Case Study

Yantradoot Villages Scheme: Agricultural mechanisation in Madhya Pradesh

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Executive Summary

The use of mechanised tools for agricultural purposes reduces not just the drudgery faced by farmers under traditional manual practices but also speedens agricultural processes, saves costs and enhances agricultural productivity. These benefits of farm mechanisation among many others have driven Indian states to motivate their farmers for switching over to the use of modern farm equipments.

One such mechanisation drive that stands out among all such efforts relates to the implementation of the Yantradoot Village Scheme in Madhya Pradesh. Under this scheme, district level officers of the Department of Agriculture Engineering periodically demonstrate the use of farm implements to farmers in 25 villages spread across 25 districts in the state and make these implements available on hire by the agricultural community at nominal prices.

The uniqueness of the Yantradoot lies in its impact driven approach. Under Yantradoot each of these 25 villages are being turned into complete models for agricultural mechanization. Farmers in these villages are using modern farm tools for each stage in the production of their crops. Such mechanization is resulting in a reduction of their agricultural input costs as they require lesser seeds, fertilizers, pesticides, human labour etc for conducting their farming exercises. Further, increased mechanization is resulting in a 40 per cent increase in the agricultural productivity of farmers because now their crops are being sown, irrigated, treated and harvested adequately and timely. Farmers' income has also seen an almost two-fold increase in the past two years that the scheme has been operational. As a result of these outcomes, many nearby villages are also switching over to the Yantradoot model of farm mechanization.

By implementing the Yantradoot scheme, the Government of Madhya Pradesh is creating an access to advanced agricultural technologies and machinery among farmers in the rural areas and subsequently increasing the overall agricultural productivity of the state and empowering its farming community.

Methodology

Working with the objective of identifying best practices in governance in India for the purpose of further replication, the Governance Knowledge Centre (GKC) research team conducts extensive research to locate initiatives that contribute towards the betterment of public service delivery. The GKC team conducted thorough secondary research using credible web sources to establish the suitability of the Yantradoot Village Scheme in Madhya Pradesh (M.P) as a best practice. This research reflected the manner in which the Yantradoot scheme is creating an

access to advanced agricultural technologies and machinery among farmers in rural M.P and subsequently resulting in the increase of agricultural productivity and farmers' income in the state.

Having recognized the Yantradoot Village Scheme as a best practice, the next step was to identify the key stakeholders and schedule interviews with them to gain a deeper insight into the operation and impact of the initiative. For primary research, the GKC team conducted a semi-structured interview with the Yantradoot team at the Directorate of Agricultural Engineering in Bhopal and also visited *Semra Sayyed* village in Bhopal district to hold discussions with the farming community who are leveraging the benefits of the scheme. This document has been compiled by putting together insights gathered during this field visit as well as the information collected through secondary research.

Background

Empirical evidence confirms that there is a strong correlation between efficient farm mechanisation and agricultural productivity. Traditional manual farming practices are time consuming, require huge amounts of human labour and effort and often fail to extract the full potential of the agricultural land, as well as the seed planted. In contrast, farm mechanisation saves not just time and labour but cuts down production costs in the long run, boosts crop output, facilitates timely marketing and ultimately increases farm income.

Farm mechanisation can address the issues of scarcity of farm labour during peak agricultural seasons of sowing and harvesting and significantly reduce the current drudgery faced by farmers. At the same time , the increase in area under plough, multiple cropping practices, development of agro-industries and related services as a result of farm mechanisation, enlarges employment opportunities both in farming and non-farming sectors. Along with these benefits, the increasing threat to natural resources, notably land and water has also necessitated a switching over to machine assisted resource-conservation techniques.
Recognizing these advantages of farm mechanization over traditional practices, many states in India are promoting the increasing usage of farming machinery and equipments among their farming community for boosting agricultural productivity. While northern states like Punjab, Haryana and Uttar Pradesh are leading this mechanisation drive, central, southern and eastern states are following suit with the increase in area under irrigation and with growing awareness among farmers.

One such pioneering effort to increase the rate of agricultural mechanisation for enhancing agricultural productivity is being carried out in Madhya Pradesh under the Yantradoot Village

Scheme more popularly known as Yantradoot Yojana since 2009. The need for the implementation of such a scheme was felt because several agriculture based researches and a baseline survey conducted by the Directorate of Agricultural Engineering in Bhopal pointed out that the manual conducting of certain agricultural operations like weeding, plant protection and the use of low capacity traditional equipments for tillage, sowing, harvesting and threshing operations were resulting in delay and yield loss across the state. These findings stressed on the need to improve certain existing farm machinery and develop and popularise new machines for increasing agricultural productivity and farm income in the state.

Under the Yantradoot Village Yojna in Madhya Pradesh, a village each has been taken as a Mission Village by agriculture officers in 25 districts across the state. In these Mission Villages also known as 'Yantradoot Villages', district level officers of the Department of Agriculture Engineering provide information related to the use of machines in agricultural operations to farmers, demonstrate the use of such machines and make the machines available for use by farmers at a nominal rate.

The uniqueness of the Yantradoot Yojana lies in the fact that it has completely transformed the nature of farming in these model villages. Not only has the process of farming become time, cost and effort saving but there has also been large scale increase in agricultural productivity in these villages.

Objectives

- To increase agricultural productivity in Madhya Pradesh through dissemination of information and know-how on improved agricultural technologies among farmers.
- To create farmers' access to such improved technologies.

Project Design

Key Stakeholders

- **Directorate of Agricultural Engineering, Madhya Pradesh:** The Directorate planned and implemented the Yantradoot Yojana. It monitors the day to day functioning of the scheme and provides constant technical support and suggestions.
- **District Level Agricultural Engineering Officers:** These officers are responsible for creating awareness among farmers about the scheme and demonstrating the usage of the new advanced agricultural implements.

- **Custom Hiring Centres:** These centres have all the new agricultural implements parked, are responsible for providing these agricultural implements on hire to farmers and providing necessary support for their usage.
- **Farmers:** They are leveraging the benefits of advanced agricultural technologies extended to them by the government.

Process Flow

The Directorate of Agricultural Engineering in Bhopal covers agricultural operations and research in 25 districts of M.P. Aiming to create model agriculturally mechanised villages, the Directorate identified one village in each of these districts as a 'Yantradoot Village' These 25 villages were selected on the basis of a baseline survey conducted to study the current farming practices, potential for introducing small costs incurring changes in the current practices and identify areas where the new agricultural equipments could be introduced.

Once the villages were identified, village meetings were organized and a community level plan was formulated for the gradual introduction of advanced machinery in the various stages of farming under the Yantradoot scheme. This plan includes actions to be taken at a community level as well as actions required by individual farmers.

The implementation of the Yantradoot scheme involves three main components:

a) Demonstrating agricultural implements at the field level
b) Making the agricultural implements available through custom hiring centres/camps
c) Enabling subsidised purchase of agricultural implements by farmers

Field demonstrations

Focused field demonstrations of various agricultural methods and implements are conducted in each of these 25 villages. These demonstrations are held periodically during both the Kharif crop season (planting of summer crops like millet, paddy, soya bean, green gram, pigeon pea happens during this season) and the Rabi crop season (planting of winter crops like wheat, gram, mustard happens during this season). Keeping in mind the varied socio-economic status of farmers, the district officials of the Department of Agriculture Engineering ensure that these demonstrations cover some agricultural equipments that can be utilized by small and marginal farmers as well as bigger equipments that can be used by larger land holding farmers.

In each demonstration, agricultural tools that are appropriate for that particular season are displayed in the village common area and a collective meeting of all village farmers is called. Agricultural officers then provide direct information to the farmers about the various tools present and the benefits that they can incur on the farmers. Subsequently, a particular farm

land is selected and an on field demonstration of various tools is presented to the farmers and all their queries are answered.

The information and technology provided to farmers under the Yantradoot Yojna covers all the phases of farming including soil preparation for cultivation, removing weeds and destroying insect habitats from the field by deep ploughing, improving the fertility of the soil, maintaining correct distance between rows of crops, promotion of seed treatment and proper harvesting and threshing procedures.

Under the Yantradoot Yojana, farmers are encouraged to replace their traditional time consuming farming practices with time saving mechanized procedures. The table below presents a snapshot of how Yantradoot has modified various farming practices in these villages

Farming stage	Old procedure	New procedure
Ploughing	Surface ploughing through bullock carts does not mix the soil well and therefore the soil has less water retention ability. The land is left unflattened for sowing.	Deep ploughing, once in every 5 years, through tractors mixes the soil well, increases soil water retention ability and kills all insects and weeds. The land is then flattened with the help of a rotavator. During regular years, work with rotavator is sufficient.
Seed separation and treatment	Often old seeds are utilized and good quality seeds are not properly separated from the infected/spoilt seeds.	Proper seed separation is conducted through a spiral separator and the spoilt seeds are not used for sowing. Separation of seeds and fertilizers. Proper treatment of seeds with adequate pesticides.
Sowing	Sowing by sprinkling with hands which often leads to the eating away of seeds by birds and often results in wastage of labour and farming area. Even in areas where crops are sown with the help of seed drills, seeds and fertilizers are mixed and then sowed.	Sowing with the help of seed cum fertiliser drills. Advance techniques like *ridge- furrow sowing* and *raised bed planting* are also promoted. Raised bed planters create beds in the soil. The seeds are planted on the raised area (beds) in two rows. This system of sowing provides enough space for the crops to grow.
Irrigation	Improper ploughing and sowing techniques reduce soil water retention capacity, therefore the soil requires more irrigation. Further inadequate irrigation techniques like flood irrigation led to wastage of water.	Advanced sowing and ploughing techniques increase soil water retention capacity. Irrigation mainly through sprinklers that save both time and water.

Harvesting	Cutting of crops manually. Highly time consuming procedure which often leaves feet long left-over stems on the field which are then burnt	Harvesting through self propelled reaper which cuts crops and bundles them, saving both time and wastage of crops. Straw reapers turn left over stems into chaff negating the need to burn them.
Threshing	Threshing was done manually and with the help of animals by making them walk on the harvest to separate the crop from the hay. This led to 20 per cent loss of grains due to breakage and leaving out some grains.	Mechanised multi crop threshers and axle flow threshers are used that thresh large amounts of crops in a short period of time.

Table 1: Comparing old and new farming techniques

a) Deep ploughing tractor

b) Seed separator and treatment machines

c) Raised bed planter for sowing

d) Pesticide sprayers

e) Water sprinkler for irrigation

f) Self propelled reaper for threshing

Figure 1: Various agricultural implements supplied under Yantradoot,
Source: Directorate of Agricultural Engineering, Bhopal

Figure 2: Tractors parked at a custom hiring centre
Source: Directorate of Agricultural Engineering Bhopal

Setting up custom hiring centres

After the field demonstrations are held, custom hiring centres/camps are set-up in these model villages. Each centre is managed by a field coordinator, who hires drivers from among the village youth for operating certain equipments. All the equipments that are demonstrated on the field are parked in these camps and can be hired by farmers for usage on their agricultural lands by paying a nominal price. Farmers contact the field coordinator and book the equipments they require and the coordinator gives them a slot i.e. day and time when the equipment will be available for their use and informs them about the hiring price. For instance, a farmer can hire a deep ploughing tractor for an hour by paying a price of Rs. 325. This cost includes the cost of the driver as well the diesel cost. All the farmer has to do is guide the driver to his land and supervise him while the driver conducts the deep ploughing process. Similarly, farmers can hire other implements for their agricultural work

The hiring rate at these custom hiring centres is cheaper than the rate at which private companies provide this service. For instance the tractor that is hired at Rs. 325 from the government custom hiring centre is given at the price of Rs 450 to 500 by private companies. Thus the custom hiring centres under the Yantradoot Yojana are helping farmers cut down on agriculture input costs.

Enabling subsidized purchase of equipments

Along with providing farmers with hiring facilities, farmers can purchase agricultural implements and avail subsidies. For this purpose, agricultural officers prepare subsidy cases of interested farmers who may then purchase the implements from the implement providers registered with the government. In this manner, 25 percent to 75 per cent costs are saved for farmers while buying agricultural equipments.

Training

In order to ensure that the benefits of the Yantradoot scheme reach the farmers adequately, it is vital to create awareness among them. For this purpose, along with the community awareness efforts during the field demonstrations, farmers are also given training at *farmer training centers/Krishi Vigyan Kendras* by scientists who educate them about the usage and benefits of advanced agricultural techniques. Farmers are also given season- specific advice. These trainings are provided not just to farmers from 'Yantradoot villages' but also to farmers from nearby villages. Recognizing the role and potential of women in transforming agricultural practices, specialized training sessions for women are also organized.

Exposure visits of farmers from nearby villages to Yantradoot villages are also organized from time to time to showcase to them the changes that Yantradoot has led to.

Along with such formal events, there is constant interaction and exchange between the farming community and district officers of the Department of Agriculture Engineering at informal events like the celebration of independence and republic day, cricket matches etc. In this manner, there is a strong rapport is built between officials and farmers which proves beneficial while implementing the Yantradoot scheme.

Monitoring

To ensure the smooth implementation of the scheme, senior level officials periodically visit these Yantradoot Villages, inspect the crops, interact with farmers and hold experience sharing meetings. This keeps senior officials up to date with the on field progress of Yantradoot. In this manner, a scrutiny is maintained on the functioning of the field agricultural officers as the farmers' inputs and field realities reflect the dedication and commitment of these officers.

Madagascar system of rice intensification

Under this new system of planting paddy that has been introduced to the farmers under Yantradoot, paddy is planted 25 cms apart in order to give adequate space for the crop to grow. This has reduced the seed requirement drastically, while earlier six to seven kgs of rice was used for planting one acre of land now only two kgs of seeds suffice for the same land. Earlier, excessive seeding used to result in overcrowding of fields, affecting the quality of the crop. Now, planting the seeds at such distance gives crops adequate space to grow, prevents the spread of an epidemic to the entire crop, and is enhancing the quality and quantity of the crop.

Figure 3: Rice planted through Madagascar rice intensification process. Source: Directorate of Agricultural Engineering, Bhopal

Funding

The Yantradoot Yojana is funded under the Krishi Shakti Yojana scheme of the Madhya Pradesh government for enhancing production and generating employment among the farming community. Funds for the scheme are also collected by merger of funds from various other Central (Macro Management Scheme, Rashtriya krishi Vikas Yojana etc.) and State government sponsored agricultural schemes.

Impact

Increase in agricultural productivity

The Yantradoot Yojana has yielded encouraging results. As much as 40 percent increase has been registered in the agricultural productivity due to the implementation of this scheme in the selected villages. It has made farming a compact activity in these villages with proper planning for each season and each phase in the farming of a particular crop. Farmers have been familiarized with time, cost and resource saving techniques of farming that are resulting in increasing yields. Farmers are now ensuring that they plough their fields up to the right dept, separate the good quality seeds from the not so good quality ones, treat their seeds, keep seed and fertilizer separately while sowing, sow their seeds at adequate depth and row to row spacing, provide proper irrigation and rightly harvest and thresh their seeds so as to avoid breakage and wastage

Yantradoot Village Semra Sayyed

Semra Sayyed is a Yantradoot Village situated an hour away from Bhopal, where farmers are being given up to date latest technologies to enhance their agricultural productivity. Small, marginal, and large land holding farmers are collectively utilizing the implements given to them under the scheme. The village has a custom hiring camp, which employs two of the village's youth and has a field coordinator who ensures that implements are supplied to farmers on time.

Productivity of major crops like soya bean and paddy has increased largely in this village and farmers' income has seen a nearly two fold increase. The farmers are satisfied with the performance of the agricultural officers and have developed a good relationship with them, which helps them voice their concerns. Semra Sayyed in the past couple of years has become a model for farmers from nearby villages, who now want their village also to be chosen as a Yantradoot Village.

Figure 4: Farmers of Semra Sayyed village sharing their experiences. Source: OneWorld Foundation India

of crops. In this manner timely and correct inputs are being given to the crops which is resulting is increased and good quality production.

A case in point would be the huge rise in the production of soya bean and paddy crop in these Yantradoot villages. While earlier only two to three quintals of soya bean was produced per acre, now the production has gone up to about fifteen to sixteen quintals per acre. Similarly there has been an increase of about two to three times in paddy yields.

Conservation of resources

One of the main achievements of Yantradoot lies in the fact that it has increased outputs without any major increase in input costs. In fact in many ways the scheme is leading to the conservation of vital agricultural inputs like water, seeds, fertilizers and pesticides. By devising resource saving mechanisms like raised bed planters and sprinklers for the prevention of excess sowing of seeds, excessive irrigation and spraying of pesticides, Yantradoot is not just saving the wastage of these resources but also ensuring the health and quality of the crop. The scheme has also introduced farmers to various farming techniques that allow high water retention which addresses the problem of scarcity of water resources and the need to conserve it.

The scheme is also making farmers adapt practices of multi-cropping in order to reduce the effect of pests and introducing new crop varieties that require less hard work, costs, time and resources but give more yield like masoor dal, spices etc.

Empowerment of the farming community

The increase in agricultural productivity and cut down in input costs is resulting in a consequent increase in farmer's income in Yantradoot Villages. Farmers are now able to ensure that their produce is amongst the first to reach the market, as a result of which they can bargain for better prices. Farmers' income in these villages has increased from about Rs. 40,000 to Rs. 100,000 per season. Farmers are now switching to multi cropping techniques, which relieves them of the restriction of earning an income only twice a year (once during the Kharif season and once during Rabi), as they are now planting monthly crops. This also makes them less susceptible to weather-based risks. This additional income is changing the quality of life of the farmers, who can now afford a decent education for their children and can also live a debt-free life. The physical burden and drudgery of women farmers has also been reduced, as many of the new technologies being adopted are women friendly and can be operated by them. Yantradoot is also providing employment to the youth in these villages by utilizing their existing farming skills to work at the Custom Hiring Centres, where they can drive tractors and operate other implements and are paid a fixed salary for their service.

Challenges in Implementation

Garnering community support

Convincing the farmers of the selected villages to give up traditional farming practices and switch over to using modern agricultural technologies was a major challenge for Yantradoot officials. Only after there were some success stories wherein willing farmers had made profits, the other farmers of the village came on board. This support was only gathered over a period time, because of the consistent efforts of the officers of the Department of Agriculture Engineering and the enterprising spirit of a few farmers.

Shortage of basic facilities

Though farmers of these Yantradoot Villages have been introduced to new techniques and are now using these tools in their day to day farming activity, problems of inadequate electricity, water, high costs of pesticides and adequate marketing facilities for crops not meant for local consumption are restricting the complete success of the scheme. While the new implements do not require large resources in terms of water, electricity and pesticides, yet their unavailability results in unplanned delays and inconveniences.

Hence there is a need to address these concerns. A possible way out could be the convergence of efforts under various government schemes. Perhaps the MGNREGA can be leveraged to create water resources (ponds etc.) in the area and efforts could be made to set up direct marketing facilities for farmers as is being done in various states across the country.

Balancing the diverse socio-economic situation

The village community is a diverse lot consisting of small, marginal and large landholding farmers. Catering to each of their interests has been a major challenge for Yantradoot officials. While large landholders have the capacity to hire and utilize these new equipments, small and marginal farmers lack both the land and monetary resources to leverage the benefits of the scheme. As a result, effort is being made to design and develop implements that can cater to farmers across the spectrum. Smaller hand driven equipments have been introduced for small and marginal land holding farmers whereas bigger equipments are being used by the large land holding farmers

Enhancements

So far Yantradoot is being implemented as a model in 25 villages across 25 districts of M.P. As the Directorate of Agricultural Engineering plans to extend its operation coverage to seven other districts, Yantradoot will be expanded to these areas as well. Meanwhile, there are also

plans to move away from a village based model system to a cluster based model system, where a collective of villages will be covered under the scheme instead of a single village. This will increase the coverage area of the scheme majorly.

With the Yantradoot Yojana, there has been a major increase in the demand for agricultural implements in the state. In order to meet this demand, the state government is planning to set-up custom hiring centres across the state under a new scheme. Individuals as well as primary agricultural cooperative societies can opt to open such custom hiring centres to provide agricultural equipments to farmers at reasonable rate. The opening of such centres will ensure that once the coverage of a village under the Yantradoot scheme expires, the mechanization can be carried out sustainably.

A major feather in the cap for Yantradoor has been its ability to inspire a National Mission on Agricultural Mechanisation (NMAM) under the 12th Plan. The Machinery & Technology Division (M&T), Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India, has proposed to launch the NMAM modelled on M.P's Yantradoot scheme. Under this mission, Rs. 10 lakh will be allocated per village across the country to ensure that the farmers are provided with adequate farming related machinery.

Conclusion

The Yantradoot scheme has succeeded in creating a model for agricultural mechanization. The scheme has cumulated the inputs of various diverse existing agricultural schemes and directed their effects in a concentrated manner on a particular village. In this way, it has created an end to end model of employing modern time and cost saving technologies for farming. Beginning with single farmers, the scheme has now created an empowered pool of villages which are inspiring many other villages to follow suit. An important lesson to learn from Yantradoot lies in its concentrated, impact driven approach which has yielded very visible effects in terms of increased agricultural productivity and rising farmer's income.

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Semi- structured interviews were conducted with the Yantradoot team at the Directorate of Agricultural Engineering in Bhopal and beneficiaries of Semra Sayyed village.

Appendix A – Interview Questionnaire

Background

1. When was the Yantradoot scheme initiated? What were the motivating factors behind the implementation of the scheme?
2. The scheme started with 25 districts in the state with plans to scale it up to cover all 50 districts. What were the criteria for choosing these 25 districts? How many villages were covered within each district?

Program Design

Key Stakeholders

3. According to our research, the key stakeholders involved in the scheme are farmers and the Directorate of Agricultural Engineering. What are their exact roles and responsibilities?
    i. Are there any other stakeholders in the scheme? If yes, who are they and what are their roles?

Information Flow

4. What are the main components of the programme?
    a. Under the scheme, farm machinery related information is disseminated to the farmers. What are the topics on which such information is shared with them (for instance, weeding, sowing, plant protection, harvesting, threshing and marketing)? What are the methods adopted for dissemination of information to the farmers?
    b. Who is responsible for the provision of this information?
6. How are the field demonstrations organized?
    i. Is it a collective exercise for the entire village or is it done farmer-wise?
    ii. Which agencies are responsible for providing resources for field demonstrations?
    iii. Are there any follow-up mechanisms to ensure demonstrations have been adapted into agricultural practices effectively?
7. Apart from information sharing, are farmers entitled to any benefits (like assistance in procuring farming equipments or subsidies in purchasing such equipments) under the scheme?

Awareness Generation and Capacity Building

8. How were farmers made aware of the existence of such a scheme? How did farmers respond to the introduction of the scheme?

9. Were service providers provided any training for sharing machinery related information and conducting demonstrations in an adequate manner? If yes, please provide details of the training provided: resource persons, participants, exact content, methodology, duration.

Monitoring

10. Who is responsible for ensuring that adequate farm machinery related information is provided to farmers on a regular basis?
11. Is a database maintained on the number of farmers to whom information has been disseminated, farm equipment been provided and field demonstrations held?

Financial costs

12. What are the financial costs for implementing the scheme? How are the funds procured? Please provide a breakdown of the major heads of expenditure.

Impact and Potential

Achievements

13. What have been the major achievements of Yantradoot?
14. How has Yantradoot impacted (a) agricultural productivity in the state (b) farmers' income and (c) the extent of farm mechanisation in the state?
15. There is a risk with introducing the high use of machinery for agriculture with regard to its impact on the environment (pollution etc.). Is there any strategy under Yantradoot that takes this negative impact into consideration and seeks to minimise it?

Challenges

16. What are the major challenges faced in the implementation of Yantradoot? How were/are they being overcome?

Enhancements

17. What are the major enhancements planned for the future?
    a) There were plans to develop 50 'Yantradoot Villages' across the 50 districts. How will these 50 villages be different and at what level is the implementation of this plan?
18. The Govt. of India has proposed to launch a National Mission on Agricultural Mechanisation (NMAM) under the 12th Five Year Plan. What has been Yantradoot's contribution to this?

19. Have any other states shown interest in replicating Yantradoot? What do you think are the necessary preconditions for the implementation and success of such a scheme?
20. Please provide the following data:
    - Data to show increase in usage of farm machinery in the state
    - Data to show increase in farm income and agricultural productivity in the state
    - Pictures
    - Yantradoot movie