Impact Evaluation Study of
"National Agricultural Technology Project (NATP)-Phase I"


Carried out by

Evaluation Sector
Implementation Monitoring and Evaluation Division (IMED)
Ministry of Planning, Government of the People's Republic of Bangladesh

Conducted by

Bangladesh Institute of Development Studies (BIDS)

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E-17 Agargaon, Sher-e-Bangla Nagar
Dhaka 1207

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FOREWORD

The Ministry of Agriculture and the Ministry of Livestock and Fisheries are implementing the "National Agricultural Technology Project (NATP)" with financial assistance from the World Bank (through IDA credit) and International Fund for Agricultural Development (IFAD). The aim of NATP is to support GOB's strategy to improve national agricultural productivity and farm income, with a particular focus on marginal and small farmers.

The focus during the Phase-1 of the program, apart from introducing better technologies related to agriculture, was on institutional development including amendment of BARC Act and establishment of Krishi Gobeshona Foundation (KGF) and decentralization of planning and funding responsibility for demand-led extension micro-plans to the Upazila level organizations. The project loan for NATP became effective on March 25, 2008.

The findings of the impact evaluation indicated that the research effort had been quite successful as they go, with better achievements in some fields compared to others. However, it appears that most studies have had limited goals and their general applicability in terms of technology developed remain to be further investigated. An issue that came up but not specifically probed was the long time needed in proposal submission, verification, award, grant release seem to be rather long while the actual research time may be comparably short for understanding the sustainability of the technology developed or tested. The NATP's process of farmers' group formation, its functioning and technology dissemination process through training may have worked quite well. These resulted in higher productivity as most farmers had adopted better technology.

I sincerely congratulate BIDS team for conducting the evaluation and successfully completing the report in time. I also thank Salma Mahmud, DG of Evaluation Sector along with her colleagues to provide necessary support and cooperation to the BIDS team members throughout the study.

I am very hopeful that the recommendations of the study will be much helpful to everyone involved in the design and implementation of similar projects in the future for higher efficiency, effectiveness and sustainability.

(Suraiya Begum ndc)
Secretary
IMED, Ministry of Planning

PREFACE

Implementing Monitoring and Evaluation Division (IMED) of the Ministry of Planning has been assigned to monitor the implementation of on-going as well as evaluate the completed development projects of the Government of Bangladesh (GoB). The evaluation sector of IMED under took to evaluate the project "National Agricultural Technology Project (NATP) - Phase I" and the Impact Evaluation Study has been completed by the Bangladesh Institute of Development Studies (BIDS).

Some of the findings of the impact evaluation are found remarkable. Findings of the impact evaluation indicated that the research effort had been quite successful as they go, with better achievements in some fields compared to others. However, it appears that most studies have had limited goals and their general applicability in terms of technology developed remain to be further investigated. Secondly, the difference in the two strands of research is not always obvious. Thirdly, time of proposal submission, verification, award, grant release seem to be long while the actual research time may be comparably short for understanding the sustainability of the technology developed or tested. The NATP's process of farmer's group formation, its functioning and technology dissemination process through training may have worked quite well. These resulted in higher productivity as most of the farmers' had adopted better technology.

I want to congratulate the BIDS team for conducting the evaluation work and concerned IMED officials to complete the report in time, also the officials of Department of Agricultural Extension, Bangladesh Livestock Research Institute and Fisheries Research Institute for their kind co-operation. Thanks are also due to all members of Technical and Steering Committee especially to the Secretary, IMED for providing us useful advice and guidance. I hope that the lessons learnt and recommendations would contribute to improve the quality and effectiveness of the similar projects to be implemented by the Ministry of Agriculture and Ministry of Fisheries and Livestock in future.

Salma Mahmud
Director General
Evaluation Sector, IMED
Ministry of Planning

ACKNOWLEDGEMENTS

Impact Evaluation Study of the "National Agricultural Technology Project (NATP) - Phase I" was initiated and financed by the IMED, Ministry of Planning, Government of Bangladesh. We are deeply grateful to them for the financial support they have provided and for their unflinching co-operation. In this connection, we specially acknowledge the help we have received from Director General, Evaluation Sector, Implementation Monitoring and Evaluation Division, Ministry of Planning and several officials of IMED.

The designation and presentation of materials in this report do not imply the expression of any opinion whatsoever on the part of IMED nor of the Government of Bangladesh, and reflect the sole opinions and views of the authors, who are fully responsible for the contents, findings and recommendations of this report. We are grateful to the Members of the Technical Assistance Team and other experts of IMED for their helpful comments at various phases of the research.

The authors are thankful to the various implementing agencies related to the NATP project and we specially acknowledge Dr. Md. Abdur Razzaque, Project Director, PCU (NATP) for co-operation in supplying us with not-so-readily-accessible information and documents. We have also benefitted immensely from our discussions with different Upazila Agriculture Officers and Sub-Assistant Agriculture Officers and it is our pleasant duty to thank them all. We must acknowledge our gratitude to the field officers and other officials who helped to get important information for this report.

The Evaluation Team
Bangladesh Institute of Development Studies (BIDS)
Dhaka, June 2014

ABBREVIATIONS

AAO	Additional Agricultural Officer
ADP	Annual Development Program
AEO	Agricultural Extension Officer
ARIs	Agricultural Research Institutes
AWD	Alternate Wetting and Drying Method
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BBS	Bangladesh Bureau of Statistics
BFRI	Bangladesh Fisheries Research Institute
BINA	Bangladesh Institute of Nuclear Agriculture
BJRI	Bangladesh Jute Research Institute
BLRI	Bangladesh Livestock Research Institute
BPH	Brown Plant Hopper
BRKB	Bangladesh Rice Knowledge Bank
BRRI	Bangladesh Rice Research Institute
BSRI	Bangladesh Sugarcane Research Institute
BTRI	Bangladesh Tea Research Institute
CCMC	Commodity Collection and Marketing Centers
CEAL	Community Extension Agent for Livestock
CGP	Competitive Grants Program
CGS	Competitive Grants Scheme
CIG	Common Interest Group
DAE	Department of Agricultural Extension
DLS	Department of Livestock Services
DOE	Department of Environment
DOF	Department of Fisheries
DOSA	Dollar Special Account
FIAC	Farmers' Information and Advice Centre
FGD	Focus Group Discussion

GOB	Government of Bangladesh
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IMED	Implementation Monitoring and Evaluation Division
IPE	Independent Procurement Expert
ITE	Independent Technical Expert
IUs	Implementing Units
KGF	Krishi Gobeshona Foundation
KII	Key Informant Interview
LEAF	Local Extension Agent for Fisheries
MIS	Management Information System
MOA	Ministry of Agriculture
MOFL	Ministry of Fisheries and Livestock
NARS	National Agricultural Research System
NATP	National Agricultural Technology Project
NGO	Non-government Organisation
PCT	Procurement Core Team
PCU	Project Coordination Unit
PIU	Project Implementation Unit
PMC	Project Management Committee
PO	Producer Organization
RADP	Revised Annual Development Plan
RYGM	Rice Yield Gap Minimisation
SAAO	Sub Assistant Agriculture Officer
SCDC	Supply Chain Development Component
SOE	Statement of Expenditure
SPGR	Sponsored Public Goods Research
SRDI	Soil Resource Development Institute
ToR	Terms of Reference
UAO	Upazila Agricultural Officer
UP	Union Parishad
WB	World Bank

CONTENTS

EXECUTIVE SUMMARY

The Project

National Agricultural Technology Project (NATP), a five year project in the Phase-1 with the financial support of the World Bank and IFAD was approved on February 07, 2008 and became effective from March 25, 2008.The NATP comprises four major components: (i) agricultural research support; (ii) agricultural extension support; (iii) development of supply chains; and (iv) project management and coordination**.**The project is launched to increase agricultural production, productivity and income of farmers. It is a long term development program with funding support from Government of Bangladesh, World Bank and IFAD for a period of 15 years in three phases.The project support comprises 4 (four) components implemented by 7 (seven) implementing units. The components are: (i) agricultural research support, (ii) agricultural extension support, (iii) development of supply chains and (iv) project management and coordination. The implementing units includes: Bangladesh Agricultural Research Council (BARC), KrishiGobeshona Foundation (KGF), Department of Agricultural Extension (DAE), Department of Livestock Services (DLS), Department of Fisheries (DoF), Hortex Foundation (Hortex) and Project Coordination Unit (PCU). The research component is being implemented nationwide, whereas the extension component is being implemented in 120 upazilas. The supply chain development component is being implemented in 20 upazilas.PCU is looking after the overall coordination and management of the project implementation under the guidance of PSC and PMC.However, the project implementation started on October, 2008. NARS institutes and public universities participated in research activities under PIU-BARC and NARS, universities, NGOs and private organizations (POs) also participated in research activities under KGF. Extension activities were implemented by DAE, DLS and DoF while the supply chain activities by Hortex Foundation. The project is implemented in 120 upazilas of 25 districts. The Project Coordination Unit (PCU) coordinated activities of the components and acted under the guidance of the Project Steering Committee (PSC).

The overall objective of the longer term program (NATP in three phases over 15 years) is to support GOB's strategy to improve national agricultural productivity and farm income, with particular focus on marginal and small farmers. The development objective of the phase-I of

the NATP is to improve effectiveness of the national agricultural technology system in Bangladesh.

The Evaluation

The IMED has entrusted the evaluation of NATP Phase 1 to the BIDS. The ToR includes 11 objectives for detailed evaluation. Part of the ToR relates to the process of the project including procurement, part on processes in the field (technology generation, CIG formation etc) and the rest on output (such as productivity increases) and outcomes (better income and expenditure capacity). Part of the methodology thus related to examination and analysis of secondary data to be obtained from various institutions involved in project implementation. The rest of the methodology involved generation data from the field based on quantitative and qualitative methods. A sample of 300 CIG and 150 control farmers were chosen for the purpose and an extensive questionnaire was used for the survey. In addition, first hand qualitative data were generated using FGDs among farmers, extensive consultation with officials both in the field and the headquarters of the organisations involved.

An Inception Report was submitted and later revised based on comments received. The present report is following the revised Inception Report that had been approved earlier by the IMED.

Research Component

From the detailed analysis of SPGR and KGF-based research (see Chapter 2), one can conclude that the research effort had been quite successful as they go, with better achievements in some fields compared to others. However, it appears that most studies have had limited goals and their general applicability in terms of technology developed remain to be further investigated. Secondly, the difference in the two strands of research is not always obvious. SPGR should have broad based goals while KGF-sponsored research may be more focused which these generally are. A third issue that came up but not specifically probed was the long time needed in proposal submission, verification, award, grant release seem to be rather long while the actual research time may be comparably short for understanding the sustainability of the technology developed or tested.

Procurement

There had been substantial procurement under the project made by the constituent organisations. While one finds that goods and works have been procured, albeit with some delays in the initial years, this has picked up well in later years. But for services there still remains some bottlenecks for which these have lagged somewhat. The other issue was the transparency and whether government and development partners' guidelines for procurement were followed. Available information on these are still sketchy. For example while one gets information on planned and actual packages procured and money spent, there is hardly any easily available information on number of bids, their shortlisting based on technical proposals and proposed cost. The team observed package file and examined at random basis sample procurements of different implementing units related to NATP. The team checked package files and examined at random basis sample procurements of different implementing units of NATP. On paper, there seems to adherence to guideline from development partner as evident from World Bank's no objection letters as well as to Govt. guidelines.

Farm Level Impacts

On the whole the team found that the NATP's process of farmers group formation, its functioning and technology dissemination process (through training, agricultural fair, exhibition, advice services, etc.) may have worked quite well (for details see Chapter 3). These resulted in higher productivity and return as farmers adopted better technology particularly in case of rice but also in case of cash food crops**.** The NATP technology recipient farmers produce more and earn higher profit compared to the control farmers. The final outcome could be in terms of higher expenditure capacity although the food still accounts for half of the total.

A Few Recommendations

Based on the analyses so far, the team recommends the following:

<u>On research component:</u>

a. Both SPGR and KGF sponsored research should be programme based for general applicability, some progress has been made by focusing on hill and coastal ecosystem which should be further carried forward

b. Because of nature of transformation from project to programme, multi-year, larger research ideas should be developed
c. SPGR should concentrate more on research for broad-based applicability and may have somewhat different perspectives than KGF's CGP which is oriented more towards applicability of existing technologies
d. The pre-award time of verification etc. may be reviewed for shortening the process.

On procurement and its transparency:

For monitoring purposes the team suggests that the format of reporting should have information on number of bidders, the number of short-listed bids according to technical merit ranking and their proposed costs and the final winner of the bid as well as the value of the bid. There should be a column stating reasons of deviation from initial proposed costs as well as reasons if the bid ranked first has not been chosen.

On nature and extent of impact at the farm level:

From what has been discussed and analysed, one sees a good case for replication of the NATP experiences all over the country, although the exact element of a particular technology may vary from place to place.

There are certain concerns regarding the lack of funds for additional works that the SAAOs carry out under NATP. This is a very time-intensive project and activities under say FIAC while these need to be further extended can not be done well with the limited allocations for incidentals that are provided. The real issue is to make NATP experiences and output and outcome sustainable when the project ends. It is towards that the NATP may need to be fine-tuned. A much more extensive field level examination of processes and the barriers to the smooth implementation need to be found out and addressed carefully.

CHAPTER 1

INTRODUCTION AND OVERVIEW

1.1 Background

According to the Sixth Five Year Plan of the Government (2011)[1], the principal goal of Bangladesh's economic policy is to reduce poverty so as to lift the vast majority of the people above the poverty line and improve the quality of life for the average citizens. Although considerable progress has been made in the fight against poverty, yet about 17.6 percent of the people of Bangladesh lived below the lower poverty line in 2010 (BBS: 2010)[2]. Thus Bangladesh has a long way to go to eliminate poverty. This requires high and inclusive economic growth on a sustained basis and rapid growth of rural and agricultural economy.

Agriculture in Bangladesh is characterized by small farms and rice-dominated farming system. The productivity of rice and other crops is low and there are large yield gaps between farmers' fields and research trials. The same is true for other agricultural commodities such as fisheries and livestock. Diversification of agricultural system to high value products is still slow with limited post-harvest value addition. A three-pronged strategy with technology at the core and requisite social mobilisation and prospects of higher economic return may help transcend out of this morass. Reaching technologies to the farmers requires technology generation and dissemination through the research and extension systems. Both research and extension in Bangladesh remain largely in the public sector. Private investment in research and extension is low. The NGOs, local governments, and community organizations are coming up but very slowly. Therefore, the public sector must continue to play a leading role in agricultural research and extension. This makes a strong case to strengthen the existing research and extension institutions in terms of human resources, reorientation, redirecting, and rationalizing and networking both nationally and internationally.

The National Agricultural Research System (NARS) is responsible for generating agricultural related technologies and the Department of Agricultural Extension (DAE), Department of Fisheries (DOF), and Department of Livestock Services (DLS) in the public sector are responsible for extension of generated technology to the farmers. The Bangladesh Agricultural Research Council (BARC) is the apex body for NARS. There are 10 research

[1] GoB, *Sixth Five Year Plan 2011-15*, 2011
[2] BBS, *Report of the Household income and Expenditure Survey*, 2010, 2011

institutes under the umbrella of NARS. These are: Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Bangladesh Jute Research Institute (BJRI), Bangladesh Sugarcane Research Institute (BSRI), Bangladesh Institute of Nuclear Research Agriculture (BINA), Soil Resource Development Institute (SRDI), Bangladesh Livestock Research Institute (BLRI), Bangladesh Fisheries Research Institute (BFRI), Bangladesh Forest Research Institute (BFRI) and Bangladesh Tea Research Institute (BTRI). The strengths and weaknesses of BARC, NARS and Extension Departments have been assessed in the preparatory phase of the National Agricultural Technology Project (NATP). It has recommended for improving accountability, objectivity and transparency in the technology generation and dissemination, supply chain development and in the procurement and financial management. Involvement of the private sector in technology dissemination and development of supply chain has also been emphasized.

On the request of the government, the World Bank (WB) agreed to support a long term development program over a period of 15 years in three phases, the first phase beginning in July 2007. The IFAD, in the process of dialogue, agreed to co-finance the program with the WB. The WB provided a loan of US$19.49 million. The development partners indicated that the government should contribute US$ 2.6 million during the first phase. The WB funding in the third phase will depend on the triggers set for the first and second phases respectively. The Phase I of the project is under implementation in 120 upazila of the country.

About the Project

The Government of Bangladesh (GOB) is implementing the NATP with financial assistance from the World Bank (through IDA credit) and International Fund for Agricultural Development (IFAD). The program of NATP is to support GOB's strategy to improve national agricultural productivity and farm income, with a particular focus on marginal and small farmers. The project intends to achieve the program objective through a phased approach. The focus during the Phase-1 of the program, apart from introducing better technologies related to agriculture, was on institutional development including amendment of BARC Act and establishment of Krishi Gobeshona Foundation and decentralization of planning and funding responsibility for demand-led extension micro-plans to the Upazila level organizations. The project loan for NATP became effective on March 25, 2008.

The Project has seven Implementing Units: (i) Project Coordination Unit (PCU), Ministry of Agriculture, (MOA) (ii) Project Implementation Unit (PIU), Bangladesh Agricultural

Research Council (BARC), (iii) Project Implementation Unit (PIU), Department of Agriculture Extension (DAE), (iv) Project Implementation Unit (PIU), Department of Fisheries (DOF), (v) Project Implementation Unit (PIU), Department of Livestock Services (DLS) (vi) Krishi Gobeshona Foundation (KGF) and (vii) Hortex Foundation (Hortex).

The Project Coordination Unit (PCU) coordinates and facilitates implementation of NATP: Phase-1 under the direction of a Project Steering Committee (PSC) and a Project Management Committee (PMC). The Project Implementation Units in BARC, DAE, DOF, DLS and implementing partners – KGF and Hortex are responsible for ensuring implementation of project activities assigned to respective organizations.

The PCU, headed by a Project Director, has five National Coordinators – one responsible for agricultural research, three responsible for extension (crops, fisheries and livestock) and one for supply chain development. It also has experts in Administration, Financial Management, Training and Communication, M&E, Social/Environmental aspects and two independent members of Procurement Core Team (PCT) to support and develop capacity of implementing agencies, as needed.

Project Components and Objectives

The NATP comprises four major components: (i) agricultural research support; (ii) agricultural extension support; (iii) development of supply chains; and (iv) project management and coordination.

The overall objective of the longer term program (NATP in three phases over 15 years) is to support GOB's strategy to improve national agricultural productivity and farm income, with particular focus on marginal and small farmers. The development objective of the phase-I of the NATP is to improve effectiveness of the national agricultural technology system in Bangladesh.

The project development objective was achieved by increasing efficiency and effectiveness of the agricultural research and extension systems, and by strengthening farmer -market linkages. More specifically, the national agricultural technology system would be enabled to support:

-High priority, pluralistic, participatory and demand-led agricultural research;

-Decentralized, participatory, demand-led and knowledge-based approach for agricultural extension;

-Improved post-harvest technology and management practices for high value agriculture by promoting farmer-market linkages as part of the development of selected supply chains and

-Agreed reforms for the agricultural research and extension system, increased public funding for the systems and promote effective use of such resources and promote public private partnership in research extension and supply chain development.

1.2 Objectives of Present Evaluation of NATP-Phase I

Terms of Reference

The main purpose of the present evaluation is to assess and examine the effect and impact of the project on the beneficiaries during its first phase. The overall objectives of the study according to TOR are:

1. To review implementation status of major components/subcomponents of the project as well as the present functional status of project activities in the sampled areas and reasons for deviation, if any.
2. To examine if the project has been successful in improving research capacities and effectiveness of National Agriculture Research System (NARS) for bridging the gap between current and potential production in crops, fisheries and livestock sectors.
3. To examine if the Sponsored Public Goods Research (SPGR) had resulted in generation of appropriate technologies in agriculture sector for marginal and landless farmers for improving productivity, sustainability and product diversification.
4. To assess the relevance and usefulness of applied and adaptive research under Competitive Grants Scheme (CGS) in generating better technologies for the concerned sectors.
5. To examine the efficacy and effectiveness of the new extension services model vis-a vis the existing ones and to find out whether the new model is participatory, decentralized and based on felt needs of targeted beneficiaries,
6. To assess the nature and impact of development of supply chains for fruits, vegetables, poultry and fish through the use of improved technologies and post-harvest value additions in terms of productivity and healthy production.

7. To assess how post-harvest technology and management practices for high value agriculture helped promote improvement in farmer-market linkages.
8. To examine whether the procurement process (invitation of tenders, evaluation, approval procedures, contract award etc) of the packages (goods, works and services) under this project was followed as per PPR08/development partner's procurement guidelines.
9. To assess the impact of project on increasing the productivity, livelihood security and profitability in crops sector, livestock and inland aquaculture.
10. To identify the strengths and opportunities as well as weaknesses and external threats that may affect functioning of the project activities.
11. To provide recommendations for more efficient and sustainable utilization of use of agriculture research and extension system, public funding, PPP enterprises, post-harvest technology and identification of best practices for replication in similar other projects.

Clearly the evaluation has to be a multi-pronged multi-institutional analysis and be based on different kinds of method for different objectives while the sources of data and information may be of varied types. These are first discussed in generic terms and then objective by objective.

1.3 Data and Method of Investigation

Steps in Impact Evaluation

The impact evaluation involves a number of steps such as**:**

a) Identification of activities, inputs and processes as well as their intended outputs
b) Choice of the methods of investigation
c) Choice of sample, as applicable
d) Questionnaire or checklist for activities, inputs, processes and outputs
e) Methodological Issues: Qualitative and Quantitative Methods

For each of the objectives, the issues involved and their analyses including the method of information collection are described below.

Evaluation of Objective 1

The first objective of the evaluation as stated earlier is

To review implementation status of major components/subcomponents of the project as well as the present functional status of project activities in the sampled areas and reasons for deviation, if any.

For meeting this objective the following method of investigation has been employed.

The NATP has 4 major components and 7 organisations are involved in carrying out the tasks. Each organisation publishes its own report on status of implementation of its part of the mandate. Furthermore, the NATP has very recently hired a group of Consultant firms to independently evaluate these same programmes. Based on these, the present Consultant has prepared an initial status report on the activities of the NATP as a whole. The Consultant then has assessed where the deviations have taken place and tried to find out why. For this, the Consultant has extensively interacted with the organisations and their coordinating team for the NATP component under its jurisdiction to find out the reasons thereof. This has been further validated with information from the NATP coordinating unit at the PD, NATP's office. One of the issues that has been carefully analysed is if there had been any duplication of works and activities and whether the remaining work can be completed within the extended time period for the phase 1 of the project.

Evaluation Objective 2

The second objective of the impact evaluation is

To examine if the project has been successful in improving research capacities and effectiveness of National Agriculture Research System (NARS) for bridging the gap between current and potential production in crops, fisheries and livestock sectors.

To properly understand the concerns here one needs to find out the support provided under the Special Public Goods Research coordinated by BARC and the applied and adaptive research sponsored under the KGF to the NARS system and what research have been carried out and if these have tried to address the yield gaps in various sub-sectors of agriculture. However as these two issues are also elaborately to be analysed under objectives 3 and 4, the part of the assessment of fulfillment of objective 2 depends upon how far the objectives 3 and 4 have been achieved. Hence we do not discuss this any further (except as noted below).

The NATP has provided support for creation of human skills and upgradation through formal academic training and other manners. The Consultant has tried to find out what has happened to the newly developed skills, particularly the assignments of the newly trained persons after training.

There is another part of the objective which is to assess how far the reform programme of the NARS has been going on and the nature of the intended reform. To the best of the Consultant's knowledge, a diagnostic report on the NARS has been prepared and recommendations made for their resolution. The consultant is analysing the report for understanding the policy implications of the recommendations.

Evaluation Objective 3

Objective 3 is

To examine if the Sponsored Public Goods Research (SPGR) had resulted in generation of appropriate technologies in agriculture sector for marginal and landless farmers for improving productivity, sustainability and product diversification.

To assess the implementation of the SPGR the Consultant has examined based on reports of the SPGR the research grants provided to the NARS and the technologies that have been invented for replication. For proper understanding one needs to find out if the research had been third party peer reviewed and certified to be robust and ready for replication. The Consultant has tried to establish that if available information allow such an assessment. Whether the technology that has been developed is good for replication among marginal and small farmers would be hard to establish unless these are already applied on the farmers' fields. However, another option could be to find out the costs of cultivation of use of the newly developed technology in farmers' conditions are lower than the existing one that is sought to be replaced. If the trials on farmers' fields have not been conducted yet and the results are based only on experiments in the research stations, it would yet be possible to provide a theoretical basis for the assessment of the cost-effectiveness of the new technology.

Evaluation Objective 4

The fourth objective is also related to the effectiveness of research this time of the component under KGF for competitive grants programme. The objective is:

To assess the relevance and usefulness of applied and adaptive research under Competitive Grants Scheme (CGS) in generating better technologies for the concerned sectors.

The manner of assessment of the KGF activities for competitive grants programme is rather similar to that for SPGR except that the KGF's operation is much wider in responding the demand from not simply the NARS but beyond that to individuals from private bodies and NGOs. Except that the method of assessment is similar to that for SPGR.

Evaluation Objective 5

The fifth objective as stated earlier is

To examine the efficacy and effectiveness of the new extension services model vis-a vis the existing ones and to find out whether the new model is participatory, decentralized and based on felt needs of targeted beneficiaries.

There are three extension systems under NATP, one each for crops, livestock and fishery respectively, for introducing technological information through training and real life demonstration in 120 upazilas. The basic process is as follows:

In each upazila, farmers are organized in Common Interest Groups (CIG) in the ratio of 7:2:1 for crops, livestock and fisheries. Farmers can be members of only one CIG through which it can receive training and participate in demonstration plots/exercises in more than one technology for the sub-sector-specific extension. Thus, a CIG may receive training and participate in demonstration in technology related to rice yield gap minimization, AWD, improved mustard and lentil technology or for any other crop among several as well as can take part in seed preservation, compost making etc. In case of livestock and fisheries the available technologies are rather limited to 2 or 3. There are CIGs which draw their membership exclusively from women farmers.

The CIGs were initially expected to be formed by NGOs. Later, however, it was decided that the DAE/DLS and DF is the main agents for forming the groups. It was expected that only in

this manner is there be a full ownership of the groups by the extension departments and that in future technological backstopping may be ensured even if the project discontinues.

Each CIG is expected to prepare its own plan of actions (training, demonstrations, planting) related to the technology. These are aggregated at the union and subsequently at the upazila level for a particular fiscal year. This provides the demand side of the plan. From the NATP/extension side there are allocations pf resources (financial, trainers etc) which are then matched with the demand and a final plan is thus prepared and implemented CIG by CIG for the particular upazila. In theory this is thus a bottom up micro level planning for technology dissemination and practice.

Investigating the process: The Consultant has tried to find out how far the practice matches with theory, and if there are deviations in practice the reasons thereof. These relate to formation of the CIGs, and their operations (appointment of office bearers, land holding groups of farmers, regularity of meeting and their minutes, savings schemes, if any, micro level planning) as well as the support received from the NATP and all the three extension services. Apart from these, there are also support provided for running what are called Farmers' Information and Advice Centres (FIAC). These centres provide necessary information to farmers on demand.

The main method of investigation here is the checking of records of the chosen CIGs, and associated FAICs, information obtained from the extension services as well as the NATP from their records of support provided and received.

The immediate output of the process are several such as trainings imparted to CIG members, demonstrations on farmers' fields, information obtained on resolution of farmers' problems through training, FAIC, demonstrations and their application by farmers. The final output has to be the actual practice of the technology or the working method. For a crop technology this is the area of land on which the technology has been applied by specific farmers, the type of farmers who have applied those, the yield levels and the inputs going into the application of the technology, the changes, if any, of the farmer's cropping patterns and calendars, the profitability of the technology and the changed cropping patterns. The Consultant tried to find out how far the adoption of the technology is related to the training and similar other services received from NATP and extensions services. It should be noted that three types of farmers were requested to provide the relevant information. These are the CIG farmers, non-CIG farmers in the same or neighbouring village and a control group of farmers in an area where

there are no CIGs. Also note that while farmers can become members of only one CIG, this does not preclude them from learning from farmers from other CIGs who may have different trainings and demonstrations. It this becomes quite a complex mosaic of activities. Thus, while one can try to have the effectiveness of a particular technology for raising yield, output and income, in reality the end result for the farmer has to be the farm level rise in aggregate output and income. All these apply in various degrees and forms also to CIGs for livestock and fishery technology although the complexities are less due to the limited number of technologies that are being introduced.

Evaluation Objective 6 and 7

Objectives 6: *To assess the nature and impact of development of supply chains for fruits, vegetables, poultry and fish through the use of improved technologies and post-harvest value additions in terms of productivity and healthy production.*

Objective 7: *To assess how post-harvest technology and management practices for high value agriculture helped promote improvement in farmer-market linkages.*

The two objectives are inter-linked as development of a supply chain of farm products must of necessity be related to market linkages as without this the development of no supply chain can be effective. In any case, here several types of post-harvest operations and their technology are sought to be introduced and farmers trained in them for their ultimate adoption and practice. These include various post-harvest processing technology, use of sex pheromones for non-pesticide control of insects and pests, shelf life improvement of products and the commodity collection and marketing centres.

In general the support to value chain activities may be observed along with CIGs and thus be CIG farmers who are expected to be part of sample for assessing effectiveness of extension activities, some of the value chain activities are not in the sampled CIGs. For each value chain activity, the Consultant found out the training and demonstrations that have been undertaken by the Hortex and received by the farmers. The information from Hortex is based on their records while farmers' information is collected first hand from them. The effectiveness of the training and demonstration received is judged based on the costs and benefits of the activities with information collected primarily from the farmers. Part of the analysis is quantitative and part is qualitative.

Objective 8

Objective 8 is:

To examine whether the procurement process (invitation of tenders, evaluation, approval procedures, contract award etc) of the packages (goods, works and services) under this project was followed as per PPR08/development partner's procurement guidelines.

This objective is straightforward and solely based on records of the entities involved in such procurement i.e., various project offices. Auditors' reports and annual reports of the organisations, as available, have been used for assessment of the expenditure procedures.

Objective 9

Objective 9 is:

To assess the impact of project on increasing the productivity, livelihood security and profitability in crops sector, livestock and inland aquaculture.

This objective is already captured under Objective 5 and is not treated separately.

Objective 10

Objective 10 is:

To identify the strengths and opportunities as well as weaknesses and external threats that may affect functioning of the project activities.

Under objectives 1-9 as and wherever applicable, the Consultant is examining the project rules and procedures, the deviations from the rules, the practices as recorded and the results thereof and also the perceptions of the farmers regarding these procedures and the outcomes of such practices. Furthermore the planning exercises from the CIG level to the upazilas has been assessed and the efficacy of the supports and initiatives examined. All of these allow the Consultant to assess how far some of these have facilitated (strengths) or hindered (weaknesses) the process and the outcomes of the project. External threats, however, is a different matter altogether. Assessing these is difficult and the Consultant is trying to understand these based on extensive discussion with the World Bank (the financier of NATP), the MoA and the Project Coordination Unit of the NATP. This has the danger that

people may not wish to discuss their own shortcomings but rather put the onus on others. How to know the real situation from all these conversations is difficult but is being tried as far as practicable by the Consultant.

Objective 11

Objective 11 is:

To provide recommendations for more efficient and sustainable utilization of use of agriculture research and extension system, public funding, PPP enterprises, post-harvest technology and identification of best practices for replication in similar other projects.

This objective is fulfilled by drawing upon the assessments and analyses under all the previous objectives.

Methods of Analyses and Investigation

Both quantitative and qualitative data was collected and analysed and assessed for effectiveness of NATP. Quantitative data was pertained to several objectives such as Objective 5 and also the research components as well as resources and financial support provided.

Qualitative method was used for understanding perceptions under several of the objectives described above. A number of techniques of qualitative analysis have been developed. These are

a) Rapid Appraisal
b) Participant Observation and Impact Assessment
c) Focus Group Discussion
d) Participatory Impact Assessment

For both qualitative and quantitative survey**,** the appropriate sample size is determined by three factors: estimated prevalence of variables of interest, desired level of confidence and acceptable margin of error.

3.12 Sample Size

As the farm households constitute the CIGs, the sample size of households covering all over Bangladesh was estimated through an approach based on confidence level and precision rate. For this purpose, the following formula has been used:

$$n = P(1-P)\left(\frac{Z}{E}\right)^2$$

Where,

n = Estimated sample size

Z = Value of standard normal variate at a given level of confidence = 1.96 (considering 95% confidence level)

P = proportion of success for the indicator i.e., becoming a member of CIG

E = Precision rate or amount of allowable error in the estimate = 0.05 (considering 5% allowable error or precision level)

In a village, the team takes it that there is at least one CIG, in some cases there may be none and other cases more than one averaging one. Now a CIG has 20 farmer members out of say 150 farmers in a village which gives a random probability of inclusion as 0.13. If there are two CIGs, the probability (.e. P rises to 0.26) which we use for the desired sample size.

Taking 95% confidence level and 5% precision rate, the total sample size of households for all over Bangladesh is estimated at 296 from above formula, taking no design effect as clustered sampling is not considered here (the farmers from CIGs are chosen at random). It has been rounded to 300. Taking 150 control households the total sample size of farmers becomes 450.

Sample Selection

More than a dozen crop-based technologies have been introduced along with several related to preservation of soil nutrients or ensuring quality seeds. Generally the technologies for yield gap minimization in rice production appears to be most widely adopted and are found in all the 120 upazilas under NATP. Other technologies are observed with certain concentration, but there appears to be little pattern in them. Livestock and fishery technologies are observed only in places where these are major economic activities. But note that in all upazilas there are some livestock and fishery-based CIGs. Also note that as discussed earlier, farmers may

have adopted any of the available technologies although they may remain members of only one CIG. Given this situation, it was prudent to go not by technology in selecting samples, but by basic agro-ecology. We actually have chosen the upazilas at random from the North-west, South-west, North-east, Central and South-east of the country. We expect to find everywhere crop, livestock and fishery-based CIGs. We have taken 4 CIGs at random from each upazila, 2 of which is crop CIGs, one is livestock and other is fishery CIG and collected data from 30 farmers in all, 20 farmers from crop CIG, 5 farmers from livestock CIG and 5 farmers from fishery CIG. That gives 300 beneficiary respondents in all. The ten upazilas selected at random are the following:

Table 1.1: Sample Districts and Upazilas (From Beneficiary Groups/CIG Farmers)

Districts	Upazilas	No. of CIG Respondents		
		Crop	Livestock	Fishery
Rangpur	Pirganj	20	5	5
Dinajpur	Dinajpur Sadar	20	5	5
Natore	Natore Sadar	20	5	5
Jessore	Jhikargachha	20	5	5
Jessore	Manirampur	20	5	5
Kushtia	Mirpur	20	5	5
Kishoregonj	Kuliar Char	20	5	5
Tangail	Gopalpur	20	5	5
Narsingdi	Belabo	20	5	5
Brahmanbaria	Nabinagar	20	5	5
Sub-Total		200	50	50
Total		300		

Selection of Control Farmers

The benefits of a program on its participants may not be reflected accurately in a comparison of the relevant indicators of the beneficiary at the completion of the programme due to some autonomous changes or various other interventions that may affect the programme beneficiary as well as non-beneficiaries. Hence, comparable non-participants in the programme – the "control" group, need to be selected. They should be selected in such a way

that the socio-economic background of the control group is similar to those of the beneficiary group, but not under the program. The rationale for selecting "control group" during for the impact survey is that it would better indicate the impact of the program on the beneficiaries. The control group has been selected from the areas not involved in the project or non-CIG farmers and the number of respondents is 150 from different upazilas (Total 15 from each upazilla and among them 10 farmers from crop CIG, 5 farmers from livestock and fishery CIG)

Sample for Supply Chain Analysis

The selection of respondents for supply chain analysis is a little difficult as only 20 upazilas so far have been brought under this component. It may be noted however that 3 of the upazilas selected at random (Jhikergacha, Delduar and Belabo) had been under the initial 10 upazilas for supply chain improvement. Of the newly added upazilas also there is one upazila in the sample above which also falls under the supply chain development (Pirganj). We expect therefore that some ideas of the efficacy of the supply chain component may be captured from the sample selected above.

While it was difficult to speculate at initial stage as to which technologies was found in the field, we expected to find RYGM practically everywhere and so the analysis of the rice crop yield, output and related changes is statistically measurable. For other technologies, it is likely to be observed more sporadically and thus the margins of error may be possibly large in such cases. To help in minimizing erroneous conclusions, we stated earlier supplement the quantitative surveys with qualitative information obtained through KIIs.

Data Collection Instruments

Both quantitative and qualitative data have been collected for the evaluation survey.

Quantitative Data: Face to Face interview using structured questionnaire

Qualitative Data: Focus Group Discussion (FGD), Key Informant Interview (KII)

Questionnaire Survey: A pre-tested structured questionnaire has been used. This has been modified based on field trial and be finally prepared and administered in Bangla. For objectives such as research grants and types of research etc under both KGF and the SPGR, a

suitable checklist was prepared for data collection. The questionnaire modeled on the recent evaluation of the NATP extension services is given in Appendix 1.

Qualitative Surveys: The present study used mainly the FGD (taking care to conduct it among homogeneous groups) and intensive discussion related to perceptions. Checklists have been prepared for KIIs and the FGDs in due course.

In-depth interview of Key Informants and Service providers: Interviews have been conducted with key persons in the service providing organisations such as the NATP PCU, BARC, KGF, the extension service providers, and Hortex.

Focus Group Discussions (FGDs): Focus group discussion has been conducted in the CIGs and Non-CIGs for understanding some of the issues related to process and perceptions regarding general conduct of the project. Each FGD has been involved 8 to 10 participants.

1.4 Implementation Method

Inception report

An Inception Report was submitted in February, This was discussed threadbare and approved by the IMED Technical and Steering Committee. The final ToR, the sampling method, the geographic coverage and the upazilas all were firmed up based on the approved Inception Report.

Team mobilisation

A four member team of experts have been mobilized. They are the Team Leader, an economist, an agricultural engineer and an agricultural economist. They prepared the questionnaire and FGD check lists.

Recruitment of Field Staff and Data Collection

The Consultant recruited 6 Field investigators including one lady investigator and 1 supervisor. They were thoroughly trained. They were formed into two groups and simultaneously covered two areas and the samples therein as well as consulting officials locally.

Pre-testing of the Questionnaire

The Team visited Gazipur (Salna) to test the questionnaire and collected information from CIG farmers. Modification and improvement of the questionnaire were made on the basis of the results of the pre-test.

Planning for Data Collection

A well thought-out, realistic and tenable work plan is essential for ensuring timely completion of field work and to get good quality data. In this regard, therefore, the first priority was to prepare a work plan before the actual fieldwork is started. While preparing the work plan, the following major considerations have been kept in mind.

- Timely and smooth completion of the field work;
- Establish rapport in the study area;
- Close supervision and monitoring of field work.

Field Visits by Research Team Members

Strict supervision of field interviewing is made to ensure collection of high quality data. The researchers made frequent field visits to supervise the fieldwork. Apart from supervisory checks, the researchers gave on-the-spot solution to the problems. These visits provided moral booster to the team members to carry out constant strenuous jobs and to maintain the desired quality of work.

Monitoring of Data Collection

Monitoring of data collection has been ensured in different ways. The key professionals and coordinators have closely supervised the work of the interviewers and perform the following duties for the purpose of assuring the quality of data:

- Verified, on-the-spot, the interviewing technique
- Made random checks to ensure that respondents are interviewed properly and correctly;
- Had all schedules checked by field interviewers as far as practicable to check for inconsistencies and incomplete responses (if any);
- Discussed problems with the interviewers ;
- Monitored the interviewers' progress report.

Data Processing and Data Management

The filled in questionnaires are considered as the source of raw data. For effective and accurate analysis and quality output generation, the following activities have been undertaken with the surveyed data:

- Filing filled in questionnaire
- Editing and coding questionnaire for entry to computer
- Quality control
- Data Input to Computer
- Preparation of Appropriate Computer Program

Not all the data was in the form of figures. There are many reports that was examined and assessed. These relate to research activities, administrative procedures and financial matters, annual reports and guidelines of organisations and soft information in the relevant web sites.

Data Analysis

Quantitative Data Analysis: For attaining the objectives of the study, both descriptive (proportion for categorical variables, mean for continuous variables having normal distribution) and empirical analysis (probit and Tobit model) are done with statistical software (SPSS 16, STATA 11). To know the differences between groups, t-test (for continuous variables) and χ^2 test (for categorical variables) are computed. Probit and Tobit model approaches are followed to know the determinants of adoption and level of adoption for T. Aman (RYGM) and Boro (RYGM) (Tobin, 1958; Maddala, 1992; Gujarati, 2003). Details of these models construction are available in Chapter 3.

Qualitative Data Analysis: Much of the qualitative data are being analysed using simple statistics such as frequency analysis and similar other techniques. These were employed extensively. In appropriate cases χ^2 tests are computed.

1.5 Present Implementation Status of the Project

The Government of Bangladesh (GOB) has been implementing the National Agricultural Technology Project (NATP) with the financial assistance from the World Bank (through IDA credit) and International Fund for Agricultural Develo nt (IFAD) to address the upcoming

issues and emerging challenges in agriculture, particularly food security. NATP is the first 5-year phase of a long term (15 years) program to support GOB's strategy to increase n onal agricultural productivity and farm incomes. Its focus is on revitalizing the agricultural technology system that includes agricultural research, extension and development of supply chain.

The Project has four components viz. agricultural research support component, agricultural extension support component, supply chain development component and project coordination and management component. These components are being implemented through 7 implementing units. These are: i) Project Coordination Unit (PCU),Ministry of Agricu ture (MOA); ii) Project Implementation Unit (PIU), Bangladesh Agricultural Research Council (BARC); iii) Project Implementation Unit (PIU), Department of Agriculture Extension (DAE); iv) Project Implementation Unit (PIU), Department of Fisheries (DOF); v) Project Implementation Unit (PIU), Department of Livestock Services (DLS); vi) Krishi Gobeshona Foundation (KGF); and vii) Hortex Foundation (Hortex).

As per DPP provision, the project activities were planed to start from July 2007 but the project loan became effective on 25 March 2008, and therefore, the NATP Phase-1 is considered commenced on 25 March 2008. Thus, different components initiated their activities in October 2008 after the release of PA funds. Many of the projects implementing units were established in the FY 2008-2009. Thus, they could not initiate all activities dur ng the year 2008-2009. During 2009-2010, all units were fully operational and initiated all activities in full swing.

The overall objective of the longer term NATP is to support GOB's strategy to improve national agricultural productivity and farm income, with particular focus on small and marginal farmers. The development objective of the Phase-1 of the NATP is to improve effectiveness of the national agricultural technology system in Bangladesh. More specifically the national agricultural system would be enabled to support:High priority, pluralistic, participatory and demand-led agricultural research;Decentralized, participatory, demand-led and knowledge based approach for agricultural extension;Improved post harvest technology and management practices for high value agriculture by promoting farmer-market linkages as part of the development of selected supply chains; and Agreed reforms for the agricultural research and extension systems; increased public funding for the systems and promote an effective use of such resources; and promote public-private partnership in research, extension and supply chain development.

Krishi Gobeshona Foundation (KGF) is responsible for management and implementation of Competitive Grants Program (CGP). Project Implementation Unit of Bangladesh Agricultural Research Council (PIU-BARC) is responsible for implementation of Sponsored Public Goods Research (SPGR) and Enhancement of Research Institutional Efficiency (ERIE) Programs. Under ERIE program, the major activities conducted were distribution of scholarships/slots and placement of scholars for in-country and international PhD, international training, local training and workshop for capacity build and skills development of NARS scientists and administrative personnel. Department of Agricultural Extension (DAE) is responsible for implementation of crop extension sub-component activities. The aim of this sub-component is to establish decentralized demand-led and knowledge-based extension services with greater accountability and responsiveness to farmers and focus on small and marginal farmers. Department of Livestock Services (DLS) is responsible for the implementation of this subcomponent. Department of Fisheries (DOF) has been implementing this sub-component. Supply Chain Development Component (SCDC) is being implemented by the Hortex Foundation. The main focus of this component was to integrate small and marginal producers of high value commodities (crops/horticulture, fisheries and livestock) with the market through supply chain development. The Project Coordination Unit (PCU) provides coordination and facilitation among the NATP implementing units.

1.5.1 Common Interest Groups

The project's perception for extension system is to develop a decentralized extension services (DES) which comprises village level extension planning through common interest groups (CIGs), and their federation (producers' organization) at union, upazila and district levels. The whole gamut of planning, implementation and monitoring processes will be done at upazila level through participatory planning by the CIGs. Creation and strengthening of social capital through technological interventions (i.e., shifting of subsistence agriculture to commercial agriculture) and increasing ability of the communities to convert their social capital into economic capital by developing organizational capacity to manage, implement and monitor agricultural development activities are of utmost priority. These obviously include the empowerment of the community organizations (CIGs and POs) to increase their ability to plan, execute and monitor their activities. The activities also include the development of gender sensitive local institutions that can manage and mobilize community assets, and make new investments in agricultural productivity increase.

Selection Criteria for CIG Member:

• Group size: A group should have 20 members (for crop, livestock, fisheries and Hortex);

• Socio-economic status: Members of a group should be of the same socio-economic status and of a specific gender, male or female. However, in case of fisheries CIGs, there could be mixed groups;

• Category of groups: Small and Marginal Farmer Groups (land ownership up to one hectare)

80 per cent, Medium and Large Farmer Groups (land ownership above one hectare) 20 per cent and Women Farmer Groups (irrespective of land ownership) 30 percent of all groups.

• Homogeneity: No mixed group of male and female with exceptions for female headed household (mostly in case of crop CIGs) but in case of livestock and fisheries CIGs, mixed group may be formed.

• Dwelling status: Has to be a permanent resident of the concerned *para*/ village. A "*Borga Chasi'* who is engaged in farming activities, may be member of a CIG but he should be a permanent resident in the community.

• Membership: One from one family.

• Member selection from existing group: Selection of CIG members from existing groups of the project of executing agencies is encouraged for avoiding duplication and conflict in the same area. However, such group members should have common interest with the other CIG members. This is equally applicable to members of local NGOs, common interest should be in agriculture related activities rather than in credit.

•Other consideration: The above criteria may be flexibly considered, in areas where they are difficult to follow. In such cases process has to be recorded very clearly.

Formation and Management of CIGs

Formation and management of CIG is a process of social mobilization. The capacity of CIG depends on the problem identification, prioritization, planning, utilization of local resources, linking with market opportunities and preparation of micro plan. Their (CIGs) contributions towards preparation, implementation and monitoring of extension activities at the union level will ultimately pave the way

for a greater extension scenario. However, they require expertise in facilitation. Union Extension Facilitation Team (UEFT) is empowered to provide such supports. The UEFT consists of SAAO of DAE, CEAL of DLS, LEAF of DOF and local NGO representatives. DAE/DOF/DLS should include training tropic/events on social mobilization in their trainers-training programme on a regular basis. The resource speakers should be selected from NGOs, government organizations, rural development academies and Universities having experience in social mobilization. This process will help institutionalizing the social mobilization process within DAE/DOF/DLS, enhance their capacity and sustaining the programme even after the project is over.

1.5.2 Farmers' Information and Advice Centers (FIACs)

Union is the lowest administrative unit of the government. It is a local government institution run by the 'Union Parishad (Council)' which is composed of an elected chairman, nine elected members and three nominated women representatives. The Union Parishad (UP) usually is associated with rural development activities like maintenance of rural roads, constructions of small bridges and culverts and also assisting GOs and NGOs in rural development activities. For enhancing two-way flow of knowledge and information between CIG and other stakeholders (extension staff, research scientists, NGOs, the private sector and the local government), Farmers' Information and Advice Centers (FIACs) at union level should be established by the DAE/DOF/DLS. The DAE should take the lead role in the establishment of FIAC.

1.5.3 Implementation Status of the Project (as on June 2013)

A. Triggers & Legal Covenants

Activities 1

Amendment of Bangladesh Agricultural Research Council (BARC) Act 1996

Target

Act to be amended

Cumulative Progress

Enforcement of BARC Act 2012 continued

Activities 2

Establishment of Krishi Gobeshona Foundation (KGP)

Target

GoB to establish KGF

Cumulative Progress

KGF established in 2007and started functioning from August 2008

Activities 3

Increasing Public Investment in Agricultural Research and Extension

Target 1

Funding to be increased in research from 0.20% of AGDP in 2007/2008

Cumulative Progress

0.30% of AGDP

Target 2

Funding to be increased in extension from l.20%ofAGDP in 2007-2008

Cumulative Progress

1.44 % of AGDP

Activities 4

Increasing Agricultural Productivity

Target

Agricultural productivity increased by 10%

Cumulative Progress

Major crops: 10 -30%, Livestock: 6-69% and Fish production: 97%- 193% increased

Activities 5

Increasing Household Income

Target

Household income increased by 20%

Cumulative Progress

Household income increased up to 84% in crops, 118% in livestock and 70% in fisheries CIGs

B. Research Support Component

Activities 1

Implementation of SPGR Subprojects

Target

SPGR subprojects to be implemented; 50 technologies to be developed

Cumulative Progress (as on June 2014)

In total, 108 SPGR subprojects awarded on various disciplines and covering different agro-ecological and stress areas of the country; 53 subprojects completed; rest in progress

Activities 2

Implementation on of CGP Research Subprojects

Target

100 CGP research subprojects to be implemented

Cumulative Progress

92 CGP research subprojects awarded on various disciplines and covering different agro ecological areas of the country

Activities 3

ERIE: HRD in Research

Target

Overseas: 29 PhDs. 10 post-docs, training and study visits; and Local: 60 PhDs & trainings to be implemented

Cumulative Progress

Overseas: 29 PhDs, 7 post-docs, 164 trainings, 66 study visits 70 seminar slots awarded

Local: 79 (including 19 in subprojects) PhDs awarded & 4129 persons in 116 batches trained

C. Extension Support Component

Activities 1

CIG Formation and Mobilization

Target 1

18.000 CIGs to be organized and mobilized in 5 years

Cumulative Progress

20,012 CIGs organized and mobilized (C-13450, L-3892. F-2670)

Target 2

330,000 farmeis to be mobilized

Cumulative Progress

385,385 farmers mobilized (C-269000, L- 76335. F-40050)

Target 3

20% of total CIG farmers to be women farmers

Cumulative Progress

Women farmers in CIGs are: crops -30%, livestock-26%, fisheries- 18%

Activities 2

FIAC Establishment

Target

1345 FIACs to be established(one FIAC/union)

Cumulative Progress

732 FIACs established in new UP complexes

Activities 3

Technology Adoption

Target

60% of CIG farmers adopted new technology

Cumulative Progress

344840 CIG farmers adopted new technologies (Crops-264500. Livestock-76335, Fisheries-40050)

Activities 4

Technology Demonstration

Target

29400 demonstrations to be setup

Cumulative Progress

Setup 81335 demonstrations (C-55102.L-20919. F-5314)

Activities 4

Technology Transfer

Target

All recommended technologies to be transferred to users

Cumulative Progress

45 technologies demonstrated (C-l4, L-11, and F-20)

Activities 5

Farmer's Training

Target

All ClG farmers to be trained on demo-technologies

Cumulative Progress

DAE, DLS & DOF trained all the CIG farmers in more than 3 events

D. Supply Chain Development Component

Activities 1

Training on commercial Agriculture

Target

14.500 public and private staff, traders and farmers to be trained in commercial practices

Cumulative Progress

Over 12.000 staffs are trained on commercial agricultural practices.

Activities 2

Linking CIGs to market

Target

400 CIGs to be linked to the market

Cumulative Progress

402 CIGs are linked to markets

Activities 3

Technology Demonstration

Target

30 improved post-harvest technologies and management practices to be demonstrated

Cumulative Progress

32 technologies on post-harvest management such as, harvesting, grading, sorting, SPS measures and packing and transportation of agro-commodities etc. demonstrated

Activities 4

Technology Adoption

Target

19,500 improved production, and post-harvest technologies; and management practices to be adopted

Cumulative Progress

Over 12,500 farmers adopted improved tcchnologics

Activities 5

Establishment of Commodity Collection and Marketing Center (CCMC)

Target

24 CCMCs to be established and made functional

Cumulative Progress

24 CCMCs in 20 upazilas established

E. Project Management and Coordination

Activities 1

Organizing PSC meetings

Target

2 meetings/year

Cumulative Progress

8 meetings

Activities 2

Organizing PMC meetings

Target

4 meetings

Cumulative Progress

10 meetings

Activities 3

Organizing coordination meetings

Target

6 meetings

Cumulative Progress

25 meetings

Activities 4

Monitoring & Evaluation and Impact Assessment Study

Target 1

Regular field visits, monitoring & evaluation to be done by project staff

Cumulative Progress

•Activities of 56 upazilas monitored

•Activities of l37 CIGs reviewed

Target 2

One Impact Assessment Study in two phases (4+3 months) by hired farm

Cumulative Progress

Filed study completed, preparing report

Target 3

Concurrent M&E: Six Quarterly & Two Annual Reports to be submitted

Cumulative Progress

Six quarterly & two annual reports submitted

Target 4

EIAT study by 5 Member Team: 20-day study annually

Cumulative Progress

Two study reports submitted

Activities 5

Organizing Workshops

Target

National /Regional workshops to be organized on progress review & assessment

Cumulative Progress

16 regional review workshops organized

Activities 6

Organizing PCU Training Courses

Target

Four training courses on "Fiduciary management", "Result based M&E, "Communication & media", and "ICT & website" are to be organized

Cumulative Progress

•Trained: 570 officers in 15 batches on financial management & procurement

•102 officers in 4 batches on result based MAE

•103 officers in 4 batches on Communication & media

•67 officers in 4 batches on ICT & website

1.5.4 Financial Status (as on June 2013)

NATP receives IDA and IFAD funds in the form of reimbursement from IDA against withdrawal application. Project Coordination Unit (PCU) of NATP transfers IDA and IFAD funds to six implementing units on the basis of six monthly estimated expenditure, approved work plans and ADP allocation. PCU receives Statement of Expenditure (SoE) from PIUs and claims reimbursement to IDA through withdrawal application. All PIUs disburse fund to their spending units (districts, upazilas, research institutes, universities, training institutes, principal investigators) according to their need after submission of SoE.

GoB contribution for PCU, BARC, DAE, KGF and Hortex are routed through Ministry of Agriculture (MOA) and that for DoF and DLS are routed through Ministry of Fisheries and

Livestock (MoFL) i.e. GoB contributions are directly routed through implementing departments/agencies. IDA and IFAD funds are claimed by PCU, NATP and IDA deposits

the amount in DOSA Account maintained in Bangladesh Bank which is maintained by PCU, NATP.

During the FY 2012-13 NATP claimed reimbursement fund amounting to USD 14.43 million (USD 10.92 million to IDA & USD 3.51 million to IFAD) through 22 (twenty two) withdrawal applications (WA-44 to 65) to the World Bank. From these withdrawal applications USD 14.09 million was received (USD 10.75 million from IDA & USD 3.34 million from IFAD) to Dollar Special Account (DOSA) in Bangladesh Bank. Table 1.2 shows the claims made to IDA and IFAD and transferred to DOSA.

Table 1.2: IDA and IFAD funds flow for the FY 2012-13 (Amount in million USD)

Donor	Reimbursement Claim	Reimbursement Received	Reimbursement Not Received
IDA	10.92	10.75	0.17
IFAD	3.51	3.34	0.17
Total	14.43	14.09	0.34

IDA and IFAD Funds (RPA) Transfer from DOSA Accounts to PIUs

PCU transfers IDA & IFAD funds from DOSA Account to implementing units operating account (including PCU) on the basis of approved work plans and ADP allocation. Table 1.3 shows the IDA and IFAD fund transferred to different units from DOSA Account and expenditure incurred by different units during the FY 2012-13.

Table 1.3: IDA and IFAD fund (RPA) transfer to PIUs in FY 2012-13 (Tk. in lakh)

Units/Agencies	Fund Received from Bangladesh Bank	Fund Transferred to PIUs
PCU	850	850
BARC	2800	2800
KGF	950	950
DAE	3795	3795
DLS	1700	1700
DOF	1085	1085
Hortex	815	815
Total	11995	11995

Fund Allocation and Expenditure Incurred

The project activities started one and half years after the NATP effective date due to late recruitment of the Project Director and other experts in PCU. This has resulted in a much lower expenditure. Since inception to June 30, 2013 total expenditure incurred in NATP stands to tk. 44608.89 lakh (RPA-Tk. 41296.86 lakh & GOB Tk. 3312.03 lakh).

A statement of unit wise RADP Allocation for the FY 2012-13 and actual expenditure against the RADP allocation are shown in Table 5.17. On an average 87.23% of the allocated fund was spent by all units. Economic code-wise expenditure statement of different PIUs for FY 2012-13 is presented in Table 1.4.

Table 1.4: Fund allocation and expenditure incurred for FY 2012-13 (Taka in Lakh)

Component	RADP 2012-2013			EXPENDITURE 2012-2013			% of RADP
	GOB	RPA	TOTAL	GOB	RPA	TOTAL	
PCU	67	1251	1318	53.24	1021.03	1074.27	81.51 %
BARC	240	3260	3500	203.44	2971.16	3174.6	90.70 %
KGF	20	1000	1020	10.99	965.08	976.07	95.69 %
DAE	250	4224	4474	194.06	3781.74	3975.8	88.86 %
Hortex	67	1480	1517	22.06	849.59	871.68	57.46 %
DLS	125	2002	2127	81.67	1910.45	1992.12	93.66 %
DOF	365	1191	1556	336.9	1129.16	1466.06	94.22 %
TOTAL	1134	14378	15512	902.39	12628.2	13530.6	87.23 %

Achievement of Expenditure to RADP allocation was similar for the FY 2012-2013 (87.23%) in comparison to that for the FY 2011-2012 (87.50%).

CHAPTER 2
ASSESSMENT OF THE RESEARCH COMPONENT UNDER NATP PHASE -1

2.1 Distribution of CGP and SPGR Project among Different Organization

Earlier it has been pointed out that the research components included two types of research, viz., SPGR and KGF-sponsored. Both have been evaluated based on records available to the evaluation team. Table 2.1 shows the distribution of research project over the NATP Phase 1 under both. It is clear that in case of sponsored public goods research (SPGR) 4 organizations have predominated for conducting research which include BARI, BRRI, BARC and BAU. For CGP under KGF funding, BARI, BAU, BSMRAU and NGOs received more projects (for details, see also Appendix Table 2.1 and Appendix Table 2.2). Only BAU appeared to be common to both the strands of research support. Also note that many organisations failed to receive any project support from CGP while under SPGR also several organisations received only a few projects. It was not possible to verify though whether these organisations submitted projects and were not successful in their bid or they did not apply for as many as others did. The preeminence of BARI among these all is understandable as BARI is involved in the research of many crops and they also have the highest number of scientists under its purview and hence there were probably more scope for scientists therein to apply for grants. Research grant under CGP has been provided for disseminating, validating and or improvement of technology or knowledge those already have been developed by the research organizations. While research grant under SPGR has been provided for developing or improving new technology or knowledge those have to be disseminated in future. So the technologies or knowledge developed under SPGR are not disseminated yet. There has some field trial results only. The technologies or knowledge listed under section 2.4.2 are in hand for further dissemination.

Table 2.1: Institution-wise distribution of project under CGP and SPGR

Category of Institute	*CGP Project Number	SPGR Project Number
NARS		
BARI	31	25
BRRI	04	13
BINA	03	05
BSRI	-	05
BJRI	-	06
BFRI (Fish)	-	04
SRDI	-	01
BTRI	-	-
BFRI (Forest)	-	03

Category of Institute	*CGP Project Number	SPGR Project Number
BLRI	-	03
BARC	-	17
BSRTI	-	-
BCDB	01	01
Sub-total	**39**	**83**
Universities		
BAU	16	16
BSMRAU	10	02
KU	03	01
CVASU	02	01
PSTU	01	
SAU (Dhaka)	-	03
DU	-	01
CU	-	01
Sub-total	**32**	**25**
NGO	**14**	**-**
OTHERS		
RDA	01	-
Total	**86**	**108**

*Initially 92 numbers of sub-projects were approved under CGP; out of them 6 sub-projects were terminated.

2.2 Distribution Pattern of Project in Different Ecosystem/areas

More interesting than the organizational distribution is perhaps that by ecosystem (Table 2.2). It is clear that the diversity here was much more. Among those which attracted more projects included saline and hill ecosystems, disease and pest management, farming system etc. It appears that SPGR was more diversified than KGF-supported research.

Table 2.2 Ecosystem/Area-wise distribution of project

SL. No.	Ecosystem/Area	CGP	SPGR
1	Saline/coastal zone	07	14
2	Hill ecosystem	06	07
3	Haor ecosystem	-	03
4	Drought	03	01
5	Char land	01	01
6	ICT	-	03
7	Socioeconomics & policy	05	06
8	Pollution and contaminant	-	07
9	Diseases and pest management	07	09
10	Soil-Water and Land Management	04	12
11	Farming System	-	08
12	All other Ecosystem	53	37
		86	108

2.3 Status of the Project

A total 86 number of projects were awarded under CGP. Out of which 67 projects were completed and rest 19 number of projects have been found ongoing or near completion. The CGP management body extended the deadline of the ongoing projects up to September 2014.

Under SPGR a total 108 number of projects were awarded of which 53 projects have been reported to be completed and rest 55 projects have been found ongoing or near completion. The SPGR management body extended the deadline of the projects up to 30 June 2014 (Table 2.3, Appendix Table 2.1 and Appendix Table 2.2).

Table 2.3 Status of sub-projects

Component	Number of project	Completed	On-going
CGP	86	67	19 (deadline September 2014)
SPGR	108	53	55 (deadline 30/06/2014)

2.4 Achievement from NATP Research Components

Near about 50% of the projects have been completed and the rest of the projects are ongoing or near completion. Several new technologies have been developed under both the CGP and SPGR components. The major achievements of the projects are compiled in bullet form below.

2.4.1 Major Achievements under CGP in Different Areas and Ecosystems

2.4.1.1 Variety Development

1. A garlic variety has been registered by NSB as BAU-garlic-3 after a rigorous field evaluation.

2.4.1.2 Crop Production Technology

2. Application of Dolochun (lime) in acid soil increased availability of P, Ca, K and Mg for crops
3. Fertilizer application following IPNS technology has increased yield of different crops in the rage of 14.28% to 40.0%.
4. Four orchards established in Rajshahi, Joydebpur, Rangpur (Pirgonj) and Nilphamari districts.

2.4.1.3 Disease Management

5. Management technology developed for i) Jackfruit gummosis disease, ii) canker disease of citrus, iii) powdery mildew of Jujube, major diseases of brinjal and tomato;
6. Management technology developed for soil bone diseases of tomato, brinjal, lentil and chick pea;
7. Management technology developed for rot disease of zinger rhizome.

2.4.1.4 Insect Pest Management

8. Double nozzles sprayer has been found to be more effective in controlling brown plant hopper (BPH) in rice field compared to single nozzle sprayer
9. In case of brinjal, utilization of pheromone trap, bio-control agent and following sanitation showed best performance in term of yield.
10. Application of Neem products, tricho-compost, miticide (omite), sanitation and removal of infected inflorescence and young nuts are found to be most suitable for managing coconut mite and significant increase in coconut production.

2.4.1.5 Cropping System

11. Short duration T. Aman rice followed by mung bean/ mustard and then Boro rice provided higher yield, higher productivity and high benefit cost ratio.
12. Four crops in a year with i) Aus rice, ii) T.Aman rice, iii) potato/mustard, iv) mung bean produced 2.9 ton more food per ha.

2.4.1.6 Socio Economics

13. Returns on investment in spice (onion, garlic, chili, ginger or turmeric) research and extension ranged 50-82% of the investment annually without incurring any loss.
14. Daily calorie intake and food security of the ethnic groups in Dinajpur, Tangail and Netrokona have been increased by introducing modern varieties and production technologies.

2.4.1.7 Post-harvest Technology

15. Developed low cost storage house at farmers' level where potato can safely be stored for 3-5 months. The experiment was set up at Munshiganj district. In the improved methods of storing, about 15% loss can be reduced compared to farmers' practices and the storage life increased by more than one month compared traditional practices.

16. A seed dryer has been developed for drying different types of grain seed under Farm Machinery and Postharvest Process Engineering Division, BARI, Gazipur. The capacity of the dryer ranged from 200 to 350 kg per batch and drying times ranged from 12 to 20 hours depending on kind of grain seed.
17. Tribal people of Madhupur region were trained to process their own fruits and vegetables to improve their livelihood. A total eighty of tribal people of which 60% male and 40% female were trained. Upon training it was reported that tribal people got motivated and adopted the technologies. Technologies developed through modification of indigenous methods would suit to the need of rural poor and help them to generate income and improve their livelihood.

2.4.1.8 Water Management

18. Alternate wet and drying (AWD) technique has been identified to be an efficient irrigation method by saving 10-25% irrigation water in case of Boro rice. The AWD technique helps to reduce production cost rice at boro season.

2.4.1.9 Farm Machinery

19. A prototype of power tiller has been fabricated which has been reported to be suitable for wet and dry land preparation.

2.4.1.10 Marketing

20. Tomato cultivation has highest comparative
21. Banana, Barley, Papaya, fresh tomato, lime, advantage for exporting followed by onion, brinjal, potato. Lemon and pineapple have been identified for export potential in worldwide market demand.

2.4.1.11 Fish culture and management

22. Survival rate of shing was found to be 70-95% while cultured in cage and snail was used as feed.

2.4.1.12 Livestock Sector

23. Milk replacer has been developed for calf which is cheaper (75% cost saving) compared to imports
24. Supplement feed for buffalo has been identified which increased milk production.
25. Identified diseases and other risk factor for calf mortality and appropriate

intervention reduced it up to 93%;

26. Developed an effective vaccine against Pollurum disease of poultry birds using a local strain of Salmonella

2.4.1.13 Hill Ecosystem

27. Khagrachari model for year round vegetable production has been developed. A small parcel of land (6 m x 6 m) accommodating a package of vegetable crops in variable sequences produces vegetables sufficient to meet demand of a small family and generates additional income. In each parcel of land in the homestead five bedseach measuring from 6 m x 1 m are prepared. Individual crop or crop variety is planted on a bed. Three packages of vegetables are provided among the farmers. The best performing package is found to be package 1 (Bed 1: Red amaranth-Gima kalmi-Red amaranth; Bed 2: Rai shak-Red amaranth-Panikachu; Bed 3: Coriander shak-Lady's finger-Raddish shak; Bed 4: Raddish shak-Gima kalmi-Raddish shak; Bed 5: Bush bean-Indian spinach-Bitter gourd). The package 1 is found to be potentially benefiting a large number of small farmers in three hill districts.
28. Water management technique has been identified in hilly region by conserving rain water for dry season irrigation.
29. Standardization of protocol for tissue culture has been done for multiplication of healthy saplings of BARI Kola-3 and BARI Kola-4

2.4.1.14 Coastal Ecosystem

30. BARI til-4 has been successfully grown during the fallow period with 44% higher yield than local variety in Khulna region.
31. Early planting of maize, chickpea and til gave highest yield at Patuakhali.
32. Non-rice crops like sunflower, maize and soybean have been successfully grown in the saline belt of Satkhira, Khulna and Noakhali.
33. Fallow–Fallow-T. Aman pattern may be converted to Fallow–Maize-T. Aman in saline zone
34. Saline tolerant varieties of some non-rice crops have been identified such as sunflower, sugar beet etc.

35. Quick growing fruits and vegetables and improved management practices introduced in Patuakhali and Jhalokathi increased yield and net income of farmers.

2.4.1.15 Climatic Vulnerability

36. In climate vulnerable areas, some best practices identified were- Zero tillage for maize, priming for chickpea, mulching for potato, relay cropping of sweet gourd with potato in drought prone areas.
37. Zero tillage for potato, floating and raised pits for vegetable, dry land cropping for millets, jujube, groundnut for flood prone areas and Zero tillage for potato, sorjan system, floating beds for saline & tide prone areas.
38. For drought prone areas two most suitable rice varieties and AWD method of irrigation has been recommended for further studies.

2.4.1.16 Cross Cutting

39. Selection of elite lines for development of short duration high yielding varieties of rapeseed-mustard, groundnut, sesame, soybean and sunflower having tolerant to disease, insect, drought and salinity is in progress

2.4.1.17 ICT

40. Spatial database GIS has been prepared for sustainable shrimp culture.
41. Potential sites of shrimp culture has been identified and categorized as most suitable, moderate suitable & less suitable

2.4.1.18 Basic Studies

42. Bioinformatic analyses of tomato yellow leaf curl virus (TYLCV) confirmed seven strains of Gemini viruses infecting tomato crops in Bangladesh,
43. Blending jute with cotton at 50:50 ratios are alike with 100% cotton denim fabric

2.4.2 Major Achievements under SPGR in different areas and ecosystems

2.4.2.1 Variety Development

1. High yielding salt tolerant rice variety has been developed and registered as BINA dhan-10
2. Aromatic rice hybrid variety has been developed and named as BU hybriddhan-1

3. Hybrid summer tomato variety has been developed and named as BARI hybrid tomato-8 (heat tolerant)
4. White jute (Chochorus capsularis, L) variety has been developed and named as BJCA 2197
5. Lentil variety: BARI masur-7 has been developed
6. Chickpea variety: BARI chola-9 has been developed
7. Garlic variety: BAU Garlic-3 has been developed
8. One short stature, early, high yielding and heat tolerant wheat line has been selected.

2.4.2.2 Production Technology

9. Newly developed BINA Dhan- 10 has been cultivated in coastal saline area in demonstrated field and produced 20 tons breeder seed and 30 tons of good quality seed. These seeds to be made available to BADC, DAE, NOGs and farmers.
10. 5 kg seeds of BARI Hybrid Tomato-8 have been produced through demonstration in farmer's plots in different districts.
11. Produced about 35 tons of TLS seeds of BARI Masur-7 by BADC and 360 kg seeds by DAE at farm level,
12. About 250 kg seeds has been produced from newly developed BAU Garlic-3 in Chalan beel areas

2.4.2.3 Disease Management

13. Management technology has been developed for controlling jackfruit plants gummosis disease and fruit borer (insect) by application of Bordeux paste and bagging of fruits, respectively.
14. A significant increase in fruit yield has been recorded as a result of application of fertilizer and irrigation during dry season.
15. Thirty nine number of diseases have been identified on nine fruit species through survey of 96 nurseries under 13 districts.

2.4.2.4 Insect Pest Management

16. Study of pest management by pheromone trap showed 100% of shoot and fruit borer has been controlled in bitter gourd and that of 75% has been controlled in brinjal.

2.4.2.5 Socio Economics

17. The production of tobacco has increased in 2010 over 1973 while the cultivated area of tobacco has decreased during this time.
18. The productivity of groundnut showed increasing trend during 1990-2010.
19. The area under sesame cultivation showed decrease in trend but the yield has increased with highly significant rate during the period of 1990-2009.
20. The overall growth rates of soybean production has increased but not significant.

2.4.2.6 Post-harvest Technology

21. Low cost improved potato storage system has been developed and installed. Data collection has been started. The sub-project is going on.
22. Plastic crate has been found effective on reduction of physical damage of brinjal and cabbage by 18.47% and 20.33%, respectively during transportation and method has been developed for increased storage life.

2.4.2.7 Water Management

23. Two to three irrigations following AWD produced the highest yield of Rabi crops like rice, potato or wheat in Pabna, Sirajgonj, Rangpur, Joypurhat, Munshigonj, and Jessore. 19-24% water has been saved in demonstration plots at Tangail, Sirajgonj, Pabna, Rajshahi, Rangpur and Kustia in Boro season following AWD techniques.
24. Higher yield of lentil was obtained at Kapasia and mustard, wheat and potato at Satkhira by irrigating at 50% depletion of soil moisture.

2.4.2.8 Farm Machinery

Several types of development have been proposed based on research. These are:

25. USG applicator has been developed in the laboratory workshop in BRRI. Different field trial has been made and necessary modification has been made based on field trial. The technology needs further validation at farmers' level to justify the applicability of the technology.
26. Electric powered expeller has been demonstration at rural level to extract oil at local level.
27. Solar pump has been demonstrated at field level for replacing the fossil fuel in farm operations.

2.4.2.9 Food Contaminants and Adulteration

28. Water and formalin have been found to be the common contaminants in milk
29. Different contaminants in feed ingredients have also been reported.
30. Frequency of pesticide application in fruits and vegetables has been found very high. Farmers apply pesticide 10-15 times for fruits and 8-30 times for vegetable cultivation.
31. In fish market, formalin is used directly on fish or formalin is mixed in feed water of ice ranging from 0.5 to 5% level.
32. About 68% of the fish feed samples were poor in quality.
33. The range of DDT has been found to be from 62.18 to 76.20 ppb and heptachlor has been found to be from 0.70 to 4.64 ppb in dry fish.
34. Milled rice of different govt. storages was found safe for human consumption.
35. The commercial brands of Jam, Jelly, squash, natural fruit juice, pickles and tomato ketchup were found to be of inferior quality compared to BSTI standards.

2.4.2.10 Marketing

36. For brackish water and marine fisheries marketing margin and profit were relatively higher in consumer market followed by primary and secondary markets.
37. Marketing margin and profit were exceptionally higher for dry fish marketing compared to frozen fish marketing.

2.4.2.11 Agro-forestry

38. Some medicinal plants and fruit species have been introduced through participation of the tribal people in hill agroforestry for better productivity and diversification through community mobilization.
39. In Gher based agro-forestry survivals of Guava and Neem have been found to be best in dyke.
40. In boundaries of crop land, different fruit species and vegetables were grown at Norshindhi and Gazipur and also in interspaces in jujube and mango plantation in Khulna. Women participants in Khulna area have been found to be significant (80%) in agro-forestry activities.
41. Farmers are encouraging to grow late jute seed in fruit tree orchards and

homesteads in combination with tree species and vegetables

2.4.2.12 Fish Culture and Management

42. Allozyme electrophoresis revealed 4 loci in Rohu fishes while 3 in Mrigal.
43. Highest growth of silver carp has been found in ditches constructed in low land. At Noakhali coastal belt, fish culture in rice field appeared successful and profitable.

2.4.2.13 Livestock Sector

44. Ninety six G-0 does produced 189 G1 kids of pure Black Bengal goat and 5 G-1 does produced 7 G2 kids (Cross bread). Preventive measures for infectious diseases have been introduced that reduced mortality of the kids. Supplementary food for pregnant does have been introduced. The farmers have already adopted the technology. Community approach of dairy cattle management following scientific method resulted in overall improvement of the dairy cow.
45. So far 17 superior and meritorious young dairy seed bulls were registered and their detail information has already been passed to the cattle breeding service providers.
46. A study was conducted for improvement of dietary nutrient based on milk urea nitrogen (MUN). In dry season significant difference in MUN was found among Genotypes (Crossbred and local cows) and lactation. The factors like genotypes (Red Chittagong cattle and Pabna cattle), milking time, Lactation, season and parities influence the milk constitutes significantly

2.4.2.14 Hill Ecosystem

47. Techniques have been developed to conserve the excess rain water in the hill to intensify the agricultural activities during dry period. Installation of pumps, ring tube well and other activities have been completed.
48. In hill ecosystem farmers obtained 57%, 60% and 71% less yield for pineapple, banana and orange respectively when compared to the research managed yield due to their ignorance and lack of modern technical knowledge

2.4.2.15 Coastal Ecosystem

49. Under coastal eco-system several crops like sunflower, maize, soybean and sesame were grown successfully. During fallow period (after T. Aman rice) BARI

til-4 has been successfully grown with 44% higher yield in Khulna region, area expansion through a pilot project under CGP is going on

2.4.2.16 Haor Ecosystem

50. Technology validated in the haor of Mohangonj included summer and winter vegetable cultivation at homestead; crop intensification in the field; Improved hen and duck rearing; Beef fattening; Cage culture of fish; Fish polyculture in seasonal pond and Fish drying resulted increased income of the farmers.

2.4.2.17 Farming Systems Research

51. Nine projects on Farming System Research have been awarded to address under different ecosystems including hill and haor. The on-going activities include intervention and monitoring the whole farm activities of small, marginal and landless farmers. Introduction of modern varieties of Jute seed, different vegetables, sharisa, mouri and roshune increased crop yield.
52. Introduced BINA dhan-7 and obtained an average yield of 4.0 t/ha. BRRI dhan28 and other inputs have given to the selected farmers.
53. Duckling and pigeon have been distributed among some female farmers. Animals in the farming system areas were vaccinated and distributed saplings of mango, year round lemon, tezpata and mahogany among the farmers

2.4.2.18 Climatic Vulnerability

54. Practically no useful information could be generated from the sub-project on fungal disease incidence in relation to climate change. In climate vulnerable area of Rangpur about 200 beneficiaries have started community based fisheries and also others involved in raising fingerling and cage culture. Some areas along the river have been declared as sanctuary, which resulted tremendous increase of different natural fishes

2.4.2.19 Cross Cutting

55. Adoption of rice-duck technology increased rice grain yield by 20-30% and 50-60% higher net income/ha over sole rice system in addition, farmers earn Tk. 600-900 daily by selling 100-150 eggs regularly.

56. Cultivating fish in the ditch and vegetables in the dyke increased farmers income in the low-lying areas of Jhalokathi and Bogra.

2.4.2.20 ICT

57. The BRKB client network has been piloting in 15 Union Parishod (UP) in 15 Upazila. In each UP a 20 member's user group has been formed headed by UAO and provided a CD of BRKB.

2.4.2.21 Basic Studies

58. Blending jute with cotton at 50:50 ratios is the best for uniform blending in cotton processing system and the properties of 10s 50:50/Jute: Cotton blended yarn and denim fabrics are comparable to the cotton denim fabric. This innovated technology has already been transferred to an industry through a MoU signed recently

2.5 Training Provided

Formal training is an important part for updating skills and acquisition of new ones. Table 2.4 provides information on Ph.D training in-country and abroad by organization. The highest number of PhD was awarded among the BARI scientist followed by BRRI, BJRI, BSRI, etc. No higher study program was awarded among BSRTI and BCDB of NARS Institute. Like distribution of number project among the NARS institute, again we find, a high concentration of PhD program distributed for two organisations, BARI and BRRI. It may be that they have more scientists than others and therefore their share is higher than others. For in-country Ph.D. programme, just a quarter of field of research is in agronomy, while soil science also received a fair quota. Other sub-disciplines were represented much more poorly. Initially 30 PhD programs in aboard were approved however, 29 out of them were achieved (Table 2.5).

Most of the in-country PhD fellows got admission in BAU (43 no.) followed by BSMRAU (12 no.), DU (03), BUET (01) and RU (01) (Table 2.6). The progresses of the PhD fellows were reported to be satisfactory. Among the PhD fellows in aboard, most the fellows got admission in China (11 No.), Thailand (08 no.), Malaysia (07 no.). No PhD fellows are allowed to get admission in western country.

Apart from Ph.D. programs, short term local training was arranged for 5623 scientists,

297 scientists received short term foreign training/study visits, 73 scientists participated in foreign seminar /workshop. In addition 10 Post -Doctoral fellowships were implemented (Table 2.8).

Table 2.4: Institute-wise distribution of PhD program

Category of Institute	In-country PhD	Abroad PhD
NARS		
BARI	25	12
BRRI	10	05
BSRI	05	03
BJRI	07	03
BFRI (Fish)	03	01
SRDI	05	01
BINA	03	-
BTRI	01	01
BFRI(Forest)	-	01
BLRI	-	01
BARC	-	01
BSRTI	-	-
BCDB	-	-
Ministries	**01**	**01**
Universities	**-**	**-**
Total	**60**	**30**

Table 2.5: Discipline-wise distribution of PhD research

Field of study	**In-country**	**Abroad***
Agronomy	15	07
Soil Science	10	04
Agril. Economics	07	01
Entomology	04	03
Horticulture	04	01
Plant pathology	04	02
Agril. Engineering/Postharvest technology	03	01
Biotechnology/Plant breeding	04	05
Agril. Extension	03	-
Aquaculture	02	01
Polymer science	01	-
Ruminant Nutrition	-	01
Seed Science & Technology	-	01
Textile Physics	-	01
Crop Botany/Crop physiology	03	01
Total	**60**	**29**

*29 numbers of PhD in abroad was achieved out of 30 numbers approved

Table 2.6 Placement of in-country PhD Fellows at different national universities

University	No. of fellows	Remarks
Bangladesh Agricultural University	43	Progress satisfactory
Bangabandhu Sheikh Mujibur Rahman Agricultural University	12	Progress satisfactory
Dhaka University	03	Progress satisfactory
Bangladesh University of Engineering & Technology	01	Progress satisfactory
Rajshahi University	01	Progress satisfactory
Total	**60**	

Table 2.7 Country and University wise Placement of International PhD Fellows

Institute	No. of fellows	Placement of university
Thailand	08	Kasetsart University-6, Asian Institute of Technology-2
Malaysia	07	University Putra Malaysia-6, University Sains Malaysia-1
China	11	Graduates School of Chinese Academy of Agricultural Sciences-6, Hunan Agricultural University-3, South China Agricultural University-2
Philippines	01	University of the Philippines Los Banos-1
India	01	Indian Institute of Technology-1
Sri Lanka	01	University of Peradeniya -1
Total	**29**	

Table 2.8 Other training and workshops/seminars

Training/Study visit (Local & foreign)	- 140 event local short term training done and beneficiary 4977 persons - 297 persons done foreign short term training/ study visit.
Post-doctoral	- 10 Post-doctoral done in different foreign countries
Workshop/Seminar (Local/foreign)	- 73 persons attend in different foreign workshop and seminar - 112 event workshop/seminars done in different issues

2.6 Discussion on Results

The results of projects under SPGR could not be examined because the technologies just have been developed and some are still under process. At this stage technology did not go to the field. However from the results of some field trial we could draw some conclusion. Out of the research endeavors many excellent outputs have been achieved in the areas of variety development, production technologies, pest and disease management, cropping system, water management, animal and fish management, crop production system for hilly, coastal, haor, barind areas and from some basic studies.

Seven varieties were developed under this program. The names of the varieties are i) BINA dhan 10, ii) aromatic rice hybrid variety: BU hybrid dhan 1, iii) hybrid summer tomato variety: BARI hybrid tomato 8, iv) white jute variety: BJCA 2197, v) lentil variety: BARI musur 7, vi) Chickpea variety: BARI chola 9, and vii) Garlic variety: BAU garlic.

The above developed varieties are important in our current cropping pattern. A high yielding short duration salt tolerant rice variety named as BINA dhan-10 will contribute in rice production in about 2.85 mha under coastal ecosystem. Heat tolerant tomato could contribute enhancing income generation in rural people in off season. Heat tolerant wheat could increase wheat production in the country towards reduction in import of wheat grain.

In addition to variety development some production technology have been developed that are helpful for achieve potential yield from the existing varieties of different crops. Some significant production technologies are application of dolochun (lime), IPNS technology on mustard, Boro, rice, wheat, jute, and maize was developed, gummosis disease of jackfruit, canker disease of citrus, powdery mildew disease of jujube, major diseases of brinjal and tomato, soil borne diseases of tomato, brinjal, lentil, and chickpea and rhizome rot disease of zinger were developed. IPM on vegetable crops and coconut mite control has been demonstrated among the farmers. Tissue culture protocol for BARI kola 3 and 4 was standardized.

Cropping pattern is an important issue in agriculture where more than one crop is grown in a year. Cropping pattern with mungbean or mustard- Boro rice – T. Aman rice, crop patterns of Aus, Aman and potato/mustard and mungbean were developed. BARI til 4 produced 44% higher yield after T. Aman rice in the Khulna region. In hill ecosystem round the year vegetable production model was developed.

Potato storage is a burning issue at present because farmers are not getting the benefit of potato production. A low cost farm level storage facilities for 3-5 months storing of potato was developed. Low cost potato storage at farm level with the modified/improved method will reduce storage loss, increase storability by more than a month and net profitability was calculated to be 1770 TK/ton compared to famer's practice.

Apart from the crop production technology there some farm machinery also has been developed. USG applicator, rice transplanter, seed drier, solar pump are some important technology. However a good drier for agro-product processing is needed.

There are successful practices on fish polyculture in low land with constructed ditches and rice + fish culture in wet land of coastal areas of Noakhali that increase income of local communities.

In livestock sector, vaccine against Pollurum disease of poultry was developed. Its impact in poultry sector is enormous. Cheaper milk replacer for calf and cheaper feed supplement to increase milk output has been developed and calf mortality has been reduced by 93%.

For sustaining further research progress in future, scientists got training in higher studies and in short courses and to facilitate quality research, some sophisticated laboratories were established equipped modern laboratory instruments in the NARS institutes under funding from the research component of NATP phase 1. In addition to publication of booklets and leaflets scientists published 49 technical bulletins, 27 full research articles out of the project activities.

2.7 Summary of Research Component Evaluation and Recommendations

The achievements under the SPGR and KGF-sponsored research may be summarized as follows:

- A total number of 108 research sub-projects have been implemented under SPGR by PIU and 86 sub – project under CGP by KGF during NATP Phase-1
- The sub-projects are distributed among the different ecosystems and areas.
- About 50% of the sub-project has been completed and the rests are near completion.
- Out of the research activities many excellent outputs have been achieved in the areas of variety development, production technologies, pest and disease management,

cropping system, water management, animal and fish management, crop production system for hilly, coastal, haor, barind areas and from some basic studies.

- Seven varieties verities are developed, namely BINA dhan 10, aromatic rice hybrid variety: BU hybrid dhan 1, hybrid summer tomato variety: BARI hybrid tomato 8, white jute variety: BJCA 2197, lentil variety: BARI musur 7, Chickpea variety: BARI chola 9, Garlic variety: BAU garlic 3.
- Several crop management technologies are developed those are In addition to variety development some production technology of application of dolochun (lime), IPNS technology on mustard, Boro, rice, wheat, jute, and maize, disease management technology, potato storage technology, insect management technology etc. are developed.
- Some important cropping patterns have been developed. For example short duration rice variety and mungbean increased farmers income and food security as well in monga prone area.
- Farm machinery for example USG applicator and seed drier could be helpful for marginal farmers.
- Fish polyculture in low land with constructed ditches and rice + fish culture in wet land of coastal areas are successful practices for income generations.
- Vaccine against Pollurum disease of poultry is promising technology in poultry sector
- A total 90 number of PhD programs were awarded among the NARS scientists including two personnel from ministries also
- Short term local training was arranged for 5623 scientists, 106 scientists received short term foreign training, 20 scientists undertook foreign study visits, and 57 scientists participated in foreign seminar /workshop.
- For further continuation of research some sophisticated laboratories were established equipped with modern instruments.

From the above one can conclude that the research effort had been quite successful as they go, with better achievements in some fields compared to others. However, it appears that most studies have had limited goals and their general applicability in terms of technology developed remain to be further investigated. Secondly, the difference in the two strands of

research is not always obvious. SPGR should have broad based goals while KGF-sponsored research may be more focused which these generally are. A third issue that came up but not specifically probed was the long time needed in proposal submission, verification, award, grant release seem to be rather long while the actual research time may be comparably short for understanding the sustainability of the technology developed or tested.

Based on these the team recommends the following:

a. Both SPGR and KGF sponsored research should be programme based for general applicability, some progress has been made by focusing on hill and coastal ecosystem which should be further carried forward

b. Because of nature of transformation from project to programme, multi-year, larger research ideas should be developed

c. SPGR should concentrate more on research for broad-based applicability and may have somewhat different perspectives than KGF's CGP which is oriented more towards applicability of existing technologies

d. The pre-award time of verification etc. may be reviewed for shortening the process.

CHAPTER 3
FINDINGS FROM SAMPLE SURVEY OF FARMERS

3.1 Socio-Economic Profile of the Respondents

Social profile of the sample farmers included age, household size, education and occupation are presented in Table 3.1.

Age: The differences of age between the CIG and control farmers are not mentionable. The farmers belonging to the age group of 40-49 years dominate in terms of number in every group except the groups of crop CIG farmers and fisheries control farmers.

Table 3.1: Socio-economic profile of the farmers

	Crop growers		Livestock		Fisheries stocking	
	CIG farmers (n=200)	Control farmers (n=100)	CIG farmers (n=50)	Control farmers (n=30)	CIG farmers (n=50)	Control farmers (n=20)
Distribution of the farmers by age group (%)						
Less than 30	5.00	5.00	6.00	3.33	2.00	5.00
30-39	16.00	15.00	22.00	23.33	22.00	20.00
40-49	24.50	32.00	34.00	46.67	30.00	35.00
50-59	37.50	27.00	26.00	6.67	24.00	40.00
60+	17.00	21.00	12.00	20.00	22.00	0.00
Average age	48.39	53.75	45.62	45.33	48.70	45.95
Household size and sex ratio						
Household size (member)	4.53	4.64	5.06	4.57	5.32	4.40
Male female ratio	1.39	1.50	1.45	1.55	1.21	1.33
Education attainment of the farmer (%)						
Illiterate	11.00	31.00	10.00	26.67	8.00	15.00
Primary/less	27.50	20.00	20.00	23.33	24.00	15.00
Grade 6-10	41.00	35.00	46.00	43.33	40.00	55.00
Grade 11-12	20.00	14.00	22.00	6.67	26.00	15.00
Graduate/above	0.50	0.00	2.00	0.00	2.00	0.00
Average year of schooling	7.02	5.40***	7.6	5.73**	7.5	6.75
Distribution of the farmers by their primary occupation (%)						
Farming	78.50	72.00	62.00	70.00	66.00	75.00
Small business	8.50	11.00	20.00	16.67	18.00	20.00
Service	5.50	7.00	8.00	6.67	8.00	0.00
Others	7.50	10.00	10.00	6.67	8.00	5.00

Note: *, ** and *** indicate mean differences between the CIG and control farmer's present situation are significant at 10%, 5%, and 1% level, respectively (t-test is used).

Household size and sex ratio: As like age, household size and male-female ratio of the CIG and control farmers are similar. Average number of household member for the crop CIG, livestock CIG and fisheries CIG are 4.53%, 5.06% and 5.32%, respectively. The household family member number for the crop, livestock and fisheries control groups are 4.64%, 4.57% and 4.40%, respectively. Households of all categories have more male members than female.

Educational attainment of the farmers: Unlike other indicators, the differences in educational status of the CIG and control farmers are notable. The CIG farmers have better education status than the control farmers. Relatively lower portion of the CIG farmers are illiterate. Proportion of the farmers belonging to the highest educational group is notably high for the CIG farmers. Their average year of schooling is also higher than the control farmers.

Primary occupation of the respondents: The primary occupation is that with which farmers spend most of their time. Farming is the primary occupation for 78.5%, 62% and 66% of the crop, livestock and fisheries CIG farmers. Interestingly proportion of respondents mentioning farming as their primary occupation is low among the livestock and fisheries farmers.

3.2 Land Ownership and Land Use Pattern for the CIG and Control Farmers

On an average a crop CIG farmer owns 226.1 decimal of land. The total cultivable land for the crop CIG farmers is 223.3 decimal, of which he owns 155.3 decimal. Compared to the Control farmers, the CIG farmers own more land and cultivates in more land. Own land constitutes relatively higher portion of the CIG farmers total cultivable land, than that of the Control farmers. In these issues, the differences between the two groups are statistically significant. After joining CIG, the farmer's total cultivable land has increased significantly. Before joining CIG, the CIG farmers were cultivating in 190.36 decimal of land. Their total land ownership has also increased (Table 3.2).

Similar pattern is observed with the livestock and fisheries growers. Compared to the control farmers, the CIG farmers have better land holding status. The CIG farmers land holding status has improved after joining CIG. The differences between the two groups are more notable for the livestock growers (Table 3.2).

An immediate issue of comparability may arise here as some of the differences in output and outcome of NATP may be more a reflection of the differences in land holding rather than the diffusion of technology. While we would like to examine this further, for the time being we may refer to a rather large recent evaluation of the NATP Phase I by PCU (NATP) which came up with similar results. For CIG farmers the average land ownership was 220.4 decimals for the PCU (NATP) survey which is just above 226 in the present case. Similarly, for the PCU (NATP) survey the average land owned by control farmers was 159.3 compared to the 164.8 for the present survey.

Table 3.2: Land ownership and land use pattern of the sample farmers (decimal)

Land use/ ownership type	Crop			Livestock			Fisheries		
	CIG farmers		Control farmers	CIG farmers		Control farmers	CIG farmers		Control farmers
	Before joining CIG	Present (2013)		Before joining CIG	Present (2013)		Before joining CIG	Present (2013)	
Homestead	16.0	16.1	19.4	15.6	16.5	15.5	21.0	21.4^{+}	18.1
Orchard	17.0	17.0	14.0	5.6	6.6^{++}	7.5	18.7	18.9	9.7
Own pond	9.4	10.2	5.4	28.3	37.4	5.7	55.1	77.9	44.5
Own cultivable land	142.9	153.8	92.0***	68.0	73.1	75.50	126.7	131.4^{+}	75.5
Total cultivable land	190.4	223.3^{++}	132.2***	99.3	111.7	114.0	215.9	297.7^{+++}	124.5**
Total land ownership	206.7	226.1	164.8*	132.5	161.1^{++}	128.1	253.0	283.8^{+}	177.7

Note: *, ** and *** indicate mean differences between the CIG and control farmer's present situation are significant at 10%, 5%, and 1% level, respectively (t-test is used). $^{+}$, $^{++}$ and $^{+++}$ indicate mean differences in the CIG farmer's present and earlier situations are significant at 10%, 5%, and 1% level, respectively (t-test is used).

Differences in land holding between the male and female CIG members are notable. Not surprisingly, compared to the female the male CIG members have higher land holding status. The average land ownership for the male is about 2.5 times higher than the female. The differences between the two groups are significant incase of own cultivable land, total cultivable land and total land ownership (Table 3.3).

Table 3.3: Crop CIG farmers present land ownership and land use pattern by gender (decimal)

Land use/ownership type	CIG farmers	
	Female (n=60)	Male (n=140)
Home stead	13.74	16.67
Orchard	6.18	19.43
Pond	3.75	12.63
Own cultivable land	74.06	175.88***
Total cultivable land	112.49	254.95***
Total land ownership	107.29	260.04***

Note: *, ** and *** indicate mean difference between male and female are significant at 10%, 5%, and 1% level, respectively (t-test is used).

3.3 Farmers' Interactions and Experiences with CIG

The NATP has initiated new participatory extension approach through forming farmer's group named as Common Interest Group (CIG). The Objective 5 of the TOR was to examine the efficacy and effectiveness of this new extension approach from the viewpoint of transparency, participation and decentralization. To attain this objective, several indicators are set to examine CIG formation process, functions and farmer's participation in different CIG activities. This section elaborately examines CIGs performances through these objectives.

3.3.1 Organizing the CIGs

The CIG groups, each with 20 members, were initiated to effectively disseminate different technologies to the farmers. The groups are constructed with 80% marginal & small, whereas the rest are medium and large farmers. The other farmers in the locality are expected to be motivated by the performances of the CIG farmers and learn and adopt different improved farming technologies. As CIGs are viewed as a bridge to reach the farmers, their selection process and acceptability to other farmers are very crucial. The selection process was quite challenging for the SAAOs. The SAAOs were responsible for organizing meetings to form CIGs. Among the crop CIG farmers 95.00% were informed by the SAAOs about CIG. Interestingly, the SAAOs informed 14.89% and 8% of the livestock and fisheries CIG members, respectively. This information sharing is beyond SAAOs regular responsibility and indicates their regular intimate interaction with the different categories of farmers. The CEAL and LEAF agents were the major information source for the livestock and fisheries CIG farmers (Table 3.4). The numbers of farm families under jurisdiction of each SAAO are quite

large. Arranging a general meeting with all of them and selecting 20 farmers with consents from all other farmers were near to impossible. In reality, the SAAOs organized meeting with the farmers with whom they have good rapport and selected members from them. Hence the selection process may not be free from bias and/or favoritism.

Table 3.4: Farmers' initial information source about CIG

Information sources	Crop CIG	Livestock CIG	Fisheries CIG
	Frequency (% of total responses)		
SAAO	190 (95.00%)	7 (14.89)	4 (8.00)
Livestock officer		13 (27.66)	
Fisheries officer			10 (20.00)
CEAL agent		24 (51.06)	
LEAF agent			29 (58.00)
Neighbor CIG farmers	10 (5.00%)	3 (6.38)	7 (14.00)

CIG has created conflict within and outside the group, though such dynamics with group approach is not very uncommon. Some CIG members were jealous of other members who received some specific technology or training or organized demonstration. This is also true for the Control. Some observed the NATP activities to be targeted to some specific farmers and considering themselves excluded from the process. Some were rigid to receive the technology even if it was beneficial to them. Minimizing such conflicts is a major area of challenge for the extension agents and CIG farmers.

3.3.2 Technologies Adopted

Among different NATP technologies, RYMG for T. Aman was the most widely adopted by the CIG farmers. Four out of every five CIG farmers adopted the T. Aman (RYGM) technology. T. Aman (RYGM) is followed by RYMG for Boro (55.50%) and AWD for Boro (30.50%). Compared to these three technologies, adoption of other technologies can be considered as sporadic (Table 3.5).

Table 3.5: Adoption of different NATP technologies by the crop CIG farmers

Name of the technology	% of CIG farmers
T. Aman (RYGM)	80.50
Boro (RYGM)	55.50
Boro (AWD)	30.50
Aus (RYGM)	8.00
Summer tomato	7.50
Brinjal (IPM practice)	7.50
Modern mustard varieties	6.50
Modern wheat varieties	5.00
Modern lentil varieties	2.00

Table 3.6 shows NATP technology adoption by different educational groups. Compared to other groups, relatively higher proportion of farmers belonging to the highest educational group (secondary or above) adopted T. Aman (RYMG), Boro (RYMG), summer tomato, modern mustard varieties, modern wheat varieties and modern lentil varieties. Incase of brinjal and Aus (RYMG) the group of illiterate farmers have better adoption rate (Table 3.6).

Table 3.6: Technology adoption by different education group

Name of the technology	% of adopters from different educational groups			
	Illiterate	Primary/less	Grade 6-10	Secondary/above
T. Aman (RYGM)	81.82	83.64	71.95	92.68**
Boro (RYGM)	59.09	49.09	56.10	60.98
Boro (AWD)	27.27	30.91	32.93	26.83
Aus (RYGM)	18.18	10.91	2.44	9.76**
Summer tomato	4.55	7.27	4.88	14.63
Brinjal (IPM practice)	13.64	7.27	7.32	4.88
Modern mustard varieties	0.00	0.00	9.76	12.20***
Modern wheat varieties	0.00	0.00	3.66	17.07***
Modern lentil varieties	4.55	0.00	1.22	4.88

Note: *, ** and *** indicate difference among the groups are significant at 10%, 5%, and 1% level, respectively (χ^2 test is used).

Proportion of farmers adopting different NATP technologies is notably higher in the group of training recipient than the group of non-recipient. The difference is significant incase of all the technologies except lentil (Table 3.7). Training effectively introduces different aspects and potentials of a technology to the participants which boost up their confidence to adopt the same.

Table 3.7: Proportion of NATP training recipient and non-recipient farmers adopting different technologies

Name of the technology	% of trainee adopting	% of non-trainee adopting
T. Aman (RYGM)	80.32	29.46***
Boro (RYGM)	56.38	16.96***
Boro (AWD)	29.79	11.61***
Aus (RYGM)	7.98	2.68**
Modern wheat varieties	18.8	0.00***
Modern mustard varieties	6.92	0.00***
Modern lentil varieties	2.13	0.00
Summer tomato	7.45	0.89***
Brinjal (IPM practice)	7.98	0.00***

Note: *, ** and *** indicate difference among the groups are significant at 10%, 5%, and 1% level, respectively (χ^2 test is used).

Model specification for identifying farm level determinants of NATP technologies adoption and level of adoption

A probit model approach is followed to identify the factors influencing farm level adoption of T. Aman (RYGM) and Boro (RYMG) technologies. Among the adopters, variation is observed in level of adoption. Some of the adopters have applied the adopted technology is all their available land, whereas some devoted portion of land for the technology. To explain reasons for differences in adoption level of these two technologies a Tobit model approach is used.

The general form of the probit model for both the technologies can be constructed as follows:

$$\Pr(y_i = 1 | x_{1i} ... x_{ki}) = \Phi(ß_1 x_{1i} + ß_2 x_{2i} + ... + ß_k x_{ki} + \varepsilon_i) \quad (3.1)$$

Where, $\Pr$ is the probability; y_i is the i th farm's adoption decision and is binary in nature (1 for adopters, 0 otherwise); Φ is the cumulative distribution function (CDF) of the standard normal distribution; and $x_{1i},...,x_{ki}$ are different exogenous variables explaining i th farm's adoption decision. The list of common explanatory variables for both the technologies are: dummy for CIG farmers (1=CIG farmers, 0=control farmers); dummy for NATP organized agricultural fair participants (1=participant, 0=non-participant); dummy for NATP training participants (1=trainee, 0=non-trainee); dummy for farmers visiting FIAC (1=visitors, 0=non-visitors); log of own cultivable land (decimal); log of annual off farm income (tk); educational status of the farmer (0= illiterate, 1=primary/less, 2= grade 6 and above); number of active family members in the household (family members within the age

range of 15-65 years); and number of household member(s) with farming as primary occupation. An additional variable to represent AWD technology adoption (dummy, 1 for adopters and 0 for non-adopters) status is used in the model for Boro (RYGM). The parameters $ß_1,...,ß_k$ are typically estimated by maximum likelihood estimation (MLE) procedure.

Model specification for analyzing factors influencing level of adoption

Level of adoption is identified as quantity of land under the technology. As the nature of the endogenous variable (quantity of land used for a technology) here is censored (some farms have 0 value as they did not cultivate that technology, whereas others cultivated), we utilize Tobit model specification to explain differences in level of adoption.

According to Tobin (1958), y_i is observed if $y_i^* > 0$ and is not observed if $y_i^* \leq 0$, and the observed y_i will be defined as;

$$y_i = \begin{cases} y_i^* = \beta x_i + \mu_i & if \quad y_i^* > 0 \\ 0 & if \quad y_i^* \leq 0 \end{cases} \tag{3.2}$$

The error term is distributed as $N(0, \sigma^2)$. Following Gujarati (2003), the specified model for the farms who have adopted and who have not, can be written as:

$$y_i = \begin{cases} \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + ... + \beta_k x_{ki} + \mu_i & if \ quantity \ of \ land > 0 \\ 0 & otherwise \end{cases} \tag{3.3}$$

Where, $\beta_0,...,\beta_k$ are the unknown parameters to be estimated; and $x_{1i},...,x_{ki}$ are the farm level explanatory variables those may influence quantity of land allotted to a specific technology. The lists of explanatory variables for both the technologies are same as is used for the probit models. Using maximum likelihood estimation (MLE) procedure, the Tobit model is estimated. According to Maddala (1992), the likelihood function for the Tobit model can be written as follows:

$$L = \prod_{v_i > 0} \frac{1}{\sigma} f\left(\frac{y_i - \beta x_i}{\sigma}\right) \prod_{v_i \leq 0} F\left(-\frac{\beta x_i}{\sigma}\right) \tag{3.4}$$

Through maximizing the function with respect to β and σ, we can get the MLE estimates of these parameters.

Farm level determinants of T. Aman (RYGM) and Boro (RYMG) technology adoption and level of adoption

Table 3.8 presents the determinants of T. Aman (RYGM) and Boro (RYMG) technology adoption and level of adoption estimated through probit and Tobit models, respectively. The table presents marginal effects estimated at mean referring to change in the probability of outcome variable due to infinitesimal change in independent variables. The detailed model estimates with coefficients and standard errors are available in Appendix 5.

CIG farmers have significantly higher probability to adopt both the technologies. Their adoption level is significantly higher in case of Boro (RYGM). CIG membership enables farmers to have better access to information and knowledge about different technologies. These farmers also have better access to extension services. The extension agents focus more with these farmers. Hence it is not surprising to have higher adoption probabilities with these farmers. Similarly higher probability with FIAC visiting farmers can be explained. The farmers who have visited FIAC are better adopters of both the RYGM technologies. They also allot more land for these technologies, though the effect is not significant in the Tobit model for T. Aman (RYGM). Here it should be noted that compared to the control farmers, significant higher proportion of CIG farmers visited FIAC. As like FIAC visitors, the agricultural fair visitors have higher probability of adopting Boro (RYGM) technology.

Probably the most crucial factor for adoption and level of adoption is farmers own land. A one percent increase in the land quantity will result in 0.00035 times increase adoption probability of T. Aman (RYGM). The similar change for the Boro farmers will increase their probability of Boro (RYGM) adoption by 0.00061 times. A 100 percent increase in own land quantity will increase land under T. Aman (RYGM) and Boro (RYGM) by 10.42 and 7.39 times, respectively.

The dummy of Boro (AWD) technology adoption has negative sign in both the models for Boro (RYGM). The negative sign in the probit model means that the AWD adopters have lower probability of adopting Boro (RYGM) technology. Compared to the AWD adopters the non-adopters have 33.4% higher probability of adopting Boro (RYGM) technology. The AWD non-adopters cultivate in 13.38% more land than the AWD adopters. This may happen, as both the technologies are for increasing Boro production, a farmer may consider adopting either one is sufficient.

Table 3.8: Marginal effect of determinants of T. Aman (RYGM) and Boro (RYGM) technology adoption and level of adoption

Regressors	T. Aman (RYGM)		Boro (RYGM)	
	Determinants of adoption	Determinants of level of adoption	Determinants of adoption	Determinants of level of adoption
	Marginal effect (S.E.)[a]			
CIG membership (dummy)	0.533 (0.122)***	42.042 (13.264)***	0.353 (0.117)***	25.011 (19.355)
Agricultural fair visitors (dummy)	-0.086 (0.096)	-4.054 (9.809)	0.161 (0.099)*	-11.910 (8.3663)
Trainee (dummy)	0.040 (0.146)	0.518 (13.605)	0.072 (0.139)	13.159 (19.763)
FIAC visitors (dummy)	0.120 (0.067)*	7.148 (8.757)	0.258 (0.067)***	23.266 (7.918)***
Log of own cultivable land (decimal)	0.035 (0.021)*	10.420 (3.311)***	0.061 (0.023)***	7.388 (3.003)***
Log of annual off farm income (tk)	-0.003 (0.007)	-0.838 (0.865)	0.00000001 (0.0000003)	-0.371 (0.704)
Education status of the farmer	-0.039 (0.042)	-5.902 (4.818)	-0.020 (0.042)	0.207 (3.695)
Active family members in the household (no)	0.006 (0.025)	9.435 (4.040)***	-0.027 (0.027)	3.217 (2.465)
Household member with farming as primary occupation (no)	-0.002 (0.058)	3.993 (6.963)	0.039 (0.057)	3.915 (5.470)
Boro (AWD) adoption (Dummy)			-0.334 (0.057)***	13.379 (7.925)*

Note: *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively.
[a] Instead of coefficients the marginal effects are reported here. Marginal effects are estimated at mean and refer to change in the probability due to infinitesimal change in independent variable.

A farmer's probability of adoption and level adoption of both the technologies is positively associated with number of active family members in his household. The positive associations mean that farms with more active family members (family members within the range of 15 to 65 years) are more likely to adopt and their adoption level is also higher. As these farms have more active members they can easily adopt and mange new technology. But the relationship is significant only in the Tobit model for T. Aman (RYGM).

3.3.3 Reasons for Joining CIGs

Farmers' responses regarding reasons for joining CIG are categorized into three broad categories: knowing modern cultivation technology, increasing production and getting appropriate and necessary advice. Knowing modern cultivation technology is the most

pronounced reason and is mentioned in 69.04%, 92.16% and 100% of the responses made by the crop, livestock and fisheries CIG members, respectively. Increasing production and getting advice are mentioned in 18.51% and 12.46% responses of crop CIG farmers, respectively (Table 3.9).

Table 3.9: Reasons for joining CIG

Reasons	Crop CIG	Livestock CIG	Fisheries CIG
	Frequency (% of total responses)		
To know modern cultivation technology	194 (69.04)	47 (92.16)	50 (100.00)
To increase production	52 (18.51)	2 (3.92)	0 (0.00)
To get appropriate and necessary advice	35 (12.46)	1 (19.6)	0 (0.00)
Total	281 (100.00)	51 (100.00)	50 (100.00)

3.3.4 Meeting and Micro-Extension Plan

The CIGs were functioning quiet efficiently. Members were regularly attending meetings, doing micro-extension plans, doing group savings, receiving and following training. Among the crop CIG members 93.50% and 90.50% were regularly participating in CIG meetings and doing micro-extension plans. In case of livestock and fisheries farmers 90% and 84% reported to regularly attend meeting. Compared to the crop CIG, farmer's involvement in micro-extension plan is not satisfactory. Proportion of livestock and fisheries farmers doing micro-extension plan are 26% and 44%, respectively. All most all the three categories of CIG farmers involved in micro-extension plan were following the plan (Table 3.10). But no budget is available for conducting these meetings. The organizer farmers and the SAAO manage some refreshment for the meeting participants by their own initiative.

Table 3.10: CIG framers' experiences with the CIG and its different activities

Different function of CIG and farmer's interactions	Crop CIG		Livestock CIG		Fisheries CIG	
	n	%	n	%	n	%
Farmers regularly participating in meeting	187	93.50	45	90.00	42	84.00
Micro-extension plan						
Farmers involved in planning	181	90.50	13	26.00	22	44.00
Farmers following the plan over farmers involved in planning	172	95.03	13	100.00	22	100.00
Training						
Farmers receiving training	187	93.50	35	70.00	38	76.00
Gained knowledge over no of trainee	186	99.47	33	94.29	38	100.00
Used training knowledge over no of trainee	182	97.33	33	94.29	38	100.00
Willing to use knowledge over no of trainee	181	96.79	33	94.29	38	100.00
Members doing savings	175	87.50	40	80.00	41	82.00
Exhibition						
Farmers visiting exhibition	64	32.00	11	22.00	14	28.00
Gained knowledge over no of visitors	63	98.44	10	90.91	14	100.00
Used knowledge over no of visitors	57	89.06	10	90.91	14	100.00
Willing to use knowledge in future over those visited	52	81.25	10	90.91	14	100.00
Field day						
Farmers visiting field day	59	29.50	10	20.00	5	10.00
Gained knowledge over no of visitors	58	98.31	9	90.00	5	100.00
Used knowledge over no of visitors	52	88.14	8	80.00	5	100.00
Willing to use knowledge in future over those visited	52	88.14	8	80.00	5	100.00
Agricultural fair						
Farmers visiting fair	46	23.00	6	12.00	8	16.00
Gained knowledge over no of visitors	44	95.65	6	100.00	7	87.50
Used knowledge over no of visitors	43	93.48	6	100.00	7	87.50
Willing to use knowledge in future over those visited	38	82.61	6	100.00	7	87.50

3.3.5 Training Received

Among the crop CIG sample farmers 187 (93.50%) received training on 14 different topics. During the FGDs farmers reported their satisfaction about the training. Through training they were informed about identification, production and preservation of improved seed varieties. This has increased farm level production of seed. Consequently farmers are relying less on seeds sold in open market. Even if they purchase those seeds, they are confident to identify quality seeds. The agricultural officers also recognized farmers' knowledge improvement about seed production and identification. After training some are sowing seeds in lines with proper spacing. Some farmers learn about balanced use of chemical fertilizers. The farmers also reported increased use of organic manure. The agricultural officers and the SAAOs was

the trainer in these sessions. The SAAOs pointed out the importance of the Training of Trainers (ToT). Among the training recipients 97.33% reported to imply their training knowledge in their daily farming, and 96.79% said that they will continue application of training knowledge in the field (Table 3.10).

3.3.6 Group Savings

Group savings are another important activity of the CIG. Total of 175 (87.50%) crop CIG members, 40 (80.00%) livestock CIG members and 41 (82.00%) fisheries CIG members reported to do regular group savings (Table 3.10). These saving were used by the members in time of need. They could take loan from these saving and use in time of need. The extension agents mentioned group savings as an important indicator for successful group activity. The groups doing regular savings was observed to be active and successfully implement different CIG activities. Savings increased ownership feeling among the members.

3.3.7 Exhibition

Farmer's participation rate in exhibition is not that much satisfactory. Only 32% of the crop CIG farmers reported to visit exhibition. They visited 10 different types of exhibitions. Almost all of them (98.44%) gained knowledge from exhibition. Among the exhibition participants 89.06% were using exhibition knowledge in farming and 81.25% expressed their willingness to continue practicing this knowledge. Participation rate incase of livestock (22%) and fisheries (28%) CIG farmers are even poor. But the proportion of farmers reporting to gain knowledge and using knowledge are similar to the crop CIG farmers (Table 3.10). According to the FGD participants the benefits of visiting exhibition are: increased production, reduced cost of production, learning about different modern technologies, and improving farming practices, etc.

3.3.8 Field Day

Among our sample crop CIG farmers 29.50% participated in different field days organized. The field days were organized on farming issues. Some of these organized by DAE are: RYGM, AWD, wheat, mustard, lentil, summer tomato, IPM on high value vegetables (sex pheromone trap), jujube orchard and compost preparation. Among the livestock CIG farmers 20% participated in field day on beef fattening and dairy cow farming. The DoF organizes

field day on carp poly-culture and tilapia culture, where only 10% of the fisheries CIG reported to participate. Among the crop CIG visitors, 98.31% reported to gain farming knowledge. Later 88.14% are found to use these knowledge and 88.14% are willing to continue to practice these knowledge. Participant farmers experiences with DLS and DoF organized field days are similar (Table 3.10).

3.3.9 Agricultural Fair

Relatively small number of CIG farmers participated in different agricultural fairs organized by DAE, DLS and DoF. Participation rate among the crop, livestock and fisheries CIG farmers are 23%, 12% and 16%, respectively. From fair organized by DAE the farmers learned about modern varieties, improved farming practices and solutions of different problems. Some of them got motivated to adopt new technology. Among the fair visitors 93.48% reported to gain knowledge from fair and 93.48% were found to use the knowledge. A total of 38 (82.61%) visitors showed their willingness to continue practice of knowledge gained from fair. Farmer's satisfaction with DLS and DoF's fair in terms of knowledge gaining and practicing knowledge at present and in future are similar to DAE fair participants (Table 3.10). The reasons mentioned by the farmers for their relatively lower participation rate are: not being informed about the event, distance, lack of time and motivation, etc.

3.3.10 FIAC Activities

Farmer's Information and Advisory Centre (FIAC) was established with a vision to work as a center to solve farmers' problem and technology diffusion. FIAC was established in the union parishad. It has facilities to display different technologies (e.g. seed, moisture meter, etc.) and ICT facilities. The respective SAAO are responsible to maintain FIAC office by rotation. Both the farmers and extension agents during FGDs viewed FIAC to be important for solving farmers' problems and disseminating technology.

Table 3.11: Farmers' interaction and experiences with the FIAC

	CIG farmers	Control farmers
	Frequency (%)	
Farmers reporting FIAC existence	123 (61.50)	33 (33.00)***
Farmers from FIAC areas visiting FIAC	93 (75.61)	18 (54.55) ***
No of visits by the farmers reporting FIAC's existence	9.51	5.28*
Reason for visiting (% of total response)		
Yellow leaf of paddy	65 (45.14)	12 (46.15)
Insect control	48 (33.33)	8 (30.77)
Other reasons	31 (21.53)	6 (23.08)
Total	144 (100.00)	26 (100.00)
Farmers receiving expected advice (% of visitors)	93 (100)	18 (100)
Farmers using advice (% of visitors)	92 (98.92)	18 (100)
Farmers benefitted by advice (% of farmers using advise)	92 (100)	18 (100)
Types of benefit (% of total response)		
Insect control	68 (38.86)	11 (36.67)
Use of balanced fertilizer	11 (6.29)	1 (3.33)
Production increased	59 (33.71)	4 (13.33)
Others	37 (21.14)	14 (46.67)
Total	175 (100.00)	30 (100.00)

Note: *, ** and *** indicate significance at 10%, 5%, and 1% level, respectively (t-test is used).

But FIAC has not been established is every union. Total of 156 (62.00%) sample farmers reported about FIAC's existence. Compared to the control farmers (33.00%), relatively higher portion of the CIG farmers (61.50%) reported CIG's existence. Significantly higher portion of the CIG farmers were visiting FIAC and their average number of visits were also higher compared to those of control farmers. Among the farmers reporting FIAC existence, 75.61% and 55.55% of the CIG and control farmers reported to visit FIAC, respectively. The average number of number visits for the CIG farmers was around 10 (9.51), whereas it was 5.28 for the control group farmers. Though the two groups of farmer's exhibit notable differences in level of participation, their experiences with CIG are almost similar. The major two problems for which they visited FIAC were: yellowish paddy leaf (45.14% and 46.15% of total response for CIG and control group, respectively) and insect attack (33.33% and 30.77% of total response for CIG and control group, respectively) (Table 3.11). Other reasons for visiting FIAC include: soil testing, seed production and preservation, different disease, etc. All of the visitors reported to receive their expected advice service. But the SAAOs and officials in extension office mentioned several constraints to deliver services. Since FIAC is not established in every union, a FIAC is to support several unions. Hence the distance becomes an issue for some of the visitors. All the SAAOs doing rotation in FIAC are not

known to the farmers coming from different unions. For these two reasons some farmers feel discouraged to visit FIAC.

Furthermore for FIAC activities SAAOs do not get any additional financial support, though the agents in LEAF and SEAL get some minimal amount. Some financial allowance may encourage the SAAOs. Many of the SAAOs do not have sufficient IT skills to use and maintain the installed computer. Things become complicated when technical difficulties arise. Along with ICT training the extension agents demanded more training on communication and farming technology.

The farmers' responses show that, even after having all these difficulties the FIACs were working better than expected. All the farmers who visited FIAC reported to be satisfied with FIAC's advice and 98.92% followed these advices. All of them were benefitted though these advice. The important benefits they received from FIAC are: insect control (38.54%), use of balanced fertilizer (5.85%), production increased (30.73%) and others (24.88%) (Table 3.11).

3.3.11 Performances of LEAF

The NATP project has appointed extension agent namely Local Extension Agent for Fisheries (LEAF). The agents are expected to work as a hub for problem solution and technology diffusion. Compared to the fisheries control farmers, significantly higher proportion of the fisheries CIG farmers reported about existence of LEAF. Among the sample fisheries CIG farmers, 92% reported about existence of LEAF; whereas only 35% of the fisheries control farmers could report about LEAF's existence. Average number of visit made to LEAF is also notably high among the CIG farmers. The most pronounced reason for visiting LEAF by both the groups is gulping. Other reasons include: malnutrition, disease and feed problems, and changing water colour. All the visitors got their expected advice and reported to follow the advice (Table 3.12).

Table 3.12: Farmers' interaction and experiences with the LEAF

	CIG farmers	Control farmers
	Frequency (%)	
Farmers reporting LEAF existence	46 (92.00)	7 (35.00)***
Farmers from LEAF areas visiting LEAF	42 (91.30)	7 (100.00)
Average no of visits by the farmers reporting LEAF's existence	11.62	6.29
Reason for visiting (% of total response)		
Gulping	33 (42.86)	5 (45.45)
Malnutrition	19 (24.68)	3 (27.27)
Fish disease and feed problems	9 (11.69)	3 (27.27)
Changing water colour	16 (20.78)	0 (0.00)
Total responses	77 (100.00)	11 (100.00)
Farmers receiving expected advice (% of visitors)	42 (100.00)	7 (100.00)
Farmers using advice (% of visitors)	42 (100.00)	7 (100.00)
Farmers benefitted by advice (% of farmers using advise)	42 (100.00)	6 (85.71)***
Types of benefit (% of total response)		
Disease cured	30 (46.88)	3 (100.00)
Improved water colour	12 (18.75)	
Production increased	22 (34.38)	
Total	64 (100.00)	3 (100.00)

Note: *, ** and *** indicate significance at 10%, 5%, and 1% level, respectively (t-test is used).

3.3.12 Performances of CEAL

As like LEAF for fisheries, Community Extension Agent for Livestock (CEAL) is appointed for the livestock farmers. Almost all of the livestock CIG farmers (96%) could report about existence of CEAL, whereas around half of the livestock control farmers (56%) could report about the same. Three out of every four CIG farmers who could report about CEAL visited CEAL and their average number of visits is 10.33. Less than half (46.67%) of the control farmers reporting about existing of CEAL visited CEAL. Average number of visit is 5.14 for the control farmers. The visitors have mentioned varieties of reasons for visiting CEAL. The list of reasons includes: *Stomatitis* (inflammation of the mouth and lips) and fever, low milk production, anorexia, worm attack and dysentery, foot and mouth disease, and artificial insemination. Of these the most pronounced reason by both the groups is worm attack and dysentery. Visitors experience with CEAL's advice can be said quite satisfactory as almost all of them reported to be benefitted by following advice (Table 3.13).

Table 3.13: Farmers' interaction and experiences with the CEAL

	CIG farmers	Control farmers
	Frequency (%)	
Farmers reporting CEAL existence	48 (96.00)	15 (56.00)
Farmers from CEAL areas visiting CEAL	36 (75.00)	7 (46.67)
No of visits by the farmers reporting CEAL's existence	10.33	5.14
Reason for visiting (% of total response)		
Stomatitis (inflammation of the mouth and lips) and fever	13 (19.70)	2 (13.33)
Low milk production	5 (7.58)	0 (0.00)
Anorexia	15 (22.73)	4 (26.67)
Worm attack and dysentery	23 (34.85)	6 (40.00)
Foot and mouth disease	7 (10.61)	2 (13.33)
Artificial insemination	3 (4.55)	1 (6.67)
Farmers receiving expected advice (% of visitors)	35 (97.22)	7 (100.00)
Farmers using advice (% of visitors)	35 (97.22)	7 (100.00)
Farmers benefitted by advice (% of farmers using advise)	35 (100.00)	7 (100.00)
Types of benefit (% of total response)		
Disease cured	30 (65.22)	7 (70.00)
Milk production increased	6 (13.04)	0 (0.00)
Artificial insemination	3 (6.52)	1 (10.00)
Others	7 (15.22)	2 (20.00)

3.4 Impact Analysis of Individual Technology

3.4.1 T. Aman (RYGM)

Compared to the control farmers, the CIG farmers bear higher cost in T. Aman season which is compensated by higher production and ultimately higher return. Fertilizer cost was the major cost component for the CIG farmers (64.25% of total cost), whereas it was labour cost for the control farmers (33.32% of total cost). Labour cost was almost similar for both the groups. Here it is noteworthy mentioning that, Aman is a season where farmers cultivate mostly local varieties and these requires low fertilizer doses. But the seed sources presented in Table 3.19 says that the CIG farmers are collecting more seeds from formal sources like BADC which are different varieties developed by research institutes and require more fertilizer doses than the local varieties do. This is also an indication of more commercialization attitude of the CIG farmers. In case of other cost items the CIG farmers bear higher cost compared to the control group farmers. As threshing cost is associated with production, relatively higher production in CIG farmers filed results in higher threshing cost (Table 3.14).

On an average the CIG farmers produced 4.995 t/ha of paddy, which is 6.57% higher than the control farmers. The impact assessment study conducted by PCU, NATP estimated 4.6 t/ha for the CIG farmers. CIG farmers gross return (48217 tk/ha) is around 20% higher than that of control group (40312 tk/ha) (Table 3.14).

Table 3.14: Cost and return from T. Aman paddy production

	CIG	**Control farmers**
Cost		
Seed (tk/ha)	1867	2034
Fertilizer (tk/ha)	59008	10996
Land preparation cost (tk/ha)	6370	5311
Labour cost (tk/ha)	12786	12716
Irrigation cost (tk/ha)	3831	2540
Insecticide cost (tk/ha)	1758	1605
Threshing cost (tk/ha)	5890	3132
Total cost (tk/ha)	91847	38158
Return		
Paddy production (ton/ha)	4.995	4.687
Gross income (tk/ha)	86980	79044
Gross return (t/ha)	48271	40312

3.4.2 Boro (RYGM)

Compared to the control farmers the CIG farmers produced more in the Boro season and earned more. Average production for the CIG farmers was 6.49 ton/ha, whereas it was 5.98 ton/ha for the control farmers. Gross return for the CIG farmers was 25.49% higher than that of the control farmers (Table 3.15).

Table 3.15: Cost and return from Boro paddy production

	CIG	Control farmers
Cost		
Seed (tk/ha)	3963	2494
Fertilizer (tk/ha)	53820	18701
Land preparation cost (tk/ha)	6958	5482
Labour cost (tk/ha)	16107	17906
Irrigation cost (tk/ha)	14145	10003
Insecticide cost (tk/ha)	2628	3629
Threshing cost (tk/ha)	7672	5129
Total cost (tk/ha)	105292	63345
Return		
Paddy production (ton/ha)	6.49	5.98
Gross income (tk/ha)	138151	110091
Gross return (t/ha)	86370	57298

3.4.3 Boro (AWD)

With no doubt, AWD is an efficient water saving technology. The adopter farmer has to perform some additional management practices (e.g. using pipe, monitoring water level, etc.). The technology also promises to cut labour requirement for weed management. But the technology is not widely adopted for two major constraints as is reported in the impact assessment report conducted by the PCU, NATP. The report says – *'Adoption of the technology was constrained in two fronts. Firstly, in the prevailing irrigation water selling system the respondents were to pay the full water charge irrespective how much less water the respondent actually used. Thus, benefit of the technology went to the management of the irrigation installation. Secondly, benefit of the technology in one or two field using AWD in the command area could not be effectively assessed, because lateral seepage from the adjacent field not using AWD influenced root zone water in the demonstration plot. These two issues might be taken care of in the next phase. Usefulness of a pilot programme applying the technology over the entire command area might be assessed.'* Hence, the adoption of this technology largely depends on water market reform through introduction of water charges based on usage quantity.

Among the CIG farmers who cultivated Boro only 16.56% were informed about AWD's water frequency and cost saving features. Only 15.92% of the Boro growing CIG farmers adopted AWD. All of the adopters were using pipe, indicating adopters' sufficient level of

understanding about the technology. According to the AWD adopters, they were able to reduce irrigation cost in Boro season by 55.19% through adopting this technology (Table 3.16).

Table 3.16: Impact of Alternate Wetting and Drying on Boro growing CIG farmers

Boro grower's experiences with AWD	Response (%)
% of farmers with AWD knowledge	16.56
% of farmers adopted AWD	15.92
% of AWD adopter using pipe	100.00
Cost saved (%)	55.19

3.4.4 Costs and Returns from Other Crops

Per farm cost and return from Aus rice, wheat, mustard and lentil are estimated and presented in Table 3.9. From methodological perspective, it is necessary to mention that number of growers for these four crops did not fulfill the large sample criterion, and hence the results here are at best indicative of the trend. Instead of per hectare analysis, farm level analysis is done for the same reason. For all the four crops, the CIG farmers have higher production and return. The CIG farmers get higher return by bearing higher cost. Most notable difference is observed between CIG and non-CIG farmers in case of wheat and mustard (Table 3.17).

Table 3.17: Cost and return from different crops (per farm)

Crop	Production (kg)	Cost (tk)	Gross return (tk)
Aus			
CIG farmers	1409	14781	9585
Control farmers	1100	12060	7964
Wheat			
CIG farmers	1553	18569	23020
Control farmers	1107	13230	7320
Mustard			
CIG farmers	377	5275	8670
Control farmers	220	5101	1968
Lentil			
CIG farmers	328	7806	14998
Control farmers	293	4490	14543

3.4.5 Crop Technology Dissemination by the CIG farmers

CIGs were established to disseminate technology. The second column of the Table 3.18 shows number of CIG farmers reporting about other farmers' adopting. The next column

shows average number of farmers adopted. The T. Aman and Boro are the most successful technology in terms of number of CIG farmers reporting dissemination and average number of adopters.

Table 3.18: Technology dissemination by the CIG farmers

Crop/technology	No of CIG farmers reporting other farmers to adopt	Average number of adopters
T. Aman (RYGM)	127	4.91
Boro (RYGM)	118	4.50
Boro (AWD)	40	4.23
Aus (RYGM)	15	4.20
Modern mustard varieties	9	5.33

3.4.6 Seed Source

A major component of the RYMG technology is to enhance use of quality seed at farm level. Farmers were trained to produce and select quality seeds. In the T. Aman season, the CIG farmers were mostly relying on own production (48.91%) and BADC (36.96%) for seed. Very few CIG farmers used seeds from open market (11.43%) and informal sources (neighbor, 1.09%). The control farmers in the season were mainly relying on own seed sources (54.55%). Compared to that of CIG farmers, proportion of control farmers using BADC seed in T. Aman season was negligible. In Boro season, proportionate distribution of both categories of farmers according to seed source is similar. The quantitative data here do not argue for much success in encouraging farm level seed production (Table 3.19). But the messages from qualitative data indicate that the situation may improve. During the FGD and KII, both the farmers and agricultural officers mentioned that farmers are now more capable producing quality seed which is reducing their dependency on market. Even if they purchase seed from external sources they can now more efficiently identify quality seed. Some farmers are even replacing BADC seed by their own seed.

Table 3.19: Frequency distribution of the rice growers according to seed sources

Seed sources	T. Aman		Boro	
	CIG farmers	Control farmers	CIG farmers	Control farmers
	Frequency (% of number of responses)			
BADC	68 (36.96)	6 (18.18)	76 (49.35)	11 (40.74)
DAE	3 (1.63)	0 (0.00)	3 (1.95)	3 (11.11)
Own	90 (48.91)	18 (54.55)	45 (29.22)	8 (29.63)
Neighbor	2 (1.09)	3 (9.09)	4 (2.60)	1 (3.70)
Market	21 (11.43)	6 (18.18)	25 (16.23)	4 (14.81)
All	184 (100.0)	33 (100.00)	154 (100.0)	27 (100.00)

3.4.7 Insect/Pest Management Practices

Compared to the CIG farmers, the control farmers rely more on chemical practices for controlling the pest and insect attacks. Among the CIG farmers, 53.21% and 62.91% practice only IPM technology in T. Aman and Boro season, respectively. Another 39.10% and 30.60% practice combination of both IPM and chemical management in T. Aman and Boro season, respectively. In both the seasons relatively lower proportion of control farmers practice IPM. Proportion of farmers following only chemical pest management practices is high in the group of control farmers (Table 3.20).

Table 3.20: Rice grower's pest management practices

Pest management practices	T. Aman		Boro	
	CIG farmers	Control farmers	CIG farmers	Control farmers
	Frequency (% of number of farmers)			
IPM	83 (53.21)	13 (40.63)	84 (62.69)	11 (47.83)
Insecticides/pesticides	12 (7.69)	10 (31.25)	9 (6.72)	2 (8.70)
Both	61 (39.10)	9 (28.13)	41 (30.60)	10 (43.48)

3.4.8 Changes in CIG Farmers' Land Area and Productivity

CIG farmers' land use and productivity from different crops increased after joining CIG. While joining CIG, on an average a farmer was cultivating T. Aman, Boro and Aus in 124.12, 140.19 and 107.25 decimal of land, respectively. After joining CIG, the area has increased in these three seasons. Productivity has also increased in the three seasons, and the increases are statistically significant. Productivity increases are 24% for T. Aman, 29% for Boro, and 27% for Aus (Table 3.21). These are very large gains and if can be sustained and replicated all over Bangladesh, would push the country in a very big way towards sustained food security.

For the other crops the sample size did not fulfill the large sample criterion, and hence the results are at best indicative of the trend. The most notable increase in land quantity occurred for mustard (233%) and wheat (41%). Productivity increases were most notable for brinjal (44%) and tomato (20%) (Table 3.21).

Table 3.21: Changes in land area and productivity for the CIG farmers

Crop	While joining CIG		Present situation (2013)		Change in land (decimal)	Change in productivity (kg/decimal)
	Land (decimal)	Productivity (kg/decimal)	Land (decimal)	Productivity (kg/decimal)		
T. Aman (RYGM)	124.12	13.89	130.85	17.17	6.73***	3.28***
Boro (RYGM)	140.19	19.77	155.01	25.46	14.82	5.70***
Aus (RYGM)	107.25	11.91	115.79	15.15	8.54	3.24***
Modern wheat varieties	53.67	9.77	75.67	12.72	22.00***	2.96***
Modern mustard varieties	10.54	3.60	35.16	6.15	24.62***	2.56
Summer tomato	10.26	92.04	15.61	110.50	5.34**	18.45*
Brinjal (IPM practice)	7.25	85.64	17.15	123.64	9.90***	38.00***

Note: *, ** and *** indicate significance at 10%, 5%, and 1% level, respectively (t-test is used).

3.4.9 Impact of Carp Poly-culture

Pond number and area under fish production

After joining fisheries CIG, the farmer's number of operational pond and area has increased significantly. While joining CIG, a farmer had 1.72 ponds with a size of 101.87 decimals. At present a CIG farmer has 2.48 ponds. The pond area for them is 194.47 decimals. Compared to the control farmers, the CIG farmers have notable better status in terms of pond number and area. The CIG farmer's pond area is more than three times higher than the control farmers (Table 3.22).

Table 3.22: No of pond and area under fish production

No of pond and area	CIG farmers		Control farmers
	While joining CIG	Present (2013)	
No of ponds	1.72	2.48^{+++}	1.27
Pond area (decimal)	101.87	194.47^{+++}	46.73**

Note: *, ** and *** indicate mean differences between the CIG and control farmer's present situation are significant at 10%, 5%, and 1% level, respectively (t-test is used). $^{+}$, $^{++}$ and $^{+++}$ indicate mean differences in CIG farmer's present and earlier situation are significant at 10%, 5%, and 1% level, respectively (t-test is used).

Management practices

Pond management practice of the sample fish farmers are presented in Table 3.23. According to the table, CIG farmers follow better management practices than the control farmers. CIG farmer's management practices improved after joining CIG. Among the sample CIG farmers 92% reported to make their pond completely weed free, whereas earlier only 34% did so. This practice was followed by half of the control farmer. The proportion of farmers destroying catfish is 88% and 45% for the CIG and control farmers, respectively. Before joining CIG only 40% were destroying catfish. Significant differences are observed in use of lime and fertilizer. Almost all the CIG farmers used lime (98%) and fertilizer (90%) in their ponds, whereas less than half of the farmers were using lime (44%) and fertilizer (40%) earlier. Proportion of lime and fertilizer users in the group of control farmers are similar to CIG farmer's earlier situation.

Table 3.23: Pond management practices of the fish farmers (%)

Management practices	CIG farmers (n=50)		Control farmers (n=20)
	Before joining CIG	Present (2013)	
% of farmers doing different weed management practices			
Completely free	34.0	92.0	50.0
Partially	62.0	8.0	5.0
Not at all	4.0	0.0	45.0
% of farmers destroying catfish	40.0	88.0	45.0
% of farmers using lime	44.0	98.0	50.0***
% of farmers using fertilizer	40.0	90.0	40.0***
% of farmers collecting fingerlings from different sources			
Government hatchery	4.0	6.0	5.0
Private hatchery	64.0	92.0	45.0
Open sources	32.0	2.0	50.0

Note: *, ** and *** indicate significance at 10%, 5%, and 1% level, respectively (χ^2 test is used).

Differences also exist incase of fingerlings sources. At present, private hatcheries are the major source of CIG farmer's fingerlings (92%). Earlier also private hatcheries were their major source, though the proportion of farmers collecting fingerlings has increased notably. Around 30% of the CIG farmers have shifted from open sources to private hatcheries. Open sources are still the major fingerlings supplier to the control farmers. The findings of the table clearly show that CIG farmers follow much better management practice than the control farmers. Before joining CIG, these farmers had similar practices to those of the control farmers (Table 3.23).

Yield and return from carp poly-culture

The CIG farmers has much higher per hectare production and return from their ponds than the control farmers. The CIG farmer's productivity has increased by more than 80% after joining CIG and the change is significant. Gross return from each hectare for the CIG farmers is 457674 tk, which is 30% higher than their counterparts (Table 3.24).

Table 3.24: Yield and return from carp poly-culture

Types of farmers	Yield (kg/ha)		Gross return ('000 tk/ha)
	Before joining CIG	Present (2013)	
CIG farmers	3055	5567***	457674
Control farmers		5457	346356

Note: *** indicates mean difference between the CIG farmer's present and earlier production is significant at 1% level (t-test is used).

Carp poly-culture technology dissemination by the CIG farmers

Among the sample fisheries CIG farmers, 84% reported that other farmers become interested about the technology by visiting their production unit. On an average around 8 adopted the technology from each CIG farmer (Table 3.25).

Table 3.25: Carp poly-culture technology dissemination by the CIG farmers

Technology	No of CIG farmers reporting other farmers to adopt	Average number of adopters
Carp poly-culture	42 (84.00)	7.57

Note: Figures in parentheses are percentage of total farmers practicing carp poly-culture technology.

3.4.10 Impact of Dairy Cow Farming and Beef Fattening

Number and average value of cows

Several interesting phenomenon can be observed from the Table 3.26. After joining CIG, number of both local and cross breed dairy cows has decreased. Decrease is more incase of local breed. Average value of local breed has also decreased, but average value of cross breed cows has increased by almost 50% than earlier. Such differences indicate that though the CIG farmers are rearing fewer number of cows than earlier, they are more concentrated with high value cross breed. Differences in CIG and control farmer's practices are supportive to this argument. Compared to the control farmers the CIG farmers have fewer number of local breed which are relatively cheap. But the situation is opposite for of cross breed.

Table 3.26: No and value of dairy cows

	Before joining CIG				Present (2013)			
	Local breed		Crossbreed		Local breed		Cross breed	
	No	Value (tk/cow)	No	Value (tk/cow)	No	Value (tk/cow)	No	Value (tk/cow)
CIG	2.10	30984	2.20	49300	1.08	23917	1.78	73870
Control farmers					1.43	30667	1.63	70476

Compared to the control farmers, the CIG farmers have more number of both local and cross breed cows for beef fattening. After joining CIG, numbers of both breeds have increased for the CIG farmers. Average value of cows has also increased for the CIG farmers than before (Table 3.27).

Table 3.27: No and value of cows for beef fattening

Farmers category	Before joining CIG				Present (2013)			
	Local breed		Cross breed		Local breed		Cross breed	
	No	Value (tk/head)	No	Value (tk/head)	No	Value (tk/head)	No	Value (tk/head)
CIG	2.00	18750	1.44	28278	2.25	17000	4.87	30800
Control farmers					1.75	30750	2.57	35286

Lactation period

Rearing of improved breed and better management practices have resulted in higher lactation period for the livestock CIG farmers. Increase in lactation period is more incase of cross breed. In case of cross breed lactation period has increased by almost 30% than earlier, whereas the increase is around 6% for the local breed. Compared to the control farmers, the CIG farmers have around 30% and 11% more lactation period for local and cross breed, respectively (Table 3.28).

Table 3.28: Average lactation period (days)

Breed	CIG farmers		Control farmers
	Earlier	Present	
Local breed	152.76	162.25	125.34
Cross breed	138.50	179.19	161.63

Milk production

As like average lactation period, the CIG farmer's milk productivity is also higher than the control farmers. The average milk productivity for the CIG farmer's local breed is 2.95 liter/cow/day and this is around 24% higher than what the control farmer's production. Milk productivity for cross breed is 8.50 liter/cow/day and 7.59 liter/cow/day for the CIG and control farmers, respectively (Table 3.29).

Table 3.29: Milk production (liter/cow/day)

Breed	CIG farmers	Control farmers
Local breed	2.95	2.38
Cross breed	8.50	7.59

Dairy cow farming and beef fattening technology dissemination

Among the CIG farmers doing dairy cow farming and beef fattening, 82.35% and 50% reported that other farmers adopted the technology from them. Average number of adopters for the dairy cow rearing and beef fattening are 3.92 and 9.71, respectively (Table 3.30).

Table 3.30: Dairy cow farming and beef fattening technology dissemination by the CIG farmers

Crop/technology	No of CIG farmers reporting other farmers to adopt	Average number of adopters
Dairy cow farming	28 (82.35)	3.92
Beef fattening	14 (50.00)	9.71

Note: Figures in parentheses are percentage of total farmers practicing that technology.

3.5 Annual Expenditure Pattern for the CIG and Control Farmers

Table 3.31 presents annual expenditure pattern for the sample households. Among the CIG farmers, the fisheries CIG farmers have highest annual expenditure (356 thousand tk) followed by the crop CIG farmers (284 thousand tk) and livestock CIG farmers (232 thousand tk). Annual average expenditure for all the three categories of CIG farmers is higher than their counterparts who were not members of CIG. Highest difference is observed between crop CIG and control farmers. The crop CIG farmers have around 28% higher annual expenditure than the control farmers. Food expenditure is the major cost component for all the groups, constituting at least one third of the total annual expenses (Table 3.30).

Table 3.31: Annual expenditure pattern for the crop CIG and control farmers ('000 tk.)

Expenditure items	Crop farmers		Livestock farmers		Fish farmers	
	CIG farmers	Control farmers	CIG farmers	Control farmers	CIG farmers	Control farmers
Food	135 (47.5)	108 (48.6)	126 (54.1)	115 (58.7)	143 (40.2)	112 (35.6)*
Education	19 (6.7)	23 (10.4)	28 (12.0)	15 (7.7)	28 (7.9)	42 (13.3)
Health	10 (3.5)	10 (4.5)	10 (4.3)	6 (3.1)***	11 (3.1)	8 (2.5)
Clothing	14 (4.9)	14 (6.3)	15 (6.4)	11 (5.6)	18 (5.1)	15 (4.8)
Festival	12 (4.2)	8 (3.6)**	13 (5.6)	9 (4.6)	18 (5.1)	18 (5.7)
Other	94 (33.1)	59 (26.6)**	40.9 (17.6)	40 (20.4)	138 (38.8)	120 (38.1)
Total	284 (100.0)	222 (100.0)***	232.9 (100.0)	196 (100.0)	356 (100.0)	315 (100.0)

Note: Figures is parentheses are percentage of total cost. *, ** and *** indicate significance at 10%, 5%, and 1% level, respectively (T-test is used).

One may note here that the previous PCU (NATP) survey came up with much lower expenditure figures for the CIG and the control group part of which may perhaps be explained by the inflation and part probably due to productivity and hence income increases. The pattern of distribution however remains roughly the same as broadly half of the expenditures were due to food expenses.

3.6 Supply Chain Development Component

Supply Chain Development Component (SCDC) is being implemented by the Hortex Foundation. The main focus of this component was to integrate small and marginal producers of high value commodities (crops/horticulture, fisheries and livestock) with the market through supply chain development. Out of 120 upazilas under NATP, SCDC covers 20 upazilas (one upazila in one district).The project sites and beneficiaries (CIG members) were selected in collaboration with the 3 extension agencies (DAE, DLS & DOF).Small and marginal farmers were selected for high value commodity production and marketing. Some "Commodity Collection and Marketing Centers (CCMC)" were established.

Hortex Foundation signed Memorandum of Understanding (MOU) with two commodity trading companies to support farmers-market linkages and marketing the products. Thirteen demonstrations on new post-harvest technologies like, washing, grading, packing (plastic crates), etc. were established for assessment of post-harvest loss that benefiting CIG members by reducing post-harvest loss. SCDC assisted four entrepreneurs to come under agency/retailers contract with the supplier company for sex-pheromone and establishment of carp hatchery for genetically pure seed production and fish feed mill for quality feed production. More than 60 training courses, seminars and workshops on improved production and post-harvest technology and management practices were organized involving over 6000 participants during the period.

The Supply Chain Development Component (SCDC) as one of the components of this project is implemented by Hortex Foundation since October 2008. It covers 20 upazilas namely Comilla Sadar, Chandina, Savar, Bogra Sadar, Shibgonj, Mirsarai, Belabo, Shibpur, Jessore Sadar, Jhikorgacha, Parbotipur, Sreemongal, Delduar, Kapasia, Kaliakoir, Birgonj, Pirgonj, Boraigram, Singra, Trishal, under thirteen districts. The development objectives of this component are to integrated small and marginal farmers agro business enterprise into modern supply chain by promoting more equitable change governance and market linkages of high value agro commodities such as fruits, vegetables, flowers, milk, meat and fish. The project works through Common Interest Group (CIG) in 20 Upazilas and each group compromises of 20 farmers. This component works in close co-operation with the Department of Agriculture Extension (DAE), Department of Livestock Services (DLS) and Department of Fisheries (DOF) under the Project Co-ordination Unit (PCU). Major activities of the component include (a). Increase productivity of targeted commodities, (b) Improvement of post-harvest

management to reduce loss, (c) Strengthening farmer market linkage, (d) Knowledge management of the difference stock holders, (e) Promotion of contract/ group farming, and (f) Development of entrepreneurs.

Though officially the SCDC component started its activities on 25 March 2008, but actually activities had been started from October 2008 after joining of the experts and release of fund from IDA in August 2008.

The Team selected 4 upazilas at random (Jhikergacha, Delduar, Belabo and Pirganj) had been under 20 upazilas for supply chain improvement. The team conducted Key Informant Interview (KIIs) with farmers involved in the process.

By conducting interviews with CIG farmers and service providers, the team observed that SCDC organized trainings, seminars and workshops, exposure visit focusing improved production, postharvest technology and market management. SCDC assisted CIG farmers for marketing products through CCMCs .Hortex also organized training on pre-cooling, sorting, grading, washing, disinfecting, peeling, slicing, postharvest treatment, packaging and transportation.

The team identified program for beef fattening in Pirganj, beef fattening, brinjal, lemon and papaya in Belabo, beef fattening and lemon in Delduar and flowers in Jhikorgacha upazilas.Some technology has been developed by SCDC experts and introduced in those upazilas. SCDC provided training to chain partners, conducted demonstrations to reduce postharvest losses. Different demonstrations were conducted in farmers' field on post harvest technologies. To collect the agricultural produces in common place and to attract the city bound agricultural commodity traders for coming to buy the CIG commodities, SCDC assisted establishment of CCMCs and SCDC made linkage for marketing CIG commodities to big cities. Major findings/observations have been summarized as follows:

- Supply chain supports to improve livelihoods of the beneficiaries
- The sustainability of the progress and impact that Hortex made will be ensured with adequate funding
- Producer organizations are not functioning everywhere
- CCMC services are not available for all the CIG members in an upazila.
- CCMC, farmers and traders linked with each other has been developed

Recommendations

- More CCMC is needed to provide production and marketing facilities
- Hortex can organize seminars/consultation meetings involving producers organizations and entrepreneurs to develop a better linkage with CCMCs
- Regular farmers' trainings are needed

3.7 Conclusions and Recommendations

On the whole the analysis shows that the NATP's process of farmers' group formation, its functioning and technology dissemination process may have worked quite well. Participants' feedbacks about different NATP activities are encouraging. But some of the programmes and activities of NATP are found to be more concentrated with the CIG farmers. Efforts are required for increasing participation in programmes like fair and exhibition. Here it is noteworthy to mention that technology distribution is found to be more successful with farmers who participate in different NATP programmes. Hence initiative should be taken to increase frequency and coverage of different NATP activities.

NATP has resulted in higher productivity as most farmers adopted better farming technology. The NATP technology recipient farmers produce more and earn higher profit compared to the control farmers. The final outcome could be in terms of higher expenditure capacity although the food still accounts for half of the total.

From what has been discussed and analysed here, NATP can be considered a good case for replication all over the country, although the exact element of a particular technology may vary from place to place.

There are certain concerns regarding the lack of funds for additional works that the SAAOs carry out under NATP. This is a very time-intensive project and activities under say FIAC while these need to be further extended can not be done well with the limited allocations for incidentals that are provided. The real issue is to make NATP experiences and output and outcome sustainable when the project ends. It is towards that the NATP may need to be fine-tuned.

CHAPTER 4
PROCUREMENT

The Project has seven Implementing Units: (i) Project Coordination Unit (PCU), Ministry of Agriculture, (MOA) (ii) Project Implementation Unit (PIU), Bangladesh Agricultural Research Council (BARC), (iii) Project Implementation Unit (PIU), Department of Agriculture Extension (DAE), (iv) Project Implementation Unit (PIU), Department of Fisheries (DOF), (v) Project Implementation Unit (PIU), Department of Livestock Services (DLS) (vi) Krishi Gobeshona Foundation (KGF) and (vii) Hortex Foundation (Hortex).

4.1 Procurement Management (2008-2009)

National Agricultural Technology Project (NATP): Phase-1 had RADP allocation of BDT 234976 thousand for the financial year 2008-09 for procurement of goods, repair & renovation works and services (Table 4.1). PIU- DAE had the highest allocation of BDT 65416 thousand followed by PIU- BARC BDT 47040 thousand. The Implementing Agencies (IAs) prepared annual procurement plans which had no objection from the World Bank (WB) and approved by the relevant HOPE. The procurement activities were also included in the annual work plan which was approved by the Project Steering Committee (PSC).

In total, NATP had 198 packages (for goods 93 pkgs., works 5 pkgs. and services 100 pkgs.). The number of packages of individual IAs has been shown in Table 6.2. The procurement of one cross country vehicle for each of PIU-DAE, PIU-DLS, PIU-DOF and KGF, one microbus for KGF and one car for PIU-BARC was completed. The extension components procured motorcycles (PIU-DAE 95 nos., PIU-DLS 99 nos. & PIU-DOF 95 nos.), bicycles (PIU-DOF 950 nos.) and computers (PIU-DAE 95 nos., PIU-DLS 87 nos. and PIU-DOF 95 nos.) for upazilas, districts and head quarters. PIU- BARC procured 28 computers for 11 NARS institutes and for PIU office at BARC. Computer and office furniture were also procured by other components for the use at their offices. Besides, photocopy machines, fax machine, IPS, multimedia & speakers (PA systems) and air coolers etc have also been procured by extension components as well as by other components for their office uses.

In terms of expenditure, PIU-DAE could utilize BDT 65342 thousand out of BDT 65416 thousand from their RADP (99.89%). PIU-DLS and PIU-DOF could spend BDT 21454 thousand (86%) and BDT 26946 thousand (77%) from their available fund in RADP BDT

24840 thousand and BDT 34900 thousand, respectively (Table 4.1). Fund utilization by other components was also satisfactory. In total, NATP: Phase-1 could utilize BDT 144939 thousand (62%) out of RADP fund BDT 234976 thousand (Table 4.1).

Table 4.1: RADP allocation and achievement for procurement, 2008-2009

Implementing agencies	**PIU-DAE**	**PIU-DLS**	**PIU-DOF**	**PIU-BARC**	**KGF**	**Hortex**	**PCU**	**Total NATP**
RADP allocation								
Goods								
GOB	3100	1725	2400	1999	1000	400	1200	11824
RPA	52300	22600	284.00	29701	15900	11600	12200	172701
Total	55400	24325	30800	31700	16900	12000	13400	184525
Works								
GOB	308	15		624	030	15	72	1064
RPA	1875	500	400	7476	970	485	800	12506
Total	2183	515	400	8100	1000	500	872	13570
Services								
GOB	372		200	167	273	150	85	1247
RPA	7461		3500	7073	9100	5000	3500	35634
Total	7833		3700	7240	9373	5150	3585	36881
Grand total	65416	24840	34900	47040	27273	17650	17857	234976
Expenditure								
Goods								
GOB	3100	1378	1880	5690	700	016		12764
RPA	52298	19468	24304	156	12600	523		109349
Total	55398	20846	26184	5846	13300	539		122113
Achievement (%)	100.00	85.70	85.01	18.44	78.70	4.49		66.18
Works								
GOB	308	13		55	1	3		380
RPA	1870	500		805	120	84		3379
Total	2178	513		860	121	087		3759
Achievement (%)	99.77	99.61		10.62	12.10	1.69		27.70
Services								
GOB	371		17	107	44	95	14	648
RPA	7395	95	745	5018	1428	3072	666	18419
Total	7766	95	762	5125	1472	3167	680	19017
Achievement (%)	99.14		20.59	70.79	15.70	61.50	18.97	51.70
Grand total	65342	21454	26946	11831	14893	3793	680	144939
Grand achievement (%)	99.89	86.37	77.21	25.15	54.61	21.49	3.81	61.68

PIU- DAE had 100% success in completion of procurement of goods, works and services followed by Krishi Gobeshona Founadation (KGF) which could complete procurement of 80% of packages including 100% success in goods procurement and 67% success in hiring

services (Table 4.2). They did not have any package for works. PIU-DLS also had 100% success in completion of goods procurement. The overall progress of procurement of all components was 51%.

PCU could not make procurement as it did not have man power neither at expert level nor at staff level. Project Director joined on 15 January 2009 and was running the official work alone. He made good progress in recruiting experts and procurement of some goods although the process could not be completed in FY 2008-2009. The process of recruiting 3 experts and 2 assistant experts were near completion and waiting for signing of contract agreement.

During the fiscal year 2008-2009, implementing agencies did not have adequate man power from the project and GOB. Though fund was released first time in September, 2008, still the progress of procurement was satisfactory.

Table 4.2: Target and achievement of procurement by different components of NATP 2008-2009

Implementing agencies	Goods			Works			Services			Total NATP		
	Target	Achievement	(%)	Target	Achivement	(%)	Target	Achievement	(%)	Target	Achivment	(%)
PIU-DAE	16	16	100	1	1	100	8	8	100	25	25	100
PIU-DLS	11	11	100				8	2	25	19	13	68
PIU-DOF	13	8	62				6	3	50	19	11	58
PIU-BARC	12	9	75	3	3	100	18	7	39	33	19	58
KGF	10	10	100				15	10	67	25	20	80
Hortex	19	1	5	1		0	17	5	29	37	6	16
PCU	12		0				28	7	25	40	7	18
Total NATP	93	55	59	5	4	80	100	42	42	198	101	51

4.2 Procurement Management (2009-2010)

The project had RADP allocation of Tk. 3476.87 lakh for FY2009-2010 for procurement of goods, works and services (Table 4.4). The Implementing Units (IUs) of the project prepared annual procurement plans for their procurement. The World Bank after reviewing gave 'no objection' to those plans and the respective Head of Procuring Entity (HOPE) of IUs approved the plan. The Project Management Committee (PMC) oversaw and the Project Steering Committee (PSC) finally approved those. Unit-wise RADP allocation and achievements are briefly described bleow.

For procurement, the project had 88 packages for goods, 19 packages for ks and 60 packages for services for all NATP units. The IUs completed the procurement of 77 packages of goods (88%), 19 packages of works (100%) and 38 packages of services (63%). Altogether, procurement of 134 packages (80%) was completed against the target of 167 packages. For all these procurement Tk 1927.55 lakh (55%) was spent out of the RADP allocation of Tk. 3462.77 lakh (Table 4.3). Major saving in procurement was because of price of actual procurement was less than the estimated cost, and also the CDVAT allocated for Cross Country Vehicle of PCU procurement could not be spent as this vehicle procurement was rescheduled for next financial year.

Table 4.3 RADP allocation, target and achievement of procurement in 2009-2010

No	**Implementing Units**	**Target of Procurement (No. of Packes)**	**Achivement (No. of Packages)**	**2009-10 RADP Allocation**	**Actual Expenditure**	**(%) of Achivement**
		Total	Total	Tk in Lac	Tk in Lac	**(%)**
1	Project Implementation Unit (BARC)	25	14	891.37	36.32	4%
2	Project Implementation Unit (DAE)	25	25	1232.58	1147.89	93%
3	Project Implementation Unit (DOF)	20	20	216.00	202.04	94%
4	Project Implementation Unit (DLS)	27	14	537.90	117.98	22%
5	Krishi Gobeshona Foundation (KGF)	7	6	99.00	60.36	61%
6	Hortex Foundation	27	26	238.14	149.22	63%
7	Project Cordination Unit (PCU)	41	34	247.78	187.78	76%
Total NATP		**172**	**139**	**3462.77**	**1901.59**	55%

Table 4.4 Target and achievement of procurement (packages), 2009-2010

	Goods			Works			Services			Total		
Name of Agencies	**Tar-**	**Achieve ment**	**3/2*100**	**Tar**	**Achieve ment**	**(%) 6/5*100**	**Tar**	**Achieve ment**	**(%) 9/8*100**	**Tar**	**Achieve ment**	**(%) 12/11*100**
1	2	3	4	5	6	7	8	9	10	11	12	13
PIU-DAE	7	7	100%	16	16	100 %	2	2	100 %	25	25	100%
PIU-DLS	18	10	56%	0	0		9	4	44%	27	14	52%
PIU-DOF	16	16	100%	0	0		4	4	100 %	20	20	100%
PIU-BARC	12	10	83%	1	1	100 %	12	3	25%	25	14	56%
KGF	4	4	100%	0	0		3	2	67%	7	6	86%
Hortex	21	21	100%	1	1	100 %	5	4	80%	27	26	96%
PCU	15	14	93%	1	1	100 %	25	19	76%	41	34	83%

4.3 Procurement Management (2010-2011)

Progress of Procurement of PCU

In the annual procurement plan of 2010-2011, there were 9 packages for goods, one package for works and 11 packages for services. Procurement of 8 packages of goods (89%), one package of works (100%) and 7 packages of services (64%) were completed. Procurement of equipment and software for ICT & MIS, was on progress. Overall achievement of procurement was 76%.

Goods procured in the FY 2010-11 were one cross country vehicle, one TV, 2 digital cameras, 3 packages of stationeries, one package of printing materials, hiring of 2 firms and 5 individual consultants.

Progress of Procurement of All Implementing Units (2010-2011)

The project had allocation of Tk 1124 lac in RADP for financial year 2010-2011 for procurement of goods, works and services. Tk 619 lac was spent out of allocated fund Tk 1124 lac. The expenditure was 55% of the RADP allocation. Major saving of procurement was because of actual procurement price was less than the estimated cost.

The Implementing Units (IUs) of the project prepared annual procurement plans for their procurement having 60 packages for goods, 9 packages for works and 38 packages of services (Table 4.5). IUs completed the procurement of 55 packages of goods (92%), 8

packages of works (89%%) and 25 packages of services (66%). In total, out of 107 packages of procurement 87 packages (88%) of procurement was completed (Table 4.5).

PIU- DAE, PIU-DOF, and KGF completed procurement of all packages (100%). PCU completed procurement of 16 packages out of 21 packages (76%), PIU-DLS completed 11 packages out of 15 packages (73%), Hortex Foundation completed 11 packages out of 12 packages (92%) and PIU-BARC completed 15 packages out of 24 packages (62%) (Table 4.5).

PIU-DAE utilized the highest amount of RADP fund (98%) for procurement followed by PIU-DOF (82%) and PCU (81%). Utilization of RADP fund for procurement of PIU- BARC was the lowest (29%). The overall progress of procurement was satisfactory (55%) for NATP (Table 4.6).

Table 4.5 Target and Achievement of Procurement 2010-11 (No.Packages)

	Goods			**Works**			**Services**			**Total**		
Imolementing Agencies/ Unitsg	**Target**	**Achievement**	**(%) 3/2*100**	**Target**	**Achievement**	**6/5*100**	**Target**	**Achievement**	**9/8*100**	**Target**	**Achievement**	**12/11*100**
1	2	3	4	5	6	7	8	9	10	11	12	13
PIU-DAE	50.37	50.37	100%	57.67	54.73	95%	45.79	45.76	100 %	153.83	150.86	98%
PIU-DLS	434.35	211.80	49%				82.70	25.00	30%	517.05	236.80	46%
PIU-DOF	16.00	11.88	74%				38.00	32.63	86%	54.00	44.51	82%
PIU-BARC	74.49	25.50	34%	45	0	0%	80	31.86	40%	199.49	57.36	29%
KGF	9	4.30	48%	-	-	-	4.00	3.43	80%	13.00	7.73	59%
Hortex	19.41	19.10	98%	2.00	1.84	92%	62.18	17.86	29%	83.59	38.80	46%
PCU	58.00	58.00	100%	5.50	4.88	89%	40.00	20.77	52%	104	84	81%
Total NATP	661.62	380.95	58%	110.17	61.45	56%	352.67	177.31	50%	1124	619.71	55%

Table 4.6 Financial Target and Achievement of Procurement 2010-11 (Taka in Lakh)

Imolementing Agencies	Target	Achievement	(%) 3/2*100	Target	Achievement	6/5*100	Target	Achievement	9/8*100	Target	Achievement	12/11*100
1	2	3	4	5	6	7	8	9	10	11	12	13
PIU-DAE	6	6	100%	6	6	100%	8	8	100%	20	20	100%
PIU-DLS	10	9	90%				5	2	40%	15	11	73%
PIU-DOF	11	11	100%							11	11	100
PIU-BARC	14	11	78%	1	0	0%	9	4	4%	24	15	63%
KGF	3	3	100%				1	1	100%	4	4	100%
Hortex	7	7	100%	1	1	100	4	3	75%	12	11	92%
PCU	9	8	89%	1	1	100%	11	7	64%%	21	16	76%
Total NATP	60	55	9%	9	8	89%	38	25	66%	107	88	88%

4.4 Procurement Management (2011-2012)

NATP had 59 packages for procurement in the financial year 2011-2012 (Table: 4.7). There were 43 packages for goods, 14 packages for services and 2 packages for works. Out of these packages, procurement of 41 packages of goods (95%), 12 packages of services (86%) and one package of works (50%) was completed. ADP allocation was Tk 1363.64 lakh for procurement. There were Tk 1163.41 lakh for procurement of goods, Tk 200.45 lakh for services and Tk 7.00 lakh for works. The major allocation, US$ 707,645.00 and Tk 1,74,98,891.00 was for procurement of ICT and MIS equipment. The equipment procurement was completed and was distributed to BARC and 7 NARS institutes (BARÍ, BRRI, BJRI, BSRI, SRDI, BLRI and BFRI). Those are functioning normally.

Table 4.7: Target and achievement of procurement

Implementing Units	Target	Achievement	Achievement (%)
PCU	13 (947.39)	13 (553.50)	100% (58%)
PIU-BARC	16 (221.00)	12 55.20)	75% (25%)
PIU-DAE	5 (15.87)	5 (15.87)	100% (100%)
PIU-DOF	5 (17.30)	5 (17.09)	100% (99%)
PIU-DLS	6 (170.89)	5 (88.56)	83% (52%)
KGF	2 (12.00)	2 (6.70)	100% (56%)
Hortex	12 (37.91)	12 (24.75)	100% (65%)
Total NATP	59 (1363.86)	54 (756.68)	93% (55%)

Note: Figures in the parentheses are ADP allocation in lakh.

Although physical progress of procurement (93%) was satisfactory the financial progress (55%) was not up to the expectation (Table 4.7). Delay in submission of bill for ICT and MIS equipment by supplier and requirement of long time to complete procedure for hiring firm and tender value being less than estimated value were reasons for less expenditure than allocated ADP fund.

The implementing units PCU, PIU-DAE, PIU-DOF and Hortex had 100% achievement in goods procurement, PCU and KGF had 100% achievement in service procurement and KGF had 100% achievement in works procurement. The financial progress (more than 90%) of PIU-BARC, PIU-DAE and PIU-DOF for goods procurement was also satisfactory. The financial achievement of PIU-BARC was low as it could not hire its **2** targeted firms and could not complete civil works for one targeted package.

The financial targets increasingly met-62 % in 2008-09, 83% in 2009-10; 88% in 2010-11 and 93% in 2011-12.

In case of BARC, There is a financing agreement between GoB and IDA regarding the BARC act. As amendment of BARC Act is a prerequisite for SPGR funding by the World Bank. Once the amendment of BARC Act is approved and its forms and substance are accepted by the World Bank, proposals will be processed for final approval and funding For BARC, No withdrawal shall be made for payments made prior to the date of agreement (Dated February 28, 2008) and unless the Receipient's Cabinet has approved the amendment of the BARC Act(which was approved on March 8, 2012), in form and substance acceptable to the Association and the closing date is December 31,2013.

4.5 Procurement Management (2012-2013)

Project Coordination Unit (PCU) had 15 packages for goods, 7 packages of services and one

package of works for procurement in the FY 2012-2013 (Table 4.8). PCU completed procurement of 15 packages of goods (100% achievement), 6 packages of services (86% achievement) and one package of works (100% achievement) within June, 2013. The estimated cost was Tk 265 lakh for goods procurement, Tk 125 lakh for services and Tk 5.97 for works for PCU (Table). The actual expenditure was Tk 213.30 lakh (81%) for goods, Tk 67.68 lakh (54%) for services and Tk 5.02 lakh (84%) for works. Actual cost was lower than estimated cost for goods and works as bid value was lower than the estimated cost. The lower

expenditure than the estimated cost for services was because the expert could not be hired within scheduled time.

Table 4.8: Summary of progress of procurement of PCU for 2012-2013

Description	**Target**		**Contract signed**	**Goods received/ Experts joined**	**Expenditure**	**Achievement (%)**	
	No.of Packages	Taka in Lakh	No.of Packages	No.of Packages	Taka in Lakh	Physical	Financial
Goods	15	265	15	15	213.30	100	81
Services	7	125	6	6	67.68	86	54
Works	1	5.97	1	1	5.02	100	84
Total	23	395.97	22	22	286.03	96	72

4.5.1 Progress of Procurement of Implementing Units (IUs)

Implementing Units (IUs) including PCU had 112 packages for procurement for the FY 2012-2013 of which 74 packages were for goods, 12 packages for works and 26 packages for services. PIUDAE, PIU-DOF, PIU-DLS, KGF and Hortex completed procurement of all of their 50 packages (100% achievement) scheduled to be procured in the FY 2012-2013 (Table 5.20). PCU completed procurement of 22 packages out of 23 packages (96% achievement).

PIU-BARC had 39 packages for procurement in the annual procurement plan for FY 2012-2013 of which bids have been invited for 30 packages (80% achievement) and procurement was completed for 13 packages (33% achievement) (Table 4.9).The unit is taking extra efforts for speeding up their process of procurement

Table 4.9: Physical progress of procurement of 7 implementing units for FY 2012-2013

(No. of Packages)

Name of implementing agencies	Target				Notification for Awards				Achievement (%)
	Goods	Works	Services	Total	Goods	Works	Services	Total	
PCU	15	1	7	23	15	1	6	22	96
PIU-BARC	26	5	8	39	10	1	2	13	33
PIU-DAE	9	3	4	16	9	3	4	16	100
PIU-DOF	2		1	3	2		1	3	100
PIU-DLS	8		3	11	8		3	11	100
KGF	4			4	4			4	100
Hortex	10	3	3	16	10	3	3	16	100
Total	74	12	26	112	58	8	19	85	76

NATP had allocation of Tk 7082 lakh for procurement of which Tk 5343 lakh was for goods, Tk 1074 lakh for works and Tk 665 lakh for services (Table). Financial achievement for procurement was 100% for DOF, 94% for PCU and 93% for DLS. KGF and Hortex had 72% and 51% respectively financial achievement in procurement. Total NATP had 40% financial achievement for procurement which was low. PIU-BARC had Tk.2919 lakh allocation for procurement out of which it could spend only Tk 269 lakh ((9% achievement) and PIU-DAE had allocation of Tk 2846 lakh out of which it could spend only TK 1467 lakh (52% achievement). Low financial achievement of PIU-BARC and PIU-DAE was the reason for low financial achievement of NATP

Table 4.10: Financial progress of procurement of implementing units for FY 2012-2013

(Taka in Lakh)

Name of implementing agencies	**Target**				**Expenditure**				Achievement (%)
	Goods	Works	Services	**Total**	Goods	Works	Services	**Total**	
PCU	265	6	125	396	300	5	68	373	94(%)
PIU-BARC	2126	444	349	2919	241	20	8	269	9(%)
PIU-DAE	2210	539	97	2846	1421	25	21	1467	52(%)
PIU-DOF	2		55	57	2		55	57	100(%)
PIU-DLS	517		15	532	480		15	495	93(%)
KGF	14			14	10			10	72(%)
Hortex	209	85	24	318	89	49	24	162	51(%)
Total	5343	1074	665	7082	2543	99	191	2833	40(%)

4.5.2 Progress in MIS (Management Information System) Development

The two members of Procurement Core Team (PCT)- Independent Technical Expert (ITE) and Independent Procurement Expert (IPE), MIS consultant of PCU and the Director of Computer and GIS of BARC are closely working in development of MIS at BARC and NARS institute. A MIS consulting firm named Joined venture of TechnoVista Ltd and Southtech Ltd has been hired for developing 9 modules at BARC and 7 NARS institutes (BARI, BRRI, BJRI, BSRI, SRDI, BLRI and BFRI). PCT is closely supervising and overseeing the progress of development of MIS work along with the MIS consultant of PCU. BARC and 7 NARS institutes received ICT and MIS equipment. The equipment has been distributed according to the need of MIS development. In few cases those have been distributed as per need of the institute without hampering MIS activities. The firm has started developing modules of MIS and it is expected that the work to be completed by November, 2013. Equipment for ICT and MIS were distributed to BARC and 6 NARS institutes (BARI, BRRI, BJRI, SRDI, BLRI and BFRI). BARC and Institutes are using those equipments.

4.5.3 Activities of Procurement Core Team (PCT)

Procurement Core Team met in 2 meetings during the year 2012-13. It submitted 5th and 6th reports to the World Bank (WB) and Chairman of Project Steering Committee (PSC). It visited 7 Implementing Units (IUs) of NATP and 20 SPGR sub-projects at BRRI and BARI two times. It was observed that IUs and Sub-Projects were doing procurement following PPR 2008 and WB guidelines. In few cases it was observed that there were some deviations in following PPR 2008 and WB guidelines. IUs and Sub-Projects were pointed out those deviations and advised not to make such deviations again. As a frequent visit of PCT to IUs and Sub-Projects it seemed that a very few mistakes were made by IUs and subprojects during procurement.

Independent Technical Expert (ITE) and Independent Procurement Expert (IPE) procured 15 packages of goods (100% achievement), 6 packages of services (86% achievement) and one package of works (100% achievement) for PCU. Procurement of PCU was one of the major functions of ITE and IPE as members of PCT.

Two members of PCT: Independent Technical Expert (ITE) and Independent Procurement Expert (IPE) procured ICT and MIS equipment for PCU and distributed to BARC and 7 NARS institutes (BARI, BRRI, BJRI, BSRI, SRDI, BLRI and BFRI) under the guidance of Project Director of PCU. A MIS consulting firm named joined venture of Techno Vista Ltd and Southtech Ltd. has been hired for developing 9 modules one each for BARC and 7 NARS institutes. ITE and IPE were involved throughout the process of procurement of the firm. They were also closely involved in supervision and overseeing the development of 9 modules of MIS and data entry for MIS at BARC and NARS institutes along with MIS consultant of PCU and Director, Computer and GIS Unit of BARC.

4.6 Present Status of Procurement (as on June 2014)

As the procurement is dynamic (running) process, not static, rest of achievement will be fulfilled within a short time.

Table 4.11: Present Status of Procurement

Implementation Units	Target of Procurement				Achievement of Procurement				(%) Achievement
	Goods	Works	Services	Total	Goods	Works	Services	Total	
PCU	47	4	39	90	47	4	37	88	98 %
PIU-BARC	80	15	23	118	80	15	19	114	96.61 %
PIU-DAE	52	15	18	85	52	15	18	85	100 %
PIU-DLS	42	8	16	66	42	8	16	66	100 %
(PIU-DOF	42	0	8	50	42	0	8	50	100 %
KGF	22	1	16	39	22	1	16	39	100 %
Hortex	57	7	40	104	57	7	40	104	100 %

The evaluation team checked package files and examined at random basis sample procurements of different implementing units of NATP. On paper, there seems to adherence to guideline from development partner as evident from World Bank's no objection letters as well as to Govt. Guidelines (PPR08/development partner's procurement guidelines).

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 The Evaluation Process

The IMED has entrusted the evaluation of NATP Phase 1 to the BIDS. The ToR includes 11 objectives for detailed evaluation. Part of the ToR relates to the process of the project including procurement, part on processes in the field (technology generation, CIG formation etc) and the rest on output (such as productivity increases) and outcomes (better income and expenditure capacity). Part of the methodology thus related to examination and analysis of secondary data to be obtained from various institutions involved in project implementation. The rest of the methodology involved generation data from the field based on quantitative and qualitative methods. A sample of 300 CIG and 150 control farmers were chosen for the purpose and an extensive questionnaire was used for the survey. In addition, first hand qualitative data were generated using FGDs among farmers, extensive consultation with officials both in the field and the headquarters of the organisations involved.

An Inception Report was submitted and later revised based on comments received. The present report is following the revised Inception Report that had been approved earlier by the IMED.

5.2 Findings and Recommendations

5.2.1 SPGR and KGF-based research

From the detailed analysis of SPGR and KGF-based research (see Chapter 2), one can conclude that the research effort had been quite successful as they go, with better achievements in some fields compared to others. However, it appears that most studies have had limited goals and their general applicability in terms of technology developed remain to be further investigated. Secondly, the difference in the two strands of research is not always obvious. SPGR should have broad based goals while KGF-sponsored research may be more focused which these generally are. A third issue that came up but not specifically probed was the long time needed in proposal submission, verification, award, grant release seem to be

rather long while the actual research time may be comparably short for understanding the sustainability of the technology developed or tested.

Based on these the team recommends the following:

Both SPGR and KGF sponsored research should be programme based for general applicability, some progress has been made by focusing on hill and coastal ecosystem which should be further carried forward

Because of nature of transformation from project to programme, multi-year, larger research ideas should be developed

SPGR should concentrate more on research for broad-based applicability and may have somewhat different perspectives than KGF's CGP which is oriented more towards applicability of existing technologies

The pre-award time of verification etc may be reviewed for shortening the process.

5.2.2 Procurement

There had been substantial procurement under the project made by the constituent organisations. While one finds that goods and works have been procured, albeit with some delays in the initial years, this has picked up well in later years. But for services there still remains some bottlenecks for which these have lagged somewhat.

The other issue was the transparency and whether government and development partners' guidelines for procurement were followed. Available information on these are still sketchy. For example while one gets information on planned and actual packages procured and money spent, there is hardly any easily available information on number of bids, their shortlisting based on technical proposals and proposed cost. While the involved institutions do claim to have followed the PPR 08 in this regard, there is no obvious and easy way to verify such claims. The evaluation team checked package files and examined at random basis sample procurements of different implementing units of NATP. On paper, there seems to adherence to guideline from development partner as evident from World Bank's no objection letters as well as to Govt. guidelines

Based on the nature of findings on procurement, we make the following tentative recommendations:

For monitoring purposes we suggest that the format of reporting should have information on number of bidders, the number of short-listed bids according to technical merit ranking and their proposed costs and the final winner of the bid as well as the value of the bid. There should be a column stating reasons of deviation from initial proposed costs as well as reasons if the bid ranked first has not been chosen.

5.2.3 Farm household impacts

On the whole we find that the NATP's process of farmers group formation, its functioning and technology dissemination process through training may have worked quite well (for details see Chapter 3). These resulted in higher productivity as most farmers had adopted better technology particularly in case of rice but also in case of cash food crops. The result had been a surging of household income as for T. Aman, the rise in income per farm in T. Aman production had been about 30%, much of it due to productivity increase. For boro, it was nearly 40%. For other crops the rises were also noticeable. The final outcome could be in terms of higher expenditure capacity although the food still accounts for half of the total

From what has been discussed and analysed, one sees a good case for replication of the NATP experiences all over the country, although the exact element of a particular technology may vary from place to place.

There are certain concerns regarding the lack of funds for additional works that the SAAOs carry out under NATP. This is a very time-intensive project and activities under say FIAC while these need to be further extended can not be done well with the limited allocations for incidentals that are provided. The real issue is to make NATP experiences and output and outcome sustainable when the project ends. It is towards that the NATP may need to be fine-tuned.

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