



**INTERNATIONAL FOOD
POLICY RESEARCH INSTITUTE**
sustainable solutions for ending hunger and poverty
Supported by the CGIAR

IFPRI Discussion Paper 00775

July 2008

Reforming the Agricultural Extension System in India

What Do We Know About What Works Where and Why?

Katharina Raabe

Development Strategy and Governance Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI) was established in 1975. IFPRI is one of 15 agricultural research centers that receive principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR).

FINANCIAL CONTRIBUTORS AND PARTNERS

IFPRI's research, capacity strengthening, and communications work is made possible by its financial contributors and partners. IFPRI gratefully acknowledges the generous unrestricted funding from Australia, Canada, China, Finland, France, Germany, India, Ireland, Italy, Japan, Netherlands, Norway, Philippines, Sweden, Switzerland, United Kingdom, United States, and World Bank.

Published by

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

2033 K Street, NW

Washington, DC 20006-1002 USA

Tel.: +1-202-862-5600

Fax: +1-202-467-4439

Email: ifpri@cgiar.org

www.ifpri.org

Notices

¹ Effective January 2007, the Discussion Paper series within each division and the Director General's Office of IFPRI were merged into one IFPRI-wide Discussion Paper series. The new series begins with number 00689, reflecting the prior publication of 688 discussion papers within the dispersed series. The earlier series are available on IFPRI's website at www.ifpri.org/pubs/otherpubs.htm#dp.

² IFPRI Discussion Papers contain preliminary material and research results. They have not been subject to formal external reviews managed by IFPRI's Publications Review Committee but have been reviewed by at least one internal and/or external reviewer. They are circulated in order to stimulate discussion and critical comment.

Copyright 2008 International Food Policy Research Institute. All rights reserved. Sections of this material may be reproduced for personal and not-for-profit use without the express written permission of but with acknowledgment to IFPRI. To reproduce the material contained herein for profit or commercial use requires express written permission. To obtain permission, contact the Communications Division at ifpri-copyright@cgiar.org.

Contents

Acknowledgments	v
Abstract	vi
Abbreviations and Acronymns	vii
1. Introduction	1
2. Conceptual Framework	3
3. Agricultural Extension Reform Initiatives	6
4. The Service Delivery Effects of Agricultural Extension Reforms	20
5. Obstacles to Reform Implementation	32
6. Performance Assessments: Methodological Constraints and Knowledge Gaps	34
7. Synthesis and Policy Recommendations	38
References	40

List of Figures

1. Conceptual framework	3
2. Organizational structure of the Agricultural Technology Management Agency	9

ACKNOWLEDGMENTS

The author wishes to thank Regina Birner for her valuable and constructive comments, criticisms, and suggestions on the structure and conceptual framework of this paper and Neeru Sharma for her valuable assistance in its preparation. The helpful comments received from an anonymous referee and participants of an internal seminar in New Delhi in September 2007 are acknowledged. The author also thanks Phyllis Skillman for English editing.

ABSTRACT

In order to realize agricultural potential and to increase agricultural yields, India's extension system has experienced major conceptual, structural, and institutional changes since the late 1990s. This paper reviews existing reform programs and strategies currently existing in agricultural extension in India. It distinguishes strategies that have been employed to strengthen both the supply and demand sides of service provision in the area of agricultural extension, and it reviews the effects of the demand- and supply-side strategies on the access to and the quality of agricultural extension services. The ultimate objectives are (1) to gain a view on what works where and why in improving the effectiveness of agricultural extension in a decentralized environment; (2) to identify measures that strengthen and improve agricultural extension service provision; and (3) to reveal existing knowledge gaps.

Although the range of extension reform approaches is wide, this paper shows that an answer to the question of what works where and why is complicated by the absence of sound and comprehensive qualitative and quantitative impact and evaluation assessment studies. Even evidence from the National Agricultural Technology Project and the Diversified Agricultural Support Project of the World Bank, the women empowerment programs of the Danish International Development Agency, the Andhra Pradesh Tribal Development Project, and the e-Choupal program of the Indian Tobacco Company is subject to methodological and identification problems. Conclusions regarding the importance (1) of implementing both decentralized, participatory, adaptive, and pluralistic demand- and supply-side extension approaches; (2) of involving the public, private, and third (civil society) sectors in extension service provision and funding; and (3) of strengthening the capacity of and the collaboration between farmers, researchers, and extension workers are necessarily tentative and require further quantification. The paper seeks to inform policymakers and providers of extension services from all sectors about the need to make performance assessments and impact evaluations inherent components of any extension program so as to increase the effectiveness of extension service reforms.

Key words: demand-driven and supply-driven agricultural extension services' extension service reforms, India

JEL classification Q16

ABBREVIATIONS AND ACRONYMNS

Agmarknet	Agricultural Marketing Research and Information Network
Agrisnet	Agricultural Informatics and Communication Network
APTD Project	Andhra Pradesh Tribal Development Project
ATMA	Agricultural Technology Management Agency
DAATC	District Agricultural Advisory Technology Center
Danida	Danish International Development Agency
DASP	Diversified Agricultural Support Project
DPCU	District Project Coordination Unit
DPIC	District Project Implementation Committee
FAC	Farmer Advisory Committee
FIAC	Farm Information and Advisory Center
ICAR	Indian Council of Agricultural Research
ICT	Information and communication technology
IFAD	International Fund for Agricultural Development
ITC	Indian Tobacco Company
ITD	Innovations in Technology Dissemination
ITDAs	Integrated Tribal Development Agencies
MANAGE	National Institute of Agriculture Extension Management
MAPWA	Madhya Pradesh Women in Agriculture
NAIP	National Agricultural Innovation Project
NATP	National Agricultural Technology Program
NeGAP	National e-Governance Action Plan
NGO	Nongovernmental organization
PCU	Project Coordination Unit
PIMSNET	Project Information and Management System
SAMETI	Agricultural Management and Extension Training Institute
SSEPER	State Extension Program for Extension Reforms
T&V model	Training and Visit model
TANWA	Tamil Nadu Women in Agriculture
TDMC	Technology Dissemination Management Committee
TDU	Technology Dissemination Unit
TEWA	Training and Extension for Women in Agriculture
VSAT	Very Small Aperture Terminal
WYTEP	Women/Youth Training Extension Project

1. INTRODUCTION

The well-being of the rural population worldwide is invariably linked to the performance of the agricultural sector and to the sector's ability to cope with the challenges that result from rising population pressures, changing demand for food and agricultural products, resource scarcity, climate change, and greater production uncertainty. The *World Development Report 2008* (World Bank 2007) emphasizes agricultural extension as an important development intervention (1) for increasing the growth potential of the agricultural sector in the light of rising demand- and supply-side pressures, and (2) for promoting sustainable, inclusive, and pro-poor agricultural and hence economic development. The call for agricultural extension services is made at a time when the underutilization of the productivity and growth potential of the agricultural sector for development poses a severe threat for achieving food security and for further reducing (rural) poverty.

The degree of institutional and economic development determines the scope and types of agricultural extension services and the ways in which these services are provided and financed (Anderson 2007). Ideally, the design of the service provision and funding arrangements reflects the inverse relationship between the stage of economic development and the importance of extension for agricultural development and poverty reduction. The access to well-defined extension services is more important for economies in which agriculture is a major or declining source of economic growth (agriculture-based and transforming economies) but less important in economies in which agriculture is a minor source of economic growth (urbanized economies).

A prominent example for the group of transforming economies is India.¹ The transition from an agriculture-based to a transforming economy was initiated by macroeconomic and nonagricultural reforms in the early 1990s, which triggered unprecedented high growth in nonagricultural (urban) sectors. At the same time, a weak, ineffective, and inefficient extension system and the consequent deficits in knowledge and technology development and dissemination constrained agricultural-sector growth, which in turn caused the share of agriculture in aggregate income to contract from approximately 31 percent in 1993 to about 19 percent in 2003–05.² In addition to constraining agricultural sector growth and thus rural development, a weak and ineffective extension system increased the exposure of the agricultural sector to the effects of high population growth, shifts in product demand, natural resource constraints, climate change, and HIV/AIDS, among others (see, for example, Birner et al. 2006; Anderson 2007; World Bank 2007).

In order to meet these challenges, India's extension system has experienced major changes since the late 1990s in governance structures, capacity, organization and management, and advisory methods. The changes involve the decentralization of extension service provision to the local level, the adoption of pluralistic modes of extension service provision and financing, the use of participatory extension approaches, capacity training of farmers to express their demands, and capacity training of service providers to respond to the demands of farmers, among others (Rivera, Qamar, and van Crowder 2001; Birner et al. 2006; Birner and Anderson 2007; Anderson 2007). The reform initiatives reflect the view that improvements in agricultural productivity require demand-driven and farmer-accountable, need-specific, purpose-specific, and target-specific extension services.

Birner et al. (2006) argue that there is no single optimal or best model for providing need-specific, purpose-specific, and target-specific extension services. The ultimate choice of the agricultural extension approach depends on (1) the policy environment, (2) the capacity of potential service providers,

¹ Another case in point is China. Because India and China pursued different policies to initiate the economic transition, the case of China is not further considered. See Gulati, Fan, and Dalafi (2005) for a comparison of the development paths of India and China.

² Author's computations from the *World Development Indicators* (2006) and information from the *World Development Report 2008* (World Bank 2007). Diao et al. (2006) and the references therein provide details on the relationships that explain the importance of the agricultural sector for the nonagricultural rural sector. Anderson and Feder (2004) and Anderson (2007) describe the properties of a poorly performing extension system.

(3) the type of farming systems and the market access of farm households, and (4) the nature of the local communities, including their ability to cooperate. Different agricultural extension approaches can work well for different sets of frame conditions. In order to use extension approaches that best fit a particular situation, the agricultural extension system has to be sufficiently flexible to accommodate the different options. To this end, the recent agricultural-sector reforms have been geared toward creating a demand-driven, broad-based, and holistic agricultural extension system (Sulaiman and Hall 2002, 2004; India, Planning Commission 2005). This has involved the design and introduction of a multitude of integrated measures that, on the demand side, enable service users to voice their needs and hold service providers accountable, and on the supply side, influence the capacity of service providers to respond to the needs of the extension service users (that is, the farmers).

This paper analyzes India's major reform initiatives implemented to create a demand-driven, broad-based, and holistic agricultural extension system. The reform projects are studied with regard to (1) the governance structures of the agricultural extension system and the institutional arrangements for funding and providing agricultural extension services, (2) the actions taken to improve the capacity of extension service providers and users to supply or demand agricultural extension services, and (3) the methods of providing agricultural extension services.³ In addition, the paper evaluates the effects of the agricultural sector reform initiatives on access to and the quality of agricultural extension services. The ultimate objective is to gain a view on what works, where, and why in improving the effectiveness of India's agricultural extension system, to identify measures that strengthen and improve agricultural extension service provision, and to reveal existing knowledge gaps.

The present paper is informed by the analysis of Birner and Anderson (2007) who review India's *Policy Framework for Agricultural Extension* (India, Ministry of Agriculture 2000) with regard to its strategies for making extension demand driven. Within this framework, Birner and Anderson (2007) identify options for providing and financing extension services, which could help to address market failures and state and community failures, and they discuss the (theoretical) relevance of the strategies to India's agricultural extension policies. In contrast to Birner and Anderson (2007), this paper does not analyze the policy framework under which agricultural reforms are implemented but studies the programs through which the extension system is being reformed.

Since the objective is to identify what works where and why in strengthening the agricultural extension system, the discussion emphasizes agricultural reform initiatives for which performance evaluation or impact assessment studies are available. In addition, the paper discusses the obstacles to the implementation of the different reform programs and emphasizes methodological limitations in the performance assessments of the reform initiatives.

The remainder of this paper is structured as follows. Section 2 presents the conceptual framework for the analysis of India's recent set of agricultural extension reforms. Using the conceptual framework in section 2, section 3 analyzes the recent agricultural reform initiatives. Major attention is paid to the demand- and supply-side elements of the reform programs. Section 4 reviews existing performance evaluation and impact assessment studies that identify the implications of the agricultural extension reforms for the quality of and access to agricultural extension services. Section 5 presents obstacles to the implementation of reforms. Section 6 discusses the methodological limitations of existing performance and impact assessment studies and identifies the major knowledge gaps that prevail with respect to (1) the real effects of the reform initiatives and (2) what works where and why in promoting agricultural development. Section 7 summarizes the main results of the literature review and discusses policy implications.

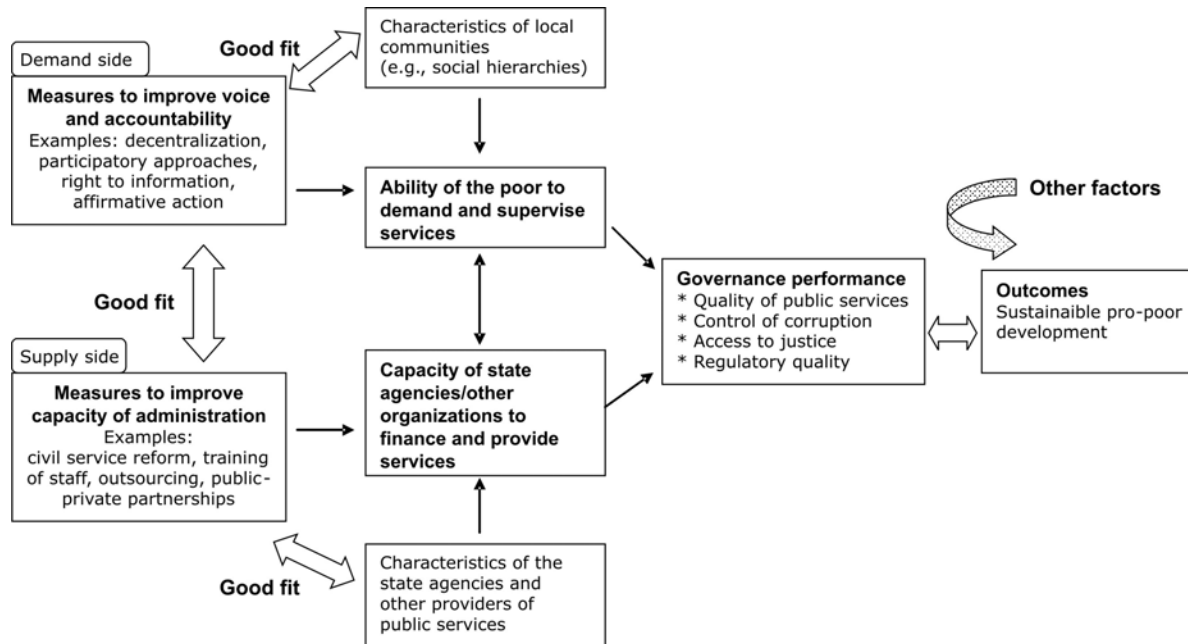
³ See Birner et al. (2006, Figure 2) for the framework for designing and analyzing agricultural extension services.

2. CONCEPTUAL FRAMEWORK

In order to analyze India's recent agricultural extension reforms, we apply the conceptual framework in Figure 1, first presented in Birner and Palaniswamy (2006). The framework identifies the major governance structures, organizational and managerial characteristics, and frame conditions (for example, socioeconomic characteristics) by which public-sector extension reforms can improve the organizational and managerial performance of service provision, lead to better public-sector governance outcomes, and generate sustainable pro-poor development. Public-sector governance outcomes can be evaluated in terms of the efficiency, effectiveness, and long-term sustainability of service provision, regulatory quality, rule of law, the degree of corruption, and equity aspects.⁴

Throughout this paper, the agricultural extension reforms and their impacts are analyzed in terms of the underlying supply and demand components of extension service provision and related reform efforts. Demand-side approaches of public-sector service reforms aim at improving the ability of the private sector (such as farm households and profit-oriented firms) and the third sector⁵ (such as nongovernmental organizations, farmers' organizations, and rural women's groups) to demand better governance and to hold public officials accountable by strengthening the voice of clients. To this end, demand-side approaches include policies that increase information and coordination in voting, strengthen the citizens' right to information, and improve the credibility of political promises. Demand-side approaches of rural service provision also involve policies that promote the political decentralization of service delivery to local governments, reserve seats in local councils for women, and advocate participatory planning and implementation methods, among others. Figure 1 indicates that demand-side reforms are likely to be more effective if they directly address socioeconomic and sociocultural obstacles that prevent citizens from exercising their voice and demanding accountability.

Figure 1. Conceptual framework



Source: Birner and Palaniswamy (2006).

⁴ Here equity outcomes refer to the ability of governance reforms to be inclusive, that is, to improve the access and the availability of services to the poor, to marginalized groups, and to women.

⁵ The third sector is also known as the civil society sector.

Strategies to strengthen the demand side of rural service provision will have little effect if they are not accompanied by strategies to increase the capacity of service providers to finance and deliver the respective services, to apply the rules of law and regulation, and to control corruption. Supply-side approaches to public service delivery reforms include the administrative and fiscal decentralization of service delivery, public expenditure management reforms, training programs for public officials, changes in procurement and audit procedures, and efforts to coordinate the activities of government agencies and departments. Another popular supply-side approach reduces the tasks that are performed by public-sector agencies. The respective strategies include outsourcing of service provision to organizations in the private and third sectors, public–private partnerships, pluralistic forms of service delivery, devolution of authority to user groups, and privatization. Recent reform trends emphasize the need for the state to play a coordinating and facilitating role and to create an enabling environment for the private and third sectors. Supply-side approaches also include strategies for cost recovery that aim to improve the financial sustainability of service provision and to strengthen the incentive for clients to demand better services. The usefulness of cost recovery schemes can be debated on equity grounds, especially in absence of specific measures (vouchers for low-income households, for example) that address this concern.

Figure 1 suggests that the success of demand- and supply-side reforms depends on the extent to which reform strategies address the sociocultural characteristics of local communities (social hierarchic structures, for example) and the bureaucratic characteristics and incentive structures of public-sector service providers (such as moral and ethical standards and elite capture). Because local communities and service providers differ in terms of characteristics, a one-size-fits-all reform approach is an inadequate mechanism for improving rural service provision for rural development. In addition, the structure and scope of reforms also depends on the feasibility of reform implementation. Rather than engaging in ambitious reform programs that address all service delivery problems at the same time, it is often necessary to concentrate initially on those reform elements for which political support can be built (Levy 2004). These relationships suggest that reform approaches should center on principles of best fit rather than best practice.

The conceptual framework in Figure 1 points to the role of decentralization as a governance mechanism to improve the quality of and the access to basic services, infrastructure, and legal and regulatory structures.⁶ The importance of decentralization for good or responsive governance is attributable to the positive effect of decentralization on the efficient use of resources, with efficiency gains arising from (1) the functional, financial, and administrative autonomy of individual government tiers; (2) role clarity; (3) people’s participation; (4) accountability; and (5) transparency, among others (see, for example, von Braun and Grote 2002). At the same time, decentralization ensures that each government tier performs those tasks in which it has a comparative advantage. The actions taken by the different government levels are then complementary to each other, with the actions being separated by clear boundaries.

Decentralization is also subject to weaknesses and is not an accountability mechanism a priori. In fact, economic theory suggests and empirical evidence shows that decentralization can reduce accountability and increase corruption.⁷ Furthermore, decentralization may lead to welfare losses because of local elite capture and administrative failures (World Bank 2004b). Local elite capture implies that a small share of the population with a disproportionate share of political and economic power resists the changes from decentralization and participatory policies because of their perceived undue influence on established power relationships (Rajaraman 2000; Narayan et al. 2000). Local elite capture is associated

⁶ Types of decentralization differ for the fiscal, administrative, and political systems. Dethier (2000) distinguishes fiscal decentralization, political devolution, and administrative deconcentration, while von Braun and Grote (2002) define decentralization as the devolution of decisionmaking powers and responsibilities to lower tiers of the government. They argue that less extensive forms of administrative and fiscal decentralization include deconcentration and delegation or shared governance systems. With deconcentration, the central government merely posts employees to the local level. With delegation or shared governance systems, the central government delegates some functions to the local level, while the main responsibility still rests with the central state.

⁷ See Dethier (2000) and the references therein.

with inefficient use of resources, inefficient and ineffective targeting of public expenditures and transfer programs, and inefficient delivery of public goods. These aspects amplify inequalities in income distribution, with consequent threats to the economic and political stability of regions (Dethier 2000; von Braun and Grote 2002). Political and economic tensions may prevail not only within regions but also between them. In fact, they might be stronger if decentralization reinforces regional asymmetries in income distribution and income growth in the absence of cross-regional income compensation schemes.

3. AGRICULTURAL EXTENSION REFORM INITIATIVES

In India, major changes in the provision and financing of agricultural extension services materialized in the late 1990s. The reform programs of the late 1990s were motivated by the failure of the World Bank-funded Training and Visit (T&V) model to promote agricultural development by providing effective and efficient extension services in a timely and sustainable manner. Launched in 1977, the T&V model aimed at establishing a close link between agricultural research and agricultural extension. To this end, the model emphasized the role of the state Departments of Agriculture as the instruments through which research institutions should pass on their extension recommendations to the farmers and receive feedback from farmers on the usefulness of new agricultural methods and practices. The T&V model failed to effectively promote agricultural development mainly because of structural problems in the organizational, financial, and institutional design of the model.⁸ Structural problems and the consequent inefficiencies in the delivery of research and extension services resulted from the operation of (1) a hierarchical, classical top-down, one-way communication system and (2) a one-size-fits-all research and extension approach that centered on the institutional, agro-climatic, and socio-economic conditions of irrigated areas but bypassed those of rainfed areas (Sulaiman and Holt 2004).

The problems inherent in the T&V model were only fully acknowledged in the 1990s. Since then, numerous, mutually reinforcing reform programs have been induced at the central and state levels. These seek to accelerate the development and dissemination of technologies, so as to promote agricultural and rural development through higher productivity growth. The reform initiatives identify and define (1) governance structures and methods for the effective and efficient development (that is, research) and dissemination (extension) of technology and (2) ways for improving the management and organization of the research and extension system within governance structures (capacity strengthening). At the core of the reform programs are supply- and demand-side elements that embrace principles of decentralization, transparency, accountability, and e-governance⁹, among others.

Two of the most prominent research and extension reform initiatives were the World Bank-funded 1998–2004 Diversified Agricultural Support Project (DASP) and the 1999–2005 National Agricultural Technology Project (NATP). The DASP initiative aimed (1) to increase agricultural productivity, (2) to promote private-sector development, (3) to improve rural infrastructure, and (4) to increase the income of farmers by supporting intensified and diversified agricultural production and farming systems. Principal objectives of the NATP initiative were (1) to improve the efficiency of the organization and management systems of the Indian Council of Agricultural Research (ICAR), (2) to strengthen the effectiveness of research programs and the capacity of scientists to respond to the technological needs of farmers, and (3) to increase the effectiveness and financial sustainability of the technology dissemination system with greater accountability to and participation by farming communities. In contrast to the DASP, the NATP did not emphasize the diversification of agricultural production and of farming systems as instruments to close the productivity gap. The NATP exclusively focused on research and extension and on an integrated system of extension delivery.

Both the DASP and NATP programs involved (institutional) supply-side and (farmer-initiated or participatory) demand-side components of service provision. On the demand side, the DASP and NATP programs aimed at enhancing agricultural productivity, agricultural growth, and rural development by pursuing broad-based, bottom-up participatory developmental approaches that centered on community mobilization. On the supply side, the DASP and NATP initiatives included (1) public expenditure reforms, (2) changes in planning and decisionmaking processes, and (3) training and capacity building.

Some agricultural reform initiatives take explicit actions for improving the access of women to agricultural extension services. Prominent examples are the ongoing Women/Youth Training Extension

⁸ See Sulaiman and Sadmate (2000) for additional information.

⁹ E-governance involves the utilization of information and communication technology infrastructure and resources to ensure the reliable, transparent, and effective access of citizens to government services (World Bank 2005b).

Project (WYTEP) in Karnataka, the 1986–2003 Tamil Nadu Women in Agriculture (TANWA) initiative, the 1998–2003 Training and Extension for Women in Agriculture (TEWA) program in Orissa, and the 1993–2005 Madhya Pradesh Women in Agriculture (MAPWA) project. Implemented under the auspices of the Danish International Development Agency (Danida), the projects mainly aimed at strengthening the position of small and marginal farm women in society and at increasing the agricultural productivity and hence income of small and marginal farm women through training in the application of low-cost technologies.¹⁰

Next to the gender-focused projects, reform efforts are also directed toward improving the livelihood of disadvantaged tribal groups. A case in point is the 1991–98 Andhra Pradesh Tribal Development Project (APTD) of the International Fund for Agricultural Development (IFAD). The project aimed to improve the income and food security situation and living conditions of tribal groups, taking gender, health, educational, environmental, and marketing and credit issues into account. In line with other programs, the IFAD initiative emphasized the importance of (1) productivity-improving farm technology and irrigation systems and (2) participatory planning and implementation as means to improve the livelihood of disadvantaged groups.

In addition to these programs, another prominent reform initiative is the ongoing e-Choupal initiative of the Indian Tobacco Company (ITC). The private-sector program employs information and communication technologies (ICTs) as instruments for improving agricultural extension service provision in terms of outreach (cost) effectiveness, efficiency, transparency, and accountability. In promoting accountability and transparency of service provision, information and communication technologies are designed to facilitate the delivery of demand-side-driven extension services.

In order to gain insights into what works where and why in improving the delivery of agricultural extension services, this paper analyzes the DASP, NATP, Danida, APTD, and e-Choupal reform initiatives in greater detail, using information from the program-specific appraisal documents and from the program-specific performance and evaluation assessment reports.¹¹ Many of these programs have informed recent reform initiatives such as the 2005 Support to State Extension Program for Extension Reforms (SSEPER), the 2006 National Agricultural Innovation Project (NAIP), or the 2003 National e-Governance Action Plan (NeGAP).¹² As these programs are in early stages of implementation, they have not yet been evaluated in terms of outcome and impact and are therefore not further considered.¹³

The following sections review the design of the supply- and demand-side elements of the DASP, NATP, Danida, APTD, and e-Choupal reform initiatives. Particular attention is paid to (1) the proposed institutional structures of the programs, (2) the actions taken to improve the capacity of extension service providers and users to supply or demand agricultural extension services, and (3) the methods that have been designed to improve the delivery of agricultural extension services. The analysis in section 4 then

¹⁰ Other gender projects are the 1989–2003 Training of Women in Agriculture program in Gujarat, the 1994–2007 Andhra Pradesh Training of Women in Agriculture program, and the ongoing Mahila Samakhya project in Andhra Pradesh, Gujarat, Karnataka, Kerala, and Uttar Pradesh. The present analysis does not discuss these projects because of the lack of information on the structure and the performance of the programs.

¹¹ Unless stated differently, the analysis of the DASP initiative rests on the Project Appraisal Document (World Bank 1998b) and the Implementation Completion Report (World Bank 2004a) of the World Bank. Similarly, the Project Appraisal Document (World Bank 1998a) and the Implementation Completion Report (World Bank 2005a) of the World Bank are employed to assess the performance of the NATP program.

¹² SSEPER aims to provide decentralized and demand-driven extension services through the active participation of farmers, extension specialists, civil societies, and agricultural science centers in 28 states and two union territories. NAIP emphasizes agricultural research and development (R&D) rather than extension. See Garai and Shadrach (2006) for an overview of many other ICT projects, which build on the success of the ITC e-Choupal initiative.

¹³ Even if formal evaluations would be available, their usefulness could be contested as the simultaneous implementation of multiple interacting programs precludes the unique identification of the effects associated with each initiative. For example, the NeGAP project on agriculture is supplemented by other e-governance projects like the Agricultural Marketing Research and Information Network (Agmarknet), the Agricultural Informatics and Communication Network (Agrisnet), and the Kisan Call Centers.

describes the actual structural changes and assesses the effects of the reform initiatives on the access to and the quality of agricultural extension services.

Finally, it should be noted that the DASP and NATP schemes are more comprehensive and complex in the scope and dimension of the envisaged structural supply- and demand-side changes than the Danida, APTD, and e-Choupal reform initiatives. For this reason, the following discussion is biased toward the DASP and NATP.

Supply-side Reforms

According to the conceptual framework in Figure 1, supply-side reforms emphasize (1) public, private, and third-sector service provision and financing; (2) administrative and fiscal decentralization; and (3) capacity strengthening and building. This section describes the different supply-side mechanisms for agricultural research and extension, mainly within the framework of the DASP and NATP programs. The supply-side reforms of the NATP program aim to (1) increase the efficiency and effectiveness of the research system, (2) intensify and support agroecological systems research, (3) improve the efficiency and outreach of technology dissemination, and (4) strengthen human capital development and capacity in project management and project implementation.¹⁴ Closely related, the supply-side reforms of the DASP initiative emphasized (1) technology dissemination, (2) private-sector involvement and public-private partnerships in agribusiness development, (3) rural infrastructure development and marketing support, and (4) project management and capacity building for economic policy analysis. In promoting rural infrastructure development, private-sector involvement and public-private partnerships in agribusiness development, the DASP supply-side reforms were more far-reaching than those of the NATP.

Administrative and Fiscal Decentralization

In the case of India, the 73rd Constitutional Amendment transferred fiscal and administrative decisionmaking authority from the central state to the local level. Fiscal and administrative decentralization are supply-side governance mechanisms to improve local governance in terms of allocative and productive efficiency, service quality and quantity, and transparency and accountability. The DASP and NATP initiative promoted fiscal and administrative decentralization as mechanisms for improving the effective and efficient dissemination of agricultural technologies and for rationalizing and reorienting public extension services.

Under the DASP reform initiative, administrative decentralization included the transfer of managerial and technical decisionmaking authority from the central to the district level. To this end, DASP operated two implementation mechanisms: the District Project Implementation Committee (DPIC) and the Agricultural Technology Management Agency (ATMA). Both mechanisms were designed to strengthen the co-ordination of the activities of different agencies and to improve the research-extension-farmer linkages.

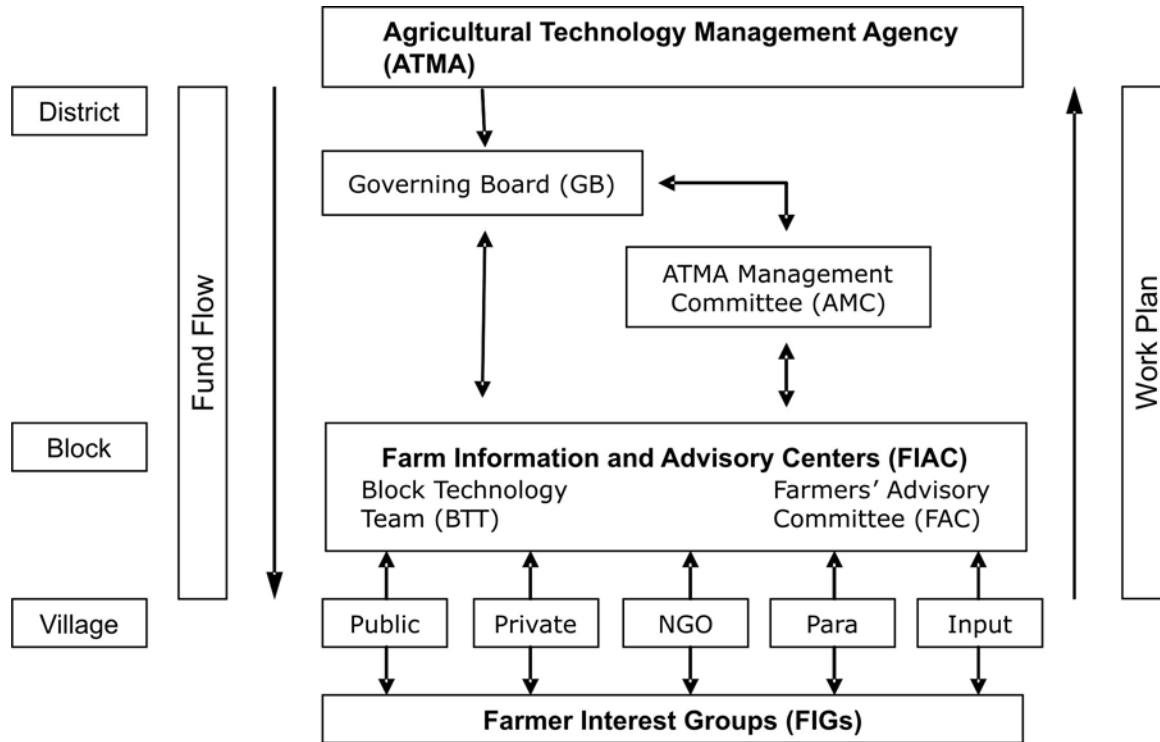
The DPIC maintained relationships with extension providers and extension users through two channels. First, the DPIC members were representatives of line departments, state agricultural universities, agricultural science centers (*Krishi Vigyan Kendras*), farmer organizations, local governments, and NGOs. Second, the DPIC implemented, guided, and monitored extension activities according to a strategic extension plan that was developed in cooperation with district officers from each line department, technical experts from local zonal research stations, and the trainers from the local agricultural science center. The strategic extension plan defined local research and extension priorities, assessed the relevance and demand for location-specific technologies, and specified the extension activities that were needed to promote farmer-driven agricultural development.

Closely related to the DPIC, the ATMA ensured technology dissemination through fiscal and administrative decentralization and interdepartmental coordination by bringing together district

¹⁴ The World Bank (1998a; 2005a) structured the NATP program around components (1) to (3). For consistency reasons, we include capacity strengthening as a separate component.

administration, line departments, NGOs, and local farmer representatives.¹⁵ The stakeholder representatives were directed by a Governing Board, which implemented extension activities according to a strategic extension plan for technology dissemination (Figure 2). In order to increase the outreach of extension services, ATMA encouraged partnerships with private and third-sector service providers at the district level and below.

Figure 2. Organizational structure of the Agricultural Technology Management Agency



Source: Singh, Swanson, and Singh (2006, p. 208).

Under the DASP, fiscal and administrative decentralization were also employed as instruments to foster rural infrastructure development and to provide marketing support. The DASP initiative recognized that the development of an intensified and diversified agricultural production and farming system critically depends on a well-developed network of roads and markets. Because rural infrastructure is by and large underdeveloped, the DASP took steps toward promoting the development of rural roads and rural markets. Regarding roads, the reform efforts were directed toward implementing a road development policy that raised funds for the appropriate maintenance and operation of roads. With respect to markets, policies were designed to reduce the public-sector leverage in the management of rural markets and to improve the operation and maintenance of rural markets by strengthening the responsibilities of traders and farmers. The upgrading of infrastructure also included actions to strengthen the participation of communities in planning, implementing, and maintaining rural infrastructure. In order to increase community ownership and commitment to newly created assets, to improve the operation and maintenance of rural infrastructure, and to increase the representation of traders and farmers, the

¹⁵ The ATMA model was particular to the DASP initiative in Uttar Pradesh. Uttaranchal did not undertake the ATMA approach, but implemented Agricultural Diversification Management Societies, which were established at each of the project districts to coordinate, plan, and implement the project through officers of line departments and farmer federations.

administrative and fiscal responsibility for rural infrastructure was transferred from line departments like the Department of Agriculture, Animal Husbandry, Dairy Development, and Rural Development to Panchayats. Under the new institutional setup, district Panchayats exercised functional control over district department officers. The process of administrative and fiscal decentralization was supported by elections to all tiers of Panchayati Raj institutions.

Under the NATP initiative, administrative decentralization was implemented in the area of technology development (research) and technology dissemination (extension). With respect to technology development, the administrative decentralization efforts resulted in changes in the expenditure decisionmaking authority and attributed greater financial management responsibilities to the technology development research staff of the ICAR system. The administrative decentralization of expenditure decisionmaking was driven by the notion that changes in the organizational and managerial structure are needed in order to enhance the efficiency and effectiveness of the research system and hence the long-term growth prospects for agricultural productivity. With regard to technology dissemination, administrative decentralization was seen as an effective way to support the state Departments of Agriculture in making the technology dissemination system knowledge based and demand driven. The underlying support mechanisms were summarized in the NATP's Innovations in Technology Dissemination (ITD) component, which emphasized the organization of the technology dissemination system at the national, state, district, block, and village levels. The remainder of this section describes the institutional setup of the technology dissemination system at the different government tiers.

At the national level, technology dissemination was facilitated by institutions that supported the effective coordination of technology dissemination activities and created a discussion forum on their usefulness (for example, the Technology Dissemination Management Committee [TDMC]) and the Technology Dissemination Unit [TDU]). The ITD component strengthened the institutions' monitoring, supervision, and evaluation roles for technology dissemination. For instance, the TDU was responsible for the daily management and supervision of the ITD component, while the TDMC supervised and approved the annual work plans of the different project units. At the state level, the technology dissemination system centered around agricultural line departments. These formed an interdepartmental working group aimed at harmonizing project activities among the different line departments at the state level and facilitating and coordinating interactions with the TDMC at the national level. The TDMC included all major stakeholders (representatives of NGOs, women's organizations, and the private sector) and thus provided a platform for these institutions to influence the reform process and the technology dissemination agenda of public institutions. In addition to interaction with the TDMC, the interdepartmental working group also monitored the progress of district-level programs.

Technology dissemination at the district, block, and village levels was institutionalized in the ATMA. The ATMA was an autonomous entity that managed technology dissemination, facilitated decentralization in planning and implementation, and promoted interdepartmental coordination and demand-driven service provision at the district, block, and village levels by bringing together district administrative entities, line departments, NGOs, and local farmer representatives (Figure 2 above).¹⁶ Being autonomous, the ATMA had full discretion over its budget and was thus flexible to respond to changing technological and environmental requirements. At the district level, ATMA was supported by a Governing Board and the management committee. Within its functional framework, the Governing Board identified the programs and procedures for district-level research and extension activities, reviewed the progress and functioning of the ATMA, and approved the Strategic Research and Extension Plan. The Management Committee implemented the district-level research and extension program and conducted participatory rural appraisals to identify problem areas in the implementation of the Strategic Research and Extension Plan. At the block level, programs were implemented through a Farm Information and Advisory Center (FIAC). This institution constituted the operational arm of ATMA and was operated by a

¹⁶ For more details see Sulaiman (2003). Under the NATP, the ATMA approach was realized in 28 districts. After the advent of SSEPER, the ATMA model was implemented in 268 districts in 28 states and 2 union territories by the end of January 2007 (GOI Ministry of Agriculture 2007).

Block Technology Team of technical advisors and a Farmer Advisory Committee (FAC). The FAC constituted a platform that encouraged interaction between all key stakeholders (including farmers and line department staff), partly by stimulating the formation of commodity-oriented farmers' and women's interest groups at the block and village levels.

Private and Third-Sector Involvement

The extent to which decentralization can improve the performance of the agricultural research and extension system is likely to depend on the efficiency and effectiveness of public, private, and third-sector service financiers and providers. The relative usefulness of the three service-provider sectors in turn may depend on the degree of excludability and substractability of research and extension activities. Theory predicts that the public sector should only fund and provide the public good components of research and extension, that is, those components with low excludability and low substractability (Sulaiman and Sadmte 2000). Similarly, the private and third sectors should only fund services with high excludability and high substractability.

Another supply-side governance mechanism emphasizes the role of the private sector as an instrument to supplement the extension and research efforts of the public sector and to improve the efficiency and effectiveness of service provision (Reddy and Swanson 2006). Private-sector participation is seen as a useful means of addressing the research and extension needs of commodity-oriented farmers' and women's interest groups since it utilizes private-sector cost advantages, private-sector capacities in research and development, and skills in multi-disciplinary and participatory research. These aspects are perceived to be critical components for improving the accountability of the public sector in agricultural research and extension, for providing demand-driven support services, for encouraging the introduction of improved inputs (such as fertilizer and seed varieties), and for strengthening marketing and postharvest activities and processing.

Both the DASP and NATP initiatives emphasized the importance of private-sector participation in the area of technology development and technology dissemination. As will be explained in the next section, the NATP program encouraged private-sector participation within the framework of competitive grants programs.¹⁷ In comparison, the DASP scheme planned to encourage private-sector participation in extension service provision by reducing the role of the government as input supply provider and by facilitating the leasing or sale of government facilities/farms to private-sector firms. In order to strengthen the move to inputs supplied by the private sector and to improve the ability of the market to respond to changing technology needs, state-level government subsidies for inputs and other services were to be phased out, moving to full cost recovery over the life of the project.

The DASP not only supported private-sector participation in input supply and support services in general but took measures to encourage private-sector involvement in agribusiness activities. The aim was to promote the development of intensified and diversified agricultural production and farming systems and to stimulate the vertical integration of smallholder agriculture with input suppliers and agroprocessors. To this end, the program sought to mobilize institutional credit and to facilitate the availability of credit for smallholders' and women's self-help groups. It was thought that the consequent removal or alleviation of credit constraints would encourage incremental investment and the adoption of improved technologies.

In addition to easing credit constraints, the DASP also planned to promote private-sector investment in agribusiness by raising the value of postharvest activities such as agroprocessing. At the core of the initiatives was the so-called Project Development Facility that helped small- and medium-sized investors to establish new ventures or to enlarge current operations so as to exploit market-led opportunities for agribusiness development. The underlying fee-based support services (such as feasibility studies, project reports, business plans, and product marketing) were meant to improve access to

¹⁷ The NATP also promoted private-sector participation in policy formulation through formal consultative mechanisms (World Bank 1998a).

technology and technical expertise, to strengthen the linkages between producers (farmers) and processors, and to improve the availability of information on markets and marketing opportunities.

The DASP and NATP programs also contained provisions for the active participation of third-sector institutions in technology dissemination. Third-sector participation was to be initiated through contracting-out arrangements. Contracting would delink funding from service provision, and it was seen as an instrument to reduce costs, to improve the cost-effectiveness of public extension services, and to ensure the financial sustainability of extension. NGOs can be important providers of third-sector extension services and useful instruments to generate, refine, and promote need-based agricultural technology for a number of reasons. The involvement of NGOs is important because their work centers on clearly defined and specific objectives (Shekara 2001; Shankar 2001; and Nataraju, Lakshminarayan, and Nagaraj 2001). A clear mission and a common objective ensure better teamwork and avoid the uncoordinated implementation of strategies. In addition, a restricted local focus; the consequent closeness to markets; and the adoption of participatory, farmer-centered, bottom-up approaches causes services to be explicitly targeted and demand driven.¹⁸

In addition to contracting out, the DASP and NATP schemes also planned to institutionalize partnerships between public–private and public–third-sector institutions in order to improve technology development, technology dissemination, and agribusiness activities through better access to credit and greater flexibility in program implementation (World Bank 2004a). In order to enhance the knowledge base and thus the quality of public extension services at the state level, the NATP scheme also advocated partnerships between public institutions. The public-public partnership involved the state Department of Agriculture and the state agricultural university or separate wings of the Department of Agriculture.

In Andhra Pradesh, cooperation between the Department of Agriculture and the state agricultural university was enforced through the operation of a District Agricultural Advisory Technology Center in all districts. These centers were supposed to refine technology, make diagnostic visits, and organize field programs in collaboration with the Department of Agriculture and allied departments so as to improve the dissemination of technology, to strengthen research capacities, and to foster human capital accumulation at ICAR institutes. Along a similar line, Punjab Agricultural University fostered adaptive research, training, and consultancy at the district level by having a multidisciplinary extension team in each district, again in collaboration with the state Department of Agriculture. In Maharashtra, the public–public partnership involved the merger of three separate wings of the Department of Agriculture—the Department of Agriculture, Horticulture, and Soil and Water Conservation—at the operational level. The resulting organization was deemed to have a broader (multidisciplinary) and more solid knowledge base and a more effective manpower intensity in the field.

Capacity Building and Strengthening

Reforms of the technology development and dissemination systems also include the rationalization and reorientation of public extension services through capacity strengthening and building. In the present context, capacity development involves steps toward improving the operational, managerial, and scientific skills and capabilities of individual research and extension workers as well as of the aggregate research and extension system. As will become evident, the existing reform initiatives pursued different approaches to strengthen the capacity of the research and extension system to implement the reform components effectively and efficiently.

The DASP especially emphasized the need for building and strengthening the capacity of those agents who were responsible for project management (line departments) or project implementation (extension workers). Project management was the responsibility of the Project Coordination Unit at the state level and the District Project Coordination Unit at the district level. Project management included the management of project activities, finances, and administration; the provision of technical support to

¹⁸ On the other hand, the restricted local focus can also be seen as a disadvantage because it constrains the dissemination of new ideas, approaches, and improvements in productivity (Alsop et al. 1999).

line departments; and the establishment of linkages between the different stakeholders. Operational flexibility and autonomy were provided by the institutional setup of the Project Coordination Unit as a registered society, which offered scope for nongovernmental fund raising.

Project implementation rested with the agricultural researchers and with the extension workers. In order to strengthen the capacities of agricultural researchers for identifying and solving problems, and to enhance the quality, relevance, and accountability of agricultural research, the DASP initiative advocated a competitive grants program. Competitive grants were available for research on key production and processing constraints of the main production systems to state agricultural universities and their zonal research stations, agricultural colleges, ICAR institutes, private-sector institutions, and NGOs. The DASP also contained provisions for improving research coordination. At the state level, this involved institutional changes in terms of governance, staffing, and operational procedures in the Council for Agricultural Research in order to improve policy guidance and to promote and facilitate the cooperation and exchange in agricultural research between institutions.

In addition to strengthening the capacity of program management and program implementation units, the DASP also took steps to improve project monitoring, evaluation, and impact assessment. At the core of the monitoring and evaluation component was the Agricultural Management Center, which had been established under the auspices of the Indian Institute of Management (Lucknow). The Center's main task was the design and implementation of a computerized project monitoring system, which supports the Program Coordination Unit in the management of the DASP program. Within this framework, the Agricultural Management Center (1) prepared economic impact studies, (2) supported the preparation of annual action plans and implementation schedules, (3) identified training needs, and (4) developed strategies for capacity strengthening. Closely related, the DASP program also supported the establishment of an Economic Policy Analysis Unit. The Unit's main objective was to strengthen the ability of the state to develop and analyze the impact of agricultural policies on rural development and to assess the efficiency of public-sector spending on agriculture.

In order to strengthen the capacity of extension workers, the DASP assisted in the redeployment and training of (existing) extension staff (1) to impart new technical skills that help line departments to assume direct responsibility for technology dissemination at the block level and (2) to convey skills in financial and group management that help to effectively operate a demand-driven public, private, and third-sector extension system. The training of extension workers was provided by the state agricultural universities, the State Institute for Rural Development, and the National Institute of Agriculture Extension Management, called MANAGE. These institutions offered professional skill training to extension personnel across all line departments and the agricultural science centers (*Krishi Vigyan Kendras*), forwarded technical information, and supported the technical training of district-level subject matter specialists and of the instructors at the agricultural science centers.

Closely related to the DASP, the NATP sought to improve the intensity, efficiency, and effectiveness of the public agricultural research system by strengthening the capacity of scientists to develop new, productivity-improving technologies that improve the performance of production systems and solve farmers' problems with their farming systems. To this end, the NATP implemented sponsored and competitive grants programs that promoted multidisciplinary and multi-institutional collaborative agroecological research. The multidisciplinary program areas were identified according to a set of national research priorities (improvement of productivity, sustainability of production systems, and precommercial technology development), which were defined to ensure the rational and efficient allocation of resources between different production systems, commodities, and socioeconomic groups. Local research priority areas differed from national research priority areas to the extent that they controlled for local agroclimatic and socioeconomic conditions.

Sponsored research programs were designed to improve the performance of major production systems under intensive irrigated, rain-fed, hill and mountain, coastal, and arid agroecological systems. Thrust areas of research were food security, sustainability, economic growth, equity, and rural welfare, with research centering on natural resource management, postharvest value addition, integrated pest management, and integrated plant nutrient management, among others. The sponsored research schemes

also (1) advocated cross-cutting research on topics that span more than one production or agroecological system and were thus not location specific and (2) promoted strategic (upstream) research on new innovative forms of managing decentralized research activities and research units. Sponsored programs were predominantly implemented by institutions within the ICAR system. In an attempt to strengthen the capacity of domestic researchers and to resolve technical constraints to improved production systems, sponsored programs encouraged the collaboration of ICAR institutes with international research institutes. The sponsored programs were supplemented by competitive grants programs. The competitive grants programs were introduced to promote research on topics that were not covered by the sponsored program and to improve the quality of research and technology development by granting access to financial resources on the basis of competitive bids. The programs were open to public, private, and third-sector institutions and to public-private and public-third-sector partnerships with the capacity to conduct research in priority areas. The competitive grants programs thus actively encouraged links between the research and development activities of public and nonpublic organizations. Funding was available for location-specific and innovative research, for research on improving the productivity and sustainability of production systems on a time-bound mission mode, for pre-commercial technical development and pilot manufacturing, and for private-sector product and process development.

Similar to the DASP initiative, the NATP program augmented efforts to improve the performance of the research system with efforts to strengthen the capacity of national- and state-level institutions to disseminate, coordinate, monitor, and evaluate technology innovations. Under the NATP, a critical source of human capital development was the National Institute of Agriculture Extension Management (MANAGE). MANAGE's main task was to enable the project-participating states to develop a decentralized, location-specific, farmer-centered, sustainable technology dissemination system. To this end, the NATP program strengthened the role of MANAGE as provider of training in extension management, strategic planning, and participatory rural appraisal to senior managers and trainers at the national and state levels. In first- and second-phase districts, MANAGE also trained the extension workers at the district and block levels.¹⁹ In third- and fourth-phase districts, the extension personnel received training from Agricultural Management and Extension Training Institutes (SAMETIs). These were established in association with either the state Department of Agriculture or a state agricultural university and had the broad mandate to provide training that supports the implementation of the ATMA model. In addition to the SAMETIs, extension workers also received training from the ATMAs. These agencies offered in-service training and technical backstopping for the extension field staff in order to strengthen the capacity of extension workers to provide broad-based technical advice to farmers. In addition, ATMAs offered training to the staff of line departments in order to improve operational capacities.

Within the framework of capacity strengthening, the reform initiatives also supported the development of information systems. For example, under the NATP, this involved the intensified use of information technology and management information systems and the development of a library information system. The management information system was installed to facilitate project coordination and monitoring, communication, financial management, and performance assessments, among others. The library information system was promoted to strengthen the efficiency and capability of the ICAR research system by improving access to information. The following section provides more details on supply-side reforms that evolve around information systems and emphasizes the use of information and communication technologies.

¹⁹ The program was introduced in a phased manner. In the first phase, the program was implemented in one district in each of the participating states. Following major reviews of the project, 12 more districts were added in the second phase and the remaining districts were added in phases three and four.

Information and Communication Technology (ICT)

ICT initiatives are driven by the objective to facilitate planning, monitoring, and the effective exchange of information between various agents such as service providers and service users. The advance of ICT programs is attributable to the rapid emergence of extensive telecommunication networks and the rising electrification of even remote areas. ICT programs are perceived to be an essential element in improving service provision and agricultural growth for two interrelated reasons. First, ICT is an effective means for improving governance and service provision by reforming government processes through greater transparency and accountability. Transparency and accountability result from ICT-driven improvements in the access to and the quality of information flows between agents such as service providers and service users. Second, these factors strengthen the scope for participatory actions on the part of service users such as farmers and make technology dissemination demand driven and available to a large number of farm households on a regular basis, mainly through private-sector participation. This section reviews initiatives that emphasize the importance of ICT in agricultural service provision.

The private sector was among the first to rely on ICT as an effective and efficient communication means in agricultural service provision. The most prominent example of a supply-side initiative of the private sector is the e-Choupal initiative of the Indian Tobacco Company (ITC).²⁰ Reflecting efforts to improve the procurement process for various cropping systems and to reduce the dependence on government-mandated agents (*mandis*), the e-Choupal initiative was launched in 2000. It now operates in 31,000 villages in six Indian states through 5,200 kiosks, extending to 3.5 million farmers.²¹ There are plans to up-scale the program to 10 million farmers in 100,000 villages of 15 Indian states by 2010. At the core of the e-Choupal initiative are kiosks in rural farming villages that are equipped with computers with internet access via phone lines or by a Very Small Aperture Terminal (VSAT) connection. As villages often face power supply shortages, each e-Choupal is equipped with a battery-based uninterrupted power supply backup, which provides sufficient energy to run the system twice a day.

Since the system is infrastructure intensive, ITC incurs significant up-front costs in creating and maintaining its own information network in rural India. It also has to identify and train a local (literate) farmer (called a *Sanchalak*) to manage each e-Choupal. Farmers can use the e-Choupal free of charge, while the managing farmer bears part of the operating costs. However, the operating costs need to be compared against the commission that the managing farmer receives for intermediating the e-Choupal transactions between ITC and the farmers. E-Choupal transactions include, for example, accessing the internet for information on scientific farming and best-practice methods, extension, farmer interaction forums, markets, market trends and prices, and weather conditions. Another transaction consists of placing purchase orders for input and consumer goods from ITC or its partners. The corresponding prices tend to be lower than those available from village traders. In addition, farmers use the e-Choupal to directly sell their crops to ITC. The corresponding prices are higher than the bid prices obtained from government-mandated agents. In paying higher prices to farmers than intermediaries, ITC operates an effective procurement system for crops. At the same time, ITC incurs lower procurement costs, given that the procurement price does not include the commission fees of the intermediaries. Annamalai and Rao (2003) argue that the corresponding savings are sufficient to meet the equipment costs from an e-Choupal in the first year of operation.

For reducing the costs of intermediation alone, the ITC e-Choupal system has to be deemed a success (see the section on ICTs in section 4). Inspired by the success and popularity of the system, the public sector has tried to increase the outreach of extension and the speed of rural transformation through comparable mechanisms. The NATP initiative, for example, actively encouraged the use of ICT facilities in order to promote the organizational and managerial efficiency of the ICAR research system and in order to strengthen the link between the research and farming system and the research and extension system. The institutional setup involved the establishment of information kiosks and information shops

²⁰ Unless stated otherwise, the discussion in this section rests on the e-Choupal case study of Annamalai and Rao (2003).

²¹ The states are Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Uttar Pradesh.

that are operated in collaboration with Farmer Information Advisory Centers at the block level. Closely related to the e-Choupal system, the information kiosks and shops offered direct training of and information for farmers on, for example, crop technology and farmers' rights, loans, and the availability of grants. In order to enable farmers to effectively use the services offered by information kiosks and shops, they received training in the use of ICTs (Singh 2006).

Considering the other reform initiatives, ICTs were mainly installed to support the reform projects' efforts in the area of monitoring, evaluation, and capacity building. The NATP, for example, sought to improve ICAR's organization and management systems by creating an information technology-based library information system and management information system (MIS). The MIS was intended to develop ICAR's Agricultural Project Information System, which aimed to provide a comprehensive overview of agricultural research activities at the national, state, district, and block levels. Under the DASP, information technology was used to develop a computerized accounting and reporting system at the level of the Project Coordination Unit. The respective system advocated a double-entry accounting system, which was interlinked with the related budgeting and financial management system in order to promote the timely generation of summary sheet claims and accounting/fixed assets records.

Demand-side Reforms

A review of the literature shows that the supply-side reforms of the DASP and NATP programs emphasized the need to make technology development and dissemination broad-based in order to promote the productive efficiency of the agricultural and hence rural sectors. As will become evident, the demand-side reforms supported this objective. The discussion of the conceptual framework in Figure 1 indicates that demand-side reforms include the empowerment of the rural population by means of political decentralization, participatory planning and implementation (for example, farmer field schools and the farming system approach), and affirmative action. For the set of reforms that we analyze, participatory planning and implementation appear to be the most prominent modes of empowerment, at least in technology development and technology dissemination.

Demand-side Governance Structures

On the demand side, the governance mechanisms highlight principles of participatory planning and implementation. Participatory approaches are considered to be useful instruments for increasing the productive efficiency of the agricultural and rural sector by establishing a decentralized, bottom-up, demand-driven, and financially sustainable technology development and dissemination system. By being decentralized, bottom-up, and demand-driven, participatory approaches help (1) to meet region-specific requirements of major production systems and farmers and hence region-specific institutional, agroclimatic, and socioeconomic conditions and (2) to improve the effectiveness and financial sustainability of the technology development and dissemination system by fostering a new division of labor between government departments, the private sector, NGOs, farmers' organizations, farmers' self-help groups, and farmer associations, with greater accountability to the farming community.

With regard to technology development under the DASP initiative, the demand-side reforms were driven by the scope and dimension of the supply-side initiatives. The supply-side reforms promoted technology development as an instrument to increase the use of agricultural knowledge and to make new technologies more adaptable and appropriate to farming conditions. In order to control for farming conditions and to account for the needs of farmers, the supply-side reforms of technology development were associated with demand-side initiatives that institutionalized the participation of farmers in problem identification and technology validation. The demand-side governance reforms in technology development were mainly targeted toward location-specific agriculture, livestock, sericulture, and horticulture.

The success of farmers' participation in technology development is dependent on the existence of effective and strong linkages between farmers, research, and extension, which ensured the effective communication of problems as well as solutions. To overcome communication barriers between the

different agents, DASP encouraged *Krishi Vigyan Kendras* and extension agencies of the line departments to conduct on-farm research, validation, and demonstration activities. Furthermore, DASP took measures to encourage the participation of farmers in the development of technology through farmers' organizations, farmers' self-help groups, commodity groups, and producers' associations. The group approach will benefit the underlying interest groups if it results in technology recommendations that meet the conditions of a narrowly defined production environment (Alex, Zijp, and Byerlee 2002) or promotes the more efficient and cost-effective utilization of resources from economies of scale and scope.

Considering technology development under the NATP initiative, the program promoted technology development via sponsored research on production systems, crosscutting research, strategic (or upstream) research, and competitive grants research. The earlier section on capacity building pointed to the existence of national and local research priority areas. The local priority research themes controlled for local conditions that were identified by using integrated participatory planning approaches, such as participatory rural appraisal schemes at the zonal level. In comparison, the national priority research themes reflected the accumulated experience of technical specialists for production systems research (scientific advisory panels) and for other modes of research (research program committees), rather than the experience of farmers as the end-users of technology developments.

Turning to technology dissemination, the DASP scheme emphasized demand-driven approaches to stimulate the participation of farming communities in the identification of problem areas, in decisionmaking, and in the implementation of proposed interventions. Similar to the reforms in the technology development system, the reforms in the technology dissemination system asked farmers to articulate their demands through farmers' organizations, self-help groups, commodity groups, and producer associations. The driving force behind the mobilization of farmers were NGOs, which supported the establishment and promotion of farmer interest groups in collaboration with the front line (district, block, and village) extension workers of the line departments and the *Krishi Vigyan Kendras*. To this end, NGOs and the front-line extension workers received training in financial management, group dynamics, group management, participatory concepts, and leadership skills, among others.

While the technology development component of the NATP initiative contained comparatively weak provisions for participatory action, technology dissemination was clearly demand driven and bottom-up. Extension accordingly involved participatory implementation processes at lower tiers of the government (Reddy and Swanson 2006; Singh and Swanson 2006). The demand-side of the technology dissemination system was predominantly defined at the block and village levels through the institutional and operational setup of ATMA. Under this agency, programs at the block level were implemented through a Farm Information and Advisory Center (FIAC), which was operated by a Farmer Advisory Committee (FAC) (see Figure 2). The FAC hosted all key stakeholders and farmer representatives. This institution's main task was to stimulate the foundation of farmers' groups on the basis of a specific commodity or a general purpose at the block and village level, in order (1) to strengthen the links of farmers to markets, credit, and marketing services through better organization of farmers and (2) to make technology dissemination and generation farmer driven and farmer accountable. The ultimate objective behind the formation of farmers' organizations, commodity-oriented farmer interest groups, farmers' cooperatives, self-help groups, or women's interest groups was to make farmers and their organizations fully responsible for the technology system.²² In addition to the FAC, NGOs supported the mobilization of farmers in voluntary informal interest groups.

²² Farmer interest groups are also formed to benefit from possible gains in operational efficiency, possible reductions in the cost of cultivation through the collective purchase of inputs and services, and the realization of scope economies.

Capacity Building and Strengthening

As opposed to the supply-side reforms, capacity building on the demand side improves the ability of farmers to demand good governance and to hold public officials accountable. In order to be effective, farmers require information on the responsibilities of service providers and on enforcement mechanisms. In addition, the success of demand-side initiatives also depends on the capacity of farmers to identify and communicate technology problems and to implement their solutions.

Under the DASP and NATP initiatives, human capital development of farmers at the block and village levels mainly concerned the effective and efficient use of agricultural input variables (such as seed and fertilizer) and other technologies. The DASP initiative addressed human capital insufficiencies of farmers by organizing extensive training programs and demonstrations on the main extension themes of integrated pest management, new varieties and management practices for horticultural crops, animal health, breed conservation, and clean milk production. These activities were provided by line departments and *Krishi Vigyan Kendras*. Like the DASP, the NATP promoted public initiatives toward more intensive training in all project districts of the country through the *Krishi Vigyan Kendras*, zonal research stations, and agricultural technology information centers. The underlying activities included the training of farmers, the dissemination of research findings, and the supply of research products (on a cost recovery basis).

The ability of public-sector training institutions to adequately meet their intended purposes is hampered by (1) tight fiscal budgets and the cutback in available financial resources, (2) the large number of increasingly diversified farmers, and (3) the need to provide training units that reflect up-to-date information (Sulaiman and Sadmata 2000; Chandre Gowda and Samanta 2002). The public-sector training activities were therefore supported by private and third-sector organizations. Third-sector institutions taught farmers to form and manage voluntary informal farmers' organizations and thus created platforms for the effective dissemination of technology innovations. Private-sector organizations provided training and technical recommendations on the efficient and adequate use of inputs to farmers and disseminated farmer-driven and farmer-accountable technologies at the district level. In providing information on the use of inputs and on the scientific management of crops and cultivation practices, among others, the private sector reinforced trends of diversification and thus intensified agricultural activities.

Affirmative Action

Affirmative action describes the steps that are taken to empower (rural) people to demand the agricultural and rural services they need, and to make service provision and financing accountable to elected bodies of local government (Birner and Palaniswamy 2006). In India, affirmative action includes specific measures such as training or the reservation of seats in elected bodies of local government for women and disadvantaged groups.

Both the DASP and NATP initiatives contained provisions for the empowerment and mobilization of women and took actions to promote the participation of women in the planning and implementation process of agricultural research and extension, although gender issues were not a key priority. For example, both programs promoted the formation of farmer and self-help groups for women and required that 30 percent of the farmer representatives on the ATMA Governing Board and the block-level FACs are women (World Bank 2005a; Reddy and Swanson 2006). The NATP program imposed the additional requirement that 30 percent of the budget for extension and research programs would be allocated to women farmers and women extension functionaries.

Gender empowerment was a key priority of the Danida projects. The WYTEP, TANWA, TEWA, and MAPWA initiatives mainly aimed at strengthening the position in society of women with small and marginal farms and increasing their productivity and hence income by training them in the application of low-cost technologies (including seed selection and treatment, postharvest storage, use of biofertilizers and biopesticides).

At least during the early phase, all projects implemented the T&V approach. The respective training emphasized the top-down delivery of standardized, predetermined messages. These mainly concerned crop production and were communicated in district agricultural training centers. While WYTEP pursued the T&V approach throughout the project period, the TANWA, TEWA, and MAPWA gradually followed a holistic and participatory farming system approach and widened the scope for agricultural training and extension activities after the initial stage. This included the provision of village-based training, which is considered to be more flexible to accommodate local-specific agroecological and socioeconomic properties, as it is not institutionalized. There are differences in the extent to which the TANWA, TEWA, and MAPWA projects broadened the scope for agricultural training and extension activities. For example, TANWA aimed at integrating agriculture with other related activities like crop diversification, horticulture, sericulture, and animal husbandry, while MAPWA only addressed crops.

Female extension staff supports technology dissemination at the village level. The training of the women extension workers was mainly accomplished in district agricultural training centers, with a few selected female extension workers also completing a six-month agricultural management and extension course at the Nordic Agricultural Academy in Denmark. The direct, village-based training built on women, who were trained in technical and communication skills in a planned five-day training course. In order to increase the effectiveness of female extension workers, the projects promoted the integration of the female staff into regular extension services. The integration of the female extension workers into the state Departments of Agriculture was supported by training sessions, workshops, and courses for male staff members. Technology dissemination at the village level was also supported by the groups for farm women and women's self-help groups. Formed with the assistance of female extension workers, the women's groups were meant to create a platform for technology dissemination, shared learning, collective action (input procurement, for example), and credit and savings activities.

In addition to the gender-focused projects, reform efforts were also directed toward improving the livelihood of disadvantaged tribal groups. A case in point is the 1991–98 Andhra Pradesh Tribal Development Project. The project was implemented in 2,077 villages in four districts that were home to four contiguous and 63,370 tribal households.²³ With annual income levels in the range of Rs 2,660 to Rs 3,770 at the start of the program, the tribal groups faced severe food insecurity. In order to improve the income, food security, and living conditions of tribal groups, the IFAD initiative institutionalized participatory actions of tribal farmers (including women) within the framework of self-help groups, cluster-level associations of self-help groups, and village development committees,²⁴ agricultural consultants, village tribal development associations, and so-called community coordination teams. Village tribal development associations were nodal institutions designed to prioritize the extension needs and to deliver development programs to the community. Community coordination teams were groups of young professionals who were supposed to assist village extension workers in social mobilization, awareness building, technology dissemination, and the identification of needs, around which development interventions could be built. Mobilization aimed at strengthening the ability of the tribal population to clearly identify the obstacles to development and to define action plans to help mitigate or even eliminate these hindrances. Self-help groups were also seen as a medium of technology dissemination and as a source of information regarding irrigation, horticulture development, soil conservation, as well as marketing, savings and credit activities (IFAD 2001).

²³ The Andhra Pradesh Tribal Development Project was replaced with the Andhra Pradesh Participatory Tribal Development Program. This IFAD program, implemented during the period 1994–2002, aimed at improving the livelihoods of tribal communities through stronger participation in small-scale construction activities, among others. Given the absence of a program evaluation report, the program is not further investigated here.

²⁴ The village development committees were meant to discuss education, health, and irrigation issues.

4. THE SERVICE DELIVERY EFFECTS OF AGRICULTURAL EXTENSION REFORMS

This section summarizes the results of existing program evaluation documents regarding the performance of the agricultural reform initiatives. As systematic program evaluations tend to be unavailable for projects that are implemented by civil-society institutions, the present review of performance assessments predominantly refers to studies of projects funded by the World Bank (such as DASP and NATP) and Danida (such as WYTEP and TEWA). Numerous caveats apply to the underlying studies.

First, the existing program evaluation studies mainly highlight the economic effects of the reform initiatives and their program subcomponents but do not identify the impact or the effects of the reform initiatives on the quality (scope and content) and outreach (accessibility) of agricultural extension services. The absence of impact assessment studies can be attributed to the nonexistence of baseline data.²⁵ Second, the program evaluation studies do not systematically assess the performance of the individual supply- and demand-side components of the reform initiatives. We therefore cannot draw conclusions with respect to the performance of all of those program components mentioned in the previous sections. Third, the existing program evaluation studies report nonempirical qualitative or quantitative evidence or both. As the respective evidence does not provide information on the statistical significance of the results, it offers scope for subjective interpretations of the observed relationships. Fourth, the studies tend not to identify the grounds on which the performance of a project is deemed to be satisfactory or unsatisfactory.

Given these constraints, section 6 will highlight the tentativeness of the conclusions about the effects of agricultural reform initiatives and the relative importance of the various supply- and demand-side initiatives. The findings on what works, where, and why in a decentralized environment should accordingly be interpreted with caution.

Economic Program Performance Assessment

In its implementation completion reports, the World Bank (2004a; 2005a) argued that the organizational and institutional changes inherent to the DASP and NATP approach had a positive economic effect. The performance of both programs was judged to be satisfactory given improvements in the prospects for productivity growth. This section summarizes the net economic benefits of the productivity gains. The discussion highlights the economic performance of the DASP and NATP program, mainly because of a lack of comparable assessments for other programs.

Under the DASP initiative, the improved prospects for productivity growth were attributed to the use of a farming –system approach, rather than a commodity-specific approach, to technology development and dissemination and to the applied research on user- and location-specific requirements. These approaches promoted the intensification of the agricultural production system and the diversification into high-value nonbasic farm products. In order to quantify the net economic benefits of program activities, the World Bank (2004a) implemented a survey that covered both project and nonproject areas and households. The sample from the project (nonproject) area consisted of 333 (164) households from 56 (28) villages in 28 (14) project blocks. Using these data, the net economic benefits of program implementation were summarized in terms of the economic and financial rate of return.

The economic rate of return was computed for the overall project and for subcomponents (agriculture, sericulture, livestock, rural roads) thereof. Using information on farm costs and benefits and deducting overhead project costs that are directly attributable to individual components, the economic rate of return was found to be almost equal: 26 percent for agriculture, 25 percent for livestock, and 24 percent for rural roads. The rate of return for the program as a whole was 21 percent. The overall economic rate of return was adjusted to exclude overhead costs that cannot be attributed to individual components.

²⁵ Even with baseline data, the impact assessment would be difficult, since it is hard to distinguish changes that are due to reforms from those that would have taken place in the absence of reforms.

Turning to the financial rate of return, it was computed as the level of farm production and breed improvements after the adoption of new technologies. The results indicate that (1) the adoption of a representative package of technologies/practices introduced by the project increased farm-level income by 63 percent per year, and (2) keeping an improved breed increased income from a cow by 125 percent and from a buffalo by approximately 22 percent. The significant increase in income for crops was attributed to four factors: cost saving, productivity gains of approximately 10 percent, diversification into higher-value crops, and increases in cropping intensity from 169 to 203 percent. Unfortunately, the World Bank (2004a) did not investigate the extent to which the rates of return were influenced (1) by the bifurcation of Uttar Pradesh and by changes in world prices for agricultural products, (2) by the lack of leadership in the Project Coordination Unit and in the line departments due to high turnover, and (3) by the lack of reporting and accounting standards during the first years of program implementation and the consequent lack of oversight over the emergence of possible problem areas.

With regard to the NATP program, productivity gains reflected accomplishments in the major objectives of (1) enhancing the organizational and managerial efficiency and effectiveness of the ICAR research system, (2) intensifying and supporting the agroecological research system, (3) improving the efficiency and outreach of technology dissemination, and (4) strengthening the capacity in project management and implementation. The net economic benefits of the NATP program activities were measured in terms of the economic rate of return for the two largest project components: the agroecological research and the Innovations in Technology Dissemination component. Both components accounted for 82 percent of the aggregate project costs.

The production systems research component involved research projects that did not contain adequate provisions for impact assessment. Because of this, the economic and financial rate of return on reforms of the agroecological research system could not be derived in a systematic fashion. Instead, the economic performance was evaluated for three selected major projects: zero tillage, integrated pest management, and household food and nutrition security. The performance assessment employed data from on-farm research for a sample of 690 participating or nonparticipating farmers from 10 states and economic and secondary published information. For these data, the economic rate of return on reforms of the agroecological research system was predicted to be 34 percent.²⁶ According to the World Bank (2005a), the high rate of economic return was driven by the high social returns from the use of research-driven eco-friendly technologies (such as integrated pest and nutrient management and zero tillage) and their significant impact on the sustainability of land and water use and their negative effect on the use of pesticides and chemical fertilizers, among others.

The net economic effect of the Innovations in Technology Dissemination component of the NATP program was determined by using information from an impact assessment survey that consisted of 1,224 project households and 486 nonproject households. The households held varying sizes of land and were randomly selected from 12 out of 28 districts. To allow for comparisons, project and nonproject households were selected from the same district (World Bank 2005a). Using these data, the monitoring and evaluation report highlighted a 21 percent increase in the level of farm income in districts that operated under the ATMA approach. This increase was assumed to reflect the effects of agricultural diversification and the associated increases in the horticulture cropping area from 12 to 16 percent, in the oilseed cropping area from 3 to 11 percent, and in the herbs and medical cropping area from 1 to 5 percent. At the same time, cereal yields increased by 14 percent, although the area for cereal cropping contracted from 55 to 47 percent during the period 1999–2003. In comparison, districts without ATMA reported an increase in household income of only 5 percent.

Overall, the evidence on the economic and financial rate of return suggests that the DASP and NATP initiatives as a whole succeeded in promoting agricultural and rural development. Unfortunately, the existing program evaluation studies did not identify the relative contribution of individual program

²⁶ The World Bank (2005a) adopted conservative assumptions about the increase in farm productivity, the adoption rate of new technologies, and the estimated benefits from the accumulation of new technology capital. See the World Bank (2005a) for details regarding the assumptions.

components to the overall program response of the agricultural sector. If at all, the evaluation studies only determined the performance of the individual program components. The following sections summarize the results of the corresponding performance assessments. Because the demand- and supply-side components of the reform programs were interdependent and mutually reinforcing, a discussion of the performance of the program components along the lines of the demand- and supply-side framework in Figure 1 and the discussion in section 3 is infeasible.

Research and Technology Development

Among the individual program components of the DASP initiative, only technology development performed below average. The unsatisfactory performance was attributed to only small improvements in technology-improving research. Although technology development did not meet expectations, there were significant improvements in the number of new technologies. It was argued that the innovations would be supported by an increase in the number of research organizations and by the explicit specification of research priorities (that is, integrated pest management, integrated plant nutrient management, animal reproduction, health, and feed management). The technologies were more swiftly disseminated to farmers thanks to the emergence of stronger research–extension–farmer linkages. Scope for improvements were found to exist in terms of the coordination of the research efforts of institutions, the development of long-term agricultural research plans and agricultural information systems, and the efficient use of research funding.

In contrast to the DASP initiative, the NATP program successfully improved the efficiency and effectiveness of the agroecological systems research. Research within the framework of the sponsored and competitive grants program improved the productivity and sustainability of production systems and precommercial technology development through high-quality collaborative research in priority areas. The high quality of research activities was explained by (1) the process of participatory planning and review that involved farmers, subject matter specialists, and peer review; and (2) the exploitation of interinstitutional scale and synergy effects from cooperation between research institutes and from public–private partnerships. According to the World Bank (2005a), the competitive grants program encouraged 65 research projects with private-sector participation.

However, private-sector participation in public research was quite low in comparison to the total number of 442 competitive grants projects.²⁷ The underrepresentation of the private sector was enforced by the insufficient commitment of ICAR’s management to public–private partnerships. Important factors in that respect were vested interests and established power relationships. In addition, the exclusion of the extension personnel from the review process indicates that extension workers were not an integrated part of the NATP research system. The consequent weak link between research and extension caused feedback flows from extension to research and the dissemination of new technologies through extension workers to be inadequate. In addition, the NATP’s production systems research involved the implementation of a large number of small-scale projects. Small-scale projects facilitated the investigation of location-specific problems, but also precluded the utilization of scale economies.

According to the World Bank (2005a), the NATP not only promoted agroecological systems research, it also increased the efficiency and effectiveness of the ICAR research system through the decentralization of decisionmaking processes and the delegation of financial responsibilities. Both developments endowed researchers with greater freedom and flexibility regarding the implementation of research activities. Research activities in turn were increasingly realized outside the national agricultural research system, with research providers being other public institutions (31 universities, 15 national institutes) and nonpublic organizations (109 other organizations and NGOs, 3 international institutes). Within this framework, the NATP also promoted the foundation of 49 public–private partnerships in organization and management research. Unfortunately, the World Bank (2005a) did not investigate the

²⁷ Out of the 442 projects, 150 projects were assigned to ICAR institutes, 227 to state agricultural universities, 8 to NGOs, and 57 to other institutions (World Bank 2005a). The other institutions were not specified in more detail.

channels through which or the extent to which each of these institutions or partnerships improved the effectiveness and relevance of research.

Next to the possible gains from greater interinstitutional cooperation, the efficiency and effectiveness of the ICAR research system also benefited from the development of information systems, including the introduction of computer facilities and databases and improvements in ICAR's library system. The World Bank (2005a) argues that these measures together were critical to the improvements in the organizational and managerial efficiency of the ICAR research system. Indicator variables of efficiency and hence productivity gains were the scientific productivity per project and the number of publications per researcher of the ICAR system. One can question the usefulness of these indicator variables since they do not account for the quality of the research.

Fiscal and Administrative Decentralization

The conceptual framework in section 2 points to the importance of fiscal and administrative decentralization as supply-side mechanisms for improving service provision. For the sample of reviewed reform initiatives, evaluation studies did not assess the economic impact of fiscal and administrative decentralization and autonomy on service delivery and accordingly on agricultural and rural development. If at all, the success of decentralization was indirectly measured in terms of the performance of the ATMAs. Their performance approximated the economic success of decentralization efforts since fiscal and administrative decentralization are inherent to the financial and operational autonomy that ATMAs possess at the district level.

According to the DASP and NATP evaluation studies, the performance of the ATMAs was highly satisfactory. The positive assessment was guided by the positive effect of the underlying institutional and procedural changes on the efficiency and outreach of the technology dissemination system. The institutional and procedural changes have been instrumental in decentralizing planning and implementation, coordinating projects between departments, and in providing demand-driven services. As a direct consequence, the ATMAs increased farm income by promoting the agricultural diversification of farm production from basic foodgrain to high-value nonfoodgrain commodities and value-added processing. Besides these effects, ATMAs also improved farm income by strengthening the linkages between research, extension, farming, and markets. The tighter linkage between research, extension, and farming stimulated the adoption of a large number of new low-cost technologies, agronomic practices, research tools and methodologies, and intermediate products through farmers. The large number of innovations in turn can be attributed to the definition of priority areas of research and the consequent targeted intensification of research.

In addition to the ATMA model, the DASP also emphasized the importance of administrative and fiscal decentralization as a precondition for promoting infrastructure development in terms of markets and roads. According to the World Bank (2004a), the DASP initiative significantly strengthened rural infrastructure development by making local governments responsible for the management and maintenance of rural markets and roads. In due course, more than 2,700 kilometers of rural roads had been improved or constructed, which helped to link more than 1,100 villages. This development was associated with an increase in traffic density of 14 percent and with an increase in the value of land in the connected villages of 25 percent. At the same time, farmers along the newly constructed roads diversified into vegetables and other horticultural crops, among others. Next to the construction of roads, the DASP initiative upgraded and constructed 114 rural markets. Under the management of village Panchayats, market activities intensified in terms of trading volume and market participants (traders and buyers). Unfortunately, the program evaluation report did not discuss the extent to which the village Panchayat administration of markets and hence administrative and fiscal decentralization contributed to the higher market volume.

With regard to the supply-side reforms of fiscal decentralization, the following relationships might be of interest. The 73rd Constitutional Amendment permits Panchayats to levy taxes and duties. Despite this right, fiscal responsibilities still do not rest with village councils but with the state. While

most Indian states grant a lump-sum payment for the ordinary work of the Panchayats, they do not grant Panchayats the right of taxation, not even for the purpose of financing the day-to-day operations. Even if states would grant communities the right of taxation, the local fiscal revenue would still be too low for two reasons. First, the tax base would be far too small to raise the required financial funds (von Braun and Grote 2002). Second, the present institutional setup does not encourage the village council to raise local fiscal revenue because revenue collection does not employ local agents with greater responsibilities or ownership. This also implies that local agents do not face incentives to improve the quality or efficiency of public services in general and to undertake the effort of providing demand-driven extension services in particular (Dethier 2000).

Participatory Planning and Implementation in Technology Dissemination

Common to the reform programs discussed in section 3 is the belief that technology dissemination needs to adopt a demand and user focus. To this end, technology dissemination should build on principles of participatory planning and implementation. The DASP and NATP program pursued this objective within the framework of the ATMA. Particular to the ATMA is the strong emphasis on (1) private-sector participation in input supply and support services, and (2) community participation in, for example, on-farm integrated pest management and integrated plant nutrient management activities. According to the World Bank (2004a; 2005a), ATMAs were very effective instruments for promoting participatory planning and implementation. The usefulness of the ATMA approach resulted from the underlying financial and operational autonomy that facilitated decentralization in planning and implementation and collective actions of farmers in the design and execution of technology development and dissemination. At the core of participatory actions was the mobilization of farmers into commodity or general purpose groups.

Within the framework of the NATP initiative, the adoption of the ATMA model resulted in the organization of more than 10,800 crop- or product-based farmer interest groups and 85 farmer associations and farmer federations. The organization of farmers has contributed to the adoption of client-focused and participatory approaches in the formulation and implementation of agricultural policy programs. In comparison, the ATMA model stimulated the organization of close to 20,000 self-help groups and 200 farmer field schools involving more than 220,000 households under the DASP initiative. The organization of farmers into self-help groups was considered to be an essential instrument for improving the socioeconomic status and decisionmaking role of farmers in general and of women in particular on grounds of the large volume of the groups' internal savings. These were given out as loans to group members for the purpose of financing short-cycle, income-generating activities and social, medical, and critical consumption needs.²⁸

Under the DASP and NATP initiatives, the organization of farmers into interest or self-help groups was supported by line departments, NGOs, and private-sector institutions. These improved the effectiveness and sustainability of the technology dissemination system by providing training programs and demonstrations on the main extension themes. The DASP initiative was judged to be successful in promoting private and third-sector participation and public-private partnerships through policy and institutional reforms and changes in input supply mechanisms (cost recovery schemes) and on-farm seed multiplication schemes, among others. In terms of public-private partnerships, the DASP scheme successfully supported their operation in agribusiness activities. At the end of the project implementation period, 125 food processing and sale licenses were assigned to agroentrepreneurs.²⁹ In comparison, the NATP program encouraged the foundation of 45 public-private partnerships in extension. ATMAs predominantly partnered with private companies in areas that facilitated the dissemination of

²⁸ Under the DASP program, self-help groups provided loans of approximately \$4.2 million in US dollars from their internal savings to their members and accessed credit worth \$4.6 million from the banks (World Bank 2004a).

²⁹ The DASP program also promoted private-third-sector partnerships: the project resulted in the signing of 110 Memoranda of Understanding between self-help groups and commercial businesses for the marketing of the groups' products.

technologies, improved the availability of inputs and credit, and helped farmers in processing and marketing their products.

Capacity Building and Strengthening

Section 3 discussed capacity building as a supply- and demand-side mechanism to strengthen the ability of extension agents to disseminate technology and of farmers to employ new technologies, respectively. Unfortunately, the lack of sound quantitative evidence makes it intrinsically difficult to assess the effect of project implementation on the capacity of service providers and service users to efficiently and effectively deliver or utilize extension services. The subsequent conclusions about the human capital effect of the different programs are therefore descriptive.

Under the DASP and NATP programs, capacity building was inherent in ATMA's extensive training and orientation program and the underlying Strategic Research Extension Plan. ATMA was found to represent effective institutional and procedural setups for promoting the collaboration of all major stakeholders. Collaboration broadened the human resource and knowledge base in research and stimulated capacity building within line departments. Regarding the NATP initiative, the World Bank (2005a) emphasized the role of ATMA as the organizing entity of close to 2,500 exposure visits, nearly 32,000 demonstrations, and 12,000 training activities. The human capital gains arose from the outreach of the activities: each of these activities respectively benefited 75,000, 88,000, and 400,000 farmers between 1999 and 2003. The *Krishi Vigyan Kendras* were a significant source of farmers' training at the state level. During the project period, these agricultural science centers organized 9,082 training courses for 324,000 farmers. The DASP evaluation study was less specific on the source of human capital gains. The study mentioned 10,158 field days for different crops as the main initiative within which the agriculture- and horticulture-related training of more than 263,000 farmers was accomplished.

Under the NATP and DASP programs, training was provided not only to farmers but also to extension workers. The NATP scheme resulted in the training of more than 70,000 extension workers. Important sources of training were the technology dissemination agency MANAGE at the national level and SAMETIs at the state level. Together they provided training to more than 25,000 extension workers. In comparison, the *Krishi Vigyan Kendras*, at the state level, organized 1,388 training courses for 45,324 field extension workers during the project period. Under the DASP, capacity strengthening occurred within line departments through an extensive training and orientation program involving nearly 22,000 officials and extension workers.

The World Bank (2005a) highlighted differences in the performance of technology dissemination agencies, with possible effects on the quality of the training activities. At the national level, MANAGE was concluded to perform satisfactorily, given its strong role (1) in training the ATMA directors and most of the district and block level extension staff, (2) in establishing the state-level SAMETIs, and (3) in linking the NATP program components at all government tiers through the design and implementation of an information technology network. The performance of MANAGE was found to critically depend on the commitment of the leadership to the tasks at hand. Performance assessments of the SAMETIs suggest that those associated with the state agricultural universities outperformed those associated with the state Departments of Agriculture in terms of providing training and supporting the implementation of the ATMA model. The differences in performance were attributed to dissimilarities in the availability of and the access to research and extension resources. The overall performance of the SAMETIs was concluded to be unsatisfactory. Although for a different reason, the interdepartmental working groups also did not perform well. The main impeding factor was the lack of responsibility in project implementation and the consequent absence of incentive structures to monitor project activities.

Affirmative Action

Both the DASP and NATP initiatives had a gender-specific focus, which at least the DASP program satisfactorily pursued (World Bank 2004a, 2005a). The success of reforms was measured in terms of the ability of women to organize in self-help groups and the number of women attending exposure visits and demonstrations. Using these indicator variables, DASP fostered the creation of 7,399 self-help groups for women (World Bank 2004a) and NATP organized 10,000 exposure visits, 21,500 demonstrations, and 75,000 training activities for women. Measured in terms of the total number of beneficiaries, the share of women in NATP activities was quite low, ranging from approximately 4.0 percent for demonstrations to 7.5 percent for exposure visits.³⁰

In addition to farmer groups and self-help groups, DASP and NATP also promoted the reservation of 30 percent of all seats on district- and block-level committees for women (and scheduled tribes). Unfortunately, the World Bank implementation assessment studies (2004a, 2005a) did not assess whether the reserved seats were indeed all captured by women. Furthermore, both projects did not provide estimates on the expected contribution of the reforms to the income of women.

More detailed qualitative information on the performance of gender-related reforms were provided by Danida. As mentioned, Danida implemented projects with a strong focus on gender-related and agricultural aspects. The following paragraphs use the Danida evaluation reports on the women-oriented extension projects WYTEP, TANWA, TEWA, and MAPWA to quantify the impact of the project activities on the economic situation and the social position of the women involved. The impact assessment centered on the question of whether training has empowered women to meet their strategic interests and needs relative to those of men. Given the absence of baseline surveys, impact was broadly defined as the sum of the short- and long-term changes in people's lives and livelihoods that were induced by project implementation.³¹ The economic impact assessment used one-time questionnaire-based interviews with 545 trained farm women and occasionally their husbands. The respective results are indicative rather than conclusive for three reasons. First, the survey sample does not reflect the actual distribution of the population of trained farm women. Second, the interview answers can be questioned in terms of reliability. Third, uncertainty prevails with respect to the nature of causal relationships and attribution.

Evaluating the results of the assessment study, Danida (2002) concluded that all projects have improved the economic status of trained women and contributed to poverty reduction. The improvement in economic status was attributed to the training received and reflected the corresponding effect of (1) higher crop yields,³² (2) savings on the use of chemical fertilizer, and (3) higher agricultural productivity through improvements in agricultural practices. Notably, the degree of poverty reduction differed among projects, with the impact being lowest under WYTEP and largest under TEWA. The differences are predominantly attributable to program dissimilarities in the type of training offered and to corresponding differences in the number of skills and methods adopted. WYTEP used institutional training at the district level, an approach that caused women to continuously use only one of the skills or methods. The institutionalization of the training in district training centers imposed significant problems with respect to offering courses, given the difficulties associated with persuading the required 30 female participants to leave home for 10 days.³³ Problems in recruiting participants also accounted for the observation that training beneficiaries were not the targeted married, small- and marginal-scale farmers, but large-scale

³⁰ Singh and Swanson (2006) identified gender-related differences in the organization of farmer interest groups. Male-dominated farmer interest groups were characterized by a homogeneous socioeconomic structure, while female-dominated farmer interest groups combined different socioeconomic backgrounds. In crosscutting socioeconomic groups within a community, women farmer interest groups were deemed to be better able to mobilize the rural poor.

³¹ According to Danida (2002), "impact" refers to the long-term and "effect" describes the short-term change associated with project implementation.

³² Danida (2002) questions the adequacy of the yield data, since the negative effects of a drought offset the positive yield effects of training.

³³ The number of training days came down to six in 2001 (Danida 2002).

farmers with more than five acres of land, or landless, young, or unmarried women. In particular, the selection bias toward landless women or those with large farms explains the unsatisfactory impact of the WYTEP on poverty reduction. While similar selection problems were also characteristic of the other programs, they were less pronounced. Furthermore, the other three projects advocated village-based training, an approach that did not cause women to leave home and therefore made them more willing to participate in the program. The village-based approach encouraged participants to use on average three skills or methods, which were group-focused, broad-based, and participatory in nature. Furthermore, the village-based training was associated with a more differentiated training approach that also offered scope for assessments of individual and contextual needs.

The differences in the type of training method used also explain cross-project differences in the degree of cost efficiency, measured as the cost per trained woman. WYTEP was cost inefficient, MAPWA was relatively cost efficient, and TEWA and TANWA were highly cost efficient. WYTEP was much more costly, taking into consideration the travel expenses incurred to train Indian female extension staff in Denmark and to find farmer women who were able to attend training away from home. The TEWA approach was cost efficient because the project used Lady Village Agricultural Workers, who provided training to a large number of women at lower wage, transportation, and total costs than the extension workers in the other projects. However, the cost-efficiency estimates of all projects were only indicative, since the variables used for the construction of the efficiency measure were not directly comparable across the different projects. Furthermore, uncertainty prevailed on whether the quality of the training received by many of the women actually qualified them as being trained. It might be that the number of women actually trained was lower than reported—a fact that is especially likely to be true for the TEWA project.

Apart from these factors, project performance was also influenced by the commitment of the state Departments of Agriculture and the Danida project advisers to the program. As indicated, the projects tried to integrate the female staff into the state Departments of Agriculture and to promote the role of women in the general extension system.³⁴ Although the projects succeeded in creating a number of regular positions in the general extension system for women, Danida (2002) argued that the integration efforts at the state Departments of Agriculture were not sufficient to accomplish the required degree of integration and gender sensitization. Men still dominated all hierarchy levels in the state Departments of Agriculture and changes in gender relations were impeded by the resentments of men toward the stronger role of women in agriculture. Resentments predominantly prevailed at lower levels in the state Departments of Agriculture. In fact, male officers at the highest levels in the state Departments of Agriculture were found to support the gender sensitization efforts. Unfortunately, the implementation of the projects coincided with a high turnover rate of project directors and other senior Department of Agriculture officers with project responsibilities. The high turnover rate and associated uncertainty precluded the effective integration of the projects into the state Departments of Agriculture, a development that hampered project acceptance and hence support, especially at lower hierarchy levels. Some degree of continuity was introduced through the low turnover among the projects' advisers.

One major objective of the Danida projects was the empowerment of women. The project assessment study determined the degree of empowerment by evaluating the impact of project implementation on individual resources (self-confidence, pride, negotiation abilities), mutually supportive social processes (among women, in families, in communities), and collective steps toward changing gender relations (mobilization in farm women groups). Obviously, the degree of empowerment cannot be quantified per se, given the intangibility of the variables. Conclusions regarding the effect of program implementation on the economic and societal positions of women were therefore at best indicative and subject to normative judgments.

³⁴ The number of public-sector female extension workers or Lady Village Agricultural Workers equaled 434, 185, 157, and 70 under TEWA, TANWA, WYTEP, and MAPWA, respectively. The extension workers mainly operated at the taluk level and in training centers, with only very few higher-level positions being filled by women. Nevertheless, the programs succeeded in reforming the extension system to also cater to the needs of women.

Regardless of the variable, Danida (2002) concluded that the programs were important means of strengthening the position of women. For example, the evaluation report documented positive effects of training on the self-confidence and self-esteem of women, with women sometimes attending training courses despite the resistance of family members. The ultimate impact of women empowerment was an increase in the ability of trained women to decide on the introduction of new farm technologies either jointly with their husbands or on their own. The stronger role of women in the decisionmaking process was particularly pronounced for the TEWA, TANWA, and MAPWA projects. Under WYTEP, women were generally excluded from the decisionmaking process. A possible reason for the lack of decisionmaking power was the program selection bias toward unmarried women and weaknesses in the institutional training and in the scope and content of extension activities.

Project participation also affected the relationship between women and the village community. On the one hand, program participation strengthened the role of women as sources of information at the village level, a development which was associated with the more respectful treatment of women. For example, the community was found to approach trained women for agricultural advice, given their perceived expertise in agricultural methods. On the other hand, program participation had no significant effect on gender relations at the village level, given that women still had no substantial influence on village-level decisionmaking.

Empowerment also concerns the extent to which women can demand the services they need. Danida (2002) argued that the projects improved the women's awareness regarding their service needs and their limited access to services. With better access to information, women were able to express their demands either individually or in social groups. Social group formation was a critical component of the Danida projects. According to the survey, the projects were particularly successful in mobilizing women via mutually supportive farm women's groups and women's self-help groups. Measured by the sheer number of farm women's groups, the TANWA project was most successful. Measured in terms of membership, social groups do not appear to be the best means to mobilize and empower women. Only about 30 percent of trained women were members of a farm women's group or a women's self-help group. The limited popularity of the social groups can be attributed to the limited range of services offered. While self-help groups provided saving-and-lending functions, they did not engage in product marketing, production activities, or the collective purchase of inputs. Danida (2002) attributed the limited success of the groups to the lack of effective leadership and to insufficient training in management and organizational skills. Other reasons had a sociocultural background, referring to the inability of the members to address and overcome caste restrictions and interpersonal conflicts.

Although the Danida projects turned out to be largely successful in strengthening the position of women, the evaluation report also identified aspects of disempowerment. Disempowerment reflected the opposition and negative reactions of men to changing gender relations, the exclusion of marginalized groups of women (Muslims and scheduled castes) from training, and the layoff of (landless) women because of an increased use of laborsaving techniques (Danida 2002). Although single Danida projects and project components did not perform as expected, each project was important for steering the development activities of the Government of India toward women and for creating awareness of their agricultural training and extension needs. In fact, the Government of India carried out comparable projects at a smaller scale in seven states not covered by the Danida project.³⁵

The review of existing projects in the previous section also emphasized the Andhra Pradesh Tribal Development Project as an example for a reform initiative that sought to improve the livelihood of disadvantaged tribal groups. In order to assess the performance, impact, and sustainability of the program, IFAD (2001) prepared a participatory rural appraisal, using primary data from project stakeholders in 35 project villages. Based on descriptive statistics, the effects of the Andhra Pradesh Tribal Development Project were ambiguous. In general, adverse project management and coordination practices negatively affected the program's performance. Project implementation was characterized by the short tenure and high turnover rate of project officers and by frequent adjustments in the project components. Program

³⁵ The states were Haryana, Himachal Pradesh, Kerala, Maharashtra, Punjab, Rajasthan, and Uttar Pradesh.

coordination was influenced by a lack of communication between institutions. Considering the performance in terms of community participation, the program did not meet expectations. Although the project gave rise to 1,231 self-help groups, roughly 50 percent of these were inactive given a lack of cohesiveness and sustainability. The lack of community participation and hence social mobilization reflected the operation of top-down rather than bottom-up approaches and the improper sequence of project components. IFAD (2001) exemplified this point by stressing investments in natural resource management that were incurred even in the absence of institutional structures such as self-help groups that could manage the natural resource base. Social mobilization and community participation were thus effectively delinked from decisionmaking processes about the nature of development activities. The nature of investment was decided upon at the state level rather than by local bureaucracies. The state-level functionaries, however, lacked incentives to institutionalize structures to support the participatory development processes that came along with the transfer of responsibilities down to the local level. Besides, the program also failed to empower tribal groups and women to demand the services they needed because the group approach evolved around a single spokesperson and traditional power structures rather than around a balanced group approach.

Information and Communication Technology

The review of supply-side reforms points to the importance of ICTs as a means to increase agricultural productivity and consequently agricultural and rural income. At least three interdependent factors account for the positive effects (Annamalai and Rao 2003; Singh 2006). First, ICTs can improve the quality and availability of public and private services to the rural poor. Benefits arise from reorientating service provision from the supply to the demand side, making it more responsive to the needs of the rural poor. Second, ICTs allow services to be delivered to a large number of people at low variable costs, with consequent efficiency gains in service provision. Third, ICTs increase the timely and transparent flow of information between service providers and service users. This strengthens the ability of (1) service providers to swiftly respond to the needs of the rural poor and of (2) service users to demand the services they need and to monitor service delivery.

Unfortunately, there are no studies that rigorously test for or quantify the benefits of using ICTs. In fact, even the popular and widely replicated ITC e-Choupal program has not been exposed to sound evaluation and impact assessment studies. While it is widely acknowledged that the e-Choupal system has had a positive effect on the incomes of participating farmers, there are no quantitative estimates of the magnitude of the effect or of the relative importance of individual factors as sources of income gain. Income gains are at best identified on the basis of narrative evidence. It is argued that gains accrue to farmers and the ITC from bypassing the intermediaries in transactions related to the purchase of agricultural inputs and the sale of agricultural commodities (Annamalai and Rao 2003). Intermediation becomes redundant since farmers strike orders directly through e-Choupals. The incentive for doing so is high since the input purchase costs are lower and the output sale price is higher. At the same time, the e-Choupal provides nonfarm income to local entrepreneurs who gain commissions on the transactions made through their kiosks. The e-Choupal system also helps to improve agricultural productivity. Productivity improvements are accomplished by providing timely and up-to-date access to information on scientific farming and best practice methods, extension, farmer interaction forums, markets and market prices, and weather conditions, among others. Moreover, productivity improvements arise because e-Choupals are a platform for input suppliers to sell products and services directly to the farmers and train the farmers on how to use them. In being a center of information and communication flows, the e-Choupal system thus creates more transparency for farmers.

One objective of the NATP scheme was to develop a library and management information system. The World Bank's project evaluation report (2005a) positively assesses the development of the NATP information systems. At the time of the performance assessment, 70 percent of the institutes and 50–100 percent of the scientists had access to a computer facility. Scientists with computer access were found to use them. Out of the projected 42 libraries, 39 had been computerized since the program's

inception. Furthermore, 310 research-executing institutes out of the projected 320 (including ICAR institutes, state agricultural universities, NGOs) had local area networks, and 280 institutes out of the projected 20 institutes were linked to the internet. Major constraints in the effective operation of the NATP information system were the limited bandwidth of the internet connection and a decline in the amount spent on the ICT component.

The NATP management information system was formalized as the project information and management system, along with an on-line component called PIMSNET. The respective systems provided an overview of NATP subprojects, agricultural research activities, institutions, and partners. Unfortunately, the project assessment report did not discuss the quality of the respective on-line entries. At the time of writing this paper, on-line access to PIMSNET still did not exist.

Considering the development of the information and technology system under the DASP scheme, the performance report documents little progress in the development of the ICT system in Uttar Pradesh. At the core of the unsatisfactory performance was the underutilization of funds allocated for technology development through the Uttar Pradesh Agricultural Research Council. In Uttaranchal, ICT had been used successfully for the development of a computerized financial management system, which promoted the timely generation of summary sheet claims and accounting/fixed-assets records.

Performance Assessment by Service Provider

So far, this review has discussed the performance of programs but disregarded the performance of service providers. There is the strong belief that the public-sector extension system performs poorly in terms of technical support and the skills of the public village extension workers, among others (Farrington, Christoplos, and Kidd 2002). In most instances, these claims are not supported by narrative, qualitative, or quantitative evidence. Given the absence of justifiable evidence, performance assessments of public-sector extension providers seem to be largely arbitrary. Sulaiman and Sadmata (2000) have provided the only (descriptive) study that explicitly compares and explains the effectiveness of different institutions in providing agricultural extension services. The analysis does not evaluate the success of particular programs like the DASP or NATP but compares the overall performance of service providers in a few selected districts in four Indian states: Bihar, Kerala, Maharashtra, and Rajasthan. Conclusions are drawn on the basis of three performance indicators, namely expenditure intensity, contact intensity, and technical manpower. Expenditure intensity refers to the amount spent on extension activities per hectare of net cropped area. Contact intensity reflects the time that an extension service provider spends with the client of the target population during a given time period and thus measures coverage. Finally, technical manpower (or the cultivator ratio) is the ratio of the target population covered by the service provider and the number of field level technical extension officers.

The effectiveness of service delivery is determined for a broad set of service providers in each of the four sampled states that include the Department of Agriculture, the state agricultural university, agricultural science centers (*Krishi Vigyan Kendras*), farmer associations, farmer cooperatives, research institutions, input companies, private consultancies, NGOs, commodity and marketing boards, and media. The descriptive study builds on data for the second half of the 1990s. In order to provide a general view on the effectiveness of service providers, Sulaiman and Sadmata (2000) compute the average of each performance indicator for each service provider across the four sampled states and compare the average values of the indicator variables with each other. For these measures, the technical manpower variable points to the superiority of extension services that were provided by the Department of Agriculture, farmer associations, and farmer cooperatives. These three extension providers were also most effective in providing extension services according to the expenditure intensity variable (state Department of Agriculture and farmer associations) and according to the measure of contact intensity (farmer associations and farmer cooperatives).

Interestingly, the comparative study by Sulaiman and Sadmata (2000) does not lend support to the common view that private companies can effectively supplement public extension efforts. The effectiveness of extension services via private companies was restricted by the nature of service delivery.

For example, most extension activities reflected marketing operations. These tended to be disconnected from farmers and their needs because marketing officers hardly interacted with farmers. The lack of interaction was amplified by limited private-sector manpower. The low contact intensity and the lack of specialized technical expertise in turn precluded any systematic private-sector extension support to farmers.

5. OBSTACLES TO REFORM IMPLEMENTATION

The implementation of reforms is subject to constraints that preclude the effective, efficient, and sustainable implementation (rather than performance) of reform efforts. The constraints usually involve political, managerial, or administrative resistance and regulatory barriers. Considering the DASP initiative, different factors constrained project implementation in Uttar Pradesh and Uttaranchal (World Bank 2004a).

In Uttar Pradesh, project implementation had a slow start given the stakeholders' unfamiliarity with procedures and concepts and the time it took to build monitoring and evaluation capacity at the Agricultural Management Center. A major obstacle to the swift implementation of the DASP were vested interests in line departments that prevented the effective coordination of program components. According to the World Bank (2004a), program implementation improved once line departments had created a sense of responsibility and ownership for project implementation.

Another obstacle to reform implementation in Uttar Pradesh was the absence of adequate field-level extension of the program components, which constrained the dissemination of technologies down to the grassroots level. At the core of the problem was the nonexistence of private and third-sector institutions that could have supported extension and the establishment of farmers' organizations and self-help groups. In Uttaranchal, program implementation was impeded by the administrative and legal complications that accompanied the creation of the state in 2000. In particular, the associated bifurcation of Uttar Pradesh required the creation of a new set of administrative units suited to the state's particular conditions and priorities.

With regard to the NATP scheme, major obstacles for the swift implementation of project components were established power and top-down hierarchical relationships. The underlying traditional chains of command precluded the effective and responsive communication of organizational and managerial reforms. At the same time, the hierarchical structures failed to create commitment among staff members to implement any reforms—a development that caused the reform process to be static rather than dynamic. The consequent slowness of the reform process was amplified by the lack of leadership at the reform-implementing entities. However, leadership is needed to overcome vested power structures and traditional chains of command and to adopt recommendations for improving the research and extension system in terms of monitoring, evaluation, and impact assessment activities and institutional, operational, and managerial efficiency.

Another obstacle to swift reform implementation was the absence of qualified personnel for priority setting, monitoring, evaluation, financial management, and impact assessment and the reluctance of the reform-implementing entities to seek advice from reform-experienced (international) agencies or to establish international partnerships. With respect to financial management, the main problems concerned the existence of an initially rudimentary accounting and reporting system and consequent weaknesses in bookkeeping, reporting and documentation, reconciliation and control of the reform-implementing agencies (Sulaiman and Sadmata 2000; World Bank 2005a). The performance of the financial management system started to improve once the World Bank enforced changes in financial management staffing and practices.

Different impediments to reform implementation prevailed for the Danida program initiatives. Danida (2002) argued that program implementation was negatively affected by institutional conflicts, which precluded an effective collaboration between farm women's groups and local government institutions (such as the Gram Panchayats). Besides institutional conflicts, program implementation was also significantly affected by difficulties in the recruitment and training of extension staff at all program stages. For example, the start of the MAPWA project had to be postponed because of the unavailability of female agricultural graduates who could be trained as extension workers. The consequent training of female science graduates was more time and resource consuming.

Unfilled female extension postings indicate that recruitment problems persisted throughout the different project phases. The WYTEP and TANWA projects in particular reported high vacancy rates for

extension postings, with the recruitment problems being particularly severe in remote or less-developed areas. The discrepancy between the desired and actual number of extension workers explains why extension activities have not been carried out or implemented at a low scale in a comparatively large number of taluks. Next to recruitment, another problem refers to the lack of transportation means, which hampered the connectivity of extension workers to villages. This problem affected the implementation of all but the TEWA project. The strength of the TEWA project in that respect can be attributed to the employment of village-based Lady Village Agricultural Workers.

The ICT projects faced severe constraints from poor telecom infrastructure development at the village level. For example, the ITC e-Choupal system was affected by slow and disruptive internet connectivity due to slow and unreliable phone connections and poorly maintained (overhead) land lines. Other sources of disruption concerned the unreliability of electricity supply and power backup systems and operational constraints from the inadequate maintenance and support of the equipment (computer, printer, connection lines via either phone, among others). Critical factors in that respect were public transportation constraints and poor road infrastructure. Characterized by infrequent connections between villages and cities, transportation constraints put an upper bound on the extent to which technical support and assistance could be swiftly provided (Annamalai and Rao 2003).

6. PERFORMANCE ASSESSMENTS: METHODOLOGICAL CONSTRAINTS AND KNOWLEDGE GAPS

As stated, the review of the existing literature was confined to reform initiatives that were subject to impact evaluations, performance assessments, or both. The number of the respective studies was low and confined to one evaluation study per program initiative. Because this precludes cross-study comparisons of the performance of reform initiatives, the results of performance assessments and the conclusions drawn critically depend on the appropriateness of the evaluation methodology and the availability of data. Therefore, the following section summarizes some methodological problems in existing program performance assessments. The next section concludes by summarizing the major knowledge gaps (partly attributable to the methodological limitations of the studies) that still prevail with respect to (1) the real effects of agricultural research and extension reforms and (2) what works, where, and why in improving agricultural extension services and in promoting agricultural development.

Methodological Issues in Performance Assessments

As stated, the review of the existing literature is confined to those programs for which performance assessments are available. Although there are many reform initiatives in the area of technology research and dissemination in India, there are only a few studies that assess the performance and the effects of the different programs. In addition, there is usually only one evaluation study per program initiative. This, however, precludes assessments regarding the robustness of the results across different model specifications.³⁶

Another factor that complicates the interpretation of the existing evidence refers to the failure of the program assessment studies (1) to control for the effects that are associated with the simultaneous implementation of other development projects, (2) to address endogeneity problems, and (3) to identify the mechanisms and institutions through which the project benefits can materialize. In addition to these common limitations, there are also program-specific methodological problems in performance assessments. The remainder of this section discusses these in greater detail, especially for the DASP and NATP initiatives.

The performance of the DASP and NATP programs was assessed in terms of the economic and financial rate of return. Unfortunately, the DASP and NATP evaluation studies do not provide information on the variables used and the assumptions imposed in the computation of the return variables. It is therefore unclear whether the performance studies report the marginal or average, private or social rate of return. The distinction between the marginal and average rate of return is important because both measures convey different information. The marginal rate of return reports the net benefit that arises from investment in one additional unit of agricultural research or extension. It thus provides information about the scope for expanding or contracting the level of agricultural research and extension. In comparison, the average rate of return only answers whether investment should or should not be carried out and compares the net benefits per unit of investment over the project period with the net benefits from zero investment. The choice between the private and social rate of return affects the economic rate of return in the presence of market distortions like government interventions in commodity markets, environmental externalities, and imperfect competition in markets with agribusiness firms (Alston et al. 2000).

In addition, the DASP and NATP assessment studies do not state whether the projects' rate of return considers the relative contribution of the project subcomponents to aggregate income and productivity improvements. Assessments of the relative importance of the project subcomponents would be useful, as financial resources could be channeled toward program components that promise to have significant pro-poor effects on income and productivity.³⁷

³⁶ In other words, the comparability of results across different assessment studies for one program is complicated by the employment of different methodologies.

³⁷ A different criticism refers to the lack of transparency regarding the factors that determine the allocation of financial

Besides these limitations, the rates of return estimates for the DASP and NATP programs may not correctly reflect the benefits of the reform efforts because of implementation and effectiveness lags (Alston et al. 2000). Investment in agricultural research and technology dissemination takes time to be organized and implemented and to become effective. Because both the DASP and the NATP are argued to have had slow starts (World Bank 2004a, 2005a) and given the time it takes for changes to fully work through the system (including indirect effects), the full return on research and development may still have had to materialize at the time of the performance assessment. As a consequence, the estimated rates of return could be too low.

Questions also prevail with respect to the reported contribution of the ATMA scheme to income growth. The NATP performance assessment suggests that districts that operated with the ATMA scheme reported income growth of 21 percent, while those that did not grew by 5 percent. The question yet to be answered is What factors lay behind the non-ATMA income growth of 5 percent, and do these factors interfere with the ATMA determinants of income growth? What is the net contribution of ATMA to income growth if one accounts for the factors that influence income growth in non-ATMA districts? It might not be equal to 16 percent (that is, 21 percent less 5 percent) if ATMA growth is affected by non-ATMA factors. Furthermore, do the income gains equally accrue to small, marginal, and large farmers?

Another limitation concerns the absence of target/benchmark values against which the performance of the initiatives can be compared. Even if the programs have positive income effects, the question is whether the income gains are consistent with expectations. Still another limitation concerns the assessment of human capital development. The NATP and DASP programs are deemed to be successful, given the organization of a large number of different training courses for a large number of farmers and extension workers. One may wonder whether information on the number of beneficiaries provides a reliable view on human capital development, as this variable does not contain information on the quality of training. In addition, the underlying numbers only provide a reliable view on human capital development if (1) the composition of farmers and extension workers differs between training programs (in other words, training is open to all farmers and extension workers) and (2) the course content differs between training units. If these conditions are not met, the statistics double count beneficiaries and the actual number of trained farmers and extension workers would be smaller.

While the World Bank (2004a, 2005a) is largely silent on the methodological problems inherent to the performance assessment of the DASP and NATP programs, the Danida (2002) impact assessment report emphasizes the shortcomings of the underlying analysis. Danida (2002) acknowledges that the project impact assessment faced constraints from the lack of adequate baseline data. In order to gain a view on the impact of and the benefits from project implementation, the impact assessment employed information from trained farm women. Danida (2002) expresses concerns regarding the reliability of the corresponding answers. In addition to the subjectivity of the answers, the impact assessment was also influenced by attribution or causality problems. For example, the study did not distinguish between the effects associated with village-based training and high female literacy.

Similar to the performance assessment of programs, the performance evaluation of service providers (Sulaiman and Sadmata 2000) is also subject to limitations. In line with the previous assessments, the evaluation study of Sulaiman and Sadmata (2000) presents tentative results, as it does not compare the performance of different extension service providers against a benchmark that depicts the optimal or desired levels of expenditure, contact intensity, and technical manpower. Although benchmark values are difficult to define, valid performance assessments of extension service providers would require quantitative thresholds of good extension practices.

In addition to threshold values, extension service providers should be evaluated on the basis of adequate and reliable performance indicator variables. Unfortunately, data availability constraints

resources to the different subcomponents of the DASP and NATP schemes. For example, the World Bank (1998a, 2004a) did not explain why rural infrastructure development received more funding than public-private partnerships. This criticism is not directly related to the methodological problems. It is emphasized because the arbitrary allocation of resources and the consequent inefficiencies give rise to distorted income effects.

adversely affect the quality and information content of the extension indicator variables (expenditure intensity, contact intensity, and technical manpower) in Sulaiman and Sadmate (2000). For example, the selected extension proxy variables do not provide information on the quality or efficiency of extension service provision. In addition, the proxy variables are not available by crop or by commodity. This results in a biased view of the effectiveness of the extension system if the quantity, quality, and efficiency of extension service provision differ among crops (commodities). In order to accommodate these differences, performance assessments should consider the relative importance of crops (commodities).

And in addition to this constraint, the performance assessments of extension service providers are also confounded by a lack of information on extension expenditures. Sulaiman and Sadmate (2000) compare the performance of the extension service providers by using total expenditure data. Unfortunately, this measure is an imperfect indicator variable of extension expenditures as it assumes that the largest share of expenditures is spent on operational activities but not on recurrent or fixed-cost activities. In reality, however, expenditures are divided between an (unspecified) large salary component and a consequently (unspecified) small operational cost component. The discrepancy between operational and recurrent costs is perceived to be particularly pronounced in the public sector.

Additional limitations prevail for performance assessments with the indicator variable of contact intensity and technical manpower. Both measures require information on the target population of extension services. The importance of information on the target population constitutes a weakness, since it causes conclusions about the effectiveness of extension services to be sensitive to the choice of the target population and to the distribution of different clients in the target population. To illustrate the mechanism, consider a target population that is skewed toward large-scale farmers. The definition of the indicator variables then implies that the contact intensity and technical manpower is potentially larger for this sample than for a target population with a skew toward small-scale farmers. To avoid this bias, research would have to control for the size distribution of clients in the target population.

As a final limitation, Sulaiman and Sadmate (2000) compare the performance of service providers between states by using information from different years. Although the timely differences amount to one or two years at most, it is not clear a priori whether the decentralization-driven structural and institutional changes still ensure the comparability of the data for different data points. In view of these limitations, the performance assessment of extension service providers in Bihar, Kerala, Maharashtra, and Rajasthan needs to be viewed with some caution.

Knowledge Gaps

Given the existing methodological constraints and the small number of evaluation studies, major knowledge gaps prevail with respect to (1) the real effects of research and extension reforms, and (2) what works, where, and why. This section discusses knowledge gaps in the area of identification, theoretical foundations, and equity and efficiency in more detail.

Identification Problems

The performance and impact assessments of reform initiatives ask whether the pursued program activities successfully promote agricultural and rural development and empower women and disadvantaged groups. In most instances, the answer is likely to be biased as it does not filter or identify the (indirect) effects associated with the simultaneous implementation of other development projects. For example, we cannot tell to what extent the 1999–2005 NATP influenced the performance of the 1993–2005 MAPWA project in Madhya Pradesh.

Identification problems not only prevail among projects but also within projects, if they consist of several interacting subcomponents. Project performance then depends on the relative importance of the individual project subcomponents and their interaction. Unfortunately, there are pronounced knowledge gaps regarding the relative importance of the individual project subcomponents for the aggregate reform effect. The knowledge gaps are attributable to the lack of empirical evidence and to the absence of theoretical foundations that guide the agricultural sector reform process and identify the channels through

which individual reform components affect the agricultural and rural sectors. Agricultural reform initiatives mainly emphasize strategies that are assumed to be effective on the grounds of sheer beliefs and common perceptions.

Efficiency, Effectiveness, and Equity Considerations

Given the literature review, it appears that substantial knowledge gaps also prevail with respect to the optimum mode of service provision. In order to decide on the optimum method of service delivery, one requires information about the dimension of market failures and government failures. For example, public financing for efficiency or equity reasons may not work for poor people in environments with significant market and government failures. The World Bank (2004b) points out that private (public) provision and financing is the preferred option when government (market) failures are the dominant source of disturbances. The argument is that government (market) failures cause public (nonpublic) service provision to be cost inefficient, ineffective, ill targeted, or all three. If this is true, the question that still needs to be answered refers to the mechanisms that need to be in place to enforce efficient, effective, and equitable nonpublic (public) service provision in the presence of government (market) failures.

Common to the existing reform initiatives is the view that the public sector is less effective and efficient in the provision of agricultural extension services and less willing and less able to respond to the extension needs of farmers, compared with the private and third sectors. The reviewed reform programs therefore emphasize the importance of the private and third sector and of public-private and public-third-sector partnerships in service provision. Unfortunately, the reform programs do not systematically evaluate the role of partnerships as service providers and do not qualify or quantify the factors that account for the success or failure of private and third-sector participation in service provision. Knowledge of these issues is, however, required in order to maximize the synergy effects of providing multidimensional extension services and to encourage nonpublic service provision in areas in which government failures in service provision are particularly pronounced. The need for targeted public-private and public-third-sector partnerships is particularly evident if one considers the large financial stakes inherent to nonpublic service provision: the 2005 budget stipulates that 10 percent of the budget for recurring activities at the district level is allocated to private-sector parties (India, Ministry of Agriculture 2005).

Furthermore, the literature argues that the shift from public supply-driven (costless) to private demand-driven (fee-based) extension services could improve the allocative efficiency and cost effectiveness of India's agricultural extension system. The gains would accrue if the active involvement of the private and public sectors promotes the diversification of institutional structures and improvements in management decision support systems. Furthermore, the private- and third-sector involvement would allow for better-targeted services if the provision of fee-based private- and third-sector services frees public financial resources, which are then used to improve the quality of existing public services, especially for those small and marginal farmers that cannot afford private extension services.

Again, these relationships are hypothetical. There are no systematic and empirically sound studies that discuss the income distribution (equity) and cost-effectiveness effects of private- and third-sector service provision. Closely related is the lack of knowledge regarding the factors that enforce the commitment of senior managers and extension workers to structural and institutional changes in service provision. Knowledge of these factors is important because it helps to define the structural setup of reforms in line with the possibilities inherent to the existing environment.

7. SYNTHESIS AND POLICY RECOMMENDATIONS

This paper has analyzed various reform strategies in agricultural extension to identify the factors that promote agricultural productivity and hence agricultural development in an environment characterized by local decentralization. The ultimate objective was to gain a view on what works where and why in improving the effectiveness of India's agricultural extension system; to identify measures that strengthen and improve agricultural extension service provision; and to reveal existing knowledge gaps.

Consistent with Anderson (2007) and Birner and Anderson (2007), the present paper cannot answer the question of what works, where, and why in promoting agricultural development, given the absence of comprehensive evidence-based reform performance assessment studies and the absence of broad-based geographic data (Anderson 2007). There are only a few performance assessment studies and the dominant share thereof employs highly aggregated data such as region- or state-level data. Unfortunately, aggregated data do not capture the structural and institutional differences between lower-level geographic units like districts, blocks, or villages. As these differences determine the channels through which changes in the agricultural extension system are propagated and amplified, aggregate data cannot be used to answer the question of what works, where, and why. The use of aggregate data thus implies that the evidence on what works in strengthening the agricultural extension system is determined by the relative importance of the regions in the sample. Similarly, the evidence of why things work is influenced by the relative importance of the regions in the sample and by the relative strength of the channels through which reform initiatives affect the performance of the agricultural extension system.

If at all, the review of the existing performance assessment and evaluation studies provides insights into what could work in strengthening the agricultural extension system. The success of reform programs appears to be critically dependent on the joint implementation of demand- and supply-side reforms. On the demand side, participatory planning and implementation seem to be important mechanisms for improving agricultural productivity through a more effective and efficient agricultural research and extension system. The growth-promoting effects of collective actions are attributed to the greater ability of the rural population to demand better public services and to hold service providers accountable.

On the supply side, these developments are supported by the greater role of the private and third sectors in agricultural extension and agricultural research and by structured attempts to strengthen the capacity of agricultural researchers and extension workers to provide the agricultural services that are demanded. Moreover, the success of reforms also depends on the institutional environment. In order to maximize the growth impact of reform initiatives, such initiatives need to be implemented by sound, committed, and well-monitored institutions with flat hierarchical structures, strong leadership, and a high degree of fiscal and administrative autonomy. Moreover, institutional conflict resolution mechanisms and communication platforms are required to ensure effective and efficient collaboration within the agricultural research and extension system and between the extension system and farmers and farmers and local governments. ATMAs and the ICTs are promising mechanisms for strengthening the linkages between research, extension, and farming.

The list of the factors that could strengthen the agricultural extension system is determined by the lack of evidence-based performance assessments of the existing reform initiatives and is therefore not exhaustive. Keeping in mind this limitation, the results of this study have three main policy implications. In order to answer the question of what works, where, and why in improving the performance of the agricultural extension system, performance assessments, evaluations, and monitoring have to become inherent components of any research and extension program. To this end, reporting standards need to be defined that help to identify the efficiency and effectiveness of programs, highlight problem areas in the implementation and budgeting of programs, and thus help to define corrective actions.

The second policy recommendation emphasizes the weak link between research and extension. In order to strengthen the linkage between research and extension and to ensure that extension can provide the technology that farmers demand within the framework of participatory planning and implementation,

policies should encourage the ICAR research system to deliver research output oriented to the demand side rather than the supply side. To this end, the linkages between research and extension at the state and district levels need to be strengthened via new institutional agreements, linkage mechanisms, and operational procedures. ATMA is a promising approach in that respect, but it needs to be more attentive to the needs of marginal and small farmers.

Policies should also provide incentives for the private and third sectors to actively participate in agricultural research and extension, either individually or in partnership with public service providers. In pooling human and financial resources across major stakeholders, complementarities in research and extension capabilities and resources can be exploited. This in turn can increase the outreach of research and extension initiatives. Of course, effective coordination mechanisms need to be in place in order to avoid the replication of initiatives and the consequent inefficient use of resources.

Although initiatives, especially of private-sector organizations, offer scope for rural development, there is a clear threat that this development benefits large-scale (rich) rather than small-scale (poor) farmers. Because public-sector intervention may lead to the underprovision of private research and extension activities, the public sector could address the consequently greater income inequality by implementing, for example, income redistribution schemes. In addition to the income or poverty status of farmers, the equitable allocation of services should also consider factors like gender, ethnicity, and caste. In order to effectively target income redistribution schemes to groups without (adequate) access to services, procedures need to be in place for collecting and processing data on the incidence of service provision.

REFERENCES

- Alex, G., W. Zijp, and D. Byerlee. 2002. *Rural extension and advisory services: New directions*. Rural Development Strategy Background Paper No. 9. Agriculture and Rural Development Department. Washington, D.C.: World Bank.
- Alsop, R., E. Gilbert, J. Farrington, and R. Khandelwal. 1999. *Coalitions of interest: Partnerships for process of agricultural change*. New Delhi and London: Sage.
- Alston, J. M., C. Chan-Kang, M. C. Marra, P. G. Pardey, and T. Wyatt. 2000. *A meta-analysis of rates of return to agricultural R&D*. Research Report No. 113. Washington D.C.: International Food Policy Research Institute.
- Anderson, J. R. 2007. *Agricultural advisory services. Background paper for the World Development Report 2008*. Agriculture and Rural Development Department. Washington, D.C.: World Bank.
- Anderson, J. R., and G. Feder. 2004. *Agricultural extension: Good intentions and hard realities*. The World Bank Research Observer 19 (1): 41–60.
- Annamalai, K., and S. Rao. 2003. *What works: ITC's e-Choupal and profitable rural transformation: Web-based information and procurement tools for Indian farmers*. Washington, D.C.: World Resources Institute.
- Birner, R., and J. Anderson. 2007. *How to make agricultural extension demand-driven? The case of India's agricultural extension policy*. Discussion Paper 00729. Washington D.C.: International Food Policy Research Institute.
- Birner, R., and N. Palaniswamy. 2006. *Public administration reform and rural service provision: A comparison of India and China*. Manuscript. Washington D.C.: International Food Policy Research Institute.
- Birner, R., K. Davis, J. Pender, E. Nkonya, P. Anandajayasekeram, J. Ekboir, A. Mbabu, D. J. Spielman, D. Horna, S. Benin, and M. Cohen. 2006. *From best practice to best fit: A framework for analyzing pluralistic agricultural advisory services worldwide*. Development Strategy and Governance Division Discussion Paper No. 37. Washington D.C.: International Food Policy Research Institute.
- Braun, von J., and U. Grote. 2002. Does decentralization serve the poor? In *Managing fiscal decentralization*, ed. E. Ahmad and V. Tanzi. London and New York: Routledge - Taylor and Francis Group, Routledge Economics.
- Chandre Gowda, M. J., and R. K. Samanta. 2002. Dynamics of collaboration in the activities of Krishi Vigyan Kendras. *MANAGE Extension Research Review* 3 (1): 50–67.
- Danida. 2002. *Evaluation/impact study of four training projects for farm women in India (WYTEP, TANWA, TEWA, MAPWA)*. Copenhagen: Udenrigsministeriet.
- Dethier, J.-J. 2000. *Some remarks on fiscal decentralization and governance*. Paper prepared for presentation at the Conference on Decentralization Sequencing, Jakarta, Indonesia, March 20, 2000.
- Diao, X., P. Hazell, D. Resnick, and J. Thurlow. 2006. *The role of agriculture in development: Implications for Sub-Saharan Africa*. Development Strategy and Governance Division Discussion Paper No. 29. Washington D.C.: International Food Policy Research Institute.
- Farrington, J., I. Christoplos, and A. D. Kidd. 2002. *Extension, poverty, and vulnerability: The scope for policy reform (final report of a study for the Neuchâtel Initiative)*. Working Paper No. 155. London: Overseas Development Institute.
- Garai, A., and B. Shadrach. 2006. *Taking ICT to every Indian village: Opportunities and challenges*. New Delhi: One World South Asia.
- Gulati, A., S. Fan, and S. Dalafi. 2005. *The dragon and the elephant: Agricultural and rural reforms in China and India*. Environment and Production Technology Discussion Paper No. 87 and Development Strategy and Governance Division Discussion Paper No. 22. Washington D.C.: International Food Policy Research Institute.

- India, Ministry of Agriculture. 2000. Policy framework for agricultural extension. Department of Agriculture and Cooperation, Extension Division. Available at:
http://agricoop.nic.in/policy_framework.htm, accessed on June 16, 2008.
- . 2005. *Support to State Extension Programs for Extension Reforms. Guidelines on the 10th Plan Scheme of the Department of Agriculture and Cooperation*. Available at:
<http://agricoop.nic.in/policyincentives/xplanscheme.htm>, accessed on May 04, 2007.
- . 2007. Annual report 2006-2007. Available at <http://agricoop.nic.in/AnnualReport06-07/OVERVIEW.pdf>, accessed on May 04, 2007.
- India, Planning Commission. 2005. *Midterm appraisal of the 10th Five Year Plan (2002-2007)*. Available at:
<http://planningcommission.nic.in/midterm/english-pdf/section-05.pdf>, accessed on May 4, 2007.
- International Fund for Agricultural Development. 2001. *Andhra Pradesh Tribal Development report. Completion evaluation*. Available at
http://www.ifad.org/evaluation/public_html/eksyst/doc/prj/region/pi/india/andhra.htm, accessed on June 7, 2007.
- Levy, B. 2004. Governance and economic development in Africa: Meeting the challenge of capacity building. In *Building state capacity in Africa*, ed. B. Levy and S. Kpundeh. Washington, D.C. and London: World Bank and Oxford University Press.
- Narayan, D., R. Patel, K. Schafft, A. Rademacher, and S. Koch-Schulte. 2000. *Voices of the poor. Can anyone hear us?* Washington, D.C.: Oxford University Press and World Bank.
- Nataraju, M. S., M. T. Lakshminarayan, and K. H. Nagaraj. 2001. Role of non-governmental organizations in the new millennium - Case studies. In *Private extension: Indian experiences*, ed. P.C. Shekara. Hyderabad: National Institute of Agricultural Extension Management (MANAGE).
- Rajaraman, I. 2000. Fiscal features of local government in India. In *Governance, decentralization, and reform in China, India, and Russia*, ed. J. –J. Dethier. Dordrecht: Kluwer Academic Press.
- Reddy, M. N., and B. Swanson. 2006. *Strategy for up-scaling the ATMA model in India*. Annual Conference Proceedings of the Association for International Agricultural and Extension Education 22: 561–569.
- Rivera, W., M. K. Qamar, and L. van Crowder. 2001. *Agricultural and rural extension worldwide: Options for institutional reform in the developing countries*. Rome: Food and Agriculture Organization of the United Nations, Extension, Education and Communication Service.
- Shankar, K. R. 2001. Private extension in India and a SWOT analysis. In *Private extension in India: Myths, realities, apprehensions and approaches*, ed. P. C. Shekara. Hyderabad: National Institute of Agricultural Extension Management (MANAGE).
- Shekara, C. 2001. Private extension: Indian way. In *Private extension: Indian experiences*, ed. P. C. Shekara. Hyderabad: National Institute of Agricultural Extension Management (MANAGE).
- Singh, J. P., B. E. Swanson, and K. M. Singh. 2006. Developing a decentralized, market-driven extension system in India: The ATMA model. In *Changing roles of agricultural extension in Asian nations*, ed. A. W. Van den Ban and R. K. Samanta. Delhi: B. R. Publishing.
- Singh, K. M., and B. E. Swanson. 2006. *Developing a market-driven extension system in India*. Annual Conference Proceedings of the Association for International Agricultural and Extension Education 22: 627–637.
- Singh, S. 2006. *Selected success stories on agricultural information systems*. APAARI Publication No. 2006/1. Bangkok: Asia-Pacific Association of Agricultural Research Institutions.
- Sulaiman, R. V. 2003. *Innovations in agricultural extension in India*. Rome: Food and Agriculture Organization of the United Nations, Sustainable Development Department. Available at
http://www.fao.org/sd/2003/KN0603_en.htm, accessed on February 08, 2007.
- Sulaiman, R. V., and A. J. Hall. 2002. An innovation system perspective on the restructuring of agricultural extension: Evidence from India. *Outlook on Agriculture* 30 (4): 235–243.

- . 2004. India: The emergence of Extension-Plus: Future for extension beyond technology transfer? In *Extension reform for rural development: Case studies of international initiatives*, Vol. 1. Washington, D.C.: World Bank and the U.S. Agency for International Development.
- Sulaiman, R.V., and G. Holt. 2004. Extension, poverty and vulnerability in India. In *Poverty, vulnerability, and agricultural extension. Policy reform in a globalizing world*, ed. I. Christoplos and J. Farrington. Oxford and New York: Oxford University Press, 44-89.
- Sulaiman, R. V., and V. V. Sadmate. 2000. *Privatizing agricultural extension in India*. NCAP Policy Paper No. 10. New Delhi: National Center for Agricultural Economics and Policy Research.
- World Bank. 1998a. *Project appraisal document on a proposed credit and a proposed loan to India for a National Agricultural Technology Project*. Report No. 17082-IN. Washington, D.C.
- . 1998b. *Project appraisal document on a proposed credit and a proposed loan to India for the Uttar Pradesh Diversified Agricultural Support Project*. Report No. 17279-IN. Washington, D.C.
- . 2004a. *Implementation completion report on a credit and a loan to India for the Diversified Agricultural Support Project*. Report No. 29529. Washington, D.C.
- . 2004b. *Making services work for poor people. World development report 2004*. Washington, D.C.: World Bank and Oxford University Press.
- . 2005a. *Implementation completion report on a credit and a loan to India for the National Agricultural Technology Project*. Report No. 34385. Washington, D.C.
- . 2005b. *E-bharat project information document - Concept stage*. Report No. AB 1334. Washington, D.C.
- . 2006. *World development indicators 2006*. Washington, D.C.
- . 2007. *Agriculture for development. World development report 2008*. Washington, D.C.: The International Bank for Reconstruction and Development/World Bank.

RECENT IFPRI DISCUSSION PAPERS

**For earlier discussion papers, please go to www.ifpri.org/pubs/pubs.htm#dp.
All discussion papers can be downloaded free of charge.**

774. *An experimental inquiry into the effect of yardstick competition on corruption*. Angelino Viceisza, 2008.
773. *Alianzas para la innovación agroalimentaria en Bolivia: Lecciones para la formulación de políticas*. Frank Hartwich, Luis Ampuero, Tito Arispe, Vicente EguezJaime Mendoza, y Nancy Alexaki, 2008.
772. *Tracing power and influence in networks: Net-Map as a tool for research and strategic network planning*. Eva Schiffer and Douglas Waale, 2008.
771. *Estimating household income to monitor and evaluate public investment programs in Sub-Saharan Africa*. Samuel Benin and Josee Randriamamonjy, 2008.
770. *Does Africa trade less than it should, and if so, why? The role of market access and domestic factors*. Antoine Bouet, Santosh Mishra, and Devesh Roy, 2008.
769. *Impacts of the Hutan Kamasyarakatan social forestry program in the Sumberjaya Watershed, West Lampung District of Sumatra, Indonesia*. John Pender, Suyanto, John Kerr, and Edward Kato, 2008.
768. *Finance and cluster-based industrial development in China*. Jianqing Ruan and Xiaobo Zhang, 2008.
767. *Introducing a genetically modified banana in Uganda: Social benefits, costs, and consumer perceptions*. José Falck-Zepeda, Enoch Kikulwe, and Justus Wesseler, 2008.
766. *Global macroeconomic developments and poverty*. Eugenio Diaz-Bonilla, 2008.
765. *Economic partnership agreements between the European union and African, Caribbean, and Pacific countries: What is at stake for Senegal*. Valdete Berisha-Krasniqi, Antoine Bouet and Simon Mevel, 2008.
764. *Marriage behavior response to prime-age adult mortality: Evidence from Malawi*. Mika Ueyama and Futoshi Yamauchi, 2008.
763. *Impacts of inventory credit, input supply shops, and fertilizer microdosing in the drylands of Niger*. John Pender, Tahirou Abdoulaye, Jupiter Ndjeunga, Bruno Gerard, and Edward Kato, 2008.
762. *Plant genetic resources for agriculture, plant breeding, and biotechnology : Experiences from Cameroon, Kenya, the Philippines, and Venezuela*. José Falck-Zepeda, Patricia Zambrano, Joel I. Cohen, Orangel Borges, Elcio P. Guimarães, Desiree Hautea, Joseph Kengue, and Josephine Songa, 2008.
761. *How change agents and social capital influence the adoption of innovations among small farmers: Evidence from social networks in rural Bolivia*. Mario Monge, Frank Hartwich, and Daniel Halgin, 2008.
760. *Gender Difference in the Long-Term Impact of Famine*. Ren Mu and Xiaobo Zhang, 2008.
759. *Rural innovation systems and networks: Findings from a study of Ethiopian smallholders*. David J. Spielman, Kristin E. Davis, Martha Negash, and Gezahegn Ayele, 2008.
758. *A Tale of two countries: spatial and temporal patterns of rice productivity in China and Brazil*. Liangzhi You, 2008.
757. *Must conditional cash transfer programs be conditioned to be effective? The impact of conditioning transfers on school enrollment in Mexico*. Alan de Brauw and John Hoddinott, 2008.
756. *From the ground up: Impacts of a pro-poor community-driven development project in Nigeria*. Ephraim Nkonya, Dayo Phillip, Tewodaj Mogues, John Pender, Muhammed Kuta Yahaya, Gbenga Adebawale, Tunji Arokoyo, and Edward Kato, 2008.
755. *Child labor and schooling responses to production and health shocks in Northern Mali*. Andrew Dillon, 2008.
754. *Decentralization, local government elections and voter turnout in Pakistan*. Kamiljon T. Akramov, Sarfraz Qureshi, Regina Birner, and Bilal Hasan Khan, 2008.
753. *Regional biotechnology regulations: Design options and implications for good governance*. Regina Birner and Nicholas Linacre, 2008.
752. *The rise of supermarkets and their development implications: International experience relevant for India*. Thomas Reardon and Ashok Gulati, 2008.

**INTERNATIONAL FOOD POLICY
RESEARCH INSTITUTE**

www.ifpri.org

IFPRI HEADQUARTERS

2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org

IFPRI ADDIS ABABA

P. O. Box 5689
Addis Ababa, Ethiopia
Tel.: +251 11 6463215
Fax: +251 11 6462927
Email: ifpri-addisababa@cgiar.org

IFPRI NEW DELHI

CG Block, NASC Complex, PUSA
New Delhi 110-012 India
Tel.: 91 11 2584-6565
Fax: 91 11 2584-8008 / 2584-6572
Email: ifpri-newdelhi@cgiar.org