increasing the efficiency and performance of the national agricultural innovation system.

There is widespread recognition of the need for consultative, needs-based research strategies. The current NARS research priorities are based on formal consultation with stakeholders (though the extent, depth and gender

balance of consultation could be broadened). This is a positive development but more needs to be done to ensure a wider range of farmers' and private sector views and needs are represented in future.

There was strong recognition of role of agricultural universities. Agricultural graduates work in a wide range of agricultural-related employment, both in the private and public sector. Some projects are underway to make teaching more learner-centred and relevant to employer needs. AIS development would be a good subject area to include in revised curricula.

Although the private sector increasingly works alongside government research and extension staff in projects and sourcing initiatives, distrust is still voiced about their motivations and their profit focus. The private sector does appear to be at the forefront of much agricultural innovation. Companies undertake market research with consumers and farmers to ensure that their products meet their needs and many government-trained researchers end up working for private companies.

Farmer organisations tend to be project related, and few seem to be sustainable (FAO, 2014). While some organisations may endure beyond the life of an intervention they appear to be absent from stakeholder consultations. The absence of an apex farmer organisation makes such consultation more difficult.

Seven possible areas of focus are proposed for further consideration and validation as innovation partnerships for potential links to the CDAIS project's activities. Further activities will be undertaken with stakeholders to determine which are most suitable for the project's capacity development interventions in years 2-4. These will then be validated at national level by the project's Steering Committee. These innovation partnerships include the export mango value chain. In May 2015 mangoes began to be exported to a supermarket chain in the UK. This is involved a wide range of public, private and international stakeholders, together with farmers, working together to meet the exacting import regulations and private standards required for exporting fresh produce to the European Union. The lessons learned need to be studied not only to support this ongoing activity but also so that they can be replicated for other crops and produce. The others are Fish - Rice farming innovative practices including fish seed production and water management; the Maize value chain including seed maize production with WISE (Women in Seed Entrepreneurship); the Dairy value chain; Agroforestry and livelihoods including medicinal plants; Local sourcing initiatives and On farm food safety. The Inception Workshop will provide opportunities for stakeholders to consider these niches and to propose others. It will be important that farmers' views are included.

Several potential service providers are also identified, which could be involved in providing training in capacity development for sector stakeholders at different levels. The National Agricultural Training Academy at Gazipur, which is the training facility of the Ministry of Agriculture, mandated to provide training for officials engaged in agriculture. The Rural Development Academy at Bogra is an autonomous body of the Rural Development and Co-operatives Division of the Ministry of Local government, Rural Development and Cooperatives with the facilities to train a wide range of beneficiaries, including farmers. The Bangladesh Academy for Rural Development at Comilla provides training to government officials and others involved in rural development. The Krishi Gobeshona Foundation promotes linkages between Bangladesh Agricultural Research Council (BARC), the National Agricultural Research System (NARS) institutes, technology dissemination systems, farmer organisations and private sector entities dealing with agricultural research, development and extension. KGF also provides support for training programmes to enhance scientific, technical and managerial capabilities of individuals and organisations involved in agricultural research (crops, livestock, and fisheries) and technology transfer.

To maximise the impact of the CDAIS project and to minimise duplication of efforts it is suggested that consideration be given for CDAIS inputs be directed towards building capacity for the NATP-2 programme. The new phase, which begins in late 2015, focuses on overcoming key constraints to increasing the efficiency and performance of the national agricultural innovation system and fits in well with the aims and objectives of the CDAIS project. Component 1: Enhancing the Agricultural Innovation System, led by the Project Management and Coordination Unit with implementation support from other agencies, will support the development of decentralised, demand-driven and integrated agricultural research. This component will include capacity enhancement for Common Interest Groups and emerging Producer Organizations, and strengthening the National Agricultural Research Institutes (NARS) (including developing one-stop farmer advisory service centres. The focal crops/sectors include rice; maize, tomato, potatoes, banana, mung beans and lentils, dairy, beef, aquaculture and open capture fish and market access. The project document (World Bank, 2015) notes that the extension system has still extremely limited reach into the country's communities (in particular for the fisheries and livestock subsectors where local level public extension workers are absent) and worse, hardly communicates with the NARS, or the relevant private and nongovernment entities engaged in technological advance.

The key issue identified in the NATP-2 project document (World Bank, 2015) is that "the national agricultural innovation system is far from exploiting the systemic interactions that should drive it to success, and the insufficiencies pervade the system both within the subsystems, the all-too disconnected and in some instances less than strong elements of the NARS: public-private links are disturbingly absent, and links between research entities public and private with the higher education sector are sparse and severely underexploited. To enable agriculture and stakeholders to adapt readily when challenges occur and to respond readily when opportunities arise, the proposed project will seek to overcome some of the key constraints to increasing the efficiency and performance of the national agricultural innovation system". These challenges and goals fit in well with the aims and objectives of the CDAIS project.

There is increasing recognition, particularly at senior level, of the need to change the way in which research is undertaken to meet the complex challenges facing agriculture in Bangladesh in the 21st century. Furthermore, the capacities espoused in AIS thinking – the capacities to navigate complexity, for collaboration, for reflection and learning and to engage in strategic and political process – have been adopted, in full or in part, in past initiatives and embraced at individual project level. Such willingness to explore how such change might be embraced and institutionalized will be an important aspect of the CDAIS project in Bangladesh.

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Acronyms and Abbreviations

AEC	Agricultural extension component
AIS	Agricultural Innovation Systems
AR4D	Agricultural Research for Development
ARMIS	Agricultural Research management Information System
BAPA	Bangladesh Agro-Processors' Association
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BARD	Bangladesh Academy for rural Development
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BCA	Bangladesh Country Almanac
BINA	Bangladesh Institute for Nuclear Agriculture
BFRI	Bangladesh Forestry Research Institute
BRRRI	Bangladesh Rice Research Institute
BFRI	Bangladesh Fisheries Research Institute
BLRI	Bangladesh Livestock Research Institute
BSMRAU	Bangabandhu Sheikh Mujibur Rahman Agricultural University
CAB	Consumer Association of Bangladesh
CBO	Community based organisation
CD	Capacity Development
CDAIS	Capacity Development for Agricultural Innovation Systems
CEGIS	Centre for Environment and GIS
CFS	Climate field School
CGP	Competitive Grants Program
CIG	Common Interest Groups
CIMMYT	International Maize and Wheat Improvement Centre
DAE	Department of Agricultural Extension
DCRMA	Disaster and Climate Risk management in Agriculture
DG	Director General
DLS	Department of Livestock Services
FAO	Food and Agriculture Organisation
FFS	Farmer Field School
FTF	Feed the Future
GDP	Gross domestic product
ICM	Integrated crop management
IPM	Integrated pest management
IRRI	International Rice Research Institute
KGF	Krishi Gobeshona Foundation
MoA	Ministry of Agriculture
MoFL	Ministry of Fisheries and Livestock
MoU	Memorandum of Understanding
NARS	National agricultural research institutes
NATP	National Agricultural Technologies Program
NGO	Non-governmental organisation
OFRD	On Farm Research Division, BARI
PAB	Practical Action Bangladesh
PKSF	Palli Karma-Sahayak Foundation
PETRRRA	Poverty Elimination Through Rice Research project
RDA	Rural Development Academy
SRDI	Soil Resource Development Institute
TAP	Tropical Agricultural Platform
T&V	Training and visit
USDA	United States Department of Agriculture
USAID	United States Agency for International Development
WISE	Women in Seed Entrepreneurship

Introduction and Background to the CDAIS Project

The importance of increasing efficiency and effectiveness to achieve food and nutrition security is widely accepted but the science and innovation systems needed to bring this about are often fragmented. In Bangladesh, agricultural sector growth is essential for reducing poverty (Harun-Ar-Rashid *et al.*, 2012b). Improving agricultural performance requires an enabling environment that acknowledges the roles and needs of a range of stakeholders. The agricultural innovation systems approach is an interactive process in which learning is important (Francis *et al.*, 2014). An agricultural innovation system (AIS) encompasses the efforts of the stakeholders - farmers, farmer organisations, research organisations, universities, extension providers, businesses (input suppliers, processors, and purchasers), regulatory agencies, and policy makers - to bring new techniques and practices into widespread use. Sustainable innovation is considered to be one of the keys to poverty reduction in developing countries (Akhter and Farrington, 2007).

Some developments in agricultural research have significantly increased agricultural productivity, such as the high yielding wheat and rice varieties linked to improved availability of inputs and irrigation as in the Green Revolution. This encouraged large-scale public investments, often financing by external borrowing, to develop capacities for agricultural research and extension (Asopa and Beye, 1997). However, in many countries such investment did not result in concomitant and sustained increases in production. There are many reasons for this. The task of transferring technologies to millions of under-resourced and undereducated farmers in the days before widespread availability of videos, the internet and smart phone technology was very expensive (ictinagriculture.org)¹ and there is a tendency for extension resources to focus on the commercially oriented farmers with larger holdings. Research investigations do not always address the priority needs of agricultural producers or were of less relevance in addressing the prevailing problems. Another ongoing concern is that the knowledge generated at the research stations and universities does not adequately reach enough producers, particularly poorer, landless and female farmers.

Much has been written on the evolution of extension methods and the challenges of providing farmers with 'effective, efficient and appropriate technology, training and information' (Jiggins *et al.*, 2000) over the past few decades. Weaknesses in the links and limited incentive to work closely together, between research and extension institutions can be a major reason for lack of innovation. Communications between public research and extension agencies can be inadequate due to limited resources, and a prevailing top-down philosophy. There may also be limited interaction between research organisations and NGOs, the private sector and farmers. The conventional transfer-of-technology model was a one-way process where technologies developed by scientists were passed on to extension services to be transferred to users (as exemplified by the training and visit (T&V) method). This model limited facilitation of farmers to identify constraints or adapt the technology to local conditions, and there was a tendency to focus on better-resourced, commercially oriented farmers, often male. Agricultural research (and extension) tends to be organised around scientific disciplines and specific sub-sectors rather than farming systems while farmers have to grapple with a complex interaction of crops and livestock, to achieve multiple goals of household food security, income generation and safeguarding the quality of their resources. This further increases the difficulty of meeting farmers' needs.

A modification to the approach permitted feedback from farmers on their responses to a new technology but the feedback function tended to rest with the extension providers, often underfunded and denigrated by the research services (Asopa and Beye, 1997). To deal with the growing number of farmers and limited resources to reach them all, farmer field schools (FFS) were set up in some countries to introduce problem-oriented training and development of sustainable solutions. FFS have been operating in Asia for 30 years - initially introduced to

¹ Increasingly private sector and non-government organisations are making use of digital technologies to support farmers in Bangladesh, such as the RDA Plant clinics and mPower's digital agricultural services.

pioneer integrated pest management in rice production. The first FFS that were organised in Bangladesh in the early 1990s (by the FAO rice IPM programme), had a strong focus on integrated pest management (IPM) and reducing pesticide related problems although subsequently they evolved to a more holistic approach of crop production (AEC, 2011). FFS adopted a participatory approach whereby extension agents (public and NGO) encouraged farmers to think about and apply their own knowledge and ingenuity to find solutions to local problems in partnership with scientists and extension agents. Participatory methods have been widely used to obtain an overview of farmer issues and to ensure that target groups are involved in a process of change. Participatory approaches in research, extension, learning and action encourage the involvement of a multidisciplinary team and respect for different viewpoints, particularly of those underrepresented - minority ethnic groups, women, and older people. Value chain approaches have evolved from this and focus on purposively linking actors in a market chain, not just farmers to traders to processors and consumers, but also considering the parts played by input suppliers, banks, research, extension, consumers, policy makers, standards agencies, institutions, such as farmers' organisations, industry associations and consumer organisations.

To foster agricultural innovation systems requires better understanding of issues from a wide range of perspectives and expertise. This highlights the need for particular learning capabilities of both individual actors and the institutions involved. Efforts to strengthen capacity in agricultural innovation have tended to focus on developing individual competencies, such as technical skill upgrading for researchers, e.g. funding for PhD study. Organisational capabilities and the systemic capacity of innovation partnerships to facilitate innovation have received limited attention. Developing the overall capacity of an agricultural innovation system requires focusing on the knowledge, attitude and skills competencies necessary to build more effective and dynamic relationships among the multiple actors (Woodhill and Pyburn, 2014). The nature and quality of the linkages, to allow a great communication between and among actors, is also important. Capacity development (CD) for AIS implies a shift in mindset in, among others, considering knowledge generation as a final objective to using it as a means to achieve change, and facilitating engagement for interactive learning between stakeholders, resulting in joint analysis, planning and collective action. It requires a shift in the culture of research and development (R&D) organisations from an exclusive focus on individual merit and competition to promoting collaboration and teamwork within and between organisations (TAP, 2016).

The Capacity Development for Agricultural Innovation Systems (CDAIS) Project is designed to address these different dimensions, and promote coherence and sustainability of actions to improve and support agricultural innovation. CDAIS is funded by the European Commission, through a grant agreement with the Agrinatura network of European research and education organisations which is partnering with the Food and Agriculture Organization of the United Nations (FAO), to strengthen agricultural innovation systems through capacity development. This four-year project will further develop and strengthen the Tropical Agriculture Platform (TAP), a global platform hosted by the FAO to promote and share capacity development experience and expertise in AIS. In addition, Agrinatura will lead the implementation of specific project actions to strengthen innovation systems in eight pilot countries: Angola, Bangladesh, Ethiopia, Guatemala, Honduras, Laos, Niger and Rwanda.

The CDAIS project fits in well with the goal of the overall EC's support in this area and that of the EU Delegation in Bangladesh. The goal of the EC's Directorate-General for International Cooperation and Development's Agricultural Research for Development (AR4D) is "to harness the power of agricultural research to provide solutions that lead to reduced poverty and hunger and to make an effective contribution to sustainable agriculture, nutrition and resilience in developing countries." (European Commission, 2014:9). Enhancing capacity and impacts at country level, based on local-developed solutions form part of the EC's policy and adoption of an innovation systems approach is recognised as the way forward "to facilitate integration of research, extension and capacity building at country level" (European Commission, 2014:25).

Why Are Scoping Studies Being Conducted?

In its first year, the CDAIS partnership will elaborate a vision on capacity development for agricultural innovation systems, based on global frameworks developed by the Tropical Agricultural Platform (TAP) as well as from scoping study findings in each of the eight pilot countries to identify the main players and forms of organisation. This will ensure that CDAIS operates through the most appropriate mechanism at the country level. Based on general principles from the TAP, and capacity development needs, national stakeholders will then tailor interventions to the specific needs of each country. By the end of the project, the partnership will have demonstrated how improved capacity in AIS can have an impact on the lives of the rural poor, and will have developed guides to policy formulation and future investments on capacity development for agriculture innovation system that can also be extended to other countries.

The main objectives of the national scoping studies are to:

1. Map and characterise stakeholders, projects, programmes, actors, individuals and existing coordination mechanisms active in AIS at the national or sub-national level, and identify those that are engaged in capacity development (CD) for AIS.
2. Identify and undertake initial characterisation of on-going innovation partnerships with potential links to the CDAIS project. Some of these will be selected as case studies, or niches, for the CD interventions in years 2-4. The selection criteria will be defined during the study by the project team.
3. Gain in-depth knowledge of the roles and performances of the main stakeholders in agricultural innovation and related capacity development in the eight pilot countries.
4. Identify and characterize “champions” in AIS or CD for AIS (leading individuals within organizations/networks) as well as potential teams with which the project could work.
5. Establish the bases for a functional working relationship with the relevant country offices of FAO and the EU as well as the Government institutions during the implementation of CDAIS.

The Agrinatura Country Focal Person (AFP), Claire Coote, of the Natural Resources Institute, University of Greenwich, led the scoping study in Bangladesh together with national consultant, Dr Zulfikar Rahman, of the Department of Agricultural Extension, Bangladesh Agricultural University (see Annex 1 for the TOR). Support was provided by Dr Nasreen Sultana, Programme Manager, FAO Bangladesh office (assistance with identification of stakeholders, facilitation of contacts with government and other organisations and participation in the visits).

The National Context for Agriculture / Agricultural and Rural Development

The importance of agriculture, trends in investments, priorities of governments, challenges and issues in agriculture, key AIS players, application of the AIS approach, AIS examples, etc.

Around 70% of the population depends on agriculture in one form or another for their livelihood (Miah *et al.*, 2015). Two-thirds of the population live in rural areas although the country is rapidly urbanizing, providing a ready market for food and agricultural raw materials. Bangladesh is the world’s most heavily populated non-island country. Most of the country is less than six metres above sea level and highly vulnerable to natural disasters (floods, cyclones and droughts). High levels of poverty and inequality exist, with more than 40% of the population living on less than US\$1.25 per day and 75% on less than US\$2. It has a relatively high rate of under nutrition, with poverty, lack of access to agricultural land, and poor eating habits contributing; it also has a high rate of child stunting at 36.8 percent. However, in 2007, Goldman Sacks listed Bangladesh among their Next 11 economies with potential to become one of the world’s largest economies in the 21st century. Nevertheless, to reach middle-income status by 2021 the country must increase its growth rate from 6% (2014) to 7 - 8% in an inclusive and sustainable manner. Bangladesh ranked 142 of 187 countries in the 2014 UNDP Human Development Index and has medium human development status.

Agriculture is still the single largest sector in the economy, contributing 16% of GDP in 2013-14, amounting to Taka 1,617,373 million or around €16 billion. Forty-seven percent of the labour force is engaged in agriculture directly and rural areas are home to 66% of the population. Rice is the main crop (Bangladesh is the sixth largest global rice producer). Other cereals include wheat, maize, millet and sorghum. After rice, potatoes are the next largest crop, in value terms. Milk, fruit (mangoes, mangosteens and guava, other tropical fruit and bananas), meat (beef and chicken), vegetables, eggs, onions, areca nuts and jute are also in the top 20 by value (FAOSTAT 2013 data). Statistics on fish are recorded separately and only given in volume terms. The fisheries sector contributes more than 4% to GDP; fish, together with rice, is the backbone of the Bangladeshi diet. The recorded *per capita* consumption is 14.9 kg; fish is especially important for poorer groups for which it is often the only source of animal protein. The top five agricultural exports by value are fish and shellfish (7% of total exports); jute; raw hides, skins and leather; tobacco, and fruit and nuts (ITC Trade Map 2013 data).

Agricultural production and productivity, particularly rice and wheat yields, has increased significantly in the past four decades since Liberation in 1971 and this has greatly improved food security (Table 1).

Table 1: Population and rice production increases and needs, 1970 to 2016

	1970*	BARC* estimate for 2012-13	USDA ** estimate for 2012-13	USDA ** estimate for 2014-15	USDA ** forecast for 2015-14
Population (million)	71	+150		160	160
Rice consumption (million tonnes)			34.9	35.3	35.6
Rice production (million tonnes)	10	34.43	34.39	34.5	34.8
Rice production area (million ha)			11.75	11.79	11.8
Average rice yields (t/ha)	1.05	4.32	2.92	2.93	2.95

Source: *BARC, 2011; USDA, 2015

Agricultural production increased at around two percent per year in the 1970s and 1980s and increased during the 1990s and 2002 to around four percent per year. The Sixth Five Year Plan had a target average annual growth of 4.5 percent and a 5.1 percent growth rate was achieved in 2010-2011. This rate did not sustain and fell sharply in 2011-2012 to 2.7 percent and to 2.2 percent in 2012-2013. The performance drop is attributed to the slower growth of the crop sector; the livestock sector initially did better but growth rates then slowed while the fisheries sector met its targets (Miah, 2015).

Further increases in productivity and diversification are vital to meet the food needs of its growing population and to provide income-earning activities in the rural areas. There are many challenges that continue to beset that the agricultural sector which are likely to become further exacerbated with the impacts of climate change (BARC, 2011). Identified challenges include raising productivity and farm profitability; diversifying in line with changing food consumption patterns and minimising trade imbalances; reducing instability of production, increasing resource use efficiency, reducing loss of arable land, minimising yield gaps, maintaining food safety and quality, expanding irrigation and mechanised production, developing resilience to climate change impacts (Miah, 2015).

Many of the stakeholders interviewed made reference to two key production challenges in particular: i) water availability, and ii) the 'yield gap' - the difference between actual and attainable yield. According to BARC (2011) this refers to the difference between national average yields and research stations yields and can be reduced through increasing resistance to pests and diseases and greater ability to withstand abiotic hazards faced by farmers (water availability, temperature, soil).

Key policies affecting the agricultural sector include the 6th and 7th 5-Year Plan; the National Agricultural Policy 2013; the New Agricultural Extension Policy 1996; the National Food Policy 2006; the National Fisheries Policy 1998; the National Livestock Development Policy 2007; the National Water Policy 1999; the National Forestry Policy 1994 and the National Sustainable Development strategy 2013.

In terms of innovative approaches to research and extension, the National Agricultural Policy emphasises a bottom-up approach for identifying research needs and setting research priorities. Similar strategies were suggested for agricultural extension. Agricultural research was recognised as being important early on and the founding of the Bangladesh Agricultural Research Council in 1973, and establishment of twelve research institutes, is testament to this. Research at these institutes is credited with increasing food and produce production, via technologies to obtain higher yields, particularly for rice and wheat. The need for research to respond to farmers' needs was highlighted by the Minister of Agriculture in 1983 (BARC, 1985:5-6) to mark ten years of BARC's establishment:

'Research should improve the conditions of our farmers, for they are striving to overcome hunger, and upon their income all economic activities depend ... Our research has to be farmer oriented ... there should also be an easy flow of information among research organisations and throughout the research system. This relationship and sense of co-operation should exist as well within agricultural extension, the agencies supplying inputs, the national seed agencies, and the governmental policy makers. Improved systems need to be developed to carry information to the general members of the public who ultimately bear the cost of the research system and to benefit such people from the research efforts.

There must be coordination in determining the present and future research priorities, and thus such different training programmes as in-service training and the education of future agricultural scientists are essential. The Government established BARC to fulfill this object [sic] to give assistance to the farmer communities. Above all the flow of research should provide maximum benefit of the planned and integrated technology to the people in general'.

Although agricultural research has contributed to significantly higher yields for the country's most important crops, rice and potatoes, many of the recommendations and technologies developed by the research institutes have tended to address national food security needs, particularly in terms of output to meet demand rather than to respond to the resource levels and requirements of the majority of farmers. This was already apparent in 1977, when it was observed, 'Farmers with double the average holding of about two acres and the opportunity and ability to take advantage of improved strains of rice will become affluent overnight. Others with small holdings, families above the average size, and difficulty in taking advantage of improved methods, will see their dependents without employment' (Parkinson, 1977).

A key component of the transformation of agricultural sector has been the development and adoption of mechanisation, which is credited for increasing cropping intensity² to around 190 percent. Over the past three decades the use of farm machinery and mechanised postharvest processes has increased considerably; a result of both the Government and the private sector playing important roles. The cutting of import duties in 1988 led to power tillers almost completely replacing the use of oxen for land preparation over the following 15 years (Harun-Ar-Rashid *et al.*, 2012). Some 80 percent of all land preparation and other primary tillage operations are now mechanised with small two-wheel tractors predominating. Additionally, 60 percent of land is irrigated by over one million small diesel powered pump-sets. Manually operated rice seedling planters, weeders and sprayers are in wide scale use and small machines thresh most of the wheat and much of the rice crop. Combine harvesters are increasingly used on larger holdings (Hossain *et al.*, 2015). The Research and Extension on Farm

² The proportion of the cultivated area that is harvested; it may exceed 100 percent where more than one crop cycle is feasible on the same area each year.

Power Issues (REFPI) project, funded by DFID and managed by the Department of Farm Power and Machinery of BAU between 1999 and 2003, played a big role in providing competitive matching grants for demand led, participatory research to develop and test approaches for delivering appropriate rural power technologies and information to poor rural households. The project encouraged partnerships between GO, NGO and private sector institutions for research and extension (Ziauddin, 2003). BARI's Farm Machinery and Postharvest Process Engineering Division is involved in developing and evaluating farm machinery use.

Key Donor Support for Research and Innovation

Many of Bangladesh's key donors to the agricultural sector have encouraged innovative approaches and tried to foster them in the projects that they support. For example, DANIDA supported the up-scaling and further development of the Farmer Field School (FFS) approach since 1997, initially through the Strengthening Plant Protection Services projects, from 1997-2006 and then through its Agricultural Sector Programme Support (Phase 1 from 2001 to 2006) and its second phase from 2006 to 2012. The Agricultural Extension Component (AEC) organised crop-based FFS on Integrated Crop Management (ICM) in rice, in 217 Upazilas in 32 districts in the North, North West and Southern parts of the country. The AEC had two immediate objectives, which were i) the improved, demand driven, integrated and decentralized extension systems developed to support poor, marginal and small farmer households and ii) enhanced capacity of concerned agencies of the Ministry of Agriculture. AEC outputs and targets focused on the enhanced capacities of the DAE, Agricultural Information Services, BARI's On Farm Research Division (OFRD) and the Seed wing. The targets for the DAE were:

- 200,000 farm families trained for 1 season (20 FFS sessions)
- 8,000 FFS with ICM approach established and developed in selected Upazilas
- 6,000 FFS developed into clubs, CBOs, and farmer associations. Clubs got support for marketing, agri-business and micro-enterprise development.
- 400 new DAE field level officers developed as facilitators
- 1,000 new Farmer Trainers (FT) developed through training for selected male and female farmers
- 2 million farmers exposed to ICM through field days with increased emphasis on linkages between agricultural production, food use and nutrition.

The Agricultural Information Services' targets were the increased use of mass media and ICT (information and communication technology) for the dissemination of extension messages and market information including awareness raising on nutritional, food use and food safety issues. For BARI's On Farm Research Division it was the development and adoption of appropriate technologies for small and marginal farmers through applied and participatory on-farm research and demonstrations, using the FFS. For the Seed Wing the targets were to support the Seed Certification Agency and private sector and the increased availability of quality seed (AEC, 2011).

The United States Agency for International Development (USAID) supported private agricultural innovation through the Agro-based Industries and Technology Development Projects I and II during 1996–2005. Since 2008, the World Bank, through the National Agricultural Technology Project, has supported the Krishi Gobeshona Foundation to fund private and public demand-driven agricultural research.

The US Government's Feed the Future (FTF) Programme, 2010 to 2015 has targeted its investments in areas with the greatest growth potential for rice production and diversification, prioritised high-value agricultural production and with high levels of poverty and malnutrition. Its objective is the increase in availability, access and use of domestically produced and nutritious foods. Project activities has taken place in 20 districts in the Southern Delta region although some are overarching and at national level, such as key investments to enhance agriculture innovation capacity. FTF is strengthening agricultural research capacity with a focus on (i) crops that are resilient to climate change-related challenges, such as salinity, drought, and floods; (ii) improved cost-

effectiveness; (iii) improved farming practices, including fertilizer use and better irrigation and (iv) high-value crops. Socioeconomic research is emphasised, especially in the promotion of agribusiness marketing, value-addition and analysis of the overall enabling environment. Natural resource management issues, such as soil fertility and erosion and the impacts of pesticide use, are an important part of building research capacity. Programmes focus on strengthening extension services to farmers through government, NGOs and the private sector to facilitate the dissemination of research results. Gender roles in farming and household gardening activities and increasing the number and skills of female extension agents is a particular focus. FTF is concentrating on scaling four technologies/practices to help smallholder farmers: fertilizer deep placement; high yielding/stress tolerant rice seeds; improved aquaculture practices (such as better feed, pond management and disease-free larvae) and a service-provider delivery model for mechanisation and irrigation. It is also strengthening extension programmes, involving both the government as well as NGOs such as US government USG-supported research. Extension approaches will emphasise strengthening local farmers' own capacity through participatory approaches that provide feedback to researchers based on farmer experiences and priorities; explore partnerships with Bangladesh Agricultural University on curricula development/modernizing and Department of Agriculture Extension Training Centre. Priority institutions are BARI, BFRI, BRRI, BAU, BSMRAU, University of Dhaka (Department of Fisheries only) and Khulna University.

The FAO's Bangladesh Country Programming Framework, Towards Sustainable Agriculture and Improved Food Security 2014 to 2018 (FAO, 2014b), sets out FAO's priorities for its technical and development assistance to the Government of Bangladesh. These focus on four priority areas:

- (i) Reducing poverty and enhance food security and nutrition (access and utilization);
- (ii) Enhancing agricultural productivity through diversification/ intensification, sustainable management of natural resources, use of quality inputs and mechanization;
- (iii) Improving market linkages, value addition, and quality and safety of the food system, and
- (iv) Further improving technology generation and adaptation through better producer-extension-research linkages.

The fourth priority area, which focuses on 'better producer-extension-research linkages' is most akin to the objectives of CDAIS. This area highlights the need for adaptive research as well as strengthening of the mainstream extension services (DAE, DLS and DoF), in terms of human or financial resources, and improvement of linkages between farmers, researchers and extension staff to ensure that the research agenda further caters to real farmer/producer needs. The need for enhancing farmer capacities through field schools and programmes of adaptive farmer-centred research is acknowledged as is the increased use of ICT to support communication in agriculture, with both knowledge and data transfer to and from the field. Strengthening of rural communication services, including traditional and modern media techniques, for improving grassroots level exchange and linkages will be another element.

The EU's Country Investment Programme: A road map towards investment in agriculture, food security and nutrition, 2010 - 2015 (CIP)³ mentions innovations (sections 2.3:3 on investment and 6.5:7 on Gender, which acknowledges the need to learn and scale up successful innovations from the NGO sector.

The EU's Multiannual Indicative Programme 2014-2020 focuses on three sectors: i) Strengthening Democratic Governance, ii) Food and Nutrition security, iii) Education and Skills Development. It will continue to promote equitable growth and improved democratic governance with the aim of eradicating extreme poverty and increasing resilience.

³ https://www.gafspfund.org/sites/gafspfund.org/files/Documents/BangladeshCIP_ARoadMap.pdf

The World Bank funded, Second National Agricultural Technology Program (NATP-2), 2015 to 2021, aims to support a million poor, small and marginal farmers in 57 of the country's 64 districts and span a broad range of agro ecological zones. These small-scale farmers will benefit from stronger linkages with research, on-farm demonstrations of improved technologies, training and skills development, agricultural extension services, and co-funding productive assets. The project aims to increase and diversify agricultural production, and ensure the poor farmers' access to markets. The project seeks to increase agricultural productivity of crops, livestock and fisheries (the focal crops/sectors include rice; maize, tomato, potatoes, banana, mung beans and lentils, dairy, beef, aquaculture and open capture fish and market access. The project will continue the formation of farmers' groups, 35 percent of which are to consist of women. The project builds on the lessons learnt and the successes of the first NATP project. NATP-2 will promote an integrated approach to help to achieve food security, adapt to climate change and enhance nutrition through safer and more diversified food. It will improve the country's agricultural research system through adopting a demand-driven, market-oriented and decentralised approach to agricultural research and strengthening agricultural research institutions.

NATP-I (2008-14) funded by the World Bank, focused on revitalising the agricultural technology system - includes agricultural research, extension and development of supply chain. The Ministry of Agriculture (MoA), the Ministry of Fisheries and Livestock (MoFL) jointly implemented the project. The Bangladesh Agricultural Research Council (BARC), the Krishi Gobeshona (Agricultural Research) Foundation (KGF), set up under the project, and the national agricultural research Institutes were responsible for implementing the research component. Other public and private research and development organisations, including universities and NGOs, participated in the Competitive Grants Program (CGP) under the research component. The Departments of Agricultural Extension (DAE), Fisheries (DoF) and Livestock Services (DLS) implemented the extension component. The Horticulture Export Development Foundation (Hortex), an autonomous organization under MoA, coordinated implementation of the development of the supply chain component. MoA was the lead ministry and implementing authority for BARC, the research institutes dealing with crops, KGF, DAE and Hortex. The Ministry of Fisheries and Livestock (MoFL) was the implementing authority for DLS, DOF, BLRI and BFRI. DAE, DLS and DoF mobilised farmers into common interest groups (CIGs) and producers' organizations (POs) for agricultural extension support.

Participation and Inclusion in Bangladesh

Bangladesh has also been at the forefront of participatory approaches and has seen a flourishing of NGOs supporting agricultural sector development over the past four decades. These organisations, both national and international, have tended to focus their efforts on supporting the poorer and marginalised producers, introducing new technologies, such as rice and fish production, as well as facilitating farmer access to markets.

Donor approaches, particularly in the last twenty years, have also encouraged focus on raising the production and poverty of the poorest. The Poverty Elimination Through Rice Research Assistance (PETRRA) project, which ran between 1999 and 2004, managed by the International Rice Research Institute (IRRI) and supported by £9.5m of DFID funding with contribution of staff time from the Government, explored and supported the development of innovative extension mechanisms through a learning-by-doing process with multiple service providers. Partnerships linked government, non-government and private sectors. Two quotes from the 2001 Project Strategy document indicate the approach used in the project:

'Poverty Elimination through Rice Research Assistance (PETRRA) is a research project whose purpose is to enhance the productive potential of rice-based farming systems in Bangladesh. The goal of the project is to substantially increase domestic rice production and incomes by 2008 such that it contributes towards a 50% reduction in rural and urban poverty by 2015.'

'PETRRA starts with people, not technology. The success of the project will be measured not only in terms of technology development but in its direct impact on the livelihoods of resource-poor farm households. To achieve this goal PETRRA will facilitate the development of a research system that is more responsive to the needs of resource-poor farmers. This will be done through financing on a competitive basis the generation of technologies and extension materials appropriate for poor farmers, through research partnerships between IRRI and the Bangladesh Rice Research Institute (BRRI), Universities, NGOs, the private sector and other local organisations.'

Topics addressed by the project included rice seed production and distribution systems, crop and soil fertility management, postharvest technologies, mobile pumps, aromatic rice and integrated rice-duck farming. The methods used include women-led group extension, whole family approaches, participatory video, Going Public and picture songs (Van Mele *et al.*, 2005). One of the key achievements was that "scientists and other partners became increasingly aware of the need to engage with farmers during research planning and all other stages in the research process". Several robust, high impact rice-related technologies were developed or adapted to local conditions. Examples include the leaf colour chart; seed health improvement; fine, aromatic and glutinous rice; integrated rice and duck production and urea super granules. Several partners made a formal commitment to continuing use and further dissemination of these technologies. There has been considerable success in supporting new partnerships and working relationships many of which were considered likely to sustain beyond PETRRA. The North West Focal Area Forum – a multidisciplinary innovation platform - was judged a particularly successful example⁴ (Risner *et al.*, 2004).

IRRI's enhanced capacity to network and work in partnership with a range of national organisations beyond the traditional research sector, and participating agencies awareness of the need for effective communication, was highlighted by project reviewers (Risner *et al.*, 2004). A further achievement was that, "Possibly for the first time a link has been established between demand led research and the process of policy development and made explicit in project design. Other examples of vertical linkages include some opportunities for farmer representatives to express voice in Upazila, district or national level forums."

The project review document (*op. cit.*) highlighted some significant challenges experienced and lessons learnt which may still be pertinent today. Two key issues identified are relevant to CDAIS. The first was that adaptive, participatory research was still regarded as being the remit of the small Adaptive Research Division (ARD) and outside the mainstream of BRRI activities.⁵

'Despite the success of BRRI in obtaining a more assured stream of GoB funding for conducting research there was no indication that these core resources will be used to build on PETRRA research successes. The prevalence of government rules and procedures, the core mandate of BRRI to conduct 'basic research' such as varietal development, the inflexibility in GoB funding rules and lack of resources for field based activities were most often cited as reasons why PETRRA type research activities are unlikely to sustain. There is therefore a very real risk that the scientists inspired to a degree by their involvement with PETRRA will become demotivated through a return, post PETRRA, to a less flexible, less participatory and more bureaucratically constrained mode of working'.

⁴ The North West Focal Area Forum did continue for 3-4 years after PETRRA ended but did not sustain. The CSIRO CRISP project is attempting to revive it in 2016.

⁵ The ARD is one of the 19 divisions of BRRI and its remit, according to BRRI's brochure (BRRI, 2104) the ARD and Training Division are mainly involved in technology transfer process in collaboration with Department of Agricultural Extension (DAE) and other GOs and NGOs providing extension services. The ARD plays the vital role in transferring BRRI released rice varieties and other potential rice based technologies to the farmers. Another example is the On Farm Research Division of BARI.

The other area highlighted was the quality and robustness of the research process in a complex, multi-faceted project with 45 sub projects and 48 partners⁶.

‘Given the lack of prior participatory research experience of most partners, varying organisational capacity and differing local conditions it is inevitable that the quality and robustness of the research process (including training, M&E, reporting) varied considerably across sub projects ... The Review Team felt there to have been insufficient evaluation of differential performance across sub projects and that an opportunity still exists for further reflection and learning, especially from those things that have not gone so well’.

The review mentioned the tendency, raised by a Bangladeshi colleague, to be ‘not keen on reporting anything as having been less than a total success’ an issue for many research projects, pilot projects and other innovations’. PhD research by a Bangladeshi researcher indicated that ‘the sustainability of the extension reform was also compromised because of poor implementation performance, complex design, parallel modes of project implementation, a failure to develop recipient ownership, and a poor capacity to learn and adapt the reform’ (Islam, 2007:ii).

These tendencies are not unique to Bangladesh and the role of considering what can be learnt from failure now has much more credence in development, business and education across the globe⁷. This is an area where CDAIS facilitation could support capacity building. Another issue is the plethora of projects, reports and recommendations that makes it hard to keep a handle on what is going on, the initiatives that work well and those that do not. “There is a very crowded marketplace of initiatives and studies in Bangladesh.” (Sida, 2012). The private sector are better at publicising their efforts and linking their efforts to wider, often, international innovation platforms. For example, Tetra-Laval’s work to support smallholder dairy development in conjunction with PRAN Ltd, the country’s largest food processing company, is included in the Sustainable Agriculture Initiative (SAI) Platform – an initiative with over 50 multinational agricultural and food sector companies

The PETRRA project was one of the earliest of several donor-funded projects that have supported agricultural research that addresses the needs of the poorest. PETRRA focused on one crop - rice - in the North West of the country⁸. It created a mechanism for interaction among the four most important stakeholders - farmers, scientists, government extension officials and donor representatives. It did so by enabling demand-led, participatory research that linked sustainable practices that emphasised environmental responsibility and gender sensitivity. Its premise was that even though improved technologies may be available from research institutes, social, economic and dissemination barriers may inhibit their uptake and resource-poor farmers remain marginalised. Supporting effective linkages between research and extension were considered critical poverty alleviation and food security. PETRRA gave priority to sub-projects that mobilised skills from a number of partners - government institutions, NGOs and the private sector - synergistically (Magor *et al.*, 2007).

The next section provides information on key organisations working in agricultural innovation. Many of these were involved in and linked via the PETRRA project. Reference is made to this as well as the organisations with which they are linked today.

⁶ Research organisations: BARC, BRRI, BARI; Extension: DAE; Training agencies: BARD, RDA; Universities: BAU, BSMRAU, SAU, Dhaka University; NGOS: APEX, Aid-Comilla, BDS, BRAC, CARE-Bangladesh, CDP, DCPUK, EPRC, FIVDB, HEED, IARD, BARCIK, IDE-Bangladesh, Mukti Nari-O-Shiru Unnayan Sanstha, PROSHIKA, RDRS, SAFE, Shusilan, TMSS, Uttaran; AAS, CPD, Grameen Krishi Foundation, Wave Foundation; IRRI

⁷ See for example the work by Engineers Without Borders Canada on the benefits of admitting to failure in development projects <https://www.admittingfailure.org/>; see also ‘No failure please, we’re British (and afraid)’, The Times 9.9.15 by Alice Thomson on what can be learnt from the American approach to business failure.

⁸ Note: rice in NW is now seen as problematic, with drawdown of water resources for irrigated *boro* rice.

One of the key issues in mapping the links between Bangladesh organisations is that very little mention is made of this in presentations and promotional literature. Often the funding or external implementation organisation highlights the organisations it is working with. It is hoped that many of the innovative approaches developed during subsequent projects, supported by the many donors working in Bangladesh, implemented by other CG centres working with national research, extension and NGOs, can be identified during the inception workshop.

Stakeholder Mapping: Characterization and Presentation of Stakeholders

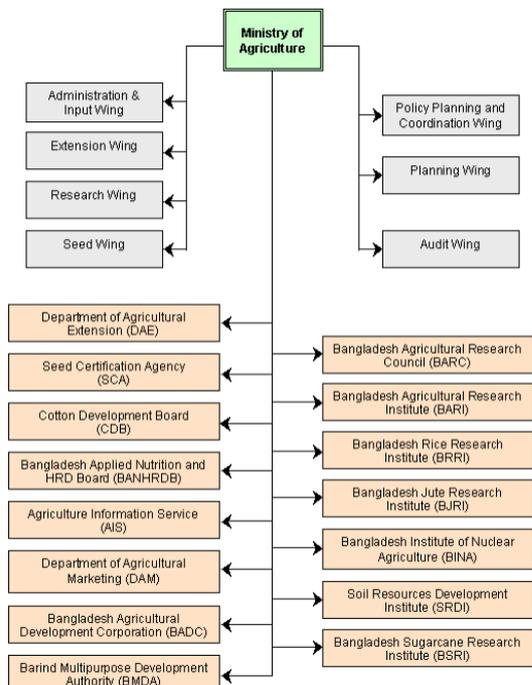
To include:

- Narratives/description of organizations visited/interviewed. Narratives could present each organizations indicating their objectives/mandate/focus/highlights/strengths/weaknesses.
- An analysis of how innovation systems is perceived, being practiced or planned by the concerned organizations in the country.
- Based on observations and literature review analyse the strength/weakness of relationships of organizations e.g. in formulating partnerships around AIS, consultations to improve collaboration with other stakeholders, willingness to collaborate.

Support for agriculture, including aquaculture, livestock and agro-forestry, rests with a large number of public sector, private sector and non-governmental stakeholder organisations. Six main ministries share responsibility for policy and administration in matters related to agricultural development: The Ministry of Agriculture, the Ministry of Fisheries and Livestock, the Ministry of Food, the Ministry of Land, Ministry of Environment and Forests and the Ministry of Local government, Rural Development and Cooperatives. Three public sector organisations provide extension services and there are several thousand NGOs working with in the agriculture and food sectors. There are several hundred private sector companies working in the agricultural input sector and food and produce processing.

The **Ministry of Agriculture (MoA)**'s responsibilities include BARC and six agricultural research institutes; the Department of Agricultural Extension; the Seed Certification Agency; the Agricultural Information Service and the Department of Agricultural Marketing (see figure 1).

Figure1: Ministry of Agriculture Institutional Organogram



Source: Ministry of Agriculture website <http://www.moa.gov.bd/site/organogram/cadbd730-df8e-4576-86cd-64fc23b40d0b/Organizational-Structure>, accessed 13.11.15

The MoA is responsible for agricultural policy development. The National Agriculture Policy of 2013 highlights the major challenges for Bangladesh agriculture as raising productivity and profitability; reducing instability; increasing resource-use efficiency; ensuring equity; improving quality and meeting demands for diversification and commercialization (Section 1.8). It recognises as a weakness, the “poor coordination among the public and private universities and research organisations” and calls for a “paradigm shift in agriculture from a supply-driven to a demand-driven approach.” The Policy stresses forging partnership (Section 4.7), “NARS institutes will create opportunities for promotion of research through increased public and private sector collaboration”. Under its Human Resources Development section (14) “The government plans to introduce innovative approaches to upgrade the skill of researcher, extensionist and farmers ...” and in Workplan Development (14.8) “The government will facilitate and strengthen training related to demand-driven research and extension.”

The **Bangladesh Agricultural Research Council (BARC)** is the apex organisation for the national research system. It is responsible for strengthening national agricultural research capability through planning and integration of resources. BARC leads the process of developing a vision and plan for national agricultural research based on national priorities. BARC is responsible for preparation of the Vision document and the National Agricultural Research Plan. The latest version - Agricultural Research Vision 2013 and Beyond (BARC, 2011) sets out the major challenges facing the agricultural sector and presents the thematic areas for twelve subsectors. BARC is also responsible for coordinating research and fostering inter-institute cooperation, monitoring and reviewing research programmes of the research institutes, assist them to strengthen research capability, maintain system-wide operational policies and standard management procedures. This involves cooperative activities across several ministries: Agriculture, Forest and Environment; Fisheries and Livestock; Rural Development; Education, Science and Technology.

BARC was a member of the project steering committee and the technical committee for PETRRA. BARC is currently involved as a partner in many projects, national and international. It is the lead executing agency for the GIZ-funded ‘Adaptation to Climate Change and Rehabilitation of Livelihoods in Selected Districts of South Bangladesh’ project which cooperates with different government institutions and NGOs at national, district and local levels. Partner NGOs include the Resource Development Foundation (RDF), the Wave Foundation, Gonoshastha Kendra (GK), INCIDIN Bangladesh, and the Association for Disaster Mitigation and Development (ADMMD). The project, which runs from 2011 to 2016, promotes agricultural technologies for climate change adaptation. It provides capacity building and start-up support for farmers and promotes appropriate seeds, including salt-tolerant varieties of rice and other crops, as well as livestock and poultry rearing. The project also encourages rural women to engage in homestead gardening, enabling them to produce more fruits and vegetables, both for domestic consumption and for the market. It stresses domestic consumption in order to improve nutrition, particularly for poor women and children, takes into account market alignment, economic efficiency, social compatibility, gender issues and the ownership of the innovations.

BARC operates the **Agricultural Research Management Information System (ARMIS)**, a database that provides details of research projects undertaken by the 13 NARS, 11 universities, the three extension services and 20 other organisations (private sector, NGOs, research institutes), since 1996. It contains around 22,000 records.

BARC was also involved in development of the **Bangladesh Country Almanac (BCA)** with CIMMYT, BIRRI and the Sustainable Development Research Initiative with Cornell University and Texas A&M University. The BCA is a GIS database system with a comprehensive spatially-linked database of various agricultural and allied information which was designed to support management of agricultural research and development. The third edition of the BCA was released at a workshop at Jahangir Nagar University, Savar, chaired by its Vice Chancellor, in 2006. Some 380 researchers, academics, post graduate students, and extension and NGO personnel received training in nine workshops. The Almanac, combined on a single CD ROM, provides both spatial and attribute data on climate, land and soils, crops, demography, hydrography, infrastructure, health, marketing, livestock, forestry

and poverty. It was the most comprehensive offline CD-based database in Bangladesh and was being used to help identify research locations and to aid in designing development programs by extension services and NGOs. The Soil Resource Development Institute (SRDI) of Bangladesh used the BCA as a platform to deliver field-level data to its headquarters. CIMMYT and the Bangladesh Agricultural Research Council organised a policy/concluding workshop on the BCA in July 2006. The Minister and the Secretary, Ministry of Agriculture, DGs and Directors of Agricultural Institutes, Vice Chancellors of Universities and the heads of NGOs and International organizations were invited to give their feedback. This tool could be immensely useful for BARC to monitor development and research initiatives but it does not appear to have sustained. According to one of the original developers at CIMMYT, Texas A&M provided the software development. They then created a private software company, AWhere Inc, which made the software licensing agreements more complicated (the original almanacs were completely license free and freely available). AWhere still have the same tools but these are now more advanced. When the original Almanac project funding ended, CIMMYT stopped working on the tool.

BARC is the national counterpart organisation for the CDAIS project.

The **Department of Agricultural Extension** (DAE) is the largest public sector extension service provider, with 26,000 positions although these are only currently 50% filled. Its overall responsibility is to provide the latest research results and scientific farming techniques, produced by the research institutes to all categories of farmers. It organises linkages between research institutes and farmers and acts as a liaison agency between farmers and other organisations, public and private. It provides training to farmers on different farming technologies. In earlier times, the DAE used the top down T&V extension method but now many of its activities are centred on projects and these tend to be more bottom-up. Agricultural extension now includes marketing as well as production. A lack of coordination with research was noted by a senior staff member. The then Director General was a member of the PETRRRA project steering committee and the then Deputy Director was a member of the TEC. The DAE was an extension provider for some project activities.

The DAE is currently involved in a number of donor-funded projects, including the Disaster and Climate Risk management in Agriculture (DCRMA) project operated by the Ministry of Disaster Management and Relief (MoDM&R) in collaboration with the DAE. UK Aid, the European Union, Norwegian Embassy, Sweden, Australian AID and UNDP support the project. Activities are taking place in five districts in the North-West drought prone areas; eight districts in South-West coastal saline prone areas (including water logged areas); eight districts in flood prone areas (including water logged areas) and five districts in flash flood prone areas, including the chars, very prone to floods and river erosion. Different types of climate change adaptation and disaster-risk reduction activities are introduced via 156 Climate Field Schools (CFS) in four climatic vulnerable areas. Each extension officer is expected to organise ten CFS per week, each of which last three to four hours. Successful adaptation technologies, such as uptake of short duration rice cultivars, zero-tillage potato cultivation, alternate wetting and drying of paddy and vegetable cultivation on floating beds, are disseminated among community farmers.

A concern has been that traditionally DAE has concentrated on providing crop advice to small/medium farmers (who operated 60% of land, but only represented 22% of farmers (ASIRP, 2003). This view was supported by findings of a more recent IFPRI survey in 2013. This found that although marginal and small farmers constitute the largest share of farmers, the outreach of agricultural extension services to these two groups of farmers is very low in absolute terms and considerably less than the service provided to medium and large farmers (Ahmed *et al.*, 2013).

The **Bangladesh Rice Research Institute** (BRRI), was established in 1970 at Gazipur to conduct research on all aspects of rice. Its work also takes place at nine regional stations. BRRI is the host institute of IRRI and has an MOU with IRRI. This includes development of new varieties for different ecosystems and component technologies for improving the productivity of rice-based cropping systems. BRRI has developed 67 high yielding

rice varieties, including four hybrids, which are cultivated in 80 percent of the total rice area and contribute over 90 percent of the country's rice production. BRRI's recent high yielding rice varieties include BRRI dhan61, a salt tolerant variety for *Boro* (irrigated dry season) planting; BRRI dhan59 and BRRI dhan60, released for *Boro* season planting, mature ten days earlier than BRRI dhan29 but yield similarly to BRRI dhan28. BRRI dhan62 has been released as the world's first zinc-enriched rice variety. It also has high protein and early maturing characteristics. BRRI dhan51 and BRRI dhan52 can tolerate flash flooding at the vegetative stage. BRRI dhan50 ('Banglamati') is an aromatic high yielding *Boro* variety, similar to Basmati rice of India and Pakistan. BRRI is doing research on introgression of vitamin A producing beta-carotene gene in BRRI dhan29. Iron and zinc enriched genotypes have already been developed. Research-Extension workshops are used to communicate research findings to DAE personnel and other extension service providers. Scientists obtain feedback on existing rice technologies for further research from DAE personnel and other government organisations and NGOs. Information on rice and rice-based technologies are available from the Bangladesh Rice Knowledge Bank⁹.

The PETRRA project was implemented in close collaboration with BRRI. The DG was chair of the technical committee (TEC) and the member secretary of the project steering committee (PSC). BRRI was a research partner of PETRRA. BRRI cooperates in programmes with agencies, such as the on-farm research of BARI, BARC, BJRI, Bangladesh Water Development Board (BWDB), BINA, BAU, Dhaka University and BSMRAU. Particular emphasis is placed on adaptive and cropping pattern research and development in farmers' fields. BRRI scientists visit farmers' fields and give on-the-spot advice. Staff also analyse soil and examine disease and insect samples sent to them and prescribe immediate or long-term remedial measures. BRRI scientists are members of national committees such as the intensive crop programmes for increased production and the National Seed Board for releasing varieties of all crops. BRRI produces breeder seed for recommended rice varieties and supplies this to the Bangladesh Agricultural Development Corporation (BADC), private seed entrepreneurs and NGOs for seed multiplication and distribution to the farm level.

The **Bangladesh Institute for Nuclear Agriculture** (BINA) is located at the BAU campus. Its mandate is to undertake research using nuclear techniques to produce new varieties of crops, scientific management of land and water, development of appropriate technology to improve quality and quantity of crops and development of methods for control of disease and insect pests. It also carries out demonstration tests of new varieties and their management practices and trains research and extension officers in the improved technology of crop production. For nine crops, 31 new high yielding varieties have been developed. BINA was a project partner in PETRRA. BINA has MoUs with the Chinese Academy of Agricultural Sciences, the Malaysian Nuclear Agency and the Africa Rice Centre.

The **Bangladesh Agricultural Research Institute** (BARI) is the largest multi-crop research institution, 800 scientists. Its research mandate covers a large number of crops, including wheat, maize, tubers, pulses, oilseeds, vegetables, fruits, spices and flowers. Its research covers variety development, soil, crop management, disease, insect management, irrigation and water management, development of farm machinery, improvement of cropping and farming system management, postharvest handling and processing and socio-economic studies related to production, marketing and consumption. The institute has six regional stations and 24 sub-stations including three hill research stations. BARI was an active member of the TEC of the PETRRA project and a research partner of PETRRA. BARI collaborates with the DAE, BADC, Hortex foundation, BRAC, CARE and is a partner on many recent projects, including with Cornell University on Fruit and Shoot Borer Resistant (FSBR)/Bt Eggplant, and has an MoU with HELVETAS Swiss Intercooperation.

BARI is a partner in a DFID-funded AGRITECH research project, starting in 2106, concerned with application of general repellents against agricultural pests, a UK SME, Russell IPM, two UK research institutes – NIAB-EMR at

⁹ www.knowledge.bank-brri.org

East Malling Kent and the Natural Resources Institute, University of Greenwich, Kent and an SME, Russell IPM Bangladesh.

The **Ministry of Fisheries and Livestock** (MoFL) is responsible for increasing production of fish, meat, milk and eggs to achieve self-sufficiency in protein and providing assistance to increase export by enhancing production through development of fisheries and livestock resources, conservation, research and extension programmes.

The **Department of Livestock Services** (DLS) provides targeted livestock services to farmers. It supports planning and implementation of all livestock-related extension activities at the grass roots level and works in partnership with government organizations, NGOs, and the private sector to develop the national livestock sector. The DLS, through its programmes and services, aims to reduce poverty, provide opportunities for job creation and gender empowerment and expand access to microcredit and micro financing for Bangladeshi farmers. It partners World Fish. DLS has an MoU with HELVETAS Swiss Intercooperation.

The **Department of Fisheries** (DoF) is responsible for all matters relating to fishing and fisheries. The Department's main focus of activities is on the development of infrastructure for improving marine fish and aquaculture productivity. Export of shrimp is one of the successful sectors in Bangladesh. The DoF is involved in the Better Fisheries Quality (BFQ) - Better Work and Standards (BEST) programme, funded by the European Union, NORAD and Government of Bangladesh and implemented by UNIDO, which works on strengthening the fish inspection and control of operations at all stages in the shrimp supply chain, establishing credible laboratory services and assisting private entrepreneurs in improving their productivity and compliance with market requirements. The Safety and Quality Management System in Bangladesh is the project of DoF, the counterpart, working side by side with BEST-BFQ. Funded by Government of Bangladesh, this project supports BEST-BFQ through capacity building in terms of infrastructure and human resource development and in participating in all activities to attain the ownership of the project for the overall development of the sector. Part of this project has focused on upgrading the fish inspection and quality control (FIQC) laboratories of the Department of Fisheries. Laboratories at Chittagong and Khulna have been configured with laboratory information management systems (LIMS). Staff have received intensive training on LIMS implementation for laboratory analyses.

The **Bangladesh Fisheries Research Institute** (BFRI) is an autonomous research organisation, which started functioning in 1986, and is linked to the MoFL, mandated to support fisheries development. Its research, training and management activities are carried out in close cooperation with national - BARI, BRRI; international agencies - World Fish, World Bank; public extension - DAE and NGOs - BRAC, PROSHIKA, CARE, Bachte Shikha, Jagoroni Chokra for dissemination of technologies and obtaining feedback. It works with national universities, particularly BAU on fishery research and development. BFRI has signed MoU with BARD and BAUEC.

BRAC is one of the world's largest NGOs. It operates in all 64 districts, over 69,000 villages and has some five million members of which many are micro-credit borrowers. In agriculture, it is involved in research and development, credit and produce marketing. Its commercial activities, which include micro-finance, banking, a dairy, food processing and a chain of retail handicraft stores, finance three-quarters of its development work. Its work on technology validation and extension involves bringing available and newly developed agricultural technologies to the farmers' fields through farmers' participatory large-scale block demonstration. Its technology dissemination strategy is to convert single crop areas into double to triple cropped areas, introducing stress tolerant crops and fish varieties to the cropping systems and accommodating high value non-rice crops in the rice-band cropping systems with shorter maturing rice varieties. BRAC works with groups of 40-50 marginal farmers and provides them with partial grants to cultivate and use modern crop varieties, fishes, production technologies and practices. Its extension staffs provide them training and latest information for getting better production from their fields. It is currently operating in 50 upazilas of 12 districts; most of the operational sites

are disaster and stress prone areas of the country. BRAC has targeted to cover around 60 thousand direct beneficiaries with improved technologies by the year 2015. Its trained extension personnel, comprising agronomists, technical assistants and aquaculture experts, provide agricultural extension services. BRAC obtains advice and expertise from government research and extension institutions. BRAC worked as a research partner of PETRRA and was represented on the PSC and the TEC. It is a partner in many more recent projects, such as the USAID Horticulture project, with the World Vegetable Centre (AVRDC) and BARI.

The **Palli Karma-Sahayak Foundation (PKSF)** is an apex development organisation, established by the Government in 1990, for sustainable poverty reduction through employment generation. Initially, PKSF's goal was to create self-employment opportunities in the rural off-farm sector. It established a credit programme, for the rural moderate poor, which has been subsequently modified to meet the changing needs of heterogeneous poverty-stricken segments and has gradually evolved into an inclusive financing programme. This targets the moderate poor in rural and urban areas, ultra-poor, micro entrepreneurs, marginal and small farmers. People in these groups are offered additional services, such as capacity building, technology transfer, and value chain development. PKSF has also started implementing a project aiming to enhance the capacities of the poor to increase their resilience to the adverse impacts of climate change. In addition, mapping of various rural business clusters has been completed to commence programmes for the development of rural industries. It works with many small NGOs, particularly micro-finance organisations, in the 64 districts. It is a partner in numerous agricultural and rural development action and research projects. These include Programmed Initiatives for *monga* Eradication (PRIME); LIFT (a study on impact of using USG on economics of rice production and related agronomic practices); Microfinance for Marginal and Small Farmers (MFMSF) Project; Second Participatory Livestock Development Project (PLDP-II); a pilot micro insurance project Developing Inclusive Insurance Sector Project (DIISP), 2010 - 2014, supported by the Japan Fund for Poverty Reduction (JFPR) under the Asian Development Bank. One activity included a study of productivity and economic returns of some innovative technologies under the project.

Practical Action - Bangladesh (PAB) (formerly Intermediate Technology Development Group) started working in Bangladesh in the early 1980s in response to requests from national NGOs. It has evolved over time to meet the challenges of poverty, inequality and vulnerability. In 1990, a Bangladesh country office was formally established with its head office in Dhaka. From 1997, Practical Action Bangladesh began implementing large-scale programmes in the technology areas of food production, agro-processing, small enterprise development and light engineering. PAB now works directly and through partners in geographically focused areas with high incidence of poverty. It has established programmes in Faridpur, Gaibandha, and Jamalpur and in Bogra, Gazipur, Dinajpur and Barisal districts. Its aim is to ultimately scale up successful experiences, achieve positive impact, and change in poor people's lives throughout the country. PAB operates the Krishi Call Centre, jointly with the Ministry of Agriculture's Agricultural Information Service, and offers advice on livestock, fisheries and agriculture. The Krishi call centre offers real-time advice on farming issues in Bangladesh. The Centre was launched in 2014 by the Agriculture Minister at the National Digital Fair at Bangabandhu International Conference Centre. Agriculture experts from the Centre provide immediate and effective solution to farmers' problems, which will help them overcome them. There are about 115 million mobile phone users across the country. Calls can be made to the Centre from any mobile operator free of charge.

PAB have also been involved in supporting the uptake of floating gardens in Gaibandha district, built using water hyacinth, which is collected to construct a floating raft. This is covered with soil and cow dung, in which summer and winter vegetables, such as gourd, okra and leafy vegetables, are grown. A new raft needs to be built every year but the old one can be used as fertiliser during the dry season. The floating gardens provide food for people during the annual *monga* (period of food shortages) and provide an alternative source of income through sale of any surplus. They are suitable for farmers who need to diversify from traditional land use. As the rafts can be moved from place to place they are ideal for those that have temporarily or permanently lost their homes and

land. Floating gardening are an age-old agricultural practice in the wetlands of southern Bangladesh (parts of Barisal, Gopalganj and Pirojpur districts). Since the late 1990s, this farming technique has been more widely adopted; a well-known agricultural programme on national television played a major role in popularising it. In 2000, IUCN and Bangladesh Centre for Advanced Studies (BCAS) tried to expand floating gardening in the wetlands of south-central Bangladesh. Around the same time, the international NGO CARE promoted this technique with vulnerable people in the south-western region to tackle water-logging, as part of its Climate Change Adaptation Initiative (2002-2005). The floating gardening, as a community-based adaptation to climate change, was further promoted by BCAS. In 2005, CARE and IUCN introduced floating gardening in the north-eastern wetlands (*haor*). Until 2009, this technology was widely promoted in some 100 villages to improve the nutritional status of extreme poor *haor* dwellers, particularly during the monsoon season. In 2005, Practical Action promoted the technology in Gaibandha in the north. This area does not have any wetlands but the technology was considered a useful option in the monsoon months for families living on the embankment eroded by the River Jamuna. From 2010–2012 Practical Action promoted the technology in a significant way (Irfanullah, 2009).

Bangladesh Agricultural University, (BAU) located in Mymensingh 100 kilometers north of Dhaka, has been in existence since 1961. It has six faculties - Veterinary Science, Agriculture, Animal Husbandry, Agricultural Economics & Rural Sociology, Agricultural Engineering and Technology and Fisheries. There are over 500 academic staff running undergraduate, postgraduate and PhD programmes. It has over 200 on-going research projects. BAU manages an agricultural extension system for 58 villages of Mymensingh *sadar* where staff of the BAU Extension Centre (BAUEC) together with MSc and PhD students undertake agricultural extension and village development activities. Over 10,000 farmers have attended training programmes arranged by BAUEC. Active engagement, including group discussions and interviews with farmers gives them good understanding of the issues they face in taking up agricultural innovations and appreciation of how farmers need to modify them to suit their personal circumstances - 'field-laboratory'. BAU was a research partner of PETRRA in several projects and is currently involved in projects with national institutions, NGOs and international agencies, including Wageningen UR. BAUEC has an MoU with DAE, RDA and BARD. It has received research grants from USAID's Feed the future Initiative to undertake applied on-farm research.

Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) at Gazipur was established in 1983 as the Bangladesh College of Agricultural Science, an academic organ of BARI and academically affiliated with BAU until 1991. The university was established by transforming the Institute of Post Graduate Studies in Agriculture (IPSA), which offered postgraduate and PhD programmes developed by Oregon State University under the cooperation of JICA-USAID-GOB. The university now has 15 departments: Agricultural Extension and Rural Development; Agronomy, Crop Botany; Entomology; Genetics and Plant Breeding; Horticulture; Plant Pathology and Soil Science; Agroforestry and Environment; Agricultural Engineering; Biochemistry and Molecular Engineering; Environmental Science; Biotechnology; Computer science and Information Technology that offer undergraduate, MSc and PhD programmes. Activities include dissemination of results of basic and applied research to field staff of DAE, NGOs and farmers. BSMRAU was a research partner of PETRRA. BSMRAU is the academic arm of BARI. Many NARS staff enrol to undertake PhDs. It works closely with ACI, GETCO Agroc Ltd, ISPAHANI Agro Ltd and ten other commercial organisations to do contract research. BSMRAU staff were involved in the BARC Agricultural Research Vision 2013.

The National Agricultural Training Academy (NATA) at Gazipur, was established in 2014 at the site of the former DAE's Agricultural Extension Training Centre. Its vision is to be a centre of excellence for the development of competent human resources and a think tank for knowledge intensive governance of agricultural services. Its mission is to develop a common platform for all organisations under the Ministry of Agriculture for human resource development by providing quality training, research and development and publications. It further plans to network with reputed institutions at home and abroad for organisational capacity building and promote a

culture of continuous learning to foster a knowledge-based governance of agriculture service. It has plans to deliver a wide range of courses such as 'e-Agriculture and its development initiatives' such apps, and 'Climate Smart Agriculture'. It proposes a new, more experiential approach to training. Its facilities on 19 acres include a conference room, auditorium, accommodation for 80 participants, a cafeteria, three training rooms, a laboratory and a library. Its refurbishment is included in the National Agricultural Policy, 2013, which indicates that NATA will offer training to officials engaged in agriculture.

The **Bangladesh Academy for Rural Development (BARD)**, Comilla, 100 kilometres east of Dhaka, is a government institution established in 1959, originally established as a training institute for government officials and representatives of local government and village organisations. It is acclaimed for its numerous innovations in rural development. The 'Comilla approach' to rural development includes a package of mutually supportive development models designed to have lasting impact on the lives and incomes of rural households. The academy has considerable experience in training and action research. BARD was a research partner of PETRRA. BARD is currently working with the Partnership for Economic Policy (PEP), an international training and development support organisation, to implement a community-based poverty monitoring system (CBMS) at the local level and ensure active local government participation and effective use of relevant information. BARD provides capacity development training opportunities through the partnership-orientated business model of the a2i (access to information) programme funded by USAID.

The **Rural Development Academy (RDA)** was established in 1974 at Bogra as an autonomous rural development academy under the Ministry of Local government, Rural Development and Cooperatives. Its objectives are to provide training to personnel of different government departments and agencies involved in rural development, conduct action research projects or pilot experimentation on different aspects of rural development, extension and implementation. The RDA was a research partner in the PETRRA project, particularly involved in the Seed Health Improvement sub-project. Some of the activities and approaches that it follows today follow approaches adopted during the project. For example, it is still involved in supporting rice seed production, via the IFC-financed 'Women in Seed Entrepreneurship project'. This five-year project is supporting the crucial, informal but often unrecognised role that women play in seed processing, preserving and storage by working with 3,000 women to improve their business skills and become a part of mainstream economic activity. Training women in good seed production practices is one way to ensure that crop yields do not decline and that yield gaps are minimised. RDA subsequently became a partner in the Chars Livelihoods Programme (CLP), funded by DFID, sponsored by Ministry of Local Government, Rural Development and Co-operatives and working with NRI. The CLP worked with extreme poor households living on island chars in NW Bangladesh, and aimed to improve the livelihoods of over one million people. RDA was responsible for creating institutional capacity to monitor poverty and social and economic development on the chars.

Agriculture is an important are of its research and development work. It has developed 14 'Green Innovations' including buried pipe irrigation, raised bed cultivation, established a rural plant clinics, where semi-educated trained men and women provide advice to farmers on dealing with pests and diseases, and set up a tele plant clinic, with 8 model clinics and 150 trained people, who provide information by mobile phone.

ACI Seed, part of ACI Ltd, started its seed business in 2006. It focuses on nationally prioritised crops. For vegetables and fruits it has developed hybrid varieties but for rice, wheat, potatoes and rape seed it supplies OPV varieties. NARS (BRRI, BARI) produce the basic seed and ACI develops special traits. ACI takes ownership of the plant material when it is High Yielding (hybrid). ACI started breeding for quality traits such as high gluten content by obtaining varieties from overseas with high gluten content. Prof Dr Lutfur Rahman, Adviser, ACI Agribusinesses, was formerly professor of plant genetics at BAU stresses the need for collaboration with universities and NARS, saying that it reduced the time for development and adoption by farmers. ACI Seed has

distributors in each district. It has its own research and development stations at the RDA, Bogra, BSMRAU, Gazipur and BAU, Mymensingh. It also has 40 on-farm groups.

ACI Seed were involved in the Innovation against Poverty (IAP) matching grant system, funded by SIDA from 2013 - 2015, to support businesses to develop services, products and processes that will benefit people living in poverty: 'ACI Seed, promoting climate smart agriculture in Bangladesh'¹⁰. ACI received a 50% matching grant to produce five crop seed mini-packs, which were sold to participants to aid sustainability to develop homestead gardening - stress tolerant seed varieties of rice, wheat, maize, rapeseed, soybean and mung bean and vegetable seeds. This led to an increase in ACI seed sales in project area of 40-50% and to the area under crops - vegetables and home garden groups. Before the project, farmers only grew rice they now produce six to seven crops, which has had nutritional impact. ACI used its own and DAE trainers on crops, production systems, and seed use and emphasised vegetable nursery and seedling production as farmers found it difficult to raise vegetables from seed. Farmers were offered markets but most produce was sold in local markets.

ACI Ltd operates Cropex – a crop exchange for sale of crops including maize and tomatoes. Farmers can sell produce through ACI if they are using seed purchased from ACI. Cropex sets out quantities required derived from contracts it has to supply food processors, such as tomatoes and chilies for PRAN Foods Ltd, which manufactures tomato ketchup. Cropex sources from farmers.

Lal Teer Seed Ltd, Gazipur, started operations in 1995. It now markets 31 varieties of 33 vegetable crops, of which 55 are hybrid varieties and 76 are Open Pollinated (OPV). It produces nine hybrid and five HYV rice varieties, three hybrid maize varieties, two hybrid cotton varieties, three hybrid flower varieties, two varieties of Jute, and one variety each of potato, mustard, mung bean and lentil. It has 16 qualified and experienced breeders engaged in research to develop varieties and technologies in two research centres. It conducts countrywide adaptation trials in 30 agro-ecological zones to observe the product performance in different climatic conditions for sustainability. About 6,200 contract growers along with 28,173 workers (80% are women) in 14 different production zones produce quality vegetable seeds under direct supervision of skilled agriculturists. In 2010, it initiated a rice research programme and 15 scientists worked in the project. Lal Teer produces hybrid rice seeds locally in collaboration with Chinese companies. It has a state-of-the-art fully automated dehumidified conditioned storage facility, seed grading and coating mechanism for processing, preservation and quality control of seeds and germplasm and is ISO 9001:2008 certified. The company has a storage capacity of 1,000 tonnes for vegetable seed and 1,500 tonnes for cereal and other crops seed. Lal Teer has an independent training wing through which about half a million farmers, 5,500 contract growers, 22,000 mobile seed vendors, 15,000 dealers and retailers have been trained. Some 215,000 opinion-exchange meetings were conducted with farmers where 66 million farmers received 'technical knowhow'. Lal Teer works with BARI, BIRRI, BJRI, Khulna University and IRRI, International Jute Study Group (IJSJ), Win-all High-Tech Seed, China, the Asian Vegetable Research and Development Center (AVRDC), Taiwan, Cornell University, USA, Beijing Genome Institute (BGI), China. It works with a number of development and cooperation partners like IFC-SEDF, USAID-PRICE project, KATALYST, HELVETUS-Bangladesh, Winrock International, CARE- Bangladesh, Action for Enterprise (AFE), International Development Enterprise. Lal Teer's executive director was formerly the director of BARI.

PRAN Foods Ltd, Dhaka is a private company that started operations in 1981 as a processor of fruit and vegetables. PRAN now produces more than 200 food products under ten different product categories including juices, drinks, bakery, snacks, culinary, confectionery, biscuits and dairy. It is the largest food processing

¹⁰ <http://www.inclusivebusinesshub.org/page/project-profile-aci-seed-climate-smart-agriculture-in-coastal-ban>

company. The company is ISO 9001 certified and is HACCP compliant. It considers its major achievement to be its attempts to consolidate fragmented land holdings and organise farmers into 'contract growers' of specific crops. Farmers receive fair prices for their products and, due to technical assistance provided, yields, quality and income have risen. PRAN was a partner organisation with the Bangladesh Local and Regional Procurement Pilot (BLRP) programme, implemented by Land O'Lakes International Development from 2010-2011, to create nutritious cereal bars made of locally produced and sourced chickpeas, puffed rice, sesame seeds and peanuts. During the project, 17 million nutrient-rich cereal bars were produced and distributed to motivate attendance and enrollment for 100,000 children in 441 schools in Jamalpur district, a very impoverished area. After the programme ended, PRAN decided to commercialise the cereal bar as a new product line. The programme helped removal of barriers that had kept local processors from sourcing their products from local farmers and PRAN learned how improve its relationships with contract farmers and specify the quality of products required. This collaboration benefited local farmers, due to a steady demand for produce and awareness of the processes and systems they must follow to be able to sell their produce. PRAN Agro Ltd is responsible for local produce sourcing. Compared to some of PRAN's other products, such as sourcing fruit for juice, they are contracting four times as many farmers of grain-based produce. The cereal bars are now exported to 20 countries.

To develop its dairy business, PRAN Dairy Ltd (PDL) established dairy hub operations where farmers are organised and given advice on dairy cattle rearing, fodder production, artificial insemination and other veterinary support to increase the dairy yields. PRAN was a partner organisation with the U.S. Department of Agriculture's (USDA) Bangladesh Dairy Enhancement Project (BDEP), implemented by Land O'Lakes International Development. PRAN currently works with 17,000 farmers supporting their dairy business. As part of "Strengthening the dairy value chain in Bangladesh" Project (2010-2020), PDL, working with Tetra Pak, Tetra Laval, Land O Lakes, UNIDO and the International Finance Corporation, will set up 60 new dairy hubs over ten years, to increase its reach to 90,000 additional farmers. The hubs support smallholder dairies by providing entire package of logistic support including, veterinary care, animal husbandry, dairy housing, feed, breed improvement and training. PRAN's late founder was also founder-president the Bangladesh Agro-Processors' Association (BAPA).

The **Horticulture Export Development Foundation**, commonly referred to as Hortex Foundation (HF), was established in 1993 by the Ministry of Agriculture as a non-profit organisation. To support the development and promotion of agribusiness. It is governed by seven directors (two from the public and other five from the private sector). It assists with all kinds of fresh and frozen fruit and vegetable export from Bangladesh. It has strong links with private and public sector organisations and been involved in a number of donor-funded projects. One of the first of these was the IDA funded Support for Horticultural Export Development Project, from 1996 to 1999, and the Agricultural Services Innovation and Reform Project (ASIRP) from 1999 to 2003. From 2012 to 2014 Hortex, together with BARI, collaborated with the University of Sydney, on "Improving Nutrition and Livelihoods through Efficient Postharvest and Supply Chain Management of Vegetables in Bangladesh" funded by the Department of Foreign Affairs and Trade (DFAT).

HF implemented the Supply Chain Development Component (SCDC) of the World Bank-funded National Agricultural Technology Project (NATP) activities in 29 upazilas (400 farmers per Upazila) with intervention in farmer-market linkages, minimising postharvest losses, improving capacity building of different stakeholders and entrepreneurship development primarily for domestic market, including fish and livestock value chains, between 2008 and 2014 with DAE. It assisted 25 commodity centres on marketing, chilling, grading. HF also provided advice services for exporters, including on legal aspects. HF is involved in the FAO Food Safety project (FSP) and developed Food Control guidelines.

HF supported the exports of mango exports to the Asda supermarket chain in the UK in 2015 from Chapainawganj district, which has around 24,000 hectares of mango orchards, producing 230,000 tonnes of

fruit. It helped exporters meet required standards and worked with an FAO training project with 20 farmers in nine upazilas. Farmers were trained in good agricultural practices, correct harvesting methods, were provided with a hot water treatment plant and supported to obtain GAP certification. HF provided market information to Basirul Islam, owner of Barkullah Traders, Chapainawabganj who sourced the mangoes and supported trial shipments by Dip International, fresh produce exporters, Dhaka. Two tonnes of fresh mangoes were exported to the UK in June 2015.

Bangladesh Agro-Processors' Association (BAPA) was founded in 1998 and has around 470 members. These include 182 factories/industries, both large companies and SMEs. In 2012-2013 the export earnings of BAPA company members was US\$102 million though it is unclear whether BAPA is still a significant player. The food processing industry represents huge potential in terms of its contribution through value addition and employment. The sector accounts for over 22% of all manufacturing production and employs about 20% of the labour force. Food-processing enterprises account for 2% of the GDP. BAPA has contributed to improvement in the qualities of agro-processed products, innovation, diversification, packaging, marketing within the country and outside through members' skill and competitiveness. BAPA has undertaken two projects under the EU's SME competitiveness grant scheme supported by the Ministry of Industry. BAPA is a member of the Executive Committee of the Agro Products Business Promotion Council (APBPC), a sector of Business Promotion Council (BPC). APBPC promotes the activities of the agro sector through arranging specialised training, workshops and seminars in collaboration with the related associations. Two seminars and two training courses were jointly sponsored by BAPA and APBPC for staff members of BAPA members' industries on different aspects of agro-processing. Experts and resource persons were hired from government agencies, universities, research organizations and BAPA member companies.

The **Consumer Association of Bangladesh (CAB)**, is a non-government, non-political and non-profit voluntary organisation founded in 1978 as a social group to protect consumers from commodity adulteration and artificial price-hikes. It has gradually widened its scope to establish and safeguard consumers' rights and interests in social, economic, health and environmental issues. CAB is also a full member of Consumers International. Its work is funded by membership fees and by grants from donors. One of its objectives is to exchange information and knowledge of various actions on consumer protection with national and international organisations and agencies.

The **Bangladesh Food Safety Network (BFSN)** was formed in 2010 by five founding NGOs - the Consumer Association of Bangladesh (CAB), UBINIG, B-Safe, SHISUK and Hunger Free World (HFW) - and supported by the previous FAO-Food Safety Project funded by the European Union. All these NGOs have already been working in the field of food safety in their individual capacities. The main aim of BFSN is to strengthen food safety awareness throughout the country through a GO-NGO collaboration model and to establish a 'food safety culture' in the society. BFSN are also working on the expansion of the network by involving local NGOs, volunteer/advocacy groups, researchers and professionals who can contribute to take the food safety movement forward. The expanded network will also help the sustainability of the present activities and their impact. The BFSN's goals are to be an effective champion and advocate of a 'food safety culture' that will have a positive impact on improved public health. The FAO has signed a letter of agreement with the BFSN to conduct a series of food safety advocacy activities, school campaigns and to develop publications to create public and consumer awareness. These activities involve participation of policy makers, professionals, journalists, civil society groups, women, children and community leaders and their communities.

The Centre for Environmental and Geographic Information Services (CEGIS), Dhaka, is a public trust and centre of excellence established by the Government of Bangladesh under the Ministry of Water Resources (MoWR) which works, with state-of-the-art GIS and remote sensing technology in resource management planning, system development, research and capacity building. Its Agricultural and Fisheries Division supports natural resources

planning and management of soil, agriculture and ecosystems as habitat for wildlife and fisheries resources. A multidisciplinary team of experts carries out specialised studies and provides support to EIA and SIA studies. CEGIS undertakes consultancy, research and development and training to assist in enhancing the quality of planning, implementation and monitoring of projects using space technology in both public and private sectors. CEGIS has conducted numerous government and non-government projects, many of which are research projects aided by different international agencies. It has worked with the FAO and BARC.

The **Krishi Gobeshona Foundation (KGF)** is a government-sponsored non-profit foundation established in 2007. It provides competitive research grants and technical support to researchers working for public sector agricultural research institutes. An important area is to encourage and promote short to medium-term research that has the potential to generate, validate, refine and scale up technologies that increase production and enhance food security. KGF has regular calls, announced via newspapers and its website, for submission of research proposals based on priority researchable areas and issues identified by BARC as national priority areas. The World Bank financed NATP (Phase 1) provided initial funding for the KGF and its CGP. Its objectives include contributing towards development of a pluralistic agricultural research system by involving public sector (NARS institutes, universities, other government and autonomous organizations and institutes), private sector and non-government organizations in agricultural research; promoting research partnerships and collaboration with the private sector agencies and the international agricultural research centres through co-financing agreements. It aims to make agricultural research more demand-driven by involving farmers and other users of research products; improving research quality and innovation by selecting projects based on rigorous peer review, and regular monitoring of the approved research projects. It promotes linkages between BARC, the National Agricultural Research System (NARS) institutes, technology dissemination systems, farmer's organizations, private sector entities dealing with agricultural research, development and extension. KGF also provides support for training programmes to enhance scientific, technical and managerial capabilities of individuals and organisations involved in agricultural research (crops, livestock, and fisheries) and technology transfer.

Scoping Studies Methodology and Adaptation to the Guidelines

The major purpose of the scoping study is to explore and outline the overall agricultural innovation systems (AIS) in Bangladesh and assess possible areas of CD interventions. A generic methodology was developed by Agrinatura to guide the study and selection of suitable key informants - individuals, organisations and companies involved in agricultural development and innovation systems in the country and capacity building. This consisted of six areas of information in the form of questions: (1) Background information; (2) Main innovation-related activities? (3) With whom do you interact for innovation work? (4) Your main CD activities with respect to innovation? (5) Strengths and weaknesses and (6) Interesting innovation experiences. Details are given in Appendix 1.

A list of key stakeholder organisations was drawn up, then revised and modified to ensure that a range of stakeholders from government, donor, research, extension, private sector (input suppliers and agro-processors), NGO and support services were selected. Semi-structured interviews were conducted with relevant personnel using the six questions above. Information gained from the interviews has been supplemented with information from websites, reports and project documents. The interviews were conducted between 30th August and 22nd September 2015. The organisations included the donor, research, education, extension, training, entrepreneurs of both government and non-government operations. A list of the organisations and individuals visited is given in Appendix 2.

The Scoping Study team members were the Agrinatura Focal Person, Claire Coote of NRI; the national consultant, Dr Zulfikar Rahman; the National Project Coordinator, Dr Mohammed Shahjahan of BARC; the Country Project Manager, Dr Nasreen Sultana. The Bangladesh team was accompanied on the visit by the CDAIS project coordinator, Dr Myra Wopereis.

Potential Case Studies or Examples of Innovation Niches

Provide narrative on examples where CDAIS could leverage on successful/challenging experiences in the countries on innovation platforms or multi-stakeholder platforms. Examples could show how strengthened interconnection between niche with system (national level) with focus on capacity development as well as the needed support to create an enabling environment.

These examples will guide the formulation of CD interventions of CDAIS in the country. Examples could be multi-stakeholder initiatives that provide scope or context for capacity development. These are selected based on:

1. Scope for impact at farmer or SME with big potential for livelihood improvement.
2. Fits into one of the three categories with different contexts i.e. high, medium or low risk foci. Low risks can be building on conventional value chain approach while high risks contains ideas (not necessarily tested at wide-scale) with high potential for impact and is designed based on the principles or concepts of AIS.
3. Captures/showcase the different types of innovation systems that highlights entry points or drivers of change i.e., i) focus on agroecology, e.g. organic or green revolution; ii) private sector led initiative vs. government led initiatives or; iii) value chain vs. result-based management.
4. It has useful/proven elements/evidence/practices; to advocate to policy makers for increased investments on capacities for AIS or the achievement of a national plan on CD for AIS.
5. Contributes to the achievement of a national policy framework on AIS or CD for AIS
6. Priority of government as written in their national strategy in agriculture or agreed by the national working group on agriculture sector.
7. Clearly visible roles of brokers/facilitators (formal or informal) which created changes or practices among the AIS actors or systems.
8. Shows how investments in strengthening the five capacities from CD Framework on AIS work at individual, organizational and institutional level.
9. Involves at least three types of stakeholders.

The study terms of reference included the identification and initial characterisation on-going innovation partnerships with potential links to the CDAIS project. Some of these will be selected as case studies, or niches, for the CD interventions in years 2-4. The possible niches proposed here have come out of discussions with stakeholders, the literature and consideration by the FAO. At this point there has been no opportunity of likely research needs from farmers. Their demand is typically for high yielding, short duration varieties, coping with variable rainfall, soil fertility issues, processing (especially for fruits and vegetables); coping with high pH in soils, coping with pest and disease whereas demand from food processors and consumers is for safe, good quality produce at a reasonable price. Possible niche areas include:

1. Export mango chain
2. Fish - rice farming innovative practices including fish seed production and water management
3. Maize value chain including seed maize production with WISE (Women in Seed Entrepreneurship)
4. Dairy value chain
5. Agroforestry and livelihoods including medicinal plants
6. Local sourcing initiatives
7. On farm food safety

An analysis of the proposed innovation partnerships/value chains, according to the nine criteria above is given in Table 2. Further details of five innovation partnerships are given below.

Mango

Mangoes are the leading seasonal cash crop in northwestern Bangladesh particularly in Rajshahi, Nawabganj and Dinajpur districts. Bangladesh is the eighth largest mango producing country but exports very few fruit. In 2015 two tonnes of mango were exported to the Asda supermarket chain in the UK from Chapainawabganj district. Various organisations were involved – Hortex, mango traders, an exporter and the FAO Food Safety training project which worked with 180 farmers in nine upazilas to achieve GLOBALGAP certification. There are several other initiatives to support mango exports, such as the Dutch NGO, Solidaridad Network Asia (SNA) and the DAE are implementing the SaFAL (Sustainable Agriculture, Food Security and Linkages project) the

involvement of the NGO ASSEDO (Agriculture Sustainable and Socio-Economic Development organisation. Wageningen UL has conducted value chain analysis for organic mango exports. BARI has promoted the uptake of fruit bags to protect fruit as they grow from pests and to reduce the use of pesticides. At a project inception workshop on Exporting Fruits and Vegetables to the International Market, in January 2016, the director of the DAE highlighted the need for closer coordination between the government agencies and private sectors to strengthen the international supply chain (The Financial Express, 2016).

Sustainable fish-based food security for improved incomes and nutrition. A number of national and international organisations are working in this area e.g. rice-based fish seed production (promoted by the NGO CARE in the Northwest) plus *molar* fish production (World fish; Department of Fisheries). A Dutch government-funded NICHE project (NICHE-BGD-156) on Integrated management of crop-fish-water resources, from 2013 – 2017 involves BAU (lead organisation); BARC and the Centre for Development Innovation, Wageningen University (WUR). BAU and BARC are developing and implementing interdisciplinary education and research in the areas of crop, fish and water, taking into account gender and labour market needs. CDAIS capacity building could link with NATP-2 objectives to promote aquaculture production and market access.

Maize value chain including seed maize production with WISE (Women in Seed Entrepreneurship): The Government of Bangladesh continues to support the development of the maize sector in an effort to reduce the country's dependency on rice. The major demand for maize grain in Bangladesh comes from the poultry and fish feed industries. Local production of maize however only meets about 70% of national demand. Huge potential to further develop the country's maize sector. By 2017, the Katalyst project (funded by DFID, DANIDA and SDC and within the Ministry of Commerce) envisions 600,000 farmers will have increased their income by taking up maize cultivation and improving competitiveness, using innovative models such as contract farming. Katalyst is promoting commercial maize cultivation in new geographic areas and in summer (*khariif*) season. Katalyst has developed credit schemes to enable its contract farmers to get loans to cultivate maize. Increasing maize farming also brings a higher proportion of women into the workforce mostly as labourers. Katalyst works with the National Academy for Planning and Development (NAPD) and Bangladesh Public Administration Training Centre (BPATC); BAU; Krishibid Institute of Bangladesh, Rural Development Academy. The Bangladesh Technical Education Board have incorporated Katalyst's experiences in their courses to make it more market and private sector responsive, as well as to improve the quality of services for small and marginal farmers. Charoen Popkhand (CP), Thai conglomerate has maize seed and feed wings in Bangladesh. Possibilities of linking NARS (BIRR, BARI, BIMA) with private sector (ACI, Lal Teer, other seed companies), and farmer seed multiplication groups. The Rural Development Academy (RDA) in Bogra in collaboration with the Seed Wing, Ministry of Agriculture and IFC/SEDF initiated an action research based model "Women in Seed Entrepreneurship (WISE)" and tested this model in 2008 in one Upazila via one NGO. RDA then involved NGO TMSS as local partner for scaling-up of this model to end 2011. IFC-SEDF has extended this project for a further period of 10 months from 2012 to June 2013 and TMSS implemented this project as local partner of RDA Bogra. RDA has been involved in promoting maize production on char areas. In the MAIZE AIS - Cereal Systems Initiative for South Asia (CSISA) projects, CIMMYT and KIT will work together with researchers and other partners to strengthen multi-stakeholder interaction mechanisms, analyse, and try out organizational models for MAIZE projects that build on an innovation systems perspective. NATP-2 includes maize production.

Dairy value chain

Milk production is one of the most important economic activities in Bangladesh, providing 3.6 million households with additional income. Several government, NGO and private sector initiatives have helped transform these small-scale operations into a more value-driven and market-oriented sector. There are three main processors involved in supporting the dairy sector – Bangladesh Milk Producers Cooperative Union Limited (BMPCUL), BRAC and PRAN Dairy Ltd. Stakeholders include the DLS, NGOs including CARE Bangladesh, which operates Krishi Utsho, a microfranchise network of agro-input shops serving smallholder dairy producers in the Bogra and

Rangpur regions; Lan) Lakes; TETRA Laval. Other stakeholders include Board of Investment Bangladesh (BOI), the Bangladesh Cold Storage Association (BCSA); the Bangladesh Krishi Bank (BKB); Bangladesh Standards & Testing Institution (BSTI) and Micro-credit providers. The dairy sector is supported by NATP-2.

Agroforestry and livelihoods including medicinal plants

The Agroforestry Improvement Partnership (AFIP) project, funded by SDC and implemented by HELVETAS Swiss Intercooperation, between 1991 and 2012 contributed to substantial positive changes in the sector, improving the lives of over 7.2 million farmers. Partners were BARC, Institute for Forestry and Environmental Sciences, BFRI, BAU, BRAC, Proshika, DAE, BARI. A review of the project in 2013 highlighted the innovation system that had evolved during the course of the intervention. **From an uncoordinated multi-stakeholder sector... to a streamlined supply chain of quality planting material**

“Government departments, agencies and institutes, public universities, private sector associations and NGOs, all were involved in the development of the agroforestry sector. 20 years ago, all these actors operated in relative isolation, without any links to nursery owners or farmers and their associations. Research institutes developed new fruit varieties without knowledge of the demand of poor and marginal farmers, the government extension services did not take into account the actual needs of the poor in terms of agroforestry technologies, practices, and techniques. Ensuring that the new released varieties, as well as new management technologies and practices, would specifically cater to the needs of small-scale, disadvantaged farmers, was an essential component of the project... Based on the successful experience of local level multiplication and distribution of quality planting material (QPM) by the nursery associations, the AFIP project aimed at establishing a national system of QPM distribution, through collaboration between the relevant public and private stakeholders. The objective was to better link the demand and supply of QPM, thereby increasing the efficiency of the sector and responding to the needs of poor and marginalised farmers. Starting in 2004 and with the involvement of all actors, a coordinated system, from research organizations to end users (the farmers), was developed.” (Helvetas, 2013).

Local sourcing initiatives:

National and international companies are involved in sourcing produce, including in the value chains and initiatives mentioned in this section. There may be a need to streamline the processes and ensure they are fair to smallholder farmers. Market access is a priority area of NATP-2.

On farm food safety

Improving the production and supply of safe, healthy food is a big concern. The 4th Global Social Responsibility Conference, hosted by the Bangladesh German Chamber of Commerce & Industry on 3rd March 2016, dedicated a panel discussion to this topic. Markus Ehmann, General Manager, Swisscontact-Katalyst, stressed that a market development approach can create the right incentives to develop new business models that focus on the production and supply of safe food: “Private companies have a great opportunity to tap into this market by providing training on safe production techniques to small farmers and engaging them in their value chain,”. Katalyst works with a number of companies such as ACI and Direct Fresh to develop new ‘safe food business models’ that benefit both farmers and private companies. The panel agreed that there was a need and a business case to further improve the food value chain and that regulation is one important aspect that needs to be further improved. The Asian Vegetable Research and Development Centre (AVRDC) has had a number of projects to support this sector. NATP-II DAE has selected vegetables (eggplant, gourd varieties, tomato) for which the access to market activities will be prioritized, subject to further analysis.

Capacity Development Champions

The scoping study also had to identify and characterize “champions” in AIS or CD for AIS (leading individuals within organizations/networks) as well as potential teams and service providers with which the project could work. Two training organisations were visited: the National Agricultural Training Academy (NATA) at Gazipur

and the Rural Development Academy (RDA) at Bogra. The RDA is up and running and established for providing training for farmers. NATA is being refurbished as a training centre for Ministry of Agriculture personnel. It would provide an ideal site for training related to CDAIS.

Other potential service providers are the Bangladesh Academy for Rural Development (BARD) at Comilla, the Centre for Environment and GIS (CEGIS), in Gulshan and the Krishi Gobeshona Foundation. CEGIS could be considered for Revival of the Bangladesh Country Almanac, together with BARC, to document all agricultural, nutrition projects to enable more equitable resource distribution

Table 2: Potential case studies or examples of innovation niches

	1: Scope for impact at farmer or SME with big potential for livelihood improvement	2: Fits into one of 3 categories with different contexts	3: Captures/showcase different types of AIS that highlights entry points or drivers of change	4: Has useful/proven elements/evidence/practices	5: Contributes to the achievement of a national policy framework on AIS or CD for AIS	6: Priority of government as written in their national strategy in agriculture	7: Clearly visible roles of brokers/facilitators which create changes or practices among AIS actors or system	8: Shows how investments in strengthening 5 capacities from CDAIS Framework work at individual, organisational & institutional level	9: Involves at least 3 types of stakeholders
i) Export mango chain	vVV	Low risk - can build on conventional value chain approach	Private and public sector involvement along value chain	Yes; needs writing up	Strong link with NATP-2	Private sector and farmer involvement is stressed in agricultural policy		Strongly evident	Hortex Foundation, DAE, FAO, BARI, private sector, farmers
ii) Fish - rice farming innovative practices incl fish seed production	vVV	Low risk - possibilities for scaling up	Poverty focus	Yes; well-documented	Yes	Strong links to nutrition and income generation	Lots of NGOs involved	Strongly evident	DAE, DoF, BRRI, BARI, NGOs, RDA, Universities, Farmers clubs
iii) Maize value chain including seed maize production	vV	Opportunities for growth of value chain	Could be private sector led	Yes; well-documented	Yes	Strong links to livestock development and income generation	Evident	Yes	Women in Seed Entrepreneurship (WISE); RDA; DAE
iv) Dairy value chain	vV	Low risk	Opportunities for growth of value chain	High involvement of women; food processing	Yes	High value sector	Evident	Yes	PRAN, NGOs, universities, RDA/BARD, DLS
v) Agroforestry including medicinal plants	vV	Agro-ecology	Opportunities for growth of value chain	Some valuable plant species identified	Yes, safeguarding of natural resources	One of BARC's research priority areas	Possible	Possible	FD, BFRI, DAE Chittagong univ, BARC; Institute for Forestry and Environmental Sciences, BAU, BRAC, BARI
vi) Local sourcing initiatives	vVV	Opportunities for growth of value chain	Could be private sector led	PRAN Ltd has pioneered. Proven elements	Yes	Private sector and farmer involvement is stressed in agricultural policy	Strongly evident	Strongly evident	DAE, NGOs, PRAN Ltd and other private sector buyers
vii) Food safety for improving on-farm safe food production	vV	Higher risk but important area relating to food security and nutrition	Work with existing FAO Food Safety project plus research on lower arsenic content of aromatic rice	Yes; well-	Yes	Food safety is GoB priority issue to reduce burden of food-borne diseases on public health and national productivity	Strongly evident	Possible	DAE, NGOs, private sector buyers, farmer organisations, Bangladesh Food Safety Network; CAB, Food Safety Unit established at Ministry of Health and Public Welfare.

Lessons, Limitations and Process Reflection

Narrative on reflection of the conduct of scoping studies that will be helpful in the future activities of CDAIS as well as the adaptation of the guidelines/approach.

Although the AIS approach promoted by the CDAIS project is not particularly new in Bangladesh, there are numerous reasons why changes in institutional behaviour may be difficult to bring about. One is a current focus by government and donors on performance measures. For example, it is easier to report that PhD studentships have been funded and completed than to find a measure of behaviour change among staff, such as the recognition of special facilitatory skills needed when supporting farmers to do research.

Centralised operations can lead to little interest in views of particular groups. Information obtained during a longitudinal study in Bangladesh on bringing the voices of the rural poor to policy makers found that nobody listened to them or took the trouble to ask their opinions. Most never attended village or union level meetings and those who did indicated that they didn't speak because "it is the elite who are supposed to talk". Rural people were reported as saying how difficult they found it to give their opinions about problems with government services. There was no space available for them to voice their views and they feared repercussions if they were perceived as complainers, "we have many complaints and suggestions but nobody ever listens". Programmes, such as PEDP-II, "tell us what to do but never ask us what should be done." (Sida, 2012)

In reviewing aquaculture development in Bangladesh through capacity-building, Nandeesh and Chapman (1999) highlight the *gher* (rice field adapted for prawn culture) system developed by farmers, during the 1970s and 1980s, for producing freshwater prawns, *Macrobrachium rosenbergii*, as an example of the innovative farmer capability. In assessing best ways to encourage innovation through farmer involvement, they highlight six key lessons. These are (i) the need to simplify science to a level where both literate and illiterate farmers can participate in the investigation process; (ii) the need to create confidence among farmers and ensure sustainability for the innovation process; (iii) the need for effective linkages between researchers and project activities that mutually benefit; that research will become more demand driven if such linkage is stronger; (iv) emphasis should be placed on increasing decision-making capacity of farmers instead of production targets; (v) farmers are competent and confident to carry out research to address some of the problems; their primary requirement is a supportive environment and access to information, and (vi) to empower farmers with knowledge, excellent facilitation skills are required coupled with awareness of social and technical issues. "Considerable effort should be expended on cementing this concept and bringing fundamental change in staff attitudes. If this is not ensured, farmers will continue to be 'research slaves'." Although these recommendations are based on work by CARE in the 1990s many, if not all, are still relevant today.

To maximise the impact of the CDAIS project and to minimise duplication it is suggested that consideration be given for CDAIS inputs for Bangladesh be directed towards building capacity for the NATP-2 programme. The focus of NATP-2 is on "supporting the NARS' research in some key sub sectors (e.g. livestock, fisheries) to reach its potential productivity in terms of releasing a sufficient stream of useful innovations (including a range of new climate smart technologies for production and post-harvesting)". The project document (World Bank, 2015) notes that the extension system has still extremely limited reach into the country's communities (in particular for the fisheries and livestock subsectors where local level public extension workers are absent) and worse, hardly communicates with the NARS, or the relevant private and nongovernment entities engaged in technological advance. The key issue identified is:

"the national agricultural innovation system is far from exploiting the systemic interactions that should drive it to success, and the insufficiencies pervade the system both within the subsystems, the all-too disconnected and in some instances less than strong elements of the NARS: public-private links are disturbingly absent, and links between research entities public and private with the higher education sector are sparse and severely underexploited. To enable agriculture and stakeholders to adapt readily

when challenges occur and to respond readily when opportunities arise, the proposed project will seek to overcome some of the key constraints to increasing the efficiency and performance of the national agricultural innovation system”

This fits in well with the aims and objectives of the CDAIS project. The proposed project development objective for NATP-2 is:

“to enhance the agricultural productivity of smallholders through better research and extension and improve their market access through better integration in selected value chains. To that effect, NATP-2 will support a decentralized, demand-driven agricultural research and extension services, and promote market-oriented smallholder production. NATP-2 will also support access to markets for smallholder farmers by facilitating their linkages with selected value chains, contributing in turn to increased farm income and to the sustainability of farmer groups and producer organizations formed by the project. The following project design emerged as an outcome of the Identification mission: Component 1: Promoting Agricultural Innovation.”

NATP-2 intends to achieve its development objectives by (i) strengthening the capacity of the NARS and the extension services to generate and diffuse agricultural technologies aimed at increasing farm productivity and (ii) promoting the sustainability of existing and newly created farmer groups and producer organizations by strengthening their linkages with markets. Sustainable intensification and diversification of agriculture through technological change requires an efficient and productive national agricultural technology system, comprising agricultural research (technology development and refinement) and agricultural extension (technology dissemination). This needs to be supported by appropriate value addition and market linkages through the strengthening of supply chains for high value agriculture. To that effect, while NATP-2 will continue supporting agricultural research and extension, it will need to have a stronger focus on market-oriented production, on value chains and on the participation of smallholders in those emerging market opportunities, than under NATP-1.

Component 1: Enhancing the Agricultural Innovation System. This component, led by the Project Management and Coordination Unit with implementation support from other agencies, will support the development of decentralized, demand-driven and integrated agricultural research. This component will likely include investments, capacity enhancement and technical assistance in areas launched under NATP-1 (such as sustainability of Common Interest Groups (CIGs) and emerging Producer Organizations (POs), rehabilitation of rural markets, technical advisory services), strengthening National Agricultural Research Institutes (NARS) (including investments in physical infrastructure), developing one-stop farmer advisory service centers. The component will also include the window for competitive research and matching grants under the Agricultural Innovation Fund.” (World Bank, 2015).

Conclusions

There is increasing recognition, particularly at senior level, of the need to change the way in which research is undertaken to meet the complex challenges facing agriculture in Bangladesh in the 21st century. This is echoed in one of the largest sources of funding available to the sector (NATP-2), which highlights the need to address key constraints to increasing the efficiency and performance of the national agricultural innovation system. Furthermore, the capacities espoused in AIS thinking – the capacities to navigate complexity, for collaboration, for reflection and learning and to engage in strategic and political process – have been adopted, in full or in part, in past initiatives and embraced at individual project level. Such willingness to explore how such change might be embraced and institutionalized will be an important aspect of the CDAIS project in Bangladesh.

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Appendices

Appendix 1: Generic Semi-Structured Interview Guidelines

These guidelines need to be adjusted to each country / situation based on documentation available, hypotheses, type of stakeholder and their specific positioning in innovation work / in AIS. All actual questions to be asked may need to be formulated so that they fit the specific country / knowledge. Note also that guidelines only provide probing questions, not closed “questionnaire-like” questions: follow-up questions will usually need to be developed “on the go” as the interview proceeds to explore some issues or points.

This interview will be directed to one or several “relevant” resource persons within each institution previously identified to be knowledgeable about the focus of the interview (such as head of organization, or head of specific program / activities in link with innovation).

Type of stakeholders: any previously identified who have had a “meaningful” involvement in innovation activities and programs (farmers’ organizations, research, extension, NGOs, in capacity building related to innovation, and in funding or supporting innovation (Ministries of Agriculture, of Science and Technology, possibly of Budget).

Your organization

- Type of organization
- Size/ main “technical” staff
 - Staff specifically involved in innovation work, if any, and their profile
- History of organization
- Scale of operation: Country / sub-regional / local
- Budget (local currency: € equivalent) & who are the main donors supporting your organization
- Stability over past 10 years (staff, budget, mandate, etc.)
- Objectives
- Main types of activities
- Who do you work with / where
- Collect documentation describing the organization (reports, web site, pamphlets, etc.)

Your main activities with respect to developing / supporting agricultural innovation

- Type of innovation-related work (including direct or indirect support to innovation) taking place in your organization, and trajectory (since when)
- Number and name of main staff currently involved
- Place of innovation work in your organization (e.g. a specific program / group in charge)
- Type of agricultural innovation you are interested / involved with (describe)
- Types of activities you develop about innovation (details)
- Types of results you have had until now
- Any documents / reports you may be able to share with us on this. (if possible in electronic format)

Any activities you develop which involve capacity development about Innovation / AIS

- Explain briefly
- Specify CD of whom? Modalities used (including formal training, workshops, learning by doing, etc.)?
- For main CD activities undertaken: what were the specific objectives? Who were the trainees and trainers? How long? Course content (summary)? Follow-up?

Your knowledge & position vis-à-vis AIS concept and perspective

- To what extent is the AIS concept known / used within your organization? Since when?
 - If yes: what source(s) does your organization use for AIS concepts / approach?
 - What does AIS mean for you concretely / operationally? Pls illustrate with past or current activities in which your organization was / is involved
 - Has the AIS concept proved useful in your work? Advantages, limits, lessons
- Any other concepts / approaches your organization may use which are perhaps similar to AIS?

Strengths and weaknesses of your organization vis-a-vis innovation work, and eventual need / opportunity for support by CD-AIS

- What are your main **strengths / advantages** when it comes to innovation work (*) your organization is involved with or would like to develop in the near future (justify)
- What are your main **weaknesses / limitations** when it comes to innovation work your organization is involved with or would like to develop in the near future (justify)
- If one could work with you to develop further your capacity with respect to Innovation work, on what specific aspects would you most require / welcome support and why?
 - NB: make sure expectations are kept as low as possible (no commitment or promises of any kind to be given at this stage).

(*) Innovation work may relate to actual involvement in innovation, or through capacity-building, funding, etc. Rephrase the questions as appropriate based on what you know about the organization from earlier parts of the interview.

Appendix 2: Stakeholders Met

Name	Position	Organisation	Date Met
Mr Gonzalo Serrano	First Secretary, Head of Section - Rural Development	Delegation of EU to Bangladesh, Dhaka	10.9.15
Ms Gaelle Perrin	Trainee, Food and Nutrition Security	Delegation of EU to Bangladesh, Dhaka	10.9.15
Dr Nur Khondaker	Assistant Representative	FAO Bangladesh	10.9.15
Mr Mike Robson	FAO Representative	FAO Bangladesh	11.9.15
Ms Afroz Sultana	Joint Secretary	Economic Relations Division, Ministry of Finance	10.9.15
Dr Abdul Kalam Azad	Executive Chairman	Bangladesh Agricultural Research Council	10.9.15
Dr Mohammed Shahjahan	Chief Scientific Officer (Forestry) (National Project Coordinator, CDAIS)	Bangladesh Agricultural Research Council	10.9.15
Mr Md. Mustafizur Rahman	PSO (Training)	Bangladesh Agricultural Research Council	10.9.15
Dr Raghieb Hassan	Additional Director	Department of Agricultural Extension, Dhaka	10.9.15
Dr Mazharul Aziz	Additional Deputy Director & Focal Person, Agro-Meteorological Information Systems Development Project	Department of Agricultural Extension, Dhaka	10.9.15
Dr John Ryder	Food Safety expert	FAO Food Safety Project	12.9.15
Prof Lutfur Rahman	Advisor, Advanced Seed Research and Biotech Centre	ACI Seed Ltd, Dhaka	12.9.15
Dr Md. Zahidur Rahman	Principal Scientist, Advanced Seed Research and Biotech Centre	ACI Seed Ltd, Dhaka	12.9.15
Ms Adeeba Raihan	Research Specialist	ACI Seed Ltd, Dhaka Industries Ltd Seed, Dhaka	12.9.15
Prof Mohammed Jialul Hoque	Head, Department of Agricultural Extension	Bangladesh Agricultural University, Mymensingh	13.9.15
Dr M. Afzal Hossain	Dean, Faculty of Agriculture	Bangladesh Agricultural University, Mymensingh	13.9.15
Dr M. Abul Kashen	Professor, Department of Agricultural Extension	Bangladesh Agricultural University, Mymensingh	13.9.15
Prof Md. Golam Farouque	Department of Agricultural Extension & director, BAUEC	Bangladesh Agricultural University, Mymensingh	13.9.15
Dr Md. Shamsher Ali	Director General	Bangladesh Institute of Nuclear Agriculture	13.9.15
Dr Md. Habibur Rahman	Head, Agricultural Economics Division /Deputy Project Director Strengthening Research Activities & Sub-Stations Development Project	Bangladesh Institute of Nuclear Agriculture, Mymensingh	13.9.15
Mr M A Matin	Director General	Rural Development Academy, Bogra	13.9.15
Mr Chandi Das Kundu	Deputy District Agricultural Officer	CIG NATP-1, Bogra	14.9.15
Mr Md. Abdur Razzak	Community Development Officer, IFMC Bogra	CIG NATP-1, Bogra	14.9.15
Ms Azifa Anyman Ana	Assistant Community Development Officer	Department of Agricultural Extension, Bogra	14.9.15
Ms Anisa Begum	Seed producer	Shapla Seed Multiplication Group, Bogra	14.9.15
Mr Bablu Mia	Seed producer	Shapla Seed Multiplication Group, Bogra	14.9.15
Ms Marzia Khatun	Seed producer	Shapla Seed Multiplication Group, Bogra	14.9.15
Dr S. M. Rafiqul Islam	Product Development Manager	ACI Seed, Bogra	14.9.15

Prof Md. Mahbubar Rahman	Vice chancellor	Bangabandhu Sheikh Mujibur Rahman Agricultural University	15.9.15
Prof Md. Safiul Islam Afrad	Head, Department of Agricultural Extension and Rural Development	Bangabandhu Sheikh Mujibur Rahman Agricultural University	15.9.15
Dr Mohammed Jalal Uddin	Director Research	Bangladesh Agricultural Research Institute, Gazipur	15.9.15
Dr Salina Parvin Banu	Chief Scientific Officer	Bangladesh Agricultural Research Institute, Gazipur	15.9.15
Dr Muhammed Math Hurul Haque	Director General	National Agricultural Training Academy, Gazipur	15.9.15
Dr M.A. Razzaque	Executive Director	Lal Teer Seed Ltd, Gazipur	15.9.15
Dr Kamal Humayun Kabir	Executive Coordinator	Lal Teer Seed Ltd, Gazipur	15.9.15
Dr G M Mohsin	Chief Plant Breeder	Lal Teer Seed Ltd, Gazipur	15.9.15
Dr Md. Abdul Jalil Bhuyan	Managing Director	Hortex Foundation, Dhaka	16.9.15
Mr Mitul K. Saha	Assistant General Manager	Hortex Foundation, Dhaka	16.9.15
Mr Md. Mahtab Uddin	Chief Operation Officer	PRAN Agro Ltd, Dhaka	20. 9.15
Mr Hasin Jahan	Country Director	Practical Action, Dhaka	20. 9.15
Nicolas Syed	Acting Country Programme Officer	IFAD Office, Dhaka	22.9.15