Document of
The World Bank

Report No: ICR00003147

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IDA-41620 IDA-41610 TF-94442)

ON TWO

CREDITS

IN THE AMOUNT OF SDR 97 MILLION
(US$ 140.5 MILLION EQUIVALENT)

AND

IN THE AMOUNT OF SDR 41.1 MILLION
(US$ 59.5 MILLION EQUIVALENT)

AND A

GLOBAL ENVIRONMENTAL FACILITY GRANT
IN THE AMOUNT OF US$ 7.34 MILLION

TO

INDIA

FOR A

NATIONAL AGRICULTURAL INNOVATION PROJECT (NAIP)

November 26, 2014

Agriculture Global Practice
India Country Management Unit
South Asia

CURRENCY EQUIVALENTS

Exchange Rate Effective in November 2014

Currency Unit = Indian Rupee Rs.
XDR 1.00 = US$1.482
US$ 1.00 = Rs. 61.405

FISCAL YEAR
April 1 – March 31

ABBREVIATIONS AND ACRONYMS

ASHOKA	Advanced Supercomputing Hub for OMICS Knowledge in Agriculture
ATMA	Agricultural Technology Management Agency
BCR	Benefit Cost Ratio
BPD	Business Planning and Development
BPDU	Business Planning Development Unit
BSL	Bio Security Level
CA	Chartered Accountant
CAG	Controller and Auditor General
CAS	Country Assistance Strategy
CAU	Central Agricultural University
CeRA	Consortium for e-Resources in Agriculture
CIG	Commodity Interest Group
CMFRI	Central Marine Fisheries Research Institute
CPS	Country Partnership Strategy
DSR	Directorate of Sorghum Research
ERR	Economic Rate of Return
FAO	Food and Agriculture Organization of the United Nations
FAQ	Frequently Asked Question
FMS	Financial Management System
MIS	Management Information System
FYP	Five Year Plan
GDP	Gross domestic production
GEF	Global Environment Facility
GEO	Global Environment Objective
GHG	Green House Gas
GIS	Geographical Information System
HRD	Human Resource Development
IARI	Indian Agricultural Research Institute
IBRD	International Bank for Reconstruction and Development (World Bank Group)
ICAR	Indian Council of Agricultural Research
ICB	International Competitive Bidding
ICGEB	International Centre for Genetic Engineering and Biotechnology
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
ICT	Information and Communications Technology
IFAD	International Fund for Agriculture Development

IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
INCOIS	Indian National Center for Ocean Information Services
INM	Integrated Nutrient Management
INSIMP	Initiative for Nutritional Security through Intensive Millets Promotion
IPDM	Integrated Pest and Disease Management
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
ISO	International Organization for Standardization
ISR	Implementation Status and Results
IWMI	International Water Management Institute
KVK	Krishi Vigyan Kendra
MGNREGA/ MNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MIS	Management Information System
MSME	Mirco, Small and Medium Enterprises
NABG	National Agricultural Bioinformatics Grid
NAIP	National Agricultural Innovation Project
NARS	National Agricultural Research System
NATP	National Agricultural Technology Project
NCB	National Competitive Bidding
NGO	Non-Governmental Organizations
NOAA	National Oceanic and Atmospheric Administration
NRM	Natural resource management
O&M	Organization & Management
PAD	Project Appraisal Document
PCS	Production to Consumption System
PCT	Patent Cooperation Treaty
PDO	Project Development Objective
PFZ	Potential Fishing Zone
PIP	Project Implementation Plan
PIU	Project Implementation Unit
PME	Priority setting Monitoring & Evaluation
PPP	Public Private Partnership
R&D	Research and Development
SAU	State Agricultural University
SHG	Self Help Group
SLEM	Sustainable Rural Livelihoods and Security through Innovations in Land and Ecosystem Management
ZTM	Zonal Technology Management

Vice President: Philippe H. Le Houerou
Country Director: Onno Ruhl
Practice Manager: Simeon Kacou Ehui
Project Team Leader: William B. Magrath
ICR Team Leader: William B. Magrath

INDIA
National Agriculture Innovation Project

CONTENTS

A. Basic Information			
Country:	India	Project Name:	National Agricultural Innovation Project
Project ID:	P092735, P112060	L/C/TF Number(s):	IDA-41610, IDA-41620, TF-94442
ICR Date:	11/26/2014	ICR Type:	Core ICR
Lending Instrument:	SIL	Borrower:	GOVERNMENT OF INDIA
Original Total Commitment:	XDR 138.10 M USD 7.34 M	Disbursed Amount:	XDR 131.01 M USD 7.34 M
Environmental Category: B		**Focal Area**: M	
Implementing Agencies: Indian Council of Agricultural Research (ICAR)			
Co-financiers and Other External Partners: GEF Secretariat			

B. Key Dates				
National Agricultural Innovation Project - P092735				
Process	**Date**	**Process**	**Original Date**	**Revised / Actual Date(s)**
Concept Review:	03/03/2005	Effectiveness:	09/18/2006	09/18/2006
Appraisal:	12/20/2005	Restructuring(s):		03/22/2011 12/10/2013
Approval:	04/18/2006	Mid-term Review:[1]	02/28/2008	06/02/2008 05/06/2010
		Closing:	12/31/2012	06/30/2014

Sustainable Rural Livelihoods and Security through Innovations in Land and Ecosystem Mgmt /Additional GEF financing to India NAIP - P112060				
Process	**Date**	**Process**	**Original Date**	**Revised / Actual Date(s)**
Concept Review:	09/22/2005	Effectiveness:	11/24/2009	11/12/2009
Appraisal:	03/18/2009	Restructuring(s):		08/16/2013
Approval:	08/04/2009	Mid-term Review:		04/14/2012
		Closing:	08/31/2013	06/30/2014

[1]Two mid-term reviews were planned in the PAD, to closely monitor and strengthen the two-phased implementation (consortium selection and sub-project implementation).

C. Ratings Summary	
C.1 Performance Rating by ICR	
Outcomes	Satisfactory
GEO Outcomes	Satisfactory
Risk to Development Outcome	Negligible to low
Risk to GEO Outcome	Negligible to low
Bank Performance	Satisfactory
Borrower Performance	Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)

Bank	Ratings	Borrower	Ratings
Quality at Entry	Satisfactory	Government:	Satisfactory
Quality of Supervision:	Satisfactory	Implementing Agency/Agencies:	Satisfactory
Overall Bank Performance	Satisfactory	Overall Borrower Performance	Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators

National Agricultural Innovation Project - P092735

Implementation Performance	Indicators	QAG Assessments (if any)	Rating:
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA)	None
Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA)	None
DO rating before Closing/Inactive status	Satisfactory		

Sustainable Rural Livelihoods and Security through Innovations in Land and Ecosystem Mgmt /Additional GEF financing to India NAIP - P112060

Implementation Performance	Indicators	QAG Assessments (if any)	Rating:
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA)	None
Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA)	None
GEO rating before Closing/Inactive Status	Satisfactory		

D. Sector and Theme Codes		
National Agricultural Innovation Project - P092735		
	Original	**Actual**
Sector Code (as % of total Bank financing)		
Agricultural extension and research	91	91
Central government administration	6	6
General information and communications sector	3	3
Theme Code (as % of total Bank financing)		
Administrative and civil service reform	14	14
Gender	14	14
Rural policies and institutions	29	29
Rural services and infrastructure	29	29
Technology diffusion	14	14

Sustainable Rural Livelihoods and Security through Innovations in Land and Ecosystem Mgmt /Additional GEF financing to India NAIP - P112060		
	Original	**Actual**
Sector Code (as % of total Bank financing)		
Agricultural extension and research	50	50
Crops	30	30
General agriculture, fishing and forestry sector	20	20
Theme Code (as % of total Bank financing)		
Biodiversity	14	14
Climate change	14	14
Land administration and management	29	29
Other rural development	29	29
Rural policies and institutions	14	14

E. Bank Staff		
National Agricultural Innovation Project - P092735		
Positions	**At ICR**	**At Approval**
Vice President:	Philippe H. Le Houerou	Pratful C. Patel
Country Director:	Onno Ruhl	Michael F. Carter
Sector Manager:	Simeon Kacou Ehui	Gajanand Pathmanathan
Project Team Leader:	William B. Magrath	Willem G. Janssen
ICR Team Leader:	William B. Magrath	
ICR Primary Author:	Mohinder S. Mudahar	
	Miki Terasawa	

Sustainable Rural Livelihoods and Security through Innovations in Land and Ecosystem Mgmt /Additional GEF financing to India NAIP - P112060[2]		
Positions	**At ICR**	**At Approval**
Vice President:	Philippe H. Le Houerou	Isabel M. Guerrero
Country Director:	Onno Ruhl	Roberto Zagha
Sector Manager:	Simeon Kacou Ehui	Gajanand Pathmanathan
Project Team Leader:	Ranjan Samantaray	Yuka Makino
ICR Team Leader:	Ranjan Samantaray	
ICR Primary Author:	Ravindranath Nijavalli Hanumantharao	
	Indu Krishnamurthy	

F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)
To contribute to the sustainable transformation of Indian agricultural sector from an orientation of primarily food self-sufficiency to one in which a market orientation is equally important for poverty alleviation and income generation. The specific objective is to accelerate the collaborative development and application of agricultural innovations between public research organizations, farmers, private sector and other stakeholders.

Revised Project Development Objectives (as approved by original approving authority)
N/A

Global Environment Objectives (from Project Appraisal Document)
To support strengthening the institutional and community capacity on sustainable land and ecosystem management through approaches and techniques that combine innovative and indigenous techniques for restoring and sustaining the natural resource base, including its biodiversity, while taking into account of climate variability and change

[2] This ICR highlights key SLEM achievements, which is drawn from the independent SLEM ICR prepared by this team.

Revised Global Environment Objectives (as approved by original approving authority)
N/A

(a) PDO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Number of partnerships between public research system, private sector and other stakeholders			
Value (quantitative or Qualitative)	0	50 consortia		145 consortia
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** NAIP financed 200 consortia, 145 of which were based on partnerships between public, private, and other stakeholders (equaling 290% of the initial target).[3]			
Indicator 2 :	Increase in agricultural innovations by end of project			
Value (quantitative or Qualitative)	0	155 innovations		485 innovations
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** There were 85 innovations in frontier science, which were patented. In addition, 400production and processing technologies were developed, transferred, and adopted by target farmers in value chain development and livelihoods enhancement.			
Indicator 3 :	Collaborative research or extension sub-projects under implementation or completed			
Value (quantitative or Qualitative)	0	91sub-projects through public private partnership		91 sub-projects through public private partnership
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** Core sector indicator retrofitted (detailed in Section 1). 161 private sector institutions and NGOs participated in development and implementation of 91 sub-projects.			

[3] The target of 50 consortia was composed of 15, 20, and 15 consortia in components 2, 3, and 4, respectively. Component 1 (ICAR capacity building) had a target of 15 consortia but through sponsored consortia (pre-identified by ICAR with no competitive selection) largely within the National Agriculture Research System (NARS). NAIP financed 55 consortia in component 1.

(b) GEO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Over 10,000 ha of agricultural land under sustainable land management practices			
Value (quantitative or Qualitative)	0	10,000 ha		8,371 ha
Date achieved	3/31/2009	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Substantially Achieved:** The practices to reverse land degradation were adopted on 8,371 ha (84% of target). This includes degraded coastal land.			
Indicator 2 :	2,500 farmers have adopted coping mechanisms for climate variability and change			
Value (quantitative or Qualitative)	0	2,500 farmers		33,902 farmers and fishermen
Date achieved	3/31/2009	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** 17,702 farmers and 16,200 fishermen benefitted from ICT-based early warning and advisory services.			

(c) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Component 1: Number of mass communication campaigns launched by media type (TV, radio, print, email, web)			
Value (quantitative or Qualitative)	0	17 campaigns		1,155 campaigns
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** These communication campaigns were launched through ICT (e-mail and websites) at large and other media, such as magazine, newspaper, radio, TV, and exhibitions.			
Indicator 2 :	Component 1: Increase in number of linkages formed with Krishi Vigyan Kendras (KVKs)[4] and community information centers (%)			
Value (quantitative or	1,000 linkages	50% increase in linkages		74% increase in linkages

[4]KVKs are district agriculture science centers linking agricultural research and extension system under the Agricultural Extension Division of ICAR. At this time, there are 636 KVKs throughout the country, which are hosted by ICAR, State Agricultural Universities (SAUs), other educational institutions, state governments, private sector, and NGOs.

Qualitative)				
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** Linkages were established through ICT-based knowledge platforms, such as agropedia and vKVK, which provided early warning and extension advisory by SMS and voice messages.			
Indicator 3 :	Component 1: The number of hits on the Indian Council of Agricultural Research (ICAR) and State Agricultural University (SAU) websites per month			
Value (quantitative or Qualitative)	50,000 hits per month	55,000 hits per month		317,239 hits per month
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** Because the project improved availability of on-line academic resources, ICAR website alone had monthly hits of about 296,000 nationally and internationally. The websites of SAUs had 11,000 hits per month, and those of ICAR institutes had about 10,000 hits.			
Indicator 4 :	Component 1: Increase in number of queries responded to from public, private, organizations, and NGOs per month (%)			
Value (quantitative or Qualitative)	1,000 queries responded	75% increase in queries and responses		101% increase in queries and responses
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** Helpdesk was established and addressed queries on sub-project design and assisted concept note and proposal preparation. Other queries, such asNAIP participation, technologies, marketing, and agribusiness were addressed by Project Implementation Unit (PIU) or relevant consortia.			
Indicator 5 :	Component 1: Total number of business planning and development units (BPDUs) established			
Value (quantitative or Qualitative)	0	5 BPDUs established		23 BPDUs established
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** BPDUs were established at23 ICAR institutes, 5 of which also served as zonal technology management (ZTM) units. The BPD and ZTM units supported business incubation, patent and license applications and provided agri-business consultancies.			
Indicator 6 :	Component 1: Total number of applications for patents and licenses			
Value (quantitative or Qualitative)	15 applications	30 applications		517 applications
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** BPDUs supported application of 186 patents[5] and 331 licenses. About 60 percent of license applications were in agriculture and horticulture.			
Indicator 7 :	Component 1: Annual number of people attending visioning and policy analysis events organized through or in association with NAIP			

[5] This includes 85 applications under the frontier agricultural research (see Indicator 27).

Value (quantitative or Qualitative)	150 participants per year	300 participants per year		1,024 participants per year (on average)
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** NAIP organized 184 visioning and policy analysis events, in which 7,682 participated. Topics included climate change, carbon finance, agriculture market intelligence, and gender.			
Indicator 8 :	Component 1: Number of weeks for the procurement cycle of high thresholds goods			
Value (quantitative or Qualitative)	50 weeks	30 weeks		26 weeks
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** The procurement cycle was reduced by 92 percent over the baseline.			
Indicator 9 :	Component 1: Share of ICAR finance managers that use the new financial management software system (%)			
Value (quantitative or Qualitative)	0	100%		80%
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Substantially Achieved:** There was a delay in outsourcing and software purchase. However, new FMS was used at all key ICAR institutes. ICAR allocated funds to train the remaining institutes by December 2014.			
Indicator 10 :	Component 2: Total number of consortia formed in component 2			
Value (quantitative or Qualitative)	0	15 consortia		51 consortia
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** In value chain development, NAIP financed 51 consortia with 191 partners, about 37 percent of which were private sector and NGOs. Each consortium had at least one private sector partner.			
Indicator 11 :	Component 2: Total number of NAIP production technologies released and adopted			
Value (quantitative or Qualitative)	0	35 production technologies		99 production technologies
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** About 36 percent of production technologies were in horticulture (such as xanthophyll enhancement in marigolds and organic fertilizer from banana pseudo stem), followed by agro-forestry and fishery (both 20 percent).			
Indicator 12 :	Component 2: Total number of processing technologies released and adopted			
Value (quantitative or Qualitative)	0	40 processing technologies		174 processing technologies
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments	**Achieved:** About 50 percent of these technologies were in horticulture (such as			

(incl. % achievement)	saffron post-harvest processing) and crops (e.g., sorghum and millet foods).

Indicator 13 :	Component 2: Total number of new rural industries established			
Value (quantitative or Qualitative)	0	14 new industries		47 new industries
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** Theproduction value of these industries over five years amounted to Rs. 109 million (about US$ 1.8 million). About 62 percent of the industries were in horticulture, followed by agro-forestry and fishery (about 15 percent each).			
Indicator 14 :	Component 2: Total number of product groups for which national or regional quality grades have been agreed on through NAIP consortia			
Value (quantitative or Qualitative)	0	10 product groups		27 product groups
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** All 27 product groups had quality grades agreed at the national level. Furthermore, the natural dye product group had international recognition by the Global Standards for Organic Textiles.			
Indicator 15 :	Component 2: Total number of private sector organizations participating in consortia			
Value (quantitative or Qualitative)	0	40 private sector organizations		51 private sector organizations
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** The51 private sector and 18 NGO partners participated in value chain development consortia.			
Indicator 16 :	Component 2: Total number of farmers involved in consortium activities			
Value (quantitative or Qualitative)	0	3,000 farmers		79,758 farmers
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** The sub-projects benefitted 9,705 farmers with agricultural inputs and technology transfer. These technologies were also adopted voluntarily by over 70,000 farmers, who were not targeted by sub-projects.			
Indicator 17 :	Component 3: Total number of consortia formed in component 3			
Value (quantitative or Qualitative)	0	20 consortia		33 consortia
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** In rural livelihood security enhancement, NAIP financed 33 consortia, composed of 183 partners, 54 percent of which were NGOs, private organizations and public institutions other than ICAR and SAUs.			
Indicator 18 :	Component 3: Total number of consortium developed technologies made available in disadvantaged areas			
Value	0	300 technologies		409 technologies

(quantitative or Qualitative)				
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** More than 70 percent of these technologies were related to integrated farming systems (e.g., rice, fish, and poultry model in Tamil Nadu), crops, and livestock (improved varieties and area-specific production practices).			
Indicator 19 :	Component 3: Total number of improved technologies adopted in disadvantaged areas			
Value (quantitative or Qualitative)	0	80 technologies		127 technologies
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** More than 80 percent of adopted technologies were integrated farming systems (see above).			
Indicator 20 :	Component 3: Total number of farmers (millions) using NAIP technologies in the disadvantaged areas			
Value (quantitative or Qualitative)	0	0.6 million farmers		0.8 million farmers
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** The sub-projects benefitted 176,519 targeted farmers with agricultural inputs and technology transfer. These technologies were also adopted voluntarily by over 633,000 farmers (not targeted by sub-projects).			
Indicator 21 :	Component 3: Increase in agriculture services and processing enterprises in project areas (%)			
Value (quantitative or Qualitative)	2,790 services and enterprises in project areas	20% increase		45% increase
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** More services and enterprises became available, including para-vets, entrepreneurs, marketing outlets, primary processing centers, and custom hiring centers for improved agricultural implements and machinery.			
Indicator 22 :	Component 3: Total increase in agriculture based employment amongst participating farming households (employment years)			
Value (quantitative or Qualitative)	0	9,000 employment years		113,403 employment years
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Significantly exceeded:** Among targeted 176,519 households, the rural livelihood security enhancement sub-projects generated incremental 113,403 employment years (full time equivalent) over 4 years.			
Indicator 23 :	Component 3: Total number of farmer groups involved in project activities			
Value (quantitative or Qualitative)	0	150 farmer groups		3,198 farmer groups
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments	**Achieved:** 3,191 commodity interest groups (CIGs) and women self-help groups			

(incl. % achievement)	(SHGs), and 7 producer companies were formed by the rural livelihood security sub-projects.			
Indicator 24 :	Component 4: Total number of consortia formed in component 4			
Value (quantitative or Qualitative)	0	15 consortia		61 consortia
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Significantly exceeded:** In frontier areas of agricultural science research, the project financed 61 consortia, composed of 258 partners, mostly public.			
Indicator 25 :	Component 4: Number of annual overseas exchange visits/training programs on basic/strategic research related topics by Indians scientists			
Value (quantitative or Qualitative)	0	50 scientists per year		70 scientists per year (on average)
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Achieved:** NAIP supported a total of 904 experts to participate in international visits or training, 487 of whom benefitted from basic and strategic research.			
Indicator 26 :	Component 4: Total number of papers published in high impact international scientific journals			
Value (quantitative or Qualitative)	0	60 papers		427 papers
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Significantly exceeded:** 427 papers were rated above 6 (out of 10), according to the Indian National Academy of Agricultural Sciences. 22 percent (95 papers) were among top ranked (above 8).			
Indicator 27 :	Component 4: Total numbers of patent applications based on NAIP funded research			
Value (quantitative or Qualitative)	0	30 applications		85 applications
Date achieved	10/3/2006	06/30/2014		06/30/2014
Comments (incl. % achievement)	**Exceeded:** 85 patents, including one international patent cooperation treaty (PCT) application, were filed in frontier areas of agriculture science alone.50 percent of these applications were in basic scientific research, including dairy and nanotechnology.			

G. Ratings of Project Performance in ISRs

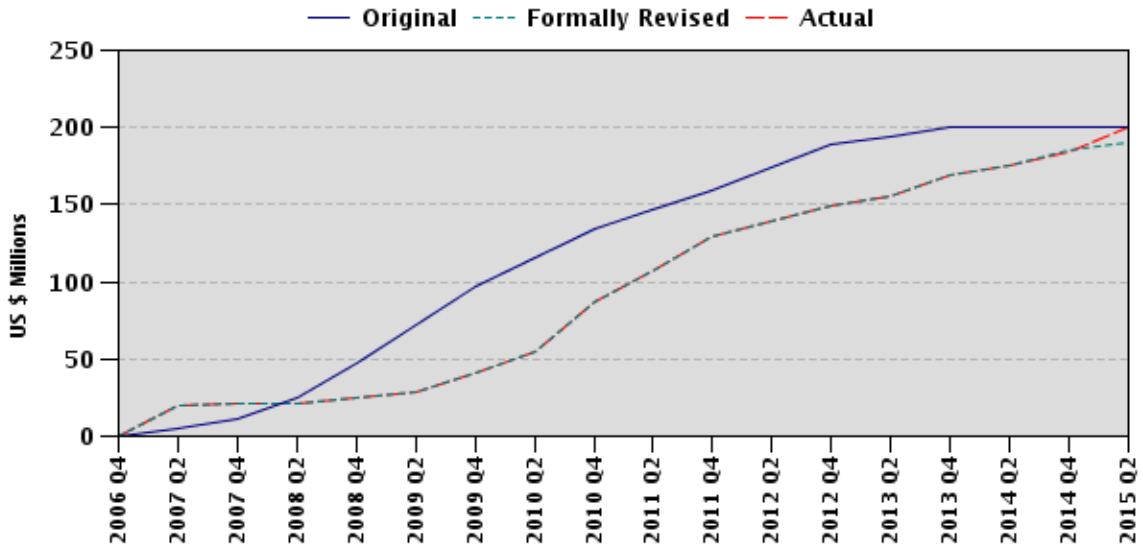
-						
No.	Date ISR Archived	DO	GEO	IP	Actual Disbursements (USD millions)	
					Project 1	Project 2
1	07/24/2006	S		S	0.00	0.00
2	10/04/2006	S		S	0.00	0.00
3	04/10/2007	S		S	20.22	0.00
4	10/05/2007	S		S	20.78	0.00
5	05/26/2008	S		MS	21.70	0.00
6	11/28/2008	S		MS	27.18	0.00
7	05/18/2009	S		MS	32.26	0.00
8	11/25/2009	S	S	MS	51.31	0.00
9	05/21/2010	S	S	MS	76.31	0.70
10	07/27/2010	S	S	MS	86.70	0.88
11	02/05/2011	S	S	S	107.16	0.95
12	05/16/2011	S	S	S	116.40	1.14
13	08/28/2011	S	S	S	134.12	2.13
14	02/10/2012	S	S	S	139.29	2.59
15	08/20/2012	S	S	MS	151.00	3.38
16	12/14/2012	S	S	MS	155.83	3.63
17	05/31/2013	S	MS	MS	168.79	5.61
18	10/14/2013	S	S	MS	172.76	5.61
19	06/24/2014	S	S	S	183.81	7.34

H. Restructuring (if any)

Restructuring Date(s)	Board Approved		ISR Ratings at Restructuring			Amount Disbursed at Restructuring in USD millions		Reason for Restructuring & Key Changes Made
	PDO Change	GEO Change	DO	GEO	IP	Project1	Project 2	
03/22/2011	N		S		S	115.62		IDA extension of closing date (to June 30, 2014)
08/16/2013		N		MS	MS		5.61	GEF extension of closing date (to June 30, 2014)
12/10/2013	N		S		MS	175.90		IDA partial cancellation of US$ 10 million likely savings (due to exchange rate fluctuations)

I. Disbursement Profile

P092735



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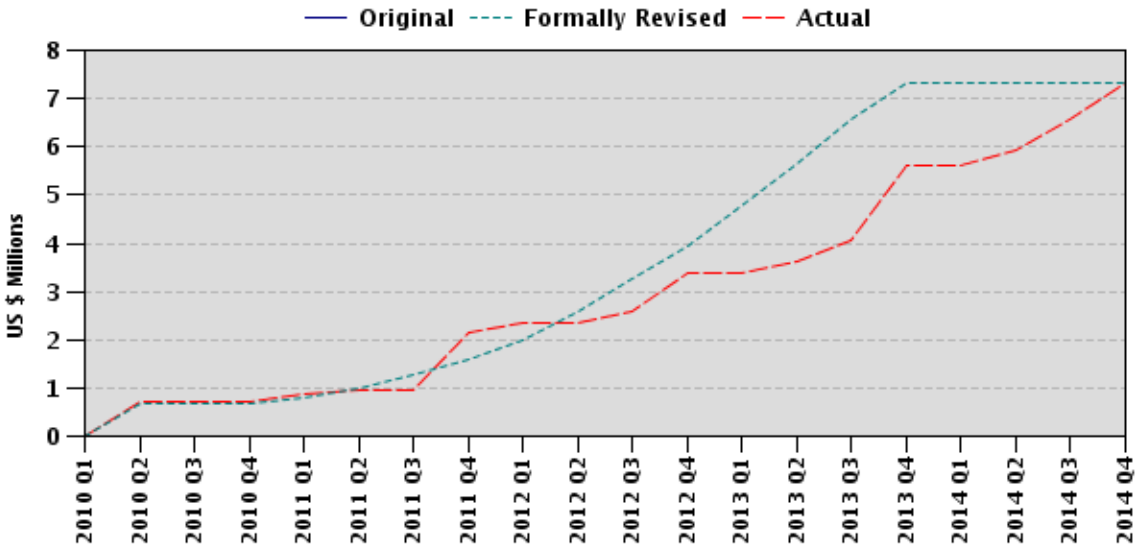
Original
Formally Revised
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2013 Q2
2013 Q3
2013 Q4
2014 Q1
2014 Q2
2014 Q3
2014 Q4

1. Project Context, Development and Global Environment Objectives Design

1.1 Context at Appraisal

1.1.1 From the late 1990s to early 2000s, Indian agriculture underwent considerable change. National food self-sufficiency was achieved, and demand for income elastic products, such as fruits, vegetables, meat, eggs, fish, milk, sugar, and edible oil, increased and encouraged diversification. Agriculture development was transitioning from production based to more market driven. However, many poor households remained food insecure. About 80 percent of the 260 million people below the poverty line in India lived in rural areas and depended on agriculture for their livelihoods. Most were small and marginal farmers exploiting a fragile resource base or were landless laborers. Market driven agricultural development affected producer incomes, consumer prices, employment, wages, and livelihoods.

1.1.2 To generate additional income and employment for the rural poor, the role of agricultural research and development (R&D) was recognized critical. With the limited scope for area expansion, enhanced productivity, profitability, and competitiveness were coming to be seen the main sources of agricultural growth. This had to be triggered by innovations and applications of science in agriculture through transformation from resource and input based growth into knowledge and science based growth. R&D should assume greater importance because it was a cost-effective method for promoting productivity and sustainability and attaining competitiveness. In the context of development of marginal and disadvantaged areas, where possibility of irrigation expansion was very limited, it was believed that productivity could only be enhanced by technological advancements complemented with institutional and policy support. Given these, the challenges for the National Agricultural Research System (NARS), led by the Indian Council of Agricultural Research (ICAR), were threefold: understanding the growing importance of market and agri-business; addressing the problems of the many poor farm families living in disadvantaged areas; and strengthening its position at the frontiers of agricultural science. By implementing three preceding World Bank financed projects, [6] ICAR/NARS developed considerable technical capacity and gradually strengthened its focus on farmers, non-staple foods, and interaction with the private sector. The National Agricultural Innovation Project (NAIP) was designed to support the development and implementation of innovations in agriculture through collaboration among farmers, private sector, civil society, and public sector organizations, in response to the new opportunities and constraints created by the transformation of Indian agriculture.

1.2 Original Project Development Objectives (PDO) and Key Indicators (as approved)

[6] The three predecessor projects were the National Agricultural Research Projects I and II, and the National Agricultural Technology Project (NATP).

1.2.1 The PDO was *to contribute to the sustainable transformation of Indian agricultural sector from an orientation of primarily food self-sufficiency to one in which a market orientation is equally important for poverty alleviation and income generation*. *The specific objective was to accelerate the collaborative development and application of agricultural innovations between public research organizations, farmers, private sector and other stakeholders.* The two PDO indicators were:

- Number of partnerships between public research system, private sector, and other stakeholders
- Increase in agricultural innovations by end of the project

1.3 Original Global Environment Objectives (GEO) and Key Indicators (as approved)

1.3.1 The NAIP was partially blended with the Global Environment Facility (GEF), financing 3 research consortia under the rural livelihood security component. The GEO was *to support strengthening the institutional and community capacity on sustainable land and ecosystem management through approaches and techniques that combine innovative and indigenous techniques for restoring and sustaining the natural resource base, including its biodiversity, while taking into account of climate variability and change*. The two GEO indicators were:

- Over 10,000 ha of agricultural land under sustainable land management practices
- 2,500 farmers have adopted coping mechanisms for climate variability and change

1.4 Revised PDO (as approved by original approving authority) and Key Indicators, and reasons/justification

1.4.1 The PDO remained unchanged. However, with the introduction of core sector indicators, the following was retrofit and monitored since January 2013:[7]

- Collaborative research or extension sub-projects under implementation or completed

1.5 Revised GEO (as approved by original approving authority) and Key Indicators, and reasons/justification

1.5.1 The GEO and key indicators remained unchanged.

1.6 Main Beneficiaries

[7]The indicator was retrofitted through the implementation status and results (ISR) No. 16, which was archived in January 2013.

1.6.1 In accelerating development and application of agricultural innovations, the main project beneficiaries were farmers, entrepreneurs, private sector and other consortium partners, and ICAR/NARS.

- **Farmers, including those in agro-climatically disadvantaged areas.** Targeted farming households benefitted from NAIP technologies and innovations in production, natural resource management, and processing. The rural livelihood security sub-projects supported vulnerable farmers, including small and marginal landholders, tribal populations, and women, in agro-climatically disadvantaged districts identified by Planning Commission of the Government of India (GOI).[8] GEF, in particular, focused on the most vulnerable areas, such as salt-affected coastal zones, tribal-dominated mountainous region, and drought-prone dry land.
- **Entrepreneurs.** Entrepreneurs benefitted from processing technologies as well as agribusiness incubation support provided by business planning and development units (BPDUs) established at selected ICAR institutions.
- **Private sector and other consortium partners.** Private sector benefitted by partnering in value chain development consortia and also by commercializing NAIP technologies. NGOs and international agricultural research institutes[9] also benefitted as consortium partners in rural livelihood security enhancement.
- **ICAR/NARS.** NARS comprises of ICAR, State Agriculture Universities (SAUs), and other national agricultural institutes. They managed or participated in sub-projects as consortium leaders or partners and benefitted from the project's institutional and infrastructure capacity development programs and activities.

1.7 Original Components (as approved)

1.7.1 NAIP had four components. Component 1 supported ICAR institutional capacity building and project management. The remaining three components provided competitive grants to consortia to generate knowledge and technologies and provide expert technical support in value chain development (Component 2), rural livelihood security enhancement (Component 3), and frontier areas in agricultural science research (Component 4).

1.7.2 **Component 1. ICAR as the catalyzing agent for management of change in the Indian NARS (US$ 46 million).**This component supported NARS institutional and infrastructure capacity development and project management, including (a) accelerating commercialization of NAIP technologies through BPDUs; (b) strengthening communication outreach and ICT-based knowledge management; (c) developing human

[8]These districts were determined on the basis of agricultural productivity per worker, agricultural wage rate, and percentage of scheduled caste and tribe populations.

[9] The international institutes include International Rice Research Institute (IRRI), International Water Management Institute (IWMI), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Food Policy Research Institute (IFPRI), and International Livestock Research Institute (ILRI). Their staff costs, which amounted to US$ 1 million, were financed by the International Fund for Agriculture Development (IFAD).

resources, financial management system (FMS), and management information system (MIS); and (d) building capacity in research and development, agricultural research policy (including gender and visioning) and impact assessment capacity.

1.7.3 **Component 2. Research on production to consumption systems (PCS) (US$ 75 million).** This component supported establishment of market-oriented collaborative research alliances in developing profitable and sustainable PCS (value chains) in selected agricultural sub-sectors. Financing was provided to value chain consortia dealing with production, harvesting, processing, and marketing.

1.7.4 **Component 3. Research on sustainable rural livelihood security (US$ 73 million).** This component supported technology transfer and agricultural service provision to farmers in disadvantaged areas, such as rain-fed, hilly and mountainous, arid land, tribal dominated areas, and coastal land, in improving their agricultural production systems. GEF financed 3 sub-projects,each supported one of the following themes: reversing land degradation, conserving biodiversity, or reducing climate change vulnerability.

1.7.5 **Component 4. Basic and strategic research in frontier areas of agricultural science (US$ 56 million).** The component focused on promoting and maintaining scientific competence to meet emerging challenges. It also had emphasis on obtaining intellectual property rights (patents and licenses) by financing focused research in well-defined areas of frontier science with strong bearing on Indian agriculture. The component financed training in advanced techniques, establishment of laboratories, and procurement of scientific equipment needed for upstream research.

1.8 Revised Components

1.8.1 The above components remained unchanged during implementation.

1.9 Other significant changes

1.9.1 The project had one additional financing and three level II restructurings. GEF financing (US$ 7.34 million) for the Sustainable Rural Livelihoods and Security through Innovations in Land and Ecosystem Management Project (SLEM) was approved in August 2009, as an Additional Financing to NAIP. It complemented rural livelihood security component. In March 2011, the closing date for IDA was extended to June 30, 2014, and that of GEF was extended in August 2013 to coincide with the above IDA closure.[10] In December 2013, due to exchange rate fluctuations, a partial cancellation was approved for likely savings of US$ 10 million (detailed in Section 2.2).[11]

[10] The NAIP extension was for 18 months. The original closing date was December 31, 2012. The GEF extension was for 10 months. The original closing date was August 31, 2013.
[11] The cancellation was from the Credit No. 41620-IN.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

2.1.1 Project preparation is rated satisfactory. Building on NATP's key outcomes, [12] NAIP was designed to accelerate pluralism, decentralization, and commercialization in agriculture innovation and application. The project adopted a consortium approach in sub-project design and implementation, intending to provide larger sub-grants (ranging US$ 3 to 10 million) on competitive basis, in value chain development, rural livelihood security enhancement, and frontier agricultural science research. In enabling the project implementation, substantial capacity building was planned for ICAR system, including SAUs and Krishi Vigyan Kendras (KVKs), which were agriculture science centers linking research and extension at local level.

2.1.2 In providing large sub-grants through consortium approach, major risks were governance and decentralized fiduciary management. To provide appropriate support for potential participants and to increase participation by non-NARS institutions, communication outreach was strengthened, and a helpdesk was established to support concept note preparation, proposal development and quality control. Transparent two-stage selection processes (concept note and full-proposal submissions) were also set forth. In ensuring financial management and procurement, each consortium partner was a cost center as well as a procurement agency, which enabled direct fund flow from PIU and reduced transactions. [13] An on-line financial management system was developed to facilitate this delegation of authority that would enable access by ICAR institutes, SAUs and non-NARS institutions.

2.2 Implementation

2.2.1 Overall implementation is rated satisfactory. There were two phases in implementation, i.e., consortium selection and sub-project implementation support. In selecting consortia, the project had to reduce the size of sub-grants, because proposals were substantially smaller than anticipated, including those submitted by sponsored consortia, which were pre-identified by ICAR. NAIP launched 3 calls for proposals, reviewed 1,475 concept notes, and selected 200 sub-projects/consortia, focusing partnership (in particular, pluralism among participants and private sector engagement) and innovativeness (while the project aimed to finance 65 consortia for all four components).[14] These consortia involved 838 public, private, and NGO partners.[15] 139 consortia (about 70 percent) were selected competitively. The increase in the number of

[12] NATP developed the district-based Agricultural Technology Management Agency (ATMA) model, which facilitated farmer to farmer technology dissemination and developed high value crop supply chains and market linkages through public-private partnership.

[13] This built on lessons learned from NATP. Cost centers in NATP were only consortium leaders, which channeled funds to consortium members. This slowed fund flows.

[14] The target of 65 consortia includes that of 15 under component 1 (detailed in footnote 2 in results framework).

[15] This does not include GEF consortia. Three GEF consortia were participated by 18 partners.

consortia as well as participating institutions had a substantial impact on processing time and sub-project implementation support, particularly FM, procurement, M&E, and project management at component and project levels. The consortia selection involved stringent peer review and committee approval processes. While the processing time was reduced to 6 months over 3 calls,[16] it took overall 36 months to complete consortium selection. The project had substantially more entities to build FM and procurement capacity prior to the first release of fund (detailed in Section 2.4). In the first two years, the project had small disbursement, due to delayed consortium selection and sub-project start-up. Implementation progress was rated moderately satisfactory in May 2008. There was a delay in fulfilling one legal covenant. An internal auditor was appointed only in February 2009.

2.2.2 After NAIP completed consortium selection, disbursement improved around June 2009. Implementation was initially slow, particularly for component 1 sub-projects, which either had delays in consortium set-up or were procuring large as well as highly complex technical items, such as super computers, bioinformatics grid, MIS/FMS, and bio security level (BSL) 3 laboratories. Around January 2010, with good sub-project implementation progress by a large number of consortia, disbursement started accelerating. During the second mid-term review in May 2010, a consortium scorecard was introduced as a performance monitoring tool. About 80 percent of consortia were rated highly satisfactory or satisfactory. The remaining consortia were rated moderately satisfactory, and performance improvement plans were developed and strengthened sub-project implementation.[17] In January 2011, in recognition of the accelerated disbursement, implementation progress was upgraded to satisfactory, and 18-month extension of closing date was approved by the Country Director in March 2011. From June 2011 to project closure, disbursement was steady. Because of delays in extensions of sub-project closing dates as well as key M&E activities, such as documenting results and lessons learned, implementation progress was downgraded to moderately satisfactory in August 2012. Implementation Progress ratings were not necessarily linked to disbursement but put pressure on PIU to enhance quality of implementation and encourage higher achievements.

2.2.3 In consolidating the project achievements, reallocations between components were approved by the Bank, which increased allocations for the components 1 and 4 by 210 and 144 percent, respectively (see Annex 1). This was to strengthen ICAR capacity in research, knowledge management, and operation by (a) covering cost overrun to purchase key ICT systems and other research equipment; (b) increasing international training participation by about 15 percent; and (c) providing additional funds to promising sub-projects in frontier agricultural science (such as nanotechnology).While the project was on track to fully disburse IDA financing agreed at appraisal (US$ 200 million),because of currency fluctuations (exchange rates from XDR to US$ and from

[16] While the first call for proposals took 18 months to process, it took only 11 months in the second call and 6 months in the third call.

[17] 40 consortia were rated moderately satisfactory and improved performance by implementing those plans. One consortium was rated unsatisfactory and was not extended.

US$ to Rs.), likely savings of about US$ 10 million (equivalent to about XDR6.52 million) were confirmed. A partial cancellation was approved by the Country Director in December 2013. In early 2014, the project initiated pending third party final impact evaluations and case studies, both of which were completed on time. Project implementation was upgraded to satisfactory in May 2014.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

2.3.1 M&E is rated overall substantial. By design, each consortium established an M&E unit, collected baseline information in targeted areas, and monitored sub-project outputs and outcomes. The data were aggregated by the NAIP M&E unit to capture the project level outputs and outcomes and update the results framework.

2.3.2 During the implementation, the increased number of consortia made M&E challenging. However, the project collected and managed robust sub-project data from each consortium, and regularly updated the NAIP MIS. Moreover, the data supported developing the consortium scorecard and tracking the progress towards agreed benchmarks. The data were also used by component coordinators to analyze achievements and prepare biannual reports at the component level. At the project level, data aggregation and analysis across components were undertaken (such as increase in entrepreneurs or agricultural services, and number of female beneficiaries) but could have been improved even further. The project's internal monitoring was complemented by third party final impact evaluation and case studies.[18]

2.3.3 The project achieved or exceeded almost all targets in the Results Framework. The project outcomes were significantly more than anticipated at appraisal, particularly in enhancing market orientation in agricultural sector, which was the overall project development objective. In hindsight, one could argue that the results framework could have measured such achievements at project level, while there were a few such intermediate outcome indicators at component level. In addition, the targets could have been rationalized, for example after the completion of consortium selection.

2.4 Safeguard and Fiduciary Compliance

2.4.1 Financial Management. FM is rated overall moderately satisfactory. Like M&E, the key challenge in fiduciary compliance was managinga larger number of consortia. Risks were substantial during implementation, because of NAIP's geographical spread and complexity, involving increased number of NARS and non-NARS consortium participants. FM training was given to each consortium partner, and FM capacity had to be certified prior to first fund release.

2.4.2 NAIP arranged two tracks in auditing. ICAR institutions were audited by GOI's Controller and Auditor General, while other stakeholders (SAUs, non-NARS research institutions, private sector and NGO partners) were audited by private certified

[18] This was contracted to Price Waterhouse Coopers.

accountants.[19] Reports were consolidated into audited financial statements, and combined audit opinions were issued. This helped NAIP focus on monitoring high risk transactions. In complementing annual audit reports, quarterly internal audit was also carried out by an international certified accountant,[20] whose feedback was given to PIU (including component coordinators at internal audit committee meetings) and reflected in FM and procurement capacity building programs.

2.4.3 There were no major delays in submitting Interim Financial Reports and Audit Reports, despite additional steps in consolidations. There was an audit disallowance of about Rs. 33 million (about US$ 550,000) for FY2008-09 and 2009-10. In FY2010-11, the auditor disallowed expenditures of Rs. 25 million (about US$ 420,000).

2.4.2 Procurement. Overall procurement was rated moderately satisfactory. Risk associated with procurement during implementation was rated substantial, because of decentralized procurement at consortium level. Given limited capacity of consortium partners, PIU provided a detailed list of frequently asked questions (FAQs) that complemented the procurement manual. It also prepared a project overall procurement plan as a planning and monitoring tool and implemented capacity building programs, including training of 1,500 officials as a procurement focal person (trainer of training) to support consortium partners.[21] The training programs built procurement capacity at consortium level and enabled PIU and consortia successfully handle highly complex consultancy and high value ICT procurement. Despite the complex, decentralized transactions amounting to about US$ 60 million in total, there were only 7 grievances related to procurement during project implementation, and all were satisfactorily addressed. Procurement capacity was built at PIU as well as consortia with reasonable improvements reflected in the post-procurement reviews.

2.4.3 Safeguards. Safeguards were rated satisfactory. NAIP was a category B project. Environmental Assessment (OP/BP 4.01) and Pest Management (OP/BP 4.09) were triggered, and Environment and Social Management Framework was prepared. The safeguard implementation was monitored at consortium level. Overall, there was no major compliance issue.

2.4.4 In value chain development and rural livelihood security enhancement sub-projects, about 11,000 farmers were trained in integrated pest management (IPM), including safe storage and use of pesticides. The sub-projects, where feasible, also introduced other environmentally friendly technologies and practices, such as crop residue management, bio-pesticides, "waste to wealth",[22] vermi-compost, and organic

[19] The Bank waived submission of audit reports for those consortium partners (around 30 organizations) with an expenditure less than Rs. 500,000 (about US$ 8,300). Instead they submitted annual financial statements certified by the head of agency.
[20] The project contracted Ernst and Young
[21] Procurement training focused on shopping and NCB. International or other complex procurement was supported by PIU.
[22] The project encouraged to use or commercialize by-products, such as decentralized power generation from plant stalks, fabric production from banana pseudo stem, and pollution-free coconut shell charcoals.

farming. These climate smart interventions were adopted by farmers and even scaled up where there were economic incentives. For example, in one sub-project, by adopting blast resistant variety of Basmati rice, farmers reduced use of fungicide and saved about Rs. 687/ha/year. Other farmers sold crop residues at Rs. 400 to 500/ton, by using biomass for power generation or biogas. In another sub-project, low cost sensors were introduced for real time application of variable rate inputs, which reduced fertilizer use on wheat by 10 percent (18kg N/ha) while increased yield by 3 percent.

2.5 Post-completion Operation/Next Phase

2.5.1 GOI requested a follow-on operation titled National Agricultural Education Project (NAEP), which is under preparation. The proposed project would strengthen SAUs in lagging states, including establishment of centers of excellence for teaching, research and extension. It would also strengthen and scale up NAIP-initiated activities within and outside of NARS, such as skill and capacity development of scientists and ICT-based knowledge management. NAEP would use the existing NAIP PIU for project preparation and management.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

3.1.1 The NAIP objectives, design, and implementation were highly relevant. The objectives were consistent with the India Country Assistance Strategies (CAS) 2005-2008, and remained so for the Country Partnership Strategies (CPS) of 2009-2012 and 2013-2017. In partnership with industries and entrepreneurs, the project supported private sector led growth and poverty reduction by strengthening innovative agricultural research and development and transferringthose to farmers, in particular thosein disadvantaged areas. The NAIP objectives were also highly relevant to GOI's National Agricultural Policy and the 10^{th} Five Year Plan (FYP), and remained so for the 11^{th} and 12^{th} FYPs. The project supported a market orientation by innovatively engaging entrepreneurs and private sector to transfer technologies to farmers and increase employment opportunities in agricultural production and processing. GEF was also relevant in promoting sustainable agricultural development, by addressing climate change adaptation in agricultural sector.

3.1.2 NAIP was designed following on the experience of earlier projects to finance sub-projects in (a) innovative agricultural research and commercialization, (b) technology transfers in value addition and rural livelihood enhancement in disadvantaged districts, and (c) NARS capacity development. Sub-projects were developed and implemented through a consortium approach by engaging private sector, NGOs, non-NARS universities, and international research institutions, which composed of 21 percent of consortium participants. The project was also designed to support agri-business incubation at BPDUs by transferring innovations and technologies to entrepreneurs.

3.1.3 Implementation was consistent with India's development priorities. The sub-projects were implemented in all 29 states of India and 5 Union Territories (out of 7),

thus, supported all low-income and special category states stipulated in CPS. NAIP set up 23 BPDUs, which supported creation of 91 new agribusinesses, market linkages for 140,000 farmers, and 220,000 new jobs. Moreover, in targeted disadvantaged districts, the project transferred area specific agricultural and natural resource management technologies and generated additional 113,403 employment years over 4 years. On average, there was a 62-percent increase in income among targeted farmers in disadvantaged areas.

Overall relevance

With a relevance of objective rated as high and a relevance of Design and Implementation rated as High, the overall relevance is rated **High**.

3.2 Achievement of Project Development Objectives and Global Environment Objectives

3.2.1 Both NAIP and GEF met their objectives by making significant achievements. The projects achieved or exceeded almost all targets, with only minor shortfalls in one indicator (use of financial management software). The outcomes are summarized below:

3.2.2 Increase in partnerships between public research system, private sector, and other stakeholders (PDO Indicator 1) & Collaborative research or extension sub-projects under implementation or completed (PDO Indicator 3). NAIP financed 200 consortia, participated by 838 public and private partners, NGOs, and international research institutes (achieved the target).[23] Additionally, GEF financed 3 consortia, engaging 18 institutions. The non-NARSprivate sector and NGO partners participated mostly in value chain development and rural livelihood security enhancement in disadvantaged districts (components 2 and 3). They facilitated social mobilization, technology dissemination, and market linkages. To foster partnerships and raise project awareness within and outside of NARS, NAIP launched more than 1,100 communication campaigns through electronicand other media (achieved the target of 17 campaigns) (detailed in Annex 2). Helpdesk was set up, and there was 101 percent increase in responding to queries on NARS and NAIP (substantially achieved the target of 75 percent).

3.2.3 Beyond research partnerships through consortia, the project actively engaged private partners in commercializing NAIP technologies (and some developed by NARS with no NAIP support). At zonal and state levels, the NAIP scaled up entrepreneurship as well as commercialization by setting up 23 BPDUs at selected ICAR institutes (exceeding the target of 5 BPDUs). These units filed 331 licenses for commercial technologies and more than 186 patent applications (total of 517 applications, which exceeded the target of 30). Almost 60 percent of license applications were in agriculture and horticulture, followed by livestock and agricultural engineering. During 4 years of operation, BPDUs also provided consultancy by supporting 1,218 entrepreneurs in

[23] The target of this PDO indicator was 50 consortia in components 2, 3, and 4 only (detailed in Section H).

business incubation, 91 of who initiated new agri-businesses. It is estimated that these agri-businesses, with their products and services, created almost 220,000 jobs and benefitted 140,000 farmers. Four entrepreneurs won national awards for best incubator by the Network of Indian Agri-Business Incubators.

3.2.4 BPDUs showcased NAIP technologies at national level through Agri-Tech Investors Meet in July 2013. More than 400 private entities and scientists participated in the Meet, where 58 NAIP technologies were commercialized to 80 licensees, which was worth Rs. 31.6 million (about US$ 527,000). The highest valued technologies were those developed by frontier agricultural science sub-projects, such as nanosulphur (Rs. 6 million, about US$ 100,000), nano-cellulose synthesis, characterization, and application in biodegradable polymer composites (Rs. 5 million, about US$ 83,000), and non-structural protein based foot and mouth disease diagnosis (Rs. 1.7 million, about US$ 28,000).

3.2.5 During project implementation, BPDUs emerged as a vehicle to foster market orientation in the agriculture sector, as it also gave incentives to supply-side of technologies and innovations. In less than 5 years, BPDUs generated Rs. 241 million (about US$ 4 million) for NARS, from consultancy and license fees (detailed in Annex 2). The revenue was shared among research team (scientists), BPDU, and hosting ICAR institute, which further encouraged innovations. The benefits were recognized by national and state governments, which provided Rs. 160 million (about US$ 2.7 million) to 7 BPDUs.[24] Box 1 in Annex 2 highlights some of key achievements of the BPDU at Indian Agricultural Research Institute (IARI) in Delhi.

3.2.6 Increase in agricultural innovations (PDO Indicator 2). The NAIP developed 485 agricultural innovations in frontier science, production, and processing (exceeded the target of 155). In undertaking the most innovative, cutting-edge agricultural research, the project supported 61 consortia, including nanotechnology (nanosulphur and nano-cellulose synthesis, mentioned above, also detailed in Box 4 in Annex 2), diagnostic and vaccines (foot and mouth disease), establishment of 4 embryonic stem cell lines and cloning buffalo,[25] molecular breeding, genomics, and agro-biodiversity management. Approximately, 427 scientific papers were published in high impact international scientific journals (exceeded the target of 60). 6 consortia received 8 most prestigious national and international awards in agricultural science (detailed in Annex 2).

3.2.7 In developing value chains, the project supported research and development of 273 production and processing technologies (exceeded the target of 75 technologies). These were transferred to almost 80,000 farmers (exceeded the target of 3,000 farmers). The project provided about 9,700 targeted farmers with agricultural inputs and direct technology transfer, thus, about 90 percent of these farmers were spontaneous adopters

[24] This includes the Ministry of Micro, Small, and Medium Enterprises.
[25] Garima-II was produced in August 2010 and gave birth to Mahima, the world first calf born to a cloned buffalo, in January 2013.

via a demonstration effect.[26] Most of these farmers, both targeted and untargeted, were linked to 47 new rural industries established by sub-projects (exceeded the target of 14 industries), through 32 producer companies. Over 5 years, the total production value of these industries was Rs. 109 million (about US$ 1.8 million). Most profitable industries were pulp wood, seafood curry export, fresh water fish processing, nurseries, and mango pulp export, which generated about 80 percent of the total production value (detailed in Annex 2). In addition, sorghum production, milling, and other processing technologies increased net income of participating 1,050 farmers by about 540 percent in kharif (rain-fed) and 110 percent in rabi (winter) seasons in four years. Various sorghum based nutritional products were produced and branded, which was scaled up locally by private sector and nationally by GOI (detailed in Box 2 in Annex 2).

3.2.8 In disadvantaged districts, NAIP transferred 409 local area-specific technologies (exceeded the target of 300 technologies) through the integrated farming system, which offered a package of production and conservation technologies in crops, horticulture, livestock, aquaculture, forestry, irrigation, and/or natural resource management (Box 3 in Annex 2 details the rice, fish, and poultry farmingsystem and its impact in Tamil Nadu). 127 high impact technologies were adopted (exceeded the target of 80) by as many as 810,000 farmers (exceeded the target of 600,000).[27] More than 3,000 farmer groups, including 376 women self-help groups (SHGs), were formed by sub-projects (exceeded the target of 150).

3.2.9 Likewise, GEF reached out to 33,902 farmers and fishermen, who adopted coping mechanisms for climate variability and change by subscribing ICT-based early warning and advisory services, i.e., m-Krishi and m-Fisheries (exceeded the target of 2,500 farmers). For example, m-Fisheries provided information on weather and potential fishing zones (PFZ) on fishermen's mobile devices. As a result, their catch increased by 25 percent. There was substantial reduction in fishing trips, thus diesel consumption. The estimated green house gas (GHG) emissions were around 1.3 million tons of $CO_{2\text{-}e}$ per year, while the State Government saved diesel subsidy of about Rs. 69.9 million per year (about US$ 1.2 million). These services were developed through public private partnership.[28] GEF also formed 178 SHGs and farmer groups, which adopted practices to reverse land degradation or conserve biodiversity, while enhancing their livelihoods by promoting indigenous biodiversity and integrated farming system covering two or three biodiversity. GEF achievements are detailed in the GEF ICR, which was prepared as an independent report.

[26] According to the final impact evaluation, which sampled 20 sub-project from this component, such adoption was particularly high in maize, sorghum, mango, guava, saffron, ginger, flowers, and agro-forestry.

[27] The range of adoption per farm varied from 29 to 100 percent.

[28] In developing m-Fisheries, Indian National Center for Ocean Information Services (INCOIS), National Oceanic and Atmospheric Administration (NOAA) and Central Marine Fisheries Research Institute (CMFRI) provided relevant data. Tata Consultancy Services (TCS) developed the service package and also invested in PFZ communication network.

3.2.10 In NAIP targeted areas, despite agro-climatic and socio-economic disadvantages, there were increases in areas under irrigation by 6,211 ha, in improved crop varieties by 72,191 ha, and in improved vegetables and spices by 10,160 ha in targeted districts (detailed in Annex 2). GEF also brought 8,371 ha under sustainable land management practices that reversed land degradation (substantially achieved the target of 10,000 ha). In NAIP areas, there were substantial increases in production of linseed, redgram, turmeric, cardamom, and "Kardaknath" poultry breed. Learning from the value chain development sub-projects, the rural livelihood security sub-projects also supported development of these value chains in Rajasthan, Bihar, and West Bengal.[29] Seven producer companies involving almost 6,000 farmers had sales of Rs. 246 million (about US$ 4 million). Overall, the rural livelihood security component created additional 113,403 employment years over 4 years (exceeded the target of 9,000 employment years [Full Time Equivalent]) for 176,519 targeted households in disadvantaged districts. While the results varied by sub-project, there was, on the average, an increase in income by 62 percent.[30]

3.2.11 These achievements in agricultural innovations in 3 components were made possible by the project's extensive capacity development programs in and outside of NARS institutions. More than 1,900 NARS scientists benefitted from highly technical training in frontier science, such as genetic marker assisted selection, fermentation technology, nanotechnology, genome resource conservation, carbon trading, neutraceuticals and allele mining. 487 scientists participated in international training (surpassed the target of 420), 21 percent of whom were from SAUs.[31] According to the impact assessment by IFPRI, there was a significant increase in the number of project proposals, technologies developed, patent application, and journal publication among the participants (detailed in Annex 2). In enhancing research capacity, the project also invested in cutting-edge technologies and equipment to improve data processing and sample analysis, including supercomputing hub for bioinformatics,[32] data center, BSL 3 laboratories, and MIS/FMS. FMS was developed and rolled out for application to 80 percent of ICAR finance managers (substantially achieved the target of 100 percent).

3.2.12 In reaching out to non-NARS scientists, students, and farmers, NAIP developed ICT-based knowledge management mechanisms. NAIP introduced e-publishing and made 20 ICAR journals available on-line, including back numbers for the last 20 years.[33]This also required ICAR policy change in publication and its procedures. The on-line journals have been accessed internationally from 184 countries, and the readership increased by 4 to 5 times. For NARS scientists, researchers and students, the project also made other knowledge resources available online, including 2,900 professional and scientific journals, 6,000 Ph. D. theses, and a group catalog of 12 major libraries (detailed

[29]Rajasthan and Bihar are categorized as low-income states (see India CPS 2013-17). West Bengal is considered as such by IFC.
[30] An increase from Rs. 29,298 (about US$ 488) to Rs. 77,532 (about US$ 1,292) (at weighted mean).
[31] The remaining 79 percent were from ICAR institutes.
[32] Advanced **S**upercomputing Hub for OMICSKnowledge in Agriculture (ASHOKA) was set up at ICAR.
[33] These were composed of 3 ICAR journals, 2 semi-technical journals and 15 society journals in agricultural sub-sectors.

in Annex 2). There was a substantial increase in access to ICAR and SAU websites, which were 317,000 hits per month (exceeded the target of 55,000).[34] Additionally, for students a total of 7 on-line agriculture modules at bachelor level were developed, which, according to an independent study, improved students' performance by 20 percent in objective and 6 percent in descriptive assessments.[35] The e-courses for agriculture received GOI's Gold Icon Award for outstanding contribution to ICT in agricultural education and extension. For farmers, NAIP supported development of 4 agricultural knowledge management systems, which provided web-based knowledge platform (rice and other crops), and mobile-based information delivery (SMS or voice alerts) and one-on-one advisory services. Among these systems, vKVK directly linked 191 KVKs with more than 35,000 farmers. Their extension and other queries were addressed by KVK experts.

3.3 Efficiency

3.3.1 The project efficiency is rated high. No economic or financial analysis was undertaken for investments in this project at appraisal. The economic and financial analysis for NAIP is based on a sample of 58 sub-projects out of a total of 200 (about 30 percent of the total). These sample sub-projects represent the diversity of the project and were selected based on purposive stratified sampling methodology. Sub-project interventions for primary survey for the analysis were randomly selected from this pool of sample sub-projects. The main beneficiaries for various project components were: scientists, researchers, entrepreneurs, extension workers, and/or farmersfor components 1 and 4, andfarmers or processors for components 2 and 3. The main sources of information for the analysis were (i) one on one meetings with consortia leaders and partners, secondary information and feedback from the PIU; (ii) one on one interviews with participatory and non-participatory beneficiaries; and (iii) collection of relevant information from the M&E documents for the selected sub-projects. More details of assumptions by components and the methodology for economic and financial analysis of this project are given in Annex 3.

3.3.2 The benefit cost ratios (BCR) and the economic rates of return (ERR) are calculated as part of the economic and financial analysis for the individual project components as well as for the NAIP project as a whole. The estimated results are summarized below:

Table 1. Benefit Cost Ratios and Economic Rates of Return by Component

Item	Financial BCR	Economic BCR	ERR (%)
Component 1: ICAR Capacity Building & Project Management	-	1.54	19.26
Component 2: Value Chain Development	2.12	2.15	50.08
Component 3: Rural Livelihood Security Enhancement	2.02	1.45	43.34
Component 4: Frontier Agricultural Science	-	1.75	57.33

[34] Between October 2013 and July 2014 (10 months), about 8 percent of access to ICAR website was outside of India from different geographical regions and countries, such as US and Indonesia.
[35] NAIP, "Component 1 Final Report," ICAR, June 2014

NAIP Total	**1.78**	**1.69**	**40.00**
GEF	1.97	3.19	-
Grand Total	**1.79**	**1.73**	**-**

3.3.3 The results clearly indicate that the returns to investment in agricultural research and development under NAIP are very high. For NAIP (without GEF), the financial BCR is 1.78, the economic BCR is 1.69, and the ERR is 40 percent. It is important to point out that both BCRs are high for all the sample sub-projects for each of the components, while they vary across sub-projects. The component 4 had high economic BCR (1.75) and the highest ERR (57.33 percent), because of their more likeliness for commercialization at a larger scale. Component 1 had attractive, but relatively low economic BCR (1.54) and the lowest ERR (19.26), as ICAR did not seek commercialization of technologies developed under this component. For the component 2, the economic BCR is slightly higher than the financial BCR (2.15 and 2.12 respectively), because the decline in costs due to adjustment in input costs for non-traded inputs is higher than the increase in costs due to adjustments in input costs for traded inputs. The component 3, on the other hand, has the lower economic BCR than the financial BCR (1.45 and 2.02, respectively), because, after appropriate adjustments, the decline in costs for non-traded inputs is less than the increases in costs in the traded inputs.

3.4 Justification of Overall Outcome and Global Environment Outcome Rating
Rating: Satisfactory

3.4.1 The overall NAIP and GEF outcome rating is satisfactory. These projects met almost all PDO and GEO indicators and exceeded in several. NAIP made substantial contribution to market orientation in the agriculture sector, particularly through the consortium approach and BPDUs' agribusiness incubation. Likewise, GEF innovatively addressed the climate change agenda, especially by the ICT-based early warning and advisory services and conserving biodiversity while enhancing rural livelihoods.

3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

3.5.1 Poverty Impacts. The rural livelihood security enhancement component worked in 60 percent of socio-economically and agro-climatically disadvantaged districts identified by the GOI's Planning Commission.[36] These districts were chronically drought prone, flood affected, rain-fed, hilly, arid land, coastal, and/or tribal areas, spread nationwide. The majority of the beneficiaries were poor: about 74 percent were small and marginal farmers, and 16 percent were landless. Likewise, 90 percent of GEF beneficiaries were marginal farmers. The key difference between this component and Bank's rural livelihood development projects was the focus on transfer and adoption of research-based area specific technologies, which were delivered through integrated farming system. Most of the component 3 sub-projects, in particular GEF-financed ones,

[36] NAIP worked in 91 such disadvantaged districts out of 150.

covered two to three biodiversity in a package, such as crop, livestock, and aquaculture, considering the whole village ecosystem. There was, on an average, 62 percent increase in income among participating farmers that has direct impact on poverty reduction.

3.5.2 Gender Aspects. Both value chain development and rural livelihood security enhancement sub-projects (including GEF) targeted farming households. Therefore, on the average, about 50 percent of beneficiary farmers were women, who participated in SHGs and undertook production and processing activities in horticulture, livestock, and aquaculture. Furthermore, in some value chains, such as coconut, saffron, and fish, 60 to 80 percent of beneficiaries were women, who were in post-harvest processing and value addition, such as virgin coconut oil extraction, bakery with coconut oil meal, and organic manure production from fish waste.[37] Out of 47 rural industries established by NAIP, 6 were owned by women SHGs (4 coconut and 2 fish enterprises). NAIP made an investment of Rs. 1.6 million (about US$ 26,000), and their production value was Rs. 5.3 million (about US$ 88,000) over 5 years.

3.5.3 In frontier agricultural science training, about 20 percent of the international training participants were women. Women were given equal opportunities, considering that female scientists at ICAR increased from 12 to about 30 percent in the last 15 years and the training participants had on average 13 years of research experience. NAIP also undertook studies on women in agriculture in relation to labor migration, use of ICT, SHG engagement, and enrollment in higher education. A gender knowledge portal was also created,[38] which provided gender analysis tools, statistics, and information.

3.5.4 Social Development. In disadvantaged districts, NAIP transferred technologies through community driven development (CDD) approach under various sub-projects. In delivering the integrated farming system, committees were formed at village and cluster levels and facilitated selection of technologies and beneficiary farmers through consultations. They ensured all community members benefit from one or more technologies offered by the sub-projects. While no social safeguard was triggered, about 20 target districts in the rural livelihood security component had around 25 to 50 percent of tribal populations.[39] On an average, almost 60 percent of beneficiary farmers were tribal in these districts, while in five districts, all beneficiaries were tribal. These populations were equally consulted during initial assessments and participated in sub-project implementations (detailed in 3.5.4). Social mobilization processes and their inclusiveness were closely monitored by implementing agencies, in particular NGOs.

3.5.5 The project also ensured transparency in its implementation. All research and other equipment procured by the project, which were individually worth more than Rs. 1

[37]The final impact evaluation indicates women accounted for 31 percent of direct beneficiaries among 58 sample sub-projects across four components. As already seen above, women's participation varies by component or even sub-project.

[38] This was created by the Directorate of Research on Women in Agriculture under ICAR. http://www.drwa.org.in/index.php/services/databases

[39]3 such districts had 50 percent or more tribal populations, and 14 districts had 25 to 50 percent.

million (about US$ 17,000), were listed on the NAIP website. Additionally, the project had an established grievance redress mechanism. During project implementation, there were 19 grievances filed, mostly related to procurement and financial management, which were addressed satisfactorily. There was no grievance on consortium selection. The project also had 55 applications, under GOI's Right to Information Act (RTI), seeking information related to different aspects of NAIP. All the requested information was provided on time. ICAR has established an on-line RTI portal, which has been mainstreamed for all ICAR operations.

(b) Institutional Change/Strengthening

3.5.6 The project made a major institutional impact at ICAR/NARS as well as targeted communities. The component 1 sub-projects were to develop and strengthen ICAR and NARS capacity. One of the key institutional changes was brought by BPDUs, which accelerated market orientation in the agricultural sector, by facilitating transfer and commercialization of emerging agricultural technologies from research. BPDUs encouraged innovations and commercialization by providing scientists and hosting institutions with financial incentives. ICAR recognized the benefits and is in the process of establishing 50 more BPDUs in selected ICAR institutes and SAUs. It was reported that ICAR scientists increasingly sought partnership in and outside of NARS, in particular with the private sector.

3.5.7 NAIP strengthened fiduciary capacity at ICAR. A new on-line FMS was developed and is now used by 80 percent of ICAR finance managers in June 2014. ICAR is committed to train the remaining finance managers by December 2014, and the FMS will be an integral part of ICAR financial management system. NAIP also trained about 1,500 scientists and administrative officers at ICAR, NARS, and other institutions in procurement and more than 800 finance officers/accountants in FM, which could have helped increase confidence in handling larger research funds. It was reported that the amount of research proposals for new research sub-projects was becoming larger than the sub-projects financed under NAIP.

3.5.8 Besides the fiduciary training, the project increased opportunities for technical training among scientists and students through e-learning modules, workshops, overseas visits, and training of trainers. In institutionalizing these regular training, ICAR appointed an Assistant Director General for Human Resource Development (HRD). All these changes and reforms triggered by NAIP have led to a change in the mind set of scientists and researchers leading to solve emerging agricultural problems through research and development and transfer of agricultural technology. The project also supported ICAR institutionalize prioritization, monitoring and evaluation (PME), which was initiated in NATP. PME was implemented in 99 ICAR institutions, where institutional goal, research priorities and performance of projects are tracked by this tool by ICAR management. ICAR has also established a PME cell and has appointed an Assistant Director General responsible for PME.

3.5.9 At community level, NAIP formed 3,191 farmer groups (SHGs and CIGs).Their activities are supported by the sustainability fund, which is managed by the village-level

committees established to implement the integrated farming system. These groups were also strengthened by linkages developed by NAIP with banks and insurance companies.In addition, NAIP developed 39 producer companies,[40] which were linked to entrepreneurs and private sector to sustain the value chains.

(c) Other Unintended Outcomes and Impacts (positive or negative)

3.5.10 Aside from commercialization through BPDUs, there were entrepreneurs who bought non-exclusive licenses of some processing technologies directly from consortia. For example, 5 entrepreneurs bought licenses to process quality virgin coconut oil, and this was in addition to 5 rural industries developed by NAIP.[41] The consortium partners received license fee income, and more entrepreneurs and farmers benefited from technologies.

3.5.11 There was also an unintended outreach to farmers in the frontier agricultural science component. On a pilot basis, some of the technologies developed by the consortia were transferred to 11,415 farmers (detailed in Annex 2). Given that these sub-projects deal with strategic research in frontier areas of agricultural science, potential impact on agricultural development is likely to be very high.

3.5.12 Another unintended outcome of the project was the capacity development of young scientists through degree programs. 364 students participated in innovative NAIP research and development sub-projects, which helped complete their own research projects to obtain M.Sc. or Ph.D. degrees.[42] There was no unintended outcome or impact of NAIP that was considered negative.

3.6 Summary of Findings of Beneficiary Survey and Stakeholder Workshops

3.6.1 The project undertook a beneficiary survey as a part of final impact evaluation and organized a number of stakeholder workshops at national, state and consortium levels, including the Agri Innovation Conclave in May 2014, which is highlighted below.

3.6.2 Beneficiary Survey. The final impact evaluation surveyed a sample of 2,672 beneficiaries in selected 58 sub-projects, who were mostly farmers participated in value chain development or rural livelihood security enhancement. Overall, the level of satisfaction with the NAIP interventions was very high. The key findings include: (a) 70 to 84 percent of the beneficiaries indicated that interventions led to moderate to significant increase in employment; (b) 87 to 93 percent of them indicated medium to high effect on increase in income; (c) 96 percent agreed that sub-projects led to adoption of more scientific and improved agricultural practices; (d) 58 percent indicated that sub-

[40] This is a sum of 32 producer companies in value chain development and 7 companies in rural livelihood security.
[41] There is no systematic tracking of the number of such entrepreneurs outside the project.
[42] 164 researchers received M.Sc. degrees, while 200 received Ph.D. degrees.About 50 percent of Master's students participated in sub-projects in value chain development, while about 70 percent of Ph. D. students did in frontier agricultural science.

projects led to institutional development activities, such as formation of SHGs; (e) 62 percent indicated that the sub-projects helped forge market linkages; and (f) 92 percent indicated that they are likely to certain to continue (sustain) the adopted interventions. Finally, the beneficiaries indicated a large impact of interventions in terms of increased productivity, income, employment, market access, technical knowledge, drudgery reduction and women empowerment as well as impact on horizontal adoption of technologies.

3.6.3 As far as project implementation is concerned, 93 percent of the consortia were satisfied with both fund disbursement and procurement process. The benefits of the consortium approach in agricultural research and development were: sharing knowledge (88 percent); better outreach to beneficiaries (69 percent); sharing research infrastructure (57 percent); efficient use of time and resources (41 percent); and an effective model for commercialization (38 percent). However, there was a feeling of lack of coordination among some partners (71 percent) and increased administrative work (38 percent). On the capacity development program, feedback from participating scientists were: 65 percent rated the impact of training as high; 82 percent indicated that training was very comprehensive; 86 percent indicated that after training they were more efficient at work, more productive and more confident of their positions; and 84 percent indicated that they were more motivated to do their job.

3.6.4 Stakeholder Workshop. The Agri Innovation Conclave was a unique and innovative knowledge management tool to share, with farmers, entrepreneurs, youth, and other stakeholders, success stories of selected 34 enterprises and high impact technologies developed by NAIP sub-projects. The entrepreneurs took a train journey to five cities, where agricultural fairs and Agri-Biz Idol Camps were organized at business schools. The Conclave encouraged active participation of stakeholders from public and private sector in promoting innovation, partnership and entrepreneur climate. The stakeholders provided positive feedback on NAIP design and implementation, particularly the project's consortium approach in research and development and its emphasis on commercialization of technologies as well as NAIP outputs and outcomes.

4. Assessment of Risk to Development Outcome and Global Environment Outcome

Rating: Negligible to low

4.1 Activities initiated under this project are to a large extent mainstreamed to the proper institutions and public budget has been allocated to ensure the continuity of tasks that fall under public good domain. ICAR, with budget from India's 12th FYP, has already mainstreamed, funded, or made commitments to finance reforms as well as research and technology transfer interventions from most of the public good type sub-projects.For example, ICAR has already allocated Rs. 830 million (about US$14 million) to further strengthen the bioinformatics grid and FMS/MIS.

4.2 ICAR continues to finance frontier agricultural science research. To strengthen research in nanotechnology and other key thematic areas, ICAR has established Consortia

Research Platformsand allocated US$83 million.[43] It has also set up National Fund for Basic, Strategic and Frontier Application Research and financed 76 new cutting-edge research projects at a total cost of about US$ 43 million. There also was an additional allocation of US$108 million to the National Fund. All new research projects adopted or plan to follow, where appropriate, the consortium mode and market orientation.

4.3 For applied research activities for which private benefits should be sufficient to ensure adequate investment, the project has worked with the private sector and demonstrated their market viability. While some value chains were self-sustaining, approximately US$ 317 million was provided by the private sector or various GOI schemes to sustain or scale up several value chain development sub-projects.[44] The rural livelihood security sub-projects established a sustainability fund of about US$ 1.25 million at project closure to maintain the project investments. The sustainability fund and support from other organizations such as banks and insurance companies as well as SHGs, producer companies, and farmer groups are likely to sustain potentially viable interventions from the sub-projects.

4.4 NAIP was instrumental in training a large number of scientists, researchers and other specialists as well as in mainstreaming the establishment of PME cell in ICAR and PME units in other ICAR institutes. To continue, further strengthen and promote capacity development programs and PME, ICAR has already appointed two new Assistant Director Generalsfor PME and HRD. These are the direct outcomes of NAIP experience.

4.5 Equally important, the ICAR scientists report having seen benefits in pluralism and commercialization that were promoted by NAIP. Among others, the project created financial incentives for scientists, BPDUs, and host institutes in innovations and technology transfer. ICAR continues to further promote commercialization and/or partnership with private sector, NGOs and other stakeholders in NARS. Given increased funding and strong ICAR commitment to implement and mainstream NAIP outcomes, the risk to development outcomes is, therefore, negligible to low.

5. Assessment of Bank and Borrower Performance

5.1 Bank Performance
(a) Bank Performance in Ensuring Quality at Entry
Rating: Satisfactory

[43]15 other thematic areas are molecular breeding, genomics, agro-biodiversity management, diagnostics and vaccines, secondary agriculture, hybrids, bio-fortification, borer, phyto-chemical and high value compounds, conservation agriculture, water, farm mechanization, energy, health foods and natural fiber.
[44]The funds were provided by the National Saffron Mission, Initiative for Nutritional Security through Intensive Millet Promotion, Central Wool Board, Consortia for Industrial Agro-forestry, Brittania Industries, Seshasayee Papers and Boards Ltd.,Ambiply Panels and Doors, TNPL, Auromira Energy Company, GOI Department of Biotechnology, ICAR, National Mission on Seabukthorn, and some State Governments.

5.1.1 The Bank performance in ensuring quality at entry was satisfactory. In designing NAIP, the Bank team built on lessons learned from the predecessor project (NATP) in further strengthening India's national agriculture innovation system and market orientation (such as BPDUs), while ensuring poverty alleviation was kept in the project scope. Preparation under estimated interest in participation in research consortia. This is understandable in that it was a novel institutional arrangement without precedent in Indian agricultural research. The team used all the current available information in designing four components, adequately assessed governance and fiduciary risks and developed mitigation measure to support management of 65 consortia. While the project design gave enough flexibility, the target of 65 consortia could have been increased at design phase, considering that smaller sub-projects would facilitate local area-specific implementation of the value chain development and rural livelihood security enhancement. On the other hand, GEF financed activities were designed per GEF guideline and focal area strategy, which were specifically assigned to pilot 3 distinct climate change themes. However, flexibility could have further increased co-benefit.

(b) Quality of Supervision
Rating: Satisfactory

5.1.2 The Bank's quality of supervision was satisfactory. The team carried out 14 implementation support missions. Given that project implementation had two phases (consortium selection and sub-project implementation), the Bank team conducted two mid-term reviews and rigorous project evaluations in June 2008 and May 2010. The Bank team had continued dialogue with ICAR management to ensure NAIP ownership and commitment. It also supported ICAR in accelerating consortia selection and improving quality of sub-project implementation by introducing a consortium scorecard and ensuring relevant Bank experts to support sub-project implementation, including ICT expert in knowledge management. In addition to biannual support missions, day to day implementation support was provided by the Delhi-based Bank team in overall project implementation and management, procurement, financial management, and safeguards to facilitate management of a large number of sub-projects. Bank processed closing date extension almost 20 months prior to the actual closing date; thereby giving plenty of time to the implementing agency for proper planning to extend sub-project closing. In addition, the Bank regularly monitored the exchange rate fluctuations in XDR, US$ and Rs. so as to cancel the excess amount on a timely basis.

5.1.3 Several national and regional workshops were organized that related to different aspects of the project that increased synergy and interactions among various component teams and consortia. The timing of major workshops was aligned with Bank supervision missions to facilitate feedback from the Bank team. In addition, two major activities (Agri-Tech Investors Meet and Agri Innovation Conclave) were organized to showcase major NAIP innovations and technologies and obtain feedback from the beneficiaries and stakeholders. The Bank team played a critical role in helping organize these events.

(c) Justification of Rating for Overall Bank Performance
Rating: Satisfactory

5.1.4 The overall Bank performance was satisfactory. The project achieved substantially more than anticipated at appraisal. This was primarily due to (a) the flexible design that accommodated the large number of sub-projects; (b) adequate and timely support by the Bank on all emerging issues related to FM, procurement, and ICT; (c) continuous and regular dialogue with ICAR management to ensure NAIP ownership and commitment; and (d) supporting innovations in market orientation and knowledge management, in particular BPDUs and ICT-based knowledge management.

5.2 Borrower Performance
(a) Government Performance
Rating: Satisfactory

5.2.1 Government performance was satisfactory. GOI had strong ownership and commitment to this project. Agricultural research, innovations, technology transfer, and adaptation for poverty alleviation were the theme of the 12th FYP, prepared by the Planning Commission. GOI also consistently provided counterpart funds, although with slight delays in fund release in 2008/09 and 20013/14. Foreign training was critical for capacity development and GOI approved in a timely manner the large number of NARS scientists for proposed international training.

(b) Implementing Agency or Agencies Performance
Rating: Satisfactory

5.2.2 ICAR performance was satisfactory. There were strong commitment and buy-in at the national as well as state levels throughout NARS, which substantially helped improve and accelerate NAIP implementation. PIU, in particular component coordinators provided substantial implementation support to each consortium in collaboration with M&E unit, such as consortium scorecard development and action plan implementation. Substantial qualitative as well as quantitative data were collected and made available at component level, which were analyzed and well documented. There were interactions between components, such as value chain development in disadvantaged districts. There, however, could have been more data aggregation and analysis at the project level, and more interactions and cross learning among components.

(c) Justification of Rating for Overall Borrower Performance
Rating: Satisfactory

5.2.3 The borrower performance was overall satisfactory. GOI as well as ICAR were committed to further evolve India's national agriculture innovation system. There were high level of interest and ownership with the project, including sustainability of the substantial results achieved. Many of the important institutional innovations have already been mainstreamed in ICAR and others are in the process. A follow on project is under preparation.

6. Lessons Learned

6.1 Followings are the key lessons learned from NAIP that may be relevant to designing and implementing similar agricultural research and development projects in future in India or in other developing countries.

6.2 In an agricultural research and development project, the consortia approach strengthened overall sub-project design, implementation, and outcomes. The consortium approach increased pluralism, partnerships among institutions, decentralization, productivity, and quality of research. The relevance, success, and commercialization of most of the 51 value chain development sub-projects and their outputs were primarily attributable to the public private partnerships as part of the consortia. The private sector participation also improved sustainability of profitable agricultural value chains. Likewise, farmers' participation and social mobilization were enhanced by NGO partners, including vulnerable poor, women, and tribal populations in 36 livelihood security sub-projects. The public sector institutions strengthened the potential contribution of public good activities in R&D.

6.3 In undertaking multi-stakeholder research projects spread across India, substantial capacity building of participating institutions is necessary in sub-project implementation, fiduciary management and monitoring. By project design, rigorous FM and procurement training to each consortium partner was essential in expediting fund release and procurement activities. NAIP developed capacity building tools, such as helpdesk in proposal development and long list of FAQs on its website. Also, a consortium scorecard facilitated monitoring and improvement in consortium performance. The strengthening of research infrastructure and capacity of scientists improved quality of research and research outcomes, particularly in the frontier areas of agriculture science.

6.4 Commercialization of agricultural technologies and innovations in sustainable manner requires incentives among scientists and research institutions. NAIP established 23 BPDUs to support commercialization of NAIP as well as NARS agricultural technologies by engaging both scientists and entrepreneurs in agri-business incubation at state and regional levels. These efforts were scaled up at national level by the Agri-Tech Investors Meet, which attracted larger number of private sector stakeholders for commercializing innovations by frontier agricultural science sub-projects. Scientists, BPDUs and the hosting institutions benefitted from license fee and royalty incomes, which further encouraged innovations at the institutional level. This business model would support market orientation in a sustainable manner and is being mainstreamed and scaled up by ICAR. There is also support from the state and national governments for this R&D business model.

6.5 ICT-based knowledge management platformswere key public goods investment, which enhanced access to ICAR and other journals by national and international researchers. Farming and fishing communities also benefitted from early warning and advisory service, where private sector could play a significant role. Digitization and on-line access to ICAR and other journals enabled national (including non-NARS) and international scientists to gain latest knowledge and developments in agricultural science. At the same time, the ICT-based knowledge

platforms also benefited farming and fishing communities. M-Fisheries not only increased the catch but also enhanced their overall livelihoods and the surrounding ecosystem.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

(b) Cofinanciers

(c) Other partners and stakeholders
(e.g. NGOs/private sector/civil society)

Annex 1. Project Costs and Financing

(a) Project Cost by Component (in USD Million equivalent)

National Agricultural Innovation Project - P092735			
Components	**Appraisal Estimate (USD millions)**	**Actual/Latest Estimate (USD millions)**	**Percentage of Appraisal (%)**
Component 1. ICAR as the catalyzing agent for management of change in the Indian NARS	40.55	85.13	209.94%
Component 2. Research on production to consumption systems	65.81	46.05	69.97%
Component 3. Research on sustainable rural livelihood security	63.56	47.15	74.18%
Component 4. Basic and strategic research in the frontier areas of agricultural science	49.94	71.67	143.51%
Total Baseline Cost	219.86	250.00	113.71%
Physical Contingencies	0.85	0.00	0.00%
Price Contingencies	29.29	0.00	0.00%
Total Project Costs	250.00	250.00	100.00%
PPF	0.00	0.00	-
Front-end fee IBRD	0.00	0.00	-
Total Financing Required	250.00	250.00	100.00

Sustainable Rural Livelihoods and Security through Innovations in Land and Ecosystem Mgmt /Additional GEF financing to India NAIP - P112060			
Components	**Appraisal Estimate (USD millions)**	**Actual/Latest Estimate (USD millions)**	**Percentage of Appraisal (%)**
NAIP Component 3 (3 sub-projects to improve climate change adaptation, biodiversity conservation, and land degradation)	7.34	7.34	100.00
Total Baseline Cost	7.34	7.34	100.00
Physical Contingencies	0.00	0.00	-
Price Contingencies	0.00	0.00	-
Total Project Costs	7.34	7.34	100.00
PPF	0.00	0.00	-
Front-end fee IBRD	0.00	0.00	-
Total Financing Required	7.34	7.34	100.00

(b) Financing

P092735 - National Agricultural Innovation Project				
Source of Funds	**Type of Financing**	**Appraisal Estimate (USD millions)**	**Actual/Latest Estimate (USD millions)**	**Percentage of Appraisal (%)**
Borrower	Grant	50.00	50.00	100.00
International Development Association (IDA)	Credit	200.00	200.00	100.00

P112060 - Sustainable Rural Livelihoods and Security through Innovations in Land and Ecosystem Mgmt /Additional GEF financing to India NAIP				
Source of Funds	**Type of Financing**	**Appraisal Estimate (USD millions)**	**Actual/Latest Estimate (USD millions)**	**Percentage of Appraisal**
Global Environment Facility (GEF)	Grant	7.34	7.34	100.00

Annex 2. Outputs by Component

This Annex details the key NAIP outputs to support the project outcomes described in Section 3.2.

Overview of Sub-projects/Consortia

The below table provides the detailed sub-project/consortium information by component, vis a vis the number anticipated at appraisal:

Table A2.1 Number of sub-projects/consortia by component

Component	No. of sub-projects anticipated at appraisal	No. of sub-projects implemented			% increase (appraisal to actual)
		Competitively selected	Sponsored	Sub-total	
Component 1	15	0	55	55	266.7%
Component 2	15	51	0	51	240.0%
Component 3	20	28	5	33	65.0%
Component 4	15	60	1	61	306.7%
NAIP Total	**65**	**139**	**61**	**200**	**207.7%**
GEF	**3**			**3**	**0**
Grand Total	**68**	**139**	**61**	**203**	

A consortium was composed of a leader and about 4 partner institutions. The rural livelihood security sub-projects had more partners than others. The breakdown by component is provided in the below table:

Table A2.2 Consortium members by component

Component	Leader	Partner	Total	No. of partners per consortium
Component 1	55	151	206	3.7
Component 2	51	140	191	3.7
Component 3	33	150	183	5.5
Component 4	61	197	258	4.2
NAIP Total	**200**	**638**	**838**	**4.2**
GEF	3	15	18	6.0
Grand Total	**203**	**653**	**856**	**4.2**

Among the participating institutions, ICAR and SAUs/Central Agricultural Universities (CAUs) accounted for about 65 percent, while the private sector, NGOs, and international institutions did 21 percent. Rest was the central and state level institutions. Breakdown is provided by the table below:

Table A2.3 Type of institutions by function

Institution	Leader	Partner	Total	% Share
ICAR	106	244	350	40.9
SAUs/CAUs	60	150	210	24.5
NGOs	7	84	91	10.6
Central Institutions	18	60	78	9.1
Private Sector	5	68	73	8.5

Institution	Leader	Partner	Total	% Share
State Institutions	2	36	38	4.4
International Institutions	5	11	16	1.9
Total NAIP	**200**	**638**	**838**	**97.9**
GEF	3	15	18	2.1
Total NAIP+GEF	**203**	**653**	**856**	**100.00**

Component 1. ICAR as the catalyzing agent for management of change in the Indian NARS

BPDUs. The table below provides a list of 23 BPDUs established by NAIP and their revenue in five years of operation. The best performer was the Indian Agricultural Research Institute (IARI) in Delhi, which generated the highest income and was ranked among the highest in NAIP's BPDU rankingin patent filing, incubation outreach to entrepreneurs, resource mobilization, and consultancy provision.

Table A2.4 Revenue generated by BPDUs from 2010 to 2014 (Rs. Lakh)

SN	BPD Units & Locations	2010-11	2011-12	2012-13	2013-14	2014-15	Total
ZTM-BPD Units							
1	ZTM & BPD Unit, IARI, New Delhi	40.95	296.21	172.49	294.64	_	804.30
2	ZTM & BPD Unit, IVRI, Izatnagar	212.179	29.647	351.91	55.97	_	649.80
3	ZTM & BPD Unit, CIRCOT, Mumbai	37.09	31.67	39.37	54.13	_	162.26
4	ZTM & BPD Unit, CIFT, Cochin	0.81	4.43	9.54	4.36	_	19.14
5	ZTM & BPD Unit, NIRJAFT, Kolkata	1.20	1.45	6.09	7.67	_	16.42
BPD Units							
6	BPD Unit, IIHR, Bangalore	_	_	_	132.95	23.24	156.20
7	BPD Unit, NDRI, KARNAL	_	_	94.10	52.54	_	146.64
8	BPD Unit, CIBA, Chennai	_	_	_	12.57	5.67	18.24
9	BPD Unit, NAARM, Hyderabad	_	_	_	16.72	_	16.72
10	BPD Unit, CIFA, Bhubaneshwar	_	_	_	5.30	_	5.30
11	BPD Unit, CIPHET, Ludhiana	_	_	_	3.80	_	3.80
12	BPD Unit, IIVR, Varanasi	_	_	_	3.60	_	3.60
13	BPD Unit, CIAE, Bhopal	_	_	_	3.41	_	3.41
14	BPD Unit, IISR, Calicut	_	_	_	2.56	_	2.56
15	BPD Unit, CRRI, Cuttack				2.44	_	2.44
16	BPD Unit, CPCRI, Kasargod	_	_	_	0.73	0.32	1.05
17	BPD Unit, CPRI, Shimla	_	_	_	8.99	_	8.99
18	BPD Unit, AAU, Anand	16.01	11.34	14.83	11.44	0.16	53.78
19	BPD Unit, BAU, Ranchi	1.02	2.92	79.98	102.34	_	186.27
20	BPD Unit, JNKVV, Jabalpur	7.42	20.73	31.33	33.35	_	92.83
21	BPD Unit, TNAU, Coimbatore	7.47	20.81	14.25	4.91	_	47.44
22	BPD Unit, CCS HAU, Hisar	5.15	25.50	10.02	24.55	2.43	67.65
23	BPD Unit, ICRISAT, Hyderabad*	_	_	_	_	_	_
Total							**2,468.84**

* BPDU, focusing on entrepreneur handholding and mentoring

The below Box 1 details salientachievements of BPDU at IARI.

Box 1. BPDU at IARI in Delhi

Established in 2009, the BPDU at IARI promoted the entrepreneurial ecosystem by: (i) streamlining intellectual property management procedures; (ii) institutionalizing technology commercialization procedures; (iii) standardizing licensing agreements; (iv) incubating agribusinesses; (v) forming producer companies; and (vi) organizing technical consulting teams.The BPDU filed 21 patent applications and 41 applications for protecting crop varieties (wheat, rice, vegetables and flowers) developed by IARI.

The BPDU was equipped with laboratories in plant tissue culture, biotechnology, microbiology, and post-harvest technology, which were used for incubations and training. 4,700 farmers and other stakeholders were trained from NGOs, private sector, and research institutes. The Unit developed a seed multiplication business model by training farmers in producing, processing, storing, and marketing high quality crop seeds, forming a producer company (beejIndia), and developing an information system in extension and marketing. The model was replicated by farmer entrepreneurs and created additional employment for 40,000 people. The BPDU also supported commercialization of bio-fertilizers and agricultural engineering technologies, which generated employment for 10,000 individuals.

During the NAIP implementation, the BPDU generated Rs. 80.4 million (about US$1.34 million). The major source of income was consultancies (Rs. 48 million, which is about US$ 800,000) and licensing fees (Rs. 31 million, about US$ 500,000) from 118 licensees, about 70 percent of which was from seeds and agricultural chemicals. Although minor, there also were BPDU membership fees from 424 members: 72 percent were seed companies, 17 percent were farmers, 6 percent were other private companies, and 5 percent were NGOs/KVKs/farmers groups.

Capacity Building. IFPRI was hired by NAIP PIU to carry out an impact assessment of the selected capacity development programs for 487 scientists who were sent abroad for training in 27 areas of research in agricultural sciences. Most trainees felt that they were able to achieve their training objectives. The results indicate that there was a significant increase in project proposals, journal articles published, patents applied and technologies developed. Seven frontier areas (marker assisted selection, fermentation technology, nanotechnology, genome resource conservation, carbon trading, neutraceuticals and allele mining) and 11 scientists were selected for conducting benefit cost analysis. The analysis was based on multiple gains from new technology which was based on efficiency, profitability, cost efficiency, productivity and time. The average BCR ranged from 11.35 to 1.13. The highest BCR range was for marker assisted selection and the lowest BCR range was for nanotechnology. These results clearly indicate substantial returns to investment in capacity development through foreign training.

Development of Research Infrastructure. One of the objectives of NAIP was to create and develop research capacity by investing in research infrastructure, laboratories, pilot plants and modern research equipment at an estimated total cost of US$ 82 million.[45] In component 1, investment was made in various infrastructures, in particular IT-based, including but not limited to: National Agricultural Bioinformatics Grid (high performance computing center for computational biology and agricultural bioinformatics), 7 on-line agriculture modules, Consortium for e-Resources in Agriculture (CeRA) (online access platform for 2,900 professional and scientific journals), KrishiKosh (online access to 7,486 abstracts and 6,000 full PhD theses), AgriCat (online access to a group catalog of 12 major libraries), Data Center (robust IT infrastructure for ICAR), FMS/MIS, and Agricultural Scientists Recruitment Board (ASRB) (online examination system for recruitment).

Communication outreach. NAIP launched more than 1,100 national, regional, and state level communication campaigns, which are summarized in the following table:

Table A2.5 Communication campaign by media

S. No.	Through	Number	Details
1	Print Media Magazine	12	India Today, The Week, The Outlook, The Frontline, The Caravan, Rural Marketing, NIABI New Letter, The ShubhYatra (Air India In-flight Magazine)
2	Print Media News Paper	17	Special NAIP awareness raising campaigns in National English & Hindi daily
3	Radio Talk/ TV Talk and exhibitions	108	Special NAIP awareness raising campaigns
4	e-mail	946	Campaigns by PIU and consortia leaders/ partners for workshop and trainings
5	Website	55	Campaigns through sub-project websites
		17	Various portals of NAIP supported sub-projects distinct from sub-project website viz., NAIP, ICAR, NIABI, AgriTech Investors Meet site, Agri Business Conclave site, Agri-portal TNAU, ASHOKA, ASRB, Unified Messaging Portal for wider knowledge access
	Total	**1155**	

Components 2&3. Research on production to consumption systems (value chain development) &Research on sustainable rural livelihood security

The below table summarizes the technologies developed and/or adopted by sub-sector in the components 2 and 3:

[45] This is extrapolated from the final impact evaluation, which verified that Rs. 1.4 billion (about US$ 23.5 million) was spent for research infrastructure development on 58 sample sub-projects.

Table A2.6 Technologies developed, transferred or adopted by sub-sector

	Crop	Horticulture	Livestock	Agro-forestry	Fishery	NRM	Integrated Farming Systems	Process Innovations	Other	Total
Component 2										
Production	8	36	15	20	20					99
Processing	40	46	24	30	34					174
Rural enterprise	2	29	1	8	7					47
Product group	4	11	3	4	5					27
Component 3										
Transferred	123	-	66	14	12	27	104	44	19	409
Adopted	4	-	7	4	0	4	104	4	0	127

Value Chain Development. There were 5 most profitable rural industries among 47 industries, which are detailed in the table below:

Table A2.7 most profitable new rural industries

Value Chain	States	No. of rural enterprises	NAIP investment / Beneficiary contribution	Production value over 5 years
Pulp wood	Tamil Nadu	1	NAIP: None Beneficiary: Rs. 1 mil (about US$ 17,000)	Rs. 32.5 million (about US$ 541,000)
Seafood curry for export	Tamil Nadu	1	NAIP: None Beneficiary: Rs. 3.5 mil (about US$ 58,000)	Rs. 18 million (about US$ 300,000)
Fish processing (fish patties, dried fish, etc.)	Kerala	5	NAIP: Rs. 2.9 mil (about US$ 48,000) Beneficiary: Rs. 1.6 mil (about US$ 26,000)	Rs. 16.8 million (about US$ 280,000)
Nurseries	Tamil Nadu	5	NAIP: None Beneficiary: Rs. 5 mil (about US$ 83,000)	Rs. 12.3 million (about US$ 205,000)
Mango pulp export	Tamil Nadu	6	NAIP: None Beneficiary: Data not available	Rs. 11.6 million (about US$ 193,000)

The below Box 2 details value chain development in millet foods, which was scaled up locally as well as nationally.

Box 2. Value Chain Development in Millet Foods

The sorghum and millet food value chain was developed by a consortium lead by the Directorate of Sorghum Research (DSR) in Hyderabad. The sub-project was implemented over a period of 7 years from 2007 to 2014 at a total cost of Rs. 80 million (about US$ 1.3 million).

In enhancing production, the consortium identified 17 product specific cultivars (7 for propping, 5 for semolina, and 5 for flour). The package of these cultivars and improved

cultivation practices were piloted in Maharashtra and Andhra Pradesh, which increased production and productivity. With buy-back assurance by private sector (ITC), rural income increased on the average by 541 percent in kharif and 109 percent in rabi seasons for four years.

Sorghum processing was also improved by 36 product technologies and innovations in machineries and equipment, of which 9 were commercialized. 5,000 women, farmers, and urban entrepreneurs were trained in processing, as well as use of new machineries. Nutritiously improved products were developed, such as multi-grain flour, semolina, flakes, vermicelli, pasta and biscuits. They were sold by DSR under its original "Eatrite" brand and by private sector (ANGRAU) in Hyderabad with substantial consumer outreach on their nutritional benefits.

Seeing the nutritious and economic benefits in developing these value chains, GOI allocated Rs. 3 billion (about US$ 50 million) in 2011 to promote millets as nutri-cereals under the Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP) project. More than 200 sorghum processing clusters were established throughout the country. A number of market linkages were developed with private sector, including M/s Britannnia industries Limited (among 15 MoU signed), Parle, and Nestle.

Rural Livelihood Security Enhancement. There was an overall increase in area under cultivation, in particular cereals, pulses, and oilseeds, covering a large number of households in targeted areas (detailed in the table below):

Table A2.8 Areas under improved varieties

	Area under cultivation (ha)	Household covered
Cereals, pulses, and oilseeds	72,192	190,978
Vegetables and fruits	8,416	70,556
Spices, and medicinal and aromatic plans	1,745	9,014
Fodder	1,053	8,496
Total	**83,406**	**279,044**

Below Box 3 highlights an integrated farming system approach in disadvantaged districts in Tamil Nadu.

Box 3. Integrated Farming Systems in Tamil Nadu

In four disadvantaged districts in Tamil Nadu, three area-specific integrated farming systems were introduced. The sub-project was implemented for 6 years at a total cost of Rs. 90.5 million (about US$ 1.5 million). The consortium was lead by Annamalai University in partnership with 2 KVKs and a private foundation.

The targeted four districts are socio-economically, agro-ecologically, and bio-climatically disadvantaged, with high scheduled caste (SC) and tribe (ST) populations. 72 percent of farmers are small or marginal landholders with farm size less than 2 ha, while 15 percent of them were landless laborers. Rice is the dominant crop in these districts, but with low productivity and diversification, due to infestation of pests and diseases, weeds, poor

water and soil management. There are frequent crop failures because of floods, which are the main source of distress among farmers. Water tanks are infested with aquatic weed water hyacinth, which interferes in crop cultivation.

In wetland, an integrated system of rice, fish, and poultry was introduced, while in rainfed upland, that of goat, millet, vegetable, and floriculture was implemented. These interventions included integrated pest and nutrient management in enhancing productivity and some value addition. In coast, on the other hand, in coast, integrated aquatic weed management was implemented, which was to restore water resources through integrated bio-control of aquatic weeds and to conserve soil fertility with agricultural inputs. Vermi-compost and mushroom cultivation were also introduced in the coast.

Over 6 years, additional 876 man days were generated, 25 percent of which were by the rice, fish, and poultry farming system. There was substantial increase in net household income among targeted 2,400 households. On the average, it was 80 percent in wetland, 74 percent in rain-fed upland, and 57 percent in coast. Commodity Interest Groups were formed, and sustainability funds were set up. The integrated farming systems adopted by these farmers were being scaled up by the State Department of Agriculture.

Component 4. Basic and strategic research in the frontier areas of agricultural science

Below Box 4 details the impact on crop yields using nanotechnology.

Box 4. Nanotechnology

This sub-project was designed to: (i) enhance the utilization of phosphorus (P) by plants using nanoparticles of magnesium (Mg), zinc (Zn) and iron (Fe); (ii) enhance the production of gum for soil binding and moisture retention by microbes through nanoparticle stimulation; and (iii) synthesize and apply nano-granules of P from rock phosphate for enhancing its utilization. Multi-location field trials were conducted with nanonutrients, including P nanofertilizers. The yield levels for pearl millet and cluster beans from the use of nano P and chemical P fertilizers, under arid field conditions, are reported below:

Table A2.10 Increase in yield of pearl millet and cluster beans

Crop	Yields (kg/ha)			
	Control	P (40 kg)	P (80 kg)	Nano-P 640 mg/ha
Pearl millet	616	690	789	790
Cluster beans	312	340	390	392

The per ha crop yield levels from 640 mg nano P application were almost same as from the application of 80 kg P fertilizer in both crops. This was due high use efficiency of nano P. The use efficiency of nano P was 58 to 61 percentwhereas it was only 15 to 16 percent for P from SSP or DAP. The yield increases for various crops under farmers' fields with the application of different nanonutrients are summarized below:

Table A2.11 Increase in yield by crop

Crops	Nanonutrient applied	% increase in yield over control in farmers' fields
Pearl millet	P, Zn, Fe, Mg	18-43
Cluster bean	P, Zn, Fe, Mg	21-37
Moth bean	P, Zn, Fe	18-27
Mung bean	P, Zn, Fe, Mg	23-38
Maize	P	23-32 (research field)
Castor	P, Zn	24-37
Cauliflower	P, Zn	47-54
Tomato	P, Zn	25-29
Rice	P	22-28 (research field)
Capsicum	P, Zn	19-24 (research field)

Note: Doses applied: P: 40ppm; Fe: 30ppm; Mg: 20ppm; and Zn: 10ppm.

The increase in crop yield varied between 18 and 54 percent over control. Again, this increase was due to high use efficiency of nanonutrients. The results showed that nanonutrients had no adverse impact on seed germination as well as soluble seed protein in important crops grown in arid areas. The microbial population in the soil increased substantially with the application of nano Zn. Furthermore, there was no adverse effect body weight, grain consumption rate and blood pH of mice with feeding of nanoparticles sprayed grain as compared to control.

In addition to an increase in crop yields, other advantages of nanonutrients applications are low cost, negligible transportation costs since they are used in small amounts and no known environmental implications for the plant, soil and water. Nanonutrients are applied to the plant as foliar spray whereas chemical fertilizers are applied to the soil. Experiments were also conducted to examine any health hazards of nanonutrients.

Testing of the material and further refinements in the technologies and methods are continuing. Three research projects under nanotechnology platform have been approved and funded using consortia mode of research. The technology is scalable and the market potential is enormous once the commercial, logistical aspects are operationalized and validated. However, it will take some time before farmers are able to use this technology on their fields. The shelf life of the material is short (about 3 months).

The following is a list of most prestigious national and international awards received by the frontier agricultural science sub-projects. In addition, there were 164awards given by other national or state entities.

Table A2.12 List of prestigious awards given to the frontier agricultural science sub-projects

No.	Awardee	Award/ Recognition (with Date)	Agency
1.	Dr. Ramesh Kumar Vijh, CPI and Principal Scientist, NBAGR, Karnal	National Award for Biotech product and commercialization on Technology Day 2013 conferred by Hon'ble President of India	Department of Biotechnology, Govt of India
2.	Dr. T. R. Sharma CPI, NRCPB, New Delhi	Rafi Ahmed Kidwai Award in Crop and Horticultural Sciences	• Indian Council of Agricultural Research, New

		2011.	Delhi
3.		NASI-Reliance Platinum Jubilee award in Biological Sciences-2013	• National Academy of Sciences, Allahabad
4.	SamiranBandyopadhyay, CCPI, IVRI, Eastern Regional Station, Kolkata	Fakhruddin Ali Ahmed Award for Outstanding Research in Tribal Farming System 2011	Indian Council of Agricultural Research
5.		INSA Young Scientist Award, 2012	Indian National Science Academy
6.	Dr Rajeev Rathour, CCPI, Scientist, CSKHPKV, Palampur	Lal Bhadur Shastri Young Scientist Award 2012	Indian Council of Agricultural Research, New Delhi
7.	Dr. A.K. Singh CCPI, Principal Scientist, IARI, New Delhi	Borlaug Award 2012	Coromandel International Limited, Secundrabad
8.	M.S. Chauhan CPI and Principal Scientist, ABTC, NDRI, Karnal	Prof. G.P. Talwar Mid-Career Scientist Award 2012 for outstanding contribution in reproductive health	Indian Council of Medical Research, Delhi

Some of the technologies developed by the frontier agriculture science sub-projects were transferred to farmers on pilot basis, which benefited relatively more male farmers than female (detailed in the table below).

Table A2.13 Farmers benefitted from component 4 sub-projects

Sub-project	Lead institution	Target State(s)	Total Beneficiaries	Women Beneficiaries
Serological diversity and molecular characterization of *Dichelobacternodosus* and development of vaccine against virulent footrot (C30013)	SKUAST-K, Srinagar	Jammu & Kashmir	500	100
Study of herbal acaricides as means to overcome the development of resistance in ticks to conventional acaricides (C2066)	IVRI, Izatnagar	Punjab, Rajasthan, Uttar Pradesh, Haryana	260*	79
Identification of quantitative trait loci for milk yield, fat and protein percent in buffaloes (C1050)	NBAGR, Karnal	Uttar Pradesh	8000	28
Design and development of rubber dams for watersheds (C10130)	DWM, Bhubaneswar	Odisha	255	8
Effect of abiotic stresses on the natural enemies of crop pests: *Trichogramma, Chrysoperla, Trichoderma* and *Pseudomonas*, and mechanism of tolerance to these stresses (C2082)	NBAII, Bangalore	Tamil Nadu, Karnataka	200	80
Standardization of selected ethnic fermented foods and beverages by rationalization of indigenous	IICPPT, Thanjavur	Tamil Nadu	1000	100

knowledge (C30031)				
Development of a set of alternative ICT models based on a study and analysis of the major ICT initiatives in agriculture in India to meet the information need of the Indian farmers. (C30012)	MLAsia, New Delhi	Andhara Pradesh, Telangana	1200	100
Total			11,415	495

* In 29 Goshalas (old cow homes)

Annex 3. Economic and Financial Analysis

Analysis at Appraisal

No economic or financial analysis was undertaken for investments in this project at appraisal. Based on the literature review, returns to investment in agricultural research in India were indicated to be high. In the literature, the estimated average economic rate of return (ERR) in the past was indicated to be 75.4 percent for aggregate analysis, 69.9 percent for individual crops, and 71.8 percent overall. Based on past studies, it was speculated at appraisal that returns to public investment in Indian agricultural research in the consortia mode might be in the order of 40 to 60 percent ERR.

Approach for Economic and Financial Analysis

NAIP is very comprehensive and highly diverse project. Each of the four components of the project deals with different aspects of agriculture and agricultural innovations, including organization and management to value chain to rural livelihoods to frontiers of science. Within each component, the sub-projects are diverse in terms of scientific theme, scope, geographical location, commodity or product, sub-sector of agriculture, pluralism of consortia and so on. Given this diversity, it is not easy to carry out the economic and financial analysis of the project. The Project Implementation Unit (PIU) for NAIP had hired the Price Waterhouse and Coopers (PWC) to carryout the End-Project Impact Evaluation for NAIP, including the economic and financial analysis. The following summary is based on this analysis.

Overall Assumptions: The economic and financial analysis for NAIP is based on a sample of 58 sub-projects/consortia out of a total of 200 sub-projects/consortia (about 30 percent of the total). These sample sub-projects/consortia were selected based on purposive stratified sampling methodology. The number of selected sub-projects/consortia is given below:

Table A3.1. Selected Consortia by Component

Component	Sub-projects/Consortia selected for Economic and Financial Analysis
C1	12
C2	20
C3	20
C4	6
Total	**58**

The largest number is from components 2 and 3 because the sub-projects/consortia in these components dealt with value chains and rural livelihoods, respectively, and actual use of innovations and agricultural technologies by farmers and processors. Sub-project interventions for primary survey for the analysis were randomly selected from the selected sample sub-projects/consortia. The primary survey sample consisted of the following:

Table A3.2. Primary Survey Sample by Beneficiary

Primary Survey Sample	Number
Farmers	2,291
Artisans	110
Processors	53
Researchers	171
Others	47
Total	**2,672**

The main beneficiaries for various project components were as follows: For component 1 were scientists, researchers and entrepreneurs; for component 2 were farmers and processors; for component 3 were farmers; and for component 4 were farmers, scientists, extension workers and entrepreneurs. The main sources of information for the analysis were (i) one on one meetings with consortia leaders and partners, secondary information and feedback from the PIU; (ii) one on one interviews with participatory and non-participatory beneficiaries; and (iii) collection of relevant information from the M&E documents for the selected sub-projects/consortia.

Components 1 and 4 Assumptions: These two components deal with potential benefits from interventions in sub-projects that are likely to occur in future due to development of technology and IT infrastructure and institutional development. Given the potential nature of benefits, the economic and financial analyses are synonymous. The potential benefits accrue over the long term. The costs include project costs, maintenance cost required for subsequent research and popularization cost. The potential benefits are in terms of shortening time lags, reducing costs and increasing benefits are assumed for the next 10 years. The maintenance and manpower costs required in the future for realizing benefits are considered notionally. The benefit cost ratios (BCR) are calculated each sub-project. The sub-project level information on benefits and costs is then added and extrapolated to calculate BCR at the component level.

Components 2 and 3 Assumptions: These two components deal with benefits from interventions in sub-projects in terms of an increase in income, agricultural productivity, agricultural production, cropping intensity and livelihood improvement. The net benefits per hectare are multiplied by the area covered to obtain total benefits from the use of an intervention. The additional costs incurred and the additional benefits obtained by the participating farmers were used to obtain the net benefits per hectare. Benefits and costs for interventions are added to calculate financial BCR at the sub-project level. Benefits and costs for all sample sub-projects are added and extrapolated to calculate financial BCR at the component level. Benefits and costs are, however, adjusted to calculate economic BCRs.

The following adjustments are made in the financial analysis in order to calculate the economic benefits and costs. In case of all non-traded inputs like land and labor, market rates are substituted by the opportunity cost. The opportunity cost for these inputs is generally lower than the market rates. On the other hand, in case of traded inputs like machinery, fertilizer, seed and chemicals, the distortions in market prices are corrected for subsidies and taxes. The market prices are generally lower than the adjusted prices. After these adjustments are made, the economic benefits and costs are calculated.

Results for Economic and Financial Analysis

The benefit cost ratios (BCR) and the economic rates of return (ERR) are calculated as part of the economic and financial analysis for the individual project components as well as for the NAIP project as a whole. The estimates results are reported in Table A3.3:

Table A3.3. Estimated BCR and IRR for project Components and NAIP

Item	Financial BCR	Economic BCR	ERR (%)
Component 1	-	1.54	19.26
Component 2	2.12	2.15	50.08
Component 3	2.02	1.45	43.34
Component 4	-	1.75	57.33
NAIP Total	**1.78**	**1.69**	**40.00**
GEF	1.97	3.19	-
Grand Total	**1.79**	**1.73**	-

The results in Table A3.3 clearly indicate that the returns to investment in agricultural research and development under NAIP are very high as reflected by the financial BCR of 1.78, economic BCR of 1.69 and ERR of 40 percent for the project, excluding GEF. The GEF grant financed only three sub-projects/consortia dealing with rural livelihood security, same as component 3 sub-projects/consortia.

However, the returns vary by components, depending on the sub-project cost, estimated returns and status of the sub-project. For the catalyzing agent for management of change component 1, the economic BCR is 1.54 and the ERR is 19.26, which is the lowest among all the four project components. The economic analysis was also carried out for each of the 12 sample sub-projects. The economic BCR is 1.04 for one sub-project but ranged between 1.22 and 1.97 for the remaining 11 sample sub-projects. For the frontiers of agriculture science component 4, the economic BCR is 1.75 and the ERR is 57.33 percent, the highest among all the project components. For the individual sample sub-projects, the estimated economic BCR is 1.01 and 1.03 for two sample sub-projects and between 1.11 and 2.27 for the remaining four sample sub-projects.

For the value chain component 2, the financial BCR is 2.12, the economic BCR is 2.15 and the ERR is 50.08 percent. The economic BCR is higher than the corresponding financial BCR because the decline in costs due to adjustment in input costs for non-traded inputs is higher than the increase in costs due to adjustments in input costs for traded inputs. The financial BCR for individual sample sub-projects is between 0.66 and 1.08 for three sub-projects and between 1.17 and 5.89 for the remaining 11 sample sub-projects. On the other hand, the economic BCR is between 0.5 and 1.1 for three sub-projects and between 1.12 and 5.9 for the remaining 11 sub-projects.

For the rural livelihood component 3, the financial BCR is 2.02, the economic BCR is 1.45 and the ERR is 43.34 percent. In this case, the economic BCR is lower than the corresponding financial BCR because, after appropriate adjustments, the decline in costs for non-traded inputs is less than the increases in costs in the traded inputs. The financial BCR for individual sample sub-projects is between 0.63 and 1.04 for four sub-projects

and between 1.18 and 3.03 for the remaining eight sub-projects. On the other hand, the estimated economic BCR is between 0.11 and 1.04 for five sub-projects and between 1.11 and 4.24 for the remaining nine sub-projects.

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Deborah Lee Ricks	Program Assistant	SASDO	Admin Support
Dhimant Jayendraray Baxi	Sr Procurement Specialist.	SARPS	Procurement
Eija Pehu	Adviser	AES	Agri. Research
Ghazali Raheem	Information Technology Analyst	AFTOS	M&E
Jacob Kampen	Consultant	AFTA1	
Jacqueline Julian	Operations Analyst	SASDA	Costing
Jock R. Anderson	Adviser	AES	Agri. Research
Michelle Lisa Chen	Program Assistant	SASDO	Admin Support
Papia Bhatachaarji	Sr Financial Management Specialist	SARFM	FM
Paul Singh Sidhu	Sr Agricultural Specialist.	SASDA	Agri. Research and Extension
Rabih H. Karaky	Senior Economist	EASER	Economist
Sara Gonzalez Flavell	Special Assistant	IEGDG	
Suryanarayan Satish	Senior Social Development Specialist	SASDS	Social Safeguards
Tapas Paul	Senior Environmental Specialist	SASDI	Environment Safeguards
Wilhelmus Janssen	Lead Agriculturalist		TTL
Supervision/ICR			
Anupam Joshi	Senior Environmental Specialist	SASDI	Environment Safeguards
Assaye Legesse	Senior Agriculture Economist	AFTA3	
Dhimant Jayendraray Baxi	Sr Procurement Specialist	SARPS	Procurement
Grahame Beaumont Richard Dixie	Adviser	AES	Agri. Business
Miki Terasawa	Social Development Specialist	SASDS	ICR
Mohinder S. Mudahar	Economic Adviser	SASDA	Agri. Research and Extension, ICR
Papia Bhatachaarji	Sr Financial Management Specialist	SARFM	FM
Paul Singh Sidhu	Sr Agricultural Spec.	SASDA	Agri. Research and Extension, TTL
Priti Jain	Senior Procurement Specialist	SARPS	Procurement
Ranjan Samantaray	Sr Natural Resources Mgmt. Specialist	SASDA	Natural Resource Management
Shashank Ojha	Senior e-Government Specialist	TWICT	ICT
Suryanarayan Satish	Senior Social Development Speccialist	SASDS	Social safeguards
Wilhelmus Janssen	Lead Agriculturalist		TTL
William B. Magrath	Lead Natural Resource Economist	SASDA	TTL

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD Thousands (including travel and consultant costs)
Lending		
FY2005	31.33	167,335.20
FY2006	47.56	274,992.65
Total:	**78.89**	**442,327.85**
Supervision/ICR		
FY2006	4.83	19,569.01
FY2007	18.13	108,922.46
FY2008	19.85	87,313.54
FY2009	21.75	89,080.98
FY2010	33.32	133,898.26
FY2011	23.52	75,826.80
FY2012	23.22	69,061.31
FY2013	31.55	121,193.03
FY2014	29.48	154,266.97
FY2015	8.13	62,696.21
Total:	**213.78**	**921,828.57**

Annex 5. Beneficiary Survey Results

The beneficiary survey for NAIP was carried out by the Price Waterhouse and Coopers (PWC), consulting company, as a part of the final impact evaluation. In addition, PWC team was also supported by individual consultants that were hired by the NAIP PIU.

1. Methodology

Sample sub-project/consortia. The beneficiary survey for NAIP is based on a sample of 58 sub-projects/consortia out of a total of 200 sub-projects/consortia (about 30 percent of the total). These sample sub-projects/consortia were selected based on purposive stratified sampling methodology. The number of selected sub-projects/consortia is given below:

Table A5.1. Final Impact Evaluation - Sampling

Component	Number of Total Sub-projects/Consortia	Sub-projects/Consortia selected for the Survey
C1	55	12
C2	51	20
C3	33	20
C4	61	6
Total	**200**	**58**

The largest number of sample sub-projects is from components 2 and 3 because the sub-projects/consortia in these components dealt with value chains and rural livelihoods, respectively, and actual use of innovations and agricultural technologies by farmers and processors. Sub-project interventions for primary survey for the analysis were randomly selected from the selected sample sub-projects/consortia.

Sample beneficiaries. The total number of direct beneficiaries (individuals, organizations or groups) from the above 58 sample sub-projects is 0.2 million. They benefited from the pilot programs, sub-project interventions or adopted and benefited from improved technologies. Approximately, 0.1 million beneficiaries were reached through the capacity development programs. In addition, about 1.5 million beneficiaries were reached through promotional and awareness programs, and horizontal expansion of sample sub-project activities.

The estimated number of women participants in component 2 and component 3 sample sub-projects was about 30.7 percent of the direct beneficiaries. This includes women farmers, SHG members and entrepreneurs. Among the women beneficiaries, 42 percent were tribal women since most of the component 3 sub-projects were implemented in tribal areas. Tribal women were also involved in activities of sub-projects under component 2.

The distribution of 0.2 million direct beneficiaries in the sample sub-projects and the share of major beneficiary groups is as follows:

Table A5.3. Direct Beneficiary Breakdown

Beneficiary Group	Percent share
Farming community (crops, livestock and/or fisheries)	87
Research community (scientists, researchers and graduate students)	7
Entrepreneurs	2
Private companies	0.04
Others	3.96
Total	100

Clearly, the main beneficiaries from NAIP sub-projects/consortia are the farming and research communities. The farming community was reached through the activities of component 2, component 3 and market intelligence activities under component 1 of the sample sub-projects. The research community was reached through activities of component 4 and the capacity development programs under component 1 of the sample sub-projects. The types of beneficiaries reached depend upon the component and nature of sub-project. The primary survey sample was made up of 2,672 beneficiaries and consisted of the following groups:

Table A5.2. Beneficiary Breakdown

Primary Survey Sample	Beneficiary Number	Percent Share
Farmers	2,291	86
Artisans	110	4
Processors	53	2
Researchers	171	6
Others	47	2
Total	**2,672**	**100**

2. Results of the Sample Beneficiary Perception Analysis

The perception analysis of the sample beneficiaries interviewed deals with (a) employment creation, (b) increase in income, (c) adoption of improved practices, (d) institutional development, (e) forging market linkages,(f) sub-project grant disbursement, (g) sustainability of interventions, and (h) overall impact of interventions.

(a) Employment Creation: Employment was created primarily in components 2 and 3. About 70 percent of sample beneficiaries in component 2 and 84 percent of sample beneficiaries in component 3 responded that interventions led to significant or moderate increase in employment. The increase in employment was achieved due to diversification, introduction of crop or livestock production in new areas, availability of agricultural inputs like seeds and water, intensive cultivation and forging of market linkages.

(b) Increase in Income: About 87 percent of sample beneficiaries in component 2 and 93 percent in component 3 indicated medium to high effect on increase in income. This was made possible by productive interventions and the adoption of improved agricultural practices in different agricultural sub-sectors and locations in the country.

(c) Adoption of Improved Practices: Approximately 96 percent of the sample beneficiaries in both components 2 and 3 agreed that the sub-projects led to the adoption

of more scientific and improved agricultural practices. This was made possible by intensive awareness and training programs, including demonstration and workshops.

(d) Institutional Development: Estimated 59 percent of the respondents in component 2 and 58 percent in component 3 indicated that sub-projects implemented institutional development activities such as the SHG, farmer or youth group formation. These groups facilitated the access to and adoption of improved agricultural practices and technology.

(e) Forging Market Linkages: About 60 percent of the sample respondents in component 2 and 40 percent in component 3 indicated that the sub-projects helped the beneficiaries forge market linkages. However, a large number of respondents (60 percent) in component 3 felt that market linkages were not forged. This is partly attributed to the absence of agricultural markets and focus on household food security in disadvantaged and tribal districts under component 3 sub-projects. The process of forging market linkages requires more time and intensive role of agricultural extension.

(f) Sub-project Grant Disbursement. Among researchers, fund disbursement process was rated satisfactory by 93 percent (highly satisfied 19 percent and satisfied 74 percent). The main reasons for satisfactory budget disbursement were clear disbursement guidelines (41 percent), electronic transfer (33 percent) and direct transfer to partners (24 percent). However, sometimes delay in release of funds and non-alignment of partner and World Bank procedures created problems that were addressed over time. Procurement process was also rated satisfactory by 93 percent (22 percent highly satisfied and 71 percent satisfied). The main reasons for satisfactory procurement process were clear procurement guidelines (60 percent) and transparency (24 percent). However, it was also pointed out that the World Bank procedures are lengthy.

(g) Sustainability of Interventions: Estimated 92 percent of the respondents in component 2 were either certain (52 percent) or likely (40 percent) to continue the adopted interventions under the sample sub-projects. The corresponding estimates for component 3 were 96 percent overall, 58 percent certain and 38 percent likely to continue with the adopted interventions. Furthermore, 77 percent of the respondents in component 2 and 97 percent in component 3 were of the view that the introduced interventions will be adopted by other farmers in the area.

Sustainability strategy varies by sub-projects and components in the project. The responses of sample sub-projects/consortia with respect to their sustainability are summarized in Table A5.3:

Table A5.3. Sustainability Strategy by NAIP Components

Component	Private Sector (%)	Own Revenue (%)	Public Funding (%)	Uncertain (%)
C1	42	-	58	-
C2	55	20	20	5
C3	25	25	30	20
C4	-	17	83	-

Public funding is important for sustaining public good type agricultural research under component 4 or institutional capacity, IT and infrastructure development type activities under component 1. Private funding is likely to be the main source for sustaining value chains under component 2. Finally, rural livelihood security type research under component 3 is likely to depend on all the sources for funding to ensure sustainability. Commercialization of NARS technologies as well as technologies developed under NAIP is likely to become an important source of revenue to promote sustainability and provide necessary incentives to scientists. More importantly, BPDUs will also facilitate the transfer of technology from the labs to the farms.

(h) Overall Impact of Interventions: Respondents from components 2 and 3 indicated a large impact of interventions in sample sub-projects at the beneficiary levelin terms ofincreased productivity (large), increased income (large), increased employment opportunity (large), increased market access (large), increased technical knowledge (large),and drudgery reduction (large).

Annex 6. Stakeholder Workshop Report and Results

NAIP organized a large number of stakeholder workshops at the national, regional and consortium levels during project implementation. Particularly, two stakeholder workshops were very unique and innovative. These are (a) Agri-Tech Investors Meet in July 2013; and (b) Agri Innovation Conclave in May 2014. This annex provides a summary of these two workshops.

(a) Agri-Tech Investors Meet

Objectives: The Agri-Tech Investors Meet was organized by NAIP PIU in Delhi on July 18-19, 2013. The purpose of the Meet was to showcase ready-to-commercialize agricultural technologies and their business potential to the possible investors in the public and private sectors and to help promote BPDUs and the entrepreneurial climate in the agricultural sector. The BPDUs were the one-stop shop for commercialization of emerging agricultural technologies and an important link between the scientists and potential entrepreneurs.

Organization: The likely output of the Agro-Tech Investors Meet was to promote and commercialize technologies developed under NAIP by licensing these technologies to the public and private sector. The Meet brought together scientists, entrepreneurs, industrialists and incubators in the form of presentations, business-to-business (B2B) meetings. The process of organizing the Meet included several steps and required the organization of several meetings: (i) partner's sensitization meeting; (ii) agro-technology selection; (iii) profiling of shortlisted technologies; (iv) mobilizing participants and technology reports; and (v) Agri-Tech Investors Meet.

The event included opening session, followed by presentations related to technologies of food processing, horticulture and agro-forestry, marine products, agricultural engineering and textiles and industries, veterinary and livestock, farm business and agricultural inputs. The presentations were followed by 98 B2B meetings between incubator team and the industrialists and agri-business entrepreneurs for technology commercialization from the pool of 60 shortlisted high impact technologies. The individual B2B meetings were followed by open discussion among all the stakeholders and then the concluding valedictory session.

Results: The followings are the main results of the Agri-Tech Investors Meet: (i) More than 300 stakeholders participated in the Meet. (ii) Total technology transfer fee was Rs. 32 million (about US$0.5 million) in the form of license fee. (iii) 58 agricultural technologies were commercialized (32 NAIP and 26 Non-NAIP) with a total of 80 licenses (45 for NAIP technologies and 35 for non-NAIP technologies). (iv) Several BPDUs and the partner institutions were recognized for their contributions in transferring and commercializing technologies through public private partnerships. The short listing of potential high impact technologies was based on several criteria, including size of investment required, industry readiness, market size, social impact, novelty of technology and intellectual property right enablement. Overall, the Agri-Tech Investors Meet was very successful in achieving its objective. The feedback was very positive.

(b) Agri Innovation Conclave

Objectives: The Agri Innovation Conclave was organized by NAIP PIU in Delhi on May 19, 2014. The main objective of the Conclave was to take technologies developed under NAIP to the potential public and private investors through public and private partnership and promote the adoption and transfer of those technologies. Again, the BPDUs played a very important role in the process of agricultural technology transfer and commercialization and providing a critical link between scientists and entrepreneurs.

Organization and Results: The Agri Innovation Conclave was the culmination of the "KrishiParivartanYatra", a train journey of 34 NAIP beneficiaries across five cities to share success stories on agri-ventures and the Agri-Biz Idol camps held to reach out to youth and start-up entrepreneurs. The Conclave included policy makers, eminent agri-business experts, professional, entrepreneurs, farmers and other stakeholders from across the country to share NAIP's success, conceive path breaking ideas for strengthening the future of agri-business in India, and promote scaling-up and partnership opportunities of various NAIP sub-projects.

The Agri-Biz Idol Camps were organized for students and start-ups from May 5-9, 2014 in 5 business schools in the country. The aim was to identify, support and encourage young entrepreneurs with high potential for business start-ups in agriculture. The camps were organized at NAARM, Hyderabad; Symbiosis International University, Pune; Tamil Nadu Agricultural University, Coimbatore; Institute of Rural Management, Anand; and IARI, New Delhi. This was followed by the KrishiParivartanYatra which started in Hyderabad on May 11, 2014.

The Yatra has provided an opportunity to cross-learn the ways for achieving success in developing agri-business enterprises. The Yatra involved the best of 34 enterprises developed from various NAIP sub-projects and share their success stories with other farmers and entrepreneurs in each of the five locations. The five different cities included in the Yatra are Hyderabad, Nagpur, Bhopal, Mathura and Delhi. The Yatra started from ICRISAT in Hyderabad and concluded and culminated in the Agri Innovation Conclave at New Delhi.

Many consortia partners were involved in the Yatra and the Conclave, including ICAR institutes, SAUs, NGOs, government agencies, cooperatives, entrepreneurs, farmer organizations and farmers. These success cases effectively translated into major transformation of the agriculture enterprises into self-sustaining successful business models. A large number of farmers participate in the agricultural fairs organized in each of the cities. Finally, the Agri Innovation Conclave brought stakeholders from all over the country on a common platform to share NAIP's success to help commercialize agricultural technologies and promote agri-business in India. In addition to a large number of participants from India, representatives of ICRISAT, FAO and the World Bank also participated.

The Conclave encouraged active participation from the public and private sector in promoting innovation, partnership and entrepreneurial climate in Indian agriculture. The Conclave participants provided a very positive feedback about the design and

implementation of NAIP, particularly the consortium mode of research, partnerships and an emphasis on commercialization of technologies. A large number of farmers and entrepreneurs were able to benefit and learn from the success stories of 34 enterprises triggered by NAIP.

Annex 7. Summary of Borrower's ICR

The National Agricultural Innovation Project (NAIP), jointly funded by The World Bank (WB) and Government of India (GOI), was implemented by the Indian Council of Agricultural Research (ICAR), Department of Agricultural Research and Education (DARE), Ministry of Agriculture, GOI. The project outlay was USD 250 million (USD 200 million by the WB credit and USD 50 million from GOI). Besides, a grant of USD 7.34 million was approved by Global Environmental Facility (GEF) under Sustainable Land and Ecosystem Management Country Partnership Program(SLEM CPP).NAIP was approved on April 18, 2006,and became operational since September 18, 2006 and with an extension of 18 months it concluded on June 30, 2014.

The overall objective of the project was to facilitate an accelerated and sustainable transformation of Indian agriculture so that it can support poverty alleviation and income generation through collaborative development and application of agricultural innovations by the public organizations in partnerships with farmer's groups, the private sector and other stakeholders. The project was implemented through four components viz., ICAR as a catalyst in management of change in Indian NARS (Component-1), research on production to consumption system through value chains approach (Component-2); research on sustainable rural livelihood security including sustainable land and eco-system Management (Component-3); and basic and strategic research in frontier areas of agricultural sciences (Component-4).

Broadly, NAIP has made significant contributions towards meeting the National objectives of increasing farm incomes and eradicating extreme poverty and hunger, which is also a Millennium Development Goal of the United Nations. The project has triggered acceleration of collaborations in the development and application of innovations in agriculture by involving the public, private, non-governmental researchers, enterprises and individual farmers.

Innovative features of NAIP

The important innovations NAIP ushered into the system are:(i) scenario planning with full involvement of the clients, (ii) consortia mode to promote pluralism in the design and implementation of research projects, (iii) public–private partnership in research, (iv) competitive selection of sub-projects, (v) delegation of powers to consortia, (vi) human capacity development in critical areas of sciences and cutting edge research, (vii) business planning, incubation and development and technology commercialization, (viii) ICT applications in agricultural research and education, (ix) multilevel support and monitoring, (x) development and application value chain models in agriculture, (xi) integrated farming system (IFS) approach for livelihood improvement in disadvantaged region of the country, (xii) social inclusion and participatory approach, (xiii) up-scaling competitive research capacity in frontier areas of agricultural sciences, (xiv) inculcating fiduciary experience in research management through specialized finance, procurement, administrative, monitoring and evaluation systems, (xv) emphasis on post project sustainability, and (xvi) cross learnings.

The project was implemented through 203 sub-projects, 856 consortium partners from ICAR Institutes (40.89 percent), State Agricultural Universities (24.53 percent), Central Universities and Organizations (9.11 percent), State Universities and Organizations (4.44 percent), CGIAR Centres (1.87 percent), Private Industries (8.53 percent), and Non-Government Organizations (10.63 percent). This is for the first time in the history of Indian agriculture that such a diversified group of partners have worked under one project. The number of approved proposals was three times more than the originally envisaged number for consortia to be supported as per the project appraisal document.

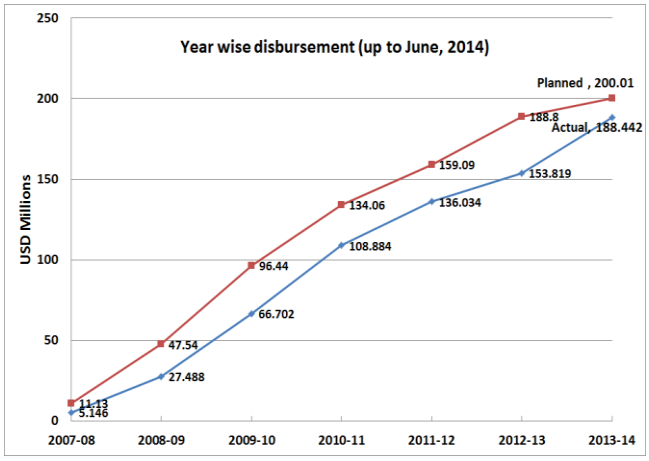
Administrative structure and governance

The ICAR institutionalized the project administration through a dedicated Project Implementation Unit (PIU). As envisaged in Project Implementation Plan (PIP), PIU coordinated and facilitated implementation of the project. It was headed by a National Director (ND) supported by National Coordinators (NCs) for each component, Finance, Procurement and Administration Units. The PIU worked under the guidance of National Steering Committee (NSC) and Project Management Committee (PMC), both headed by the Director General, ICAR. These Committees were supported by an O&M Program Committee (O&MPC) for Component 1 and Research Program Committee (RPC) for Components2, 3 and 4. Technical Advisory Groups (TAG) were constituted, each for Component 2,3 and 4, for peer reviewing of concept note and full research proposal submitted as part of the competition process and ensure quality through scientific and technical evaluation for final consideration by the RPC of sub-project proposals under their respective Components. Detailed Terms of Reference of these Committees are included in Project Implementation Plan (PIP). During the project period NSC met 10 times, PMC 35 times, RPC 41 times and O&MPC 22 times at PIU.

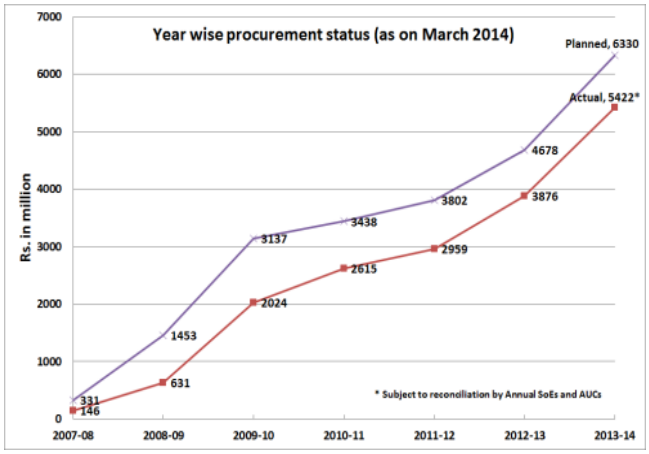
The project was executed in three phases. Phase 1 (September, 2006- March, 2009) dealt with identification of areas of research, inviting concept notes and proposals to meet the NAIP objectives; peer review and approval of the proposals. Due to overwhelming response of proposals under competitive funding and to ensure the quality of approved proposals, this phase involved three calls for submission of project proposals. Phase 2(July, 2007 – March, 2012) was the implementation, monitoring and evaluation phase of the approved sub-projects. During this period, the consortia implemented the approved technical program to meet the objectives of the respective subprojects. Phase 3 (April, 2012 – June, 2014) covered the extension period granted to the project with focus on consolidation of gains, scaling up of high payoff interventions, commercialization of technologies, filing of patent applications etc. Impact assessment of NAIP by independent consultant was undertaken during this period.

Finance: PIU-Finance, headed by Director Finance was responsible for overall financial management across 365 spending units that included planning the budget and timelines, expenditure, conducting timely audit and settlement of audit paras and getting reimbursement. The innovative features of financial management included maintaining separate bank account, timely submission of bank reconciliation statements and fund

transfer directly to consortium partners through real time gross settlement (RTGS). A common set of rules and guidelines were adopted for all the Consortia spread throughout the country following the Financial Management System Manual prepared for NAIP. The main achievement of financial management was the full utilization of the credit made available as per the agreement; a rare feat in annals of organizational financial management.



Procurement: Under NAIP, procurement was in a decentralized mode exercised by consortium partners based on sanctions under their sub-projects and as per the provisions of "Procurement and Consultant's Services" annexed to Project Agreement. A 'Procurement Manual' dovetailing procedures for procurement of goods, works and services, was prepared and 1,492 personnel at 34 different locations were trained in the processes. A procurement consultant was hired to guide and assist consortia in procurement and the service was available to the consortia as well. The hall mark was a totally decentralized and transparent procurement effected by the consortia themselves through more than 10,000 contracts worth nearly INR 6,000 million. The equipment costing more than Rs. 10 lakhs were geo-tagged and put on the website of NAIP.



Complaint and grievance redress mechanism

Adequate grievance redress mechanism was put in place and necessary guidance was issued to all consortia. National Coordinator, Component -3 was identified as a Nodal Officer. The Under Secretary was the contact point person. All complaints were addressed on priority. To monitor the progress a complaint register was maintained at PIU, Procurement Cell.

Component-wise salient achievements

A steady stream of new technologies emanated from the NAIP funded research. These included development of 99 production and 174 processing technologies, piloting of 47 rural industries, livelihood improvement of more than 1.7 lakh direct beneficiary farmers

(as a model) living in 97 disadvantaged districts of the country through IFS approach, filing of 186 patent/intellectual property protection applications, publication of 427 research papers in high impact international journals, establishment of 91 sub-projects through public-private partnerships, 23 business planning and development units and 39 producer companies. A large number of success stories were captured by TV and newspaper media, websites etc. In recognition of meritorious services, 349 awards were given to scientists, farmers and organizations for the project work. Overall 200 Ph.D. and 164 M. Sc. students completed their degrees under the project.

Component-1: ICAR as the Catalyzing Agent for Management of Change in the Indian NARS

Activities of the component 1 were aimed at system-wide efficiency, effectiveness and productivity in NARS through 55 sub-projects distributed over the five sub-components. Some of the national initiatives took off were: online accessibility for more than 3,000 research journals, online access to high-end statistical computing software, e-publishing and online access to ICAR journals, development of 425 e-courses for degree programs in seven disciplines of agriculture, Knowledge Management Portals, digital library repository of rare and important books, journals, reports, high speed gigabit internet connectivity in 57 institutions and 19 state agricultural universities, establishment of a Data Centre on the latest cutting edge global technology, etc.

Mobile and web portal applications developed under Agropedia and Market Intelligence sub-projects, delivered and exchanged information in multiple Indian languages through, SMS/voice transactions, virtual Krishi Vigyan Kendras (vKVKs) serving 35,000 farmers, over 160 video films/capsules and audio capsules, more than 2,100 news/features, 400 news and success stories posted on ICAR website, 400 TV/Radio programs telecasted, 106 agricultural scientists trained in knowledge management and agricultural communication, 6,000 farmers/entrepreneurs benefited, about 105 videos uploaded on YouTube on agricultural innovations and a number of media interactions/webcasting and media meet such as Agri-Tech Investor Meet, Agri Innovation Conclave and Agri Biz Idol Program were organized. Social media (Facebook, You Tube and blogs) as a means of dissemination of agricultural knowledge has been introduced.

The first supercomputing hub "ASHOKA" was installed to support biotechnological research in agriculture under the sub-project, National Agricultural Bioinformatics Grid (NABG). Infrastructure for conduct of online examinations has been established and Agricultural Scientists Recruitment Board successfully conducted the first online examination for ARS/NET during March 26 – April 04, 2014 at 23 centers across the country.

The 23 Business Planning and Development (BPD) Units were established. It incubated 1,218 entrepreneurs, graduated 91 incubatees, commercialized 331 technologies from NARS, facilitated 186 patent applications and trained about 3,700 entrepreneurs, generated revenue of INR 247 million. The BPDUs provided platform for technology incubation and commercialization in agriculture for the first time in the country. Agri-

Tech Investors Meet during July 18-19, 2013 and the Agri-Innovation Conclave during May 18-19, 2014 showcased more than 80 NAIP technologies and commercialized 58 for a value of about INR 32 million and many MoUs were signed. These meets brought the innovator, entrepreneur and industries on one platform through business to business (B2B) meets.

487 scientists were trained abroad at a cost of INR 382.60 million in 27 frontier areas of agricultural sciences and under consortia to keep them abreast with the latest advancement and 1,500 scientists underwent National Trainings in 92 programs offered by a small pool of experts drawn from India and abroad.

A robust and flexible Enterprise Resource Planning (ERP) solution for ICAR, which includes Financial Management, Project Management, Material Management, Payroll & Pension and Human Resource Management, was put in place. The solution based on Oracle ERP (Oracle R12.13) was customized as per ICAR requirements and implemented at ICAR Head Quarter and its 62 institutes.

A multi-disciplinary PME Cell has been established in all ICAR institutions. Market intelligence cells of 11 centers provided 298 commodity price forecasts covering 19 crops in 10 states by publishing in 130 leading dailies and through Text and Voice SMS directly to more than 150,000 farmers.

Component-2: Research on Production to Consumption Systems (PCS)

Component-2 implemented 51 sub-projects and established market oriented collaborative research alliances for value chains in cereals, fruits, vegetables, flowers, meat, fish, dairy foods, bio-colors, neutraceuticals, and bio-energy aiming at higher returns to the actors in the chain. Ninety nine production and 174 processing technologies were developed and adopted. Fifty one public-private partnerships were formed and 47 new rural industries were piloted. Some of the promising value chains were on agro-forestry, flowers, guava, banana pseudostem, saffron, sorghum, millets, linseed, pashmina fiber, milk, small pelagic, oysters and tuna fisheries. Innovative value added products were developed from millets, fishes, pork, by-products of milling industries, etc. and new entrepreneurs were promoted to establish processing units. Five models of value chains were identified and several pilot plants were set up in value chain sub-projects.

Agro-forestry value chain resulted in a horizontal expansion of 44,724 ha, millet foods backstopped more than 200 processing industries, campaigning on sorghum value added foods and nutrition covered over 12,000 farmers horizontally, flower value chains brought down the post-harvest losses in jasmine from 40 to 10 percent and the enhanced shelf life enabled through a packaging technology expanded the international market by time and space, increased dry flower export value to INR 95 million from INR 43 million, and contract farming system in marigold enabled about 13,000 farmers get a steady price. The saffron value chain with a new production technology revived its cultivation besides increasing the yield and area posting an economic gain of INR 937.5 million to the society. Value chain on guava and mango brought in a farmer producer

company tied up with an assured export market that fetched premium price for the produce. The interventions under linseed value chain, increased the crop area by 55,000 ha, productivity by 585 kg/ha, income by INR 22,000/ha and production and branding of a range of products rich in Omega 3. The yield of coconut was increased by 50 nuts/palm and a protocol for cost effective production of Virgin Coconut Oil developed besides a technology for pollution free activated charcoal preparation from coconut shells. A few value chains had a direct bearing on women empowerment, employment and esteem.

Component-3: Research on Sustainable Rural Livelihood Security (SRLS)

The Component 3 strived for sustained improvement in the incomes and well-being of farm families in disadvantaged areas through 36 sub-projects[46] implemented in 97 disadvantaged districts including 20 districts with more than 50 percent tribal population. The component was implemented through 201 consortium partners consisting of 50 ICAR institutes, 48 SAUs, 67 NGOs and 36 other units. Sustainable models were developed for livelihood security of vulnerable groups' particularly landless people, marginal and small farmers based on integrated farming system (IFS) approach. Some of the IFS models on rice-fish-poultry, rice-fish-vegetables, forest produce processing groups, livestock based interventions like improved breeds of goats, poultry, pig, etc. showed good results in enhancing livelihood. One hundred and four crop-horticulture-livestock production models were recommended for mainstreaming through the State extension systems. About 0.81 million farmers (cumulative) were covered during the project period in development of livelihood improvement models, 72,191 ha area was brought under improved crop cultivation, 10,160 ha area under vegetable cultivation practices and 6,211 ha under additional irrigation. The efforts resulted into increase of weighted mean income from INR 29,298 to INR 77,532 per annum. Pipeline networking and social engineering for participatory management enabled sustained and equitable use of ground water among the tribal participants in Rangareddy district. Reclamation of salt affected soils increased rice and wheat yield by 22-28 per cent besides improving soil health parameters. Community based bio gas cum vermi compost unit besides solving the energy problem created employment for the participants. Organic farming and GI registration were also demonstrated for higher income. The success of rice-fish-poultry witnessed a horizontal expansion among more than 400 farmers. More than 1.5 lakh farmers adopted various interventions demonstrated under the component. The project developed successful marketing models through agricultural producer companies; farmers owned marketing centers, linkages with established marketing units etc. Synergy with various ongoing programs was developed for holistic development of the farming community.

The component3, in all had addressed 176,519 direct beneficiaries. The interventions increased the household income to INR 77,532 vis-à-vis the baseline income of INR 29,298. The component research generated 104 livelihood models for different disadvantaged districts, 213 papers, 397 bulletins/books, etc. Five successful livelihood value chains were developed by community participation and social mobilization.

[46] This includes 3 GEF-financed sub-projects.

Women based SHGs, agro processing units, hand tools for drudgery reduction, activities like ornamental aquaculture, mushroom production, value addition of agro-forest produce, goat husbandry, small scale food processing units, training program on entrepreneurship development (EDP), etc. are some of the component activities aimed at empowering them.

A unique concept of sustainability fund was conceived and created, mobilizing an amount of INR75 million for the continuity of various interventions beyond the project period. The concept of goat bank, seed bank, and fodder bank was introduced for post project sustainability. Four seed societies, each with 22 members, were created to enhance availability of quality seeds in tribal areas of Jhabua. Seven agribusiness producer companies were formed in Rajasthan, West Bengal and Bihar. A few Rural Technology Centers were established by different consortia to provide advisory services. Five patents applications were filed by IVRI, Izatnagar under the component.

Under GEF funding to three subprojects, 8,371 ha area (including degraded coastal land) was brought under improved crop cultivation; 17,702 farmers and 16,200 fishermen were covered through agri-farm advisories; 26 community seed banks and 15 rural resource centers were established.

Component-4: Strengthening Basic and Strategic Research in Frontier Areas of Agricultural Sciences (BSR)

The objective of Component-4 was to enhance capacity and attain excellence in the basic and strategic research in frontier areas of agricultural sciences like biotechnology, integrated pest management (IPM), post-harvest technology (PHT); engineering, sensors and precision agriculture; animal production, nutrition, physiology and health; natural resource management and climate change; nano-technology and science; biosystematics and biodiversity; social sciences, etc. Sixty one sub-projects were approved under this component.Component-4 supported novel and cutting edge research which provided strong underpinnings for addressing the near, medium and long term problems of Indian agriculture.

Promising output from component-4 includes: 11 genes specific to fiber development in cotton and their deployment through transgenic approach; assortment of basmati rice lines containing blast resistance genes with good cooking quality; parentage verification kits and ‘Confirm Paternity’ software for buffalo, cattle, goat, camel and other animals; cloned buffalo ‘Garima-II’ and its normally delivered calf, ‘Mahima’ along with four stem cell lines developed and conserved for the long term through repeated passages; herbal extracts for control of ticks in cattle; diagnostic kit for detecting plant viruses especially in vegetable crops; whole cell vaccine against virulent sheep footrot in mountainous regions; prolific fruiting types from the inter-specific crosses of okra which can be used for further breeding and allele mining; chip based bio-sensor and micro-well chip platform for detection of ultra-trace concentrations of pesticides and adulterants in milk; standardized protocols for safe production and application of biological and phosphate nanoparticles; and flexi-rubber check-dams for harnessing surface flow water

in small streams. Other prominent outcomes were: novel methodological tools, including new methods for synthesizing nano-sulphur, nano-cellulose and bio-degradable plastic with nano-fibril fillers; technology for detection of contaminants in milk, validated and licensed to commercial dairy giant 'Mother Dairy'; filing of 85 patent applications including one international PCT application filed, and another Australian short patent granted; publication of 742 research papers, including 427 research papers in highly rated (>6/10) international/ peer reviewed journals; 581 other publications brought out including symposia/conference papers, chapters in books, technical bulletins and other reports and sensitization/awareness/publicity material; over 2.85 million molecular resources generated/ identified and documented; developed a state-of-the-art national referral centre for milk, a spacious phenotyping facility for plant biotechnology research, an international biosafety compliant controlled climate facility for carrying out research on white fly, an obnoxious insect pest, and a virus detection lab for citrus, etc.; fabricated high clearance multi-utility vehicle for precision farming applications; and equipped the labs of different consortia partners with sophisticated equipment for enhancing their research capacity in basic and strategic research

Environmental and Social Safeguards

NAIP subprojects were designed to have minimum or no adverse effect of environment and social fabric of the society. Adequate mitigation measures were adopted wherever required. The environmental and social safeguards (E&S) framework for all the approved proposals of Components- 2, 3 and 4 were prepared in the prescribed format, revised in consultation with the World Bank and put up on the NAIP website. Environment friendly technologies like agro-forestry, water harvesting, organic farming, etc. were encouraged. In case of interventions with excessive use of farm machines, use of insecticides, pesticides, etc., methods to mitigate their effects were implemented.

Some of the safeguard measures taken were (i) community Seed Bank to salvage and reintroduce landraces of wheat, sorghum and pearl millet; (ii) introduction of local breeds of poultry, Kadaknath and small ruminant, Sirohi goats; (iii) formation of Producer Companies for new business opportunities through crop diversification; (iv) profitable integrated farming systems; (v) federating large number of women self-help groups (SHGs); and (vi) rainwater harvesting and micro irrigation systems.

Use of integrated nutrient management (INM) and integrated pest management (IPM) in crop production, production of vermi-compost and compost, use of bio pesticides, organic farming, etc. reduced the use of agro-chemicals besides increasing productivity and improving soil health.

'Waste to wealth' concept was followed under component 2 through proper utilization of by-products. Some of the major activities included decentralized power generation from plant stalks, banana pseudostem for fabric, candy and vermi-compost, etc.

Most of the Component-4 sub-projects are involved in laboratory-based and a few on experimental field studies. Broadly, the research component under these sub-projects is

environment friendly (or having positive environmental effects) and socially safe. Animal welfare issues wherever applicable have been taken care for maintaining the animals and collecting samples. In biotechnology related sub-projects involving studies on manipulation of genes, alleles, transcription factors and vectors, etc., all such works have been restricted only to laboratory and contained greenhouse facilities. All the materials were handled as per the prevailing Biosafety Committee (IBSC) regulation. At the higher order in genetic manipulation, wherever applicable, guidelines of various Committees such as Review Committee on Genetic Manipulation (RCGM) and Genetic Engineering Appraisal Committee (GEAC) were deemed to have been followed.

Monitoring and Evaluation

The project design included appropriate indicators for monitoring progress and achievement of the PDO. A professional M&E consultant firm was hired to assist PIU in planning and organizing the baseline survey or 2,800 respondents for components 2&3, 56 ICAR institutes and 25 State Agricultural Universities for component 1.A user-friendly 'M&E Manual' was prepared laying out the monitoring mechanism including Consortium Monitoring Unit (CMU), Consortium Implementation Committee (CIC), and Consortium Advisory Committee (CAC) at consortium level and by RPC/OMPC, PMC and NSC at PIU level.

Comprehensive outcome focused impact evaluation of the sub-projects was conducted by an independent consultant firm covering a sample of more than 5,500 stakeholders consisting of participant and control farmers, artisans, scientists, traders, processors, agro-industrialists, etc. associated with 65 sub-projects.

Financial and economic analyses

Impact in Components2 and 3 was largely in terms of increase in income, productivity and production, cropping intensity, etc. Impact in Components1 and 4 was evaluated on basis of the potential benefits likely to accrue in future due to development of technology and IT infrastructure. Therefore, impact of the sub-projects under Components1 and 4 was measured in terms of Net Present Value (NPV) after discounting the likely future benefits.

Component-1 created an overall better access to knowledge repository, ICT application, and innovative platform for incubation of technologies, start-ups and commercialization. Component-2 resulted in strengthening value chains though customized interventions at critical stages leading to creation of rural industry/companies and quality enhancement. Component-3 resulted in enhanced income, employment generation, formation of farmer groups and SHGs and community infrastructures. Component-4major impacts were on quality of publication, patent application and enhanced capabilities for scientific and technological problem solving.

NAIP sub-projects had an overall financial and economic benefit cost ratio of 1.78 and 1.69 respectively, based on the extrapolation of the sample sub-projects to whole NAIP.

Total benefit accrued was estimated to be INR 23,098.74 million on an initial investment of INR 12,931.10 million.

Post project sustainability arrangements

A major emphasis of NAIP was on developing a mechanism of sustaining project activities beyond the project period. Most of the activities of Component-1 consortia are mainstreamed in the XII Plan of the participating institutions - CeRA by DKMA; e-Granth by Agricultural Education Division of ICAR; NABG has evolved into a separate Division of IASRI; ARS/NET online examination by ASRB; and SAS and MIS/FMS by IASRI. ASRB can also hire out its online exam facilities for other agencies like conducting online exams for revenue generation. Market Intelligence work is already being carried by NCAP funded by MoA, GOI and TNAU funded by State Planning Commission. A Technology Foresight Centre has been established to work on visioning, technological forecasting, etc. PME cells have been institutionalized.

A few sub-projects in Component-2 were able to utilize their profits to sustain, whereas, some consortia were able to manage support from the line Departments. SKUAST-Kashmir received support of Rs.4,110 million from National Saffron Mission and Rs.100 million from Central Wool Board to sustain the research on value chains on saffron and 'Pasmina' fiber respectively. CSKHPKV, Palampur is being supported by National Mission on Seabuckthorn with a budget of Rs. 10,000 million for its extension in five states. BVT, Pune received support from DST for continuing research activities value chain on linseed. DSR, Hyderabad received support from INSIMP scheme of DAC for Rs.3,000 million. The income generated from greenhouses, nurseries and produce/ products and contributions by the associated industries will sustain the agroforestry and flower value chains. CPCRI, Kasargod is in process of licensing its technologies to about 30 entrepreneurs. CIFT, Cochin received support from Fisheries Department of Kerala to further the research on small pelagic. Besides, RKVY, National missions on Cotton, Coconut, Bamboo, Horticulture, MSME and Private sector may chip in support for sustenance of sub-projects of their interest.

Development of sustainability fund concept, revolving fund approach, village level seed and feed banks, etc. were the measures taken to sustain the Component 3 sub-projects post-NAIP funding. All the sub-projects have generated sustainability fund, amounting to Rs. 7.51 crore signifying the community mobilization. Thirteen consortia reported a support of Rs.313 million by various agencies to strengthen their activities: UAS, Raichur received support of about Rs.120 million from various Departments for livelihood improvement; CRIDA, Hyderabad received support of about Rs.30 million from NREGS, DWMA, NPDCL & ITDA, JP Morgan/Planet water foundation, CLDP, NABARD-WDF watershed program, etc.; and BCKV, Kalyani received Rs.26 million from DRDC; Dept. of Agri. Marketing-Govt. of West Bengal and NABARD. Rice-fish-poultry IFS scheme in TN is likely to be funded by the state government. The various financial inclusion schemes of GOI may pick up some of the activities for financing through SHGs/NGOs.

Under Component-4, many consortia had already sought or were in the process of seeking extramural support for the continuation of their research; and some activities were mainstreamed by the ICAR institutes in their XII Plan or on the consortia research platforms supported by the Council. Some consortia like rubber dam, and nano-fertilizers had entered into post-NAIP MOUs to jointly pursue their research and commercial interests whereas some other consortia like nano-pesticides, sensors of multi-analyses to detect milk and water impurities/contamination were in the process of entering into similar post-NAIP agreements.

Lessons Learnt

Some of the lessons learnt which could be mainstreamed in the NARS are:

The NAIP website and the NAARM Helpdesk served as the major source of information in conceptualization of the sub-projects. Concept of helpdesk needs to be promoted. Identification of Consortia Partners was a great challenge before the Project. The Consortia promoted pluralism, synergy and value addition contributing to strengthening the NARS working with non-traditional Partners like NGOs, private sector and others. This arrangement has worked very well and that is how technologies which were lying on the shelf are now being commercialized. However, there is a need to be more careful in selection of partners in future projects, as some of the partners did not perform satisfactory.

Competitive funding contributed to get creative ideas and quick, quality revision and response. Transparent and responsive governance contributes to public confidence and smooth project management and considerably reduced the time taken for completing the review and approval process. Costing of the project by a Committee is a major reform in rationalizing the budget of the sub-projects.

Empowering the Consortium Principal Investigators (CPIs) for fund utilization has led to decentralization of power and timely action. Notwithstanding some of the minor administrative issues it needs to be promoted for better output, budget utilization and accountability.

Decentralization of administrative and financial authority for timely flow of funds has ushered in a new way of working. All the consortia have expressed greater satisfaction with online fund transfer to the separate account created for the purpose

It took time to streamline adoption of the World Bank procedures as it differed from the procedure followed by many of the implementing agencies. However, massive capacity building program undertaken by PIU-NAIP facilitated the smooth adoption of World Bank financial and procurement procedures. The procurement of supplies including equipment through the World Bank (WB) process, has been considered to be useful because of more transparency. But, stringent procurement procedures of WB led to delay in procurement, particularly in remote backward areas.

Researchers have learnt to shift from uni-disciplinary mode of functioning to multidisciplinary research in NATP and now multi-organizations collaborations in NAIP.In the process scientists have learnt to develop and maintain scientific linkages and also cross-learnt different work cultures.

IT enabled Project Management System linking all the Consortia and Partners ensured proper and timely implementation of different activities and updated information.

Researchers have started thinking out of box towards post funding sustainability of the projects in terms of sustainability fund, social mobilization, self-help and producer groups, to cite a few. However, venture capital fund (VCF) for value chain project should be thought of in future programs.

Very strong mechanism has been built into the sub-projects to periodically monitor their progress - technical, financial and infrastructure, by internal and external. But, too much of reporting created some practical problem as the researchers were made to spend more time on report preparation at the cost of actual research.

Concurrent comprehensive independent evaluation in NAIP vs ex-post in NATP is an improvement as the evaluators could see the project in action and the comprehension is better as 'seeing is believing'.

The online project monitoring and tracking system was initiated but could not be fully developed. Such a system needs to be developed and commissioned in futures projects.

M&E should be concurrent with a full-fledged M&E Unit with agricultural economists in place throughout the project period.

Monitoring system by WB in terms of performance indicators, agreed actions, scoring and grading of the consortia kept project pace on track. However, some of the PAD indicators and targets could have been better formulated.

Way Forward

The NAIP is the world's biggest innovation project in agriculture to be ever funded by the WB till now. The project has made tremendous impact in terms of innovations, partnerships, technology commercialization, patenting, capacity building, etc. Research is a continuous process and hence, it is necessary to consolidate the gains of livelihood and value chain models and to harness the investment on huge infrastructure made in ICT and basic and strategic research. Ideally, an NAIP Phase II would have enabled carrying forward most of these innovations in Toto. In its present state, concerned implementing agencies may be sensitized to take up the gains of NAIP forward.

For the time being, the National Agricultural Education Program (NAEP) evolving can absorb some of the component 1 projects particularly e-courses and capacity building.

The means of sustaining other components have been discussed under the head sustainability and scalability.

NAIP worked on the strength of pluralism in PPP mode and decentralized delegation of powers for execution (CPI/CCPI), re-appropriation of budget (CIC, CAC), approval (RPC/OMPC, PMC). It needs to be dovetailed into future projects.

Innovations should result in wealth and job creation for the country. The vision should be in striving for an agricultural research and education system that imparts skill and incubates the students or scholars who can create jobs than seeking one. Knowledge accumulation and application should evolve a whole innovation system in agriculture encompassing all the actors beyond NARS to drive the development towards sustenance and rapid poverty reduction and turn agriculture to a more competitive, sustainable and inclusive activity.

Agricultural research stations should emerge as innovation and incubation clusters. Innovation has to become a way of life and work culture. This cannot be achieved overnight or by infusion of massive interventions alone. It has to come by creativity and enabling mechanism to sustain and build on creativity. The education system should ensure the necessary skill development towards this end than mere manufacturing of degrees. The traditional linear system of agricultural R&D keeps away many other actors needed and responsible for innovation process.

Constitution of a National Agricultural Innovation Fund and its support to innovation clusters will make a real difference in bringing innovative ideas from the lab to the marketplace. The government plays a fundamental role in creating the necessary economic, social and institutional conditions that foster innovation through effective policies.

A Venture Capital Fund will go a long way in creating and sustaining the value chains in agriculture by private sector.

The Results Framework Indicators should be clearly definable, tangible, measurable, and trackable. The researchers should be fully sensitized and oriented for tracking results as measured in terms of these indicators right from the start of the program without losing sight of the technical front.

Borrower's performance

ICAR effectively used NAIP to integrate non-traditional partners in the NARS, particularly for harnessing the research skills which were not available in the ICAR-SAU system. Project was able to capture some of the latent creativity and innovation in the agricultural scientific community and has made significant progress in building an environment that encourages partnerships and capacity building for taking a holistic approach to research and solving the problems in agricultural production/marketing chains. ICAR performance is rated as Highly Satisfactory. It is evident from the fact that

100 percent of the budget has been utilized and achievements have exceeded targets in almost all the cases.

Government of India performance

The Department of Economics Affairs, Planning Commission and Comptroller of Aid Accounts and Audit (CAAA) extended full cooperation in timely clearance, extension and approvals to the project. Convergence with Central schemes such National Horticulture Mission, RKVY, National Food Security Mission, NICRA, BGREI, etc. of NAIP activities contributed to the social goal of inclusive growth. GoI performance is rated as Highly Satisfactory.

Bank's performance

Bank was prompt in assisting the project during the consortia formation, implementation phases and all through the execution of mega ICT initiatives. Mission field visits greatly encouraged and steered the consortia in realizing the project outputs. The Aide Memoirs critically evaluated the performance of the project and kept the project on track through Agreed Actions. The Bank performance is rated Highly Satisfactory.

Annex 8. Comments of Co-financiers and Other Partners/Stakeholders

Annex 9. List of Supporting Documents

1. Project Appraisal Document (PAD), Report No. 34908-IN, March 9, 2006
2. GEF SLEM Project Papers
3. Restructuring Paper (Extension of the Closing Date), Report No. 60024-IN, March 10, 2011
4. Aide Memoires and ISRs following Implementation Support Missions
5. World Bank Management Letters
6. India Country Assistance Strategy (CAS) FY 05-08 and FY 09-10
7. India Country Partnership Strategy (CPS) FY 2013-2017
8. NAIP Project Implementation Plan (PIP), ICAR, February, 2006
9. Procurement Manual
10. Financial Management Manual
11. Manual for Accounting, Auditing and Reimbursement Procedures, NAIP, ICAR, 2005
12. Borrower's Implementation, Completion and Results Report for NAIP, PIU, October 2014
13. Borrower's Implementation, Completion and Results Report for SLEM, PIU, September 2014
14. Outcome Focused Impact Evaluation of NAIP, Final End-Term Evaluation Report, NAIP PIU and Price Waterhouse and Coopers (PWC), June 2014
15. NAIP – Case Studies, NAIP PIU and PWC, June 2014
16. Half-Yearly, Annual and Final Progress Reports by Components, NAIP, PIU, ICAR
17. A Compendium of Agro Technologies, Agri-Tech Investors Meet 2013, 18-19, July 2013, New Delhi, NAIP PIU, ICAR
18. Cross Learning, Reflections and Experiences of NAIP, Directorate of Oilseeds Research, ICAR, June 2014
19. Final Progress Reports for all the Sub-projects/Consortia funded under NAIP, 2014
20. ICAR Guidelines for Intellectual Property Management and Technology Transfer and Commercialization, ICAR, New Delhi, October 2006
21. Annual Report, 2013-14, ICAR, New Delhi
22. Vision 2030, ICAR, New Delhi, January 2011
23. Innovation to Impact, A Compendium of Innovative Agro-Technologies of NAIP-ICAR, May 2014
24. National Agricultural Innovation Project, Special Volume, Indian Farming, May 2014
25. Faster, Sustainable and More Inclusive Growth, An Approach to the 12th Five Year plan, Planning Commission, Government of India, October 2011
26. Report of the High Power Committee on Management of KrishiVigyan Kendra (KVK), Agricultural Extension Division, ICAR, January 2014
27. Impact Assessment of Capacity Development Programs under NAIP, South Asia Regional Office, IFPRI, New Delhi, 2014
28. Monitoring and Evaluation Report for NAIP, PIU, ICAR, June 2014
29. Mobilizing Mass media Support for Sharing Agro-Information, NAIP Final Report, Directorate of Knowledge Management in Agriculture, ICAR, 2014
30. Capacity Building through International and national Training (2006-2014), NAIP PIU

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