# Efforts of Government on Reforming Agricultural Extension in Bihar: The ATMA Approach

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## Abstract

The extension system being an increasingly important engine for transfer of knowledge, innovations, and developments in agriculture, needs reforms over time. During mid-1990s, the Government of India (GoI) and the World Bank explored a new approach to address the prevalent problems and constraints of the agricultural extension system. A new approach known as Agricultural Technology Management Agency (ATMA) was pilot-tested through Innovations for Technology Dissemination (ITD) component of the World Bank funded, National Agricultural Technology Project (NATP) that became effective in 1998 and concluded in June 2005. The present study was undertaken to measure the impact of ATMA model implemented under the ITD component of NATP in Bihar using following indicators: research-extension-farmer interface, level of diversification, adoption of technology, and change in crop yields in the study locale. The study has revealed that the NATP-ATMA approach generated some financial resources, developed infrastructure, and facilitated the trainings of farmers. The study revealed that scientists have become more responsive to the needs of farmers and have sharpened their focus of research to meet location-specific requirements of farmers. Considerable improvement in adoption of new technologies and farm practices by all categories of farmers was observed. The spillover effect of these interventions was also seen in the nearby districts.

**Key words:** ATMA Model, NATP, Extension Reforms, Innovations in technology dissemination, Impact assessment

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### Introduction

The agricultural extension system is largely responsible for dissemination of technological knowledge to farmers in India. It is being operated by the Department of Agriculture (DoA), Government of India, through state, district and block levels machinery. The research institutes and agricultural universities in the country also play a limited role in delivery of extension services. The extension system being an increasingly important engine for transfer of knowledge, innovations, and developments in agriculture, needs reforms over time (Rivera and Suleiman 2009).

The emphasis of agricultural extension system has changed from production to organizing farmers and recently, to linking of farmers to markets (Swanson 2006; Shepherd 2007). During mid-1990s, the Government of India (GoI) and the World Bank explored a new approach to address the prevalent problems and constraints of the agricultural extension system.

The new decentralized extension approach emphasized more on agricultural diversification and increasing farm income and rural employment came into existence. A new approach known as Agricultural Technology Management Agency (ATMA) was pilot-tested through Innovations for Technology Dissemination (ITD) component of the World Bank funded, National Agricultural Technology Project (NATP) that became effective in 1998 and concluded in June 2005. As a follow-up action, the Government of India, on the success of ATMA model, initiated a new scheme on Support to State Extension Programs for extension reforms, and provided funds for setting up of ATMA in all the 588 rural districts of the country.

The ATMA model envisages a paradigm shift from top-down to bottom-up planning and in implementation of agricultural development programs. However, to make future program more effective, scientific study of the technology transfer system is essential. It is observed that technological interventions through ATMA have enhanced the knowledge level of farmers on several sub-sectors such as bee-keeping. The knowledge level of farmers has a significant association with several independent variables, such as age, education, family type, family size, sources of information utilized, etc. (Prakash and De 2008).

Therefore, the study presented in this chapter was undertaken to measure the impact of ATMA model implemented under the ITD component of NATP in Bihar using following indicators: research-extension-farmer interface, level of diversification, adoption of technology, and change in crop yields in the study locale.

The study is based on the data collected from farmers in three NATP-districts (Munger, Madhubani, and Patna) and three non-NATP districts (Banka, Nalanda, and Darbhanga) using a pre-tested and semi-structured interview schedule. The sample units were selected through

multi-stage stratified random sampling method. From each NATP district, 9 representative villages (3 from each equidistant blocks) and 15 farmers (from each selected village) representing different landholding classes were selected randomly. Similarly, 15 farmers from each selected village in non-NATP district, representing different farm-size classes, were selected as control. A total of 540 farmers (405 from NATP districts and 135 from non-NATP districts) responded for this investigation. The impact assessment was conducted at process and outcome level of NATP.

The agro-economic conditions of sample farmers were compared for pre and post-technological intervention over a period of three years from 2005 to 2007, by conducing assessment surveys in 2005 and 2007.

**Change in agro-economic status of farmers**

The change in impact indicators among NATP and non-NATP districts is presented in Table 1. A perusal of Table 1 reveals that the average operational landholding size among NATP districts was larger in Munger (3.02 ha) than in Madhubani and Patna (2.04 ha) districts and among non-NATP districts, it was larger in Banka (3.48 ha) than in Nalanda and Darbhanga (each 2.18 ha) districts. Between 2005 and 2007, the size of operational holding increased more in Munger (0.48 ha) than in Madhubani and Patna (each 0.18 ha) districts.

The proportion of irrigated gross cropped area shows that Madhubani and Patna districts had higher irrigated area than Munger district. The study has shown an increase in irrigated area in both NATP and non-NATP districts during 2005 to 2007.

Although cropping intensity increased in both NATP and non-NATP districts, the increase were highest in NATP district Munger. It can be attributed to the fact that in the NATP districts, efforts were made to introduce new crops, especially horticultural crops, while in the non-NATP districts; emphasis was on various on-going programs and superior cereals.

The extent of diversification was assessed through comparing cropping pattern across pre- and post-NATP situations. On an average, some shift in cropped area under horticulture was noticed in both NATP and non-NATP districts. But across districts, shift was relatively higher in the NATP districts than non-NATP districts.

Among NATP districts, the shift in area was quite high in Madhubani (14.26%) and among non-NATP districts; it was high in Nalanda (15.62%). Investigation has also revealed that the majority of households in NATP districts were associated with farmers' groups/organizations as NATP follows a group approach. The households associated with farmers organizations were highest in Madhubani (60.2%), followed by Patna (38.90%) and Munger (28.90%) districts.

**Table 1. Change in impact indicators in NATP and non-NATP districts in Bihar, India (n=540)**

| Year | NATP district | | | Non-NATP district | | |
|---|---|---|---|---|---|---|
| | Patna | Munger | Madhubani | Nalanda | Banka | Darbhanga |
| *Average operational landholding per household (ha)* | | | | | | |
| 2005 | 2.04 | 3.02 | 2.04 | 2.18 | 3.48 | 2.18 |
| 2007 | 2.22 | 3.5 | 2.22 | 2.18 | 3.48 | 2.18 |
| Change | 0.18 | 0.48 | 0.18 | - | - | - |
| *Irrigated area ( % of gross cropped area)* | | | | | | |
| 2005 | 93.5 | 65 | 93.5 | 92.6 | 90.0 | 92.6 |
| 2007 | 97.3 | 83.7 | 97.3 | 97.7 | 94.6 | 97.7 |
| Change | 3.8 | 18.7 | 3.8 | 5.1 | 4.6 | 5.1 |
| *Cropping intensity (%)* | | | | | | |
| 2005 | 199 | 147 | 199 | 185 | 185 | 185 |
| 2007 | 200 | 187 | 200 | 191 | 200 | 191 |
| Change | 001 | 040 | 001 | 006 | 015 | 006 |
| *Gross sown area under horticulture* (*in ha*) | | | | | | |
| 2005 | 7.5 | 4.5 | 3.3 | 14.6 | - | 0.6 |
| 2007 | 11.4 | 4.0 | 17.6 | 30.6 | - | 3.0 |
| Change | 3.9 | (-) 0.5 | 14.2 | 16.0 | - | 2.4 |
| *Households associated with farmers organizations (%)* | | | | | | |
| 2005 | - | - | - | - | - | - |
| 2007 | 38.9 | 28.9 | 60.2 | - | - | - |
| Change | 38.9 | 28.9 | 60.2 | - | - | - |

**Source:** Singh et al. (2009)

***Change in Research-Extension-Farmer Linkages***

Improving research-extension-farmer linkages was one of the objectives of NATP and to attain this, a number of steps were taken in addition to in-built institutional and operational mechanism. The ATMA Governing Board (AGB), ATMA Management Committee and (AMC), and Block Technology Team (BTT) provided a robust mechanism for regular interface among scientists, extension functionaries and farmers. In addition, joint workshops and training program were also organized. The scientists and extension personnel were sensitized to interact regularly with farmers in order to obtain feedback on research and extension activities. The assessment of two-way linkages at different levels revealed that interaction across farmers, extension personnel, and research scientists affiliated to Krishi Vigyan Kendras (KVKs), State Agricultural Universities (SAUs), and Zonal Research Station (ZRS) increased during the NATP period.

**Table 2. Change in research-extension-farmer interface in Bihar, India (n=540)**

| Particulars | NATP districts (%) | | | Non-NATP districts (%) | | |
|---|---|---|---|---|---|---|
| | 2005 | 2007 | Change | 2005 | 2007 | Change |
| *Farmers visits to extension personnel and scientists* | | | | | | |
| Village extension workers | 10.28 | 28.72 | 18.44 | 6.81 | 12.12 | 5.31 |
| Block level line department officers | 13.82 | 50.35 | 36.53 | 1.51 | 10.61 | 9.10 |
| District level line department officers | 3.90 | 26.95 | 23.05 | - | 9.09 | 9.09 |
| Non-governmental organizations (NGOs) | - | 6.38 | 6.38 | - | - | - |
| Extension staff of agri-business firms | 11.70 | 29.43 | 17.73 | 2.27 | 36.36 | 34.09 |
| Scientists of KVK/SAU/ZRS | 10.28 | 31.20 | 20.92 | 2.27 | 3.78 | 1.51 |
| *Extension personnel and scientists visiting farmers' field* | | | | | | |
| Village extension workers | 8.10 | 31.56 | 23.46 | 3.03 | 8.33 | 5.30 |
| Block level line department officers | 12.05 | 51.06 | 39.01 | 0.75 | 3.03 | 2.28 |
| District level line department officers | 3.50 | 30.14 | 27.64 | - | 2.27 | 2.27 |
| Non-governmental organizations | - | 7.09 | 7.09 | - | - | - |
| Extension staff of agribusiness firms | 1.77 | 26.95 | 25.18 | 1.51 | 6.06 | 4.55 |
| Scientist of KVK/SAU/ZRS | 5.31 | 23.04 | 17.73 | - | 1.51 | 1.51 |

**Source:** Singh et al. (2009)

The ATMA Governing Board and ATMA Management Committee facilitated common platforms for regular and face-to-face interaction among scientists, extension functionaries, and farmers. On one hand, it improved the awareness level of farmers and on the other hand, scientists and extension personnel understood the farmers' needs and problems. Some of the steps taken by ATMA for improving such linkages included organization of joint workshops, meetings and training programs. Thus, ATMA-NATP substantially contributed to strengthening of research-extension-farmer linkages. The extension system could put demands on the research system and received feedback/solutions from it. Farmers could also get their due place in this link-chain through representation in the Governing Board (GB) and AMC. Moreover, the Farmers Advisory Committee (FAC) provided access to the linkage mechanism through which they could articulate their problems and influence research and extension priorities. However, regardless of the fact that farmers' feedback could somehow reach the

research and extension system, this mechanism and chain is yet to take a permanent shape, as FAC is yet to attain the needed institutional status. The process has been initiated in the NATP districts and the research system is becoming more and more demand-driven. Instead of issuing blanket recommendations on the identified problems (as expressed by farmers), the ATMA system carried out various adaptive trials and issued recommendations on those location-specific priorities identified in the Strategic Research Extension Plan (SREP).

***Change in diversification of farming system***

The major emphasis of ATMA's field activities was on the diversification of farming system as a strategy for risk management and sustainable income for the farming community. The farmers were motivated and trained through trainings, exposure visits to successful sites within and outside state, and suitable demonstrations on latest recommended technologies. The study has revealed that the existing farming systems were diversified by inclusion of animal husbandry / dairying, horticulture, fisheries, goat-rearing, poultry and bee keeping (Table 3). Such a high level of change is attributed mainly to diversification from food crops to horticultural crops due to introduction of scientific cultivation of medicinal and aromatic plants, vegetable farming, floriculture, and vermicomposting by a large number of farmers. The diversification initiatives yielded highly positive results in Patna and Madhubani districts. In Patna district about 33.67 percent farmers started horticultural activities, whereas in Madhubani district, the change consisted of horticulture and dairying along with fish farming. Some non-NATP districts also reported diversification like vegetable cultivation in Nalanda and animal husbandry in Darbhanga; however, Banka did not report any such attempt by farmers.

**Table 3: Enterprises introduced in farming system in NATP and non-NATP districts in Bihar, India (n=540)**

| New enterprise | NATP districts (%) | | | Non-NATP districts (%) | |
|---|---|---|---|---|---|
| | Patna | Madhubani | Munger | Nalanda | Darbhanga |
| Animal husbandry | 25.0 | 10.8 | 32.0 | 2.2 | 17.8 |
| Vegetables cultivation | 8.7 | 10.8 | 25.8 | 28.9 | - |
| Horticultural crops | 3.3 | - | 1.0 | - | - |
| Fisheries/duckery | - | 7.5 | 1.0 | - | - |
| Bee-keeping | 2.2 | 4.3 | - | - | - |
| Vermi-compost | 4.3 | - | 1.0 | - | - |
| Nursery management | 5.4 | - | 1.0 | - | - |
| Aromatic & medicinal plants | 8.7 | - | - | - | - |
| Floriculture | 3.3 | - | - | - | - |
| Exotic vegetables | 2.2 | - | - | - | - |

**Source:** Singh et al. (2009)

### *Adoption of new technologies/ practices*

The NATP directed considerable efforts on promoting sustainability in agriculture through dissemination of environment-friendly technologies and latest improved farm practices (Table 4). Some of these included adoption of zero tillage, integrated pest management, scientific cultivation of fruits, fodder production, fish production, scientific dairy farming, and makhana production technologies. A number of training programs and exposure visits for farmers were conducted through ATMA initiatives to promote these technologies/practices. The IPM practices have been found to have wide acceptability among farmers in the NATP districts. The zero tillage has become quite popular in the Munger and Patna districts and is seen by the farmers as a measure for sustainability and cost reduction.

**Table 4: Adoption of improved technologies in districts in Bihar, India (n=540).**

| Improved technology | NATP districts (%) | | |
|---|---|---|---|
| | Patna | Madhubani | Munger |
| Zero tillage | 8.7 | - | 11.3 |
| Integrated pest management in paddy | 2.3 | - | - |
| Scientific cultivation of fruits | - | 5.4 | 2.1 |
| Fodder production technology | - | 1.1 | 1 |
| Fish production technology | - | 1.1 | - |
| Scientific dairy farming | - | 1.1 | - |
| Makhana production technology | - | 1.1 | - |

**Source:** Singh *et al.* (2009)

### *Change in crop yields in NATP and non-NATP districts*

The increase in crop yield and total household income are presented in Table 5. The adoption of various improved technologies and farm practices resulted in yield enhancement in both NATP and non-NATP districts. The increase in yield was higher in the NATP districts due to several interventions made by the NATP. The diversified farming system and adoption of improved farming technologies/practices increased crop yields which resulted in increase of farmers' income. The average/household's total annual income is depicted in Table 6. On an average, the annual income in baseline year 2005 was relatively high (Rs. 93541) in the non-NATP districts compared to NATP districts (Rs. 89049). The average income increased by more than 11 percent in NATP districts as compared to 7 percent in non-NATP districts. The incremental income is due to rise in crop yield and diversification towards high-value crops.

The study has clearly shown that strengthening/improvement in the existing agricultural extension system was able to reduce adoption lag and farmers could diversify their income sources. However, increase in income was higher in those districts which were more developed and base-income was already quite high. However, farmers in the non-NATP districts also experienced an overall increase of 7 percent in household income.

**Table 5 Change in crop yield (q/ha) in NATP and non-NATP districts in Bihar, India (n=540).**

| Crop | NATP districts | | | Non-NATP districts | | |
|---|---|---|---|---|---|---|
| | 2005 | 2007 | Gain | 2005 | 2007 | Gain |
| Paddy | 31.0 | 33.6 | 2.6 | 35.5 | 36.3 | 0.8 |
| Wheat | 30.00 | 32.1 | 2.1 | 30.0 | 27.1 | (-)2.9 |
| Maize | 56.8 | 56.0 | (-) 0.8 | 48.2 | 48.8 | 0.6 |
| Potato | 172.4 | 175.2 | 2.8 | 195.9 | 184.8 | (-)11.1 |
| Tori (Mustard) | 9.6 | 10.0 | 0.4 | 4.3 | 9.0 | 4.7 |
| Onion | 190.4 | 205.7 | 15.3 | 123.3 | 157.2 | 33.9 |
| Yellow sarson (Mustard) | 13.4 | 14.4 | 1.0 | 8.5 | 9.0 | 0.5 |
| Lentil | 11.5 | 11.7 | 0.2 | 10.9 | 10.2 | (-)0.7 |
| Gram | 11.2 | 9.6 | (-)1.6 | 10.6 | 8.9 | (-)1.7 |
| Lathyrus | 10.8 | 12.4 | 1.6 | - | - | - |
| Brinjal | 222.4 | 214.3 | (-)8.1 | - | - | - |
| Cauliflower | 199.4 | 202.5 | 3.1 | - | - | - |
| Bhindi (Okra) | 101.1 | 140.7 | 39.6 | - | - | - |
| Moong (Mung bean) | 11.1 | 11.5 | 0.4 | 5.6 | 10.4 | 4.8 |
| Sugarcane | 576.6 | 500.0 | (-)76.6 | - | - | - |
| Arhar (Pigeon pea) | 15.6 | 13.8 | (-)1.8 | - | - | - |

**Source:** Singh *et al.* (2009).

**Table 6: Change in annual income of farmers in NATP and non-NATP districts in Bihar, India (n=540)(in Rs)**

| District | NATP districts | | | Non-NATP districts | | |
|---|---|---|---|---|---|---|
| | 2005 | 2007 | Net gain (%) | 2005 | 2007 | Net gain (%) |
| Patna | 99462 | 107312 | 7850 (7.89) | 117763 | 124299 | 6536 (5.55) |
| Munger | 111223 | 116602 | 5379 (4.83) | 118230 | 121535 | 3305 (2.79) |
| Madhubani | 56463 | 74355 | 17892 (31.68) | 44632 | 55096 | 10464 (23.44) |
| Overall | 89049 | 99423 | 10374 (11.64) | 93542 | 100310 | 6768 (7.23) |

**Source:** Singh *et al.* (2009).

## Conclusions

The study has revealed that the NATP-ATMA approach generated some financial resources, developed infrastructure, and facilitated the trainings of farmers. The study revealed that scientists have become more responsive to the needs of farmers and have sharpened their focus of research to meet location-specific requirements of farmers. The need-based trainings and exposure visits to farmers' fields and farmer-led extension service delivery have proved to be an effective tool for technology dissemination. Considerable improvement in adoption of new technologies and farm practices by all categories of farmers was observed. Since NATP was not started in all districts at the same time, the performance of districts varied. Madhubani district showed a better performance as NATP started functioning early in the district.

The interventions made in the NATP for improving and strengthening the agricultural extension process could substantially increase the income of almost all sections of farmers in NATP districts. The spillover effect of these interventions was seen in the nearby districts also. On the whole, it may be concluded that pilot testing of ATMA experiment has shown quite encouraging results and it should be extended across the whole state. Some states, where this NATP was implemented on pilot-testing basis, have already started planning on these lines. However, NATP intervention requires some more time to be fully operational, especially in the newly adopted-districts. The study has indicated that this novel concept of innovative transfer of technology in an integrated manner should be adopted not only in the state of Bihar but should the integral part of national policy.

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