

Participatory Technology Development in Agricultural Mechanization Research

Chanda Gurung and Scott Justice




In 2001, the International Wheat and Maize Improvement Center

(CIMMYT) proposed two projects on new resource conservation tillage technologies in the Indo-Gangetic Plains (IGPs). The research and extension projects came in response to a renewed interest in rural mechanization, which for decades has received little attention in international development.

The projects aimed at strengthening equity of access, poverty reduction and gender orientation in current rural mechanization processes in Nepal and South Asia. Specifically, the projects promoted machine-based resource conservation and drudgery reduction technologies in tillage and crop establishment among small farmers.

The result was a combined participatory action research and extension project in Nepal, where farmers and scientists from CIMMYT and National Agricultural Research Systems worked towards equitable access to new resource conservation technologies. In the Nepal research site, the basic power source for most of the technologies are Chinese power tillers (PTs), which are two-wheel walking tractors with mobile power units. Activities concentrated on rice-wheat cropping systems on the plains or *terai*.

Development Challenges in Agricultural Mechanization

 Private industries select most of the agriculture machinery made available to farmers who are left with no choice.

This paper published by the National Agricultural and Environmental Forum, Nepal www.naef-nepal.org is primarily intended for fieldworkers seeking to learn and apply participatory approaches in their agricultural mechanization and research activities.

✍ Expensive machinery with large horsepower (hp) is not suitable and affordable to small farmers.

✍ The public research and development (R&D) sector and agricultural engineers often fail to publicize rare success cases, which result to the withdrawal of research funding for agricultural mechanization.

✍ Farmers and manufacturers miss the chance to try out and evaluate new mechanization technologies due to continued lack of interest and funding in mechanization research.

✍ Poor farmers are natural community service providers if resource conservation technologies like the PT are offered at affordable payment schemes.

This new PTD approach requires additional skills in project management and coalition building among stakeholders, which are not normally associated with CIMMYT and the Consultative Group on International Agricultural Research (CGIAR). According to local CIMMYT scientists, there is no known precedent for using PTD in agricultural engineering and mechanization R&D.



From 1996 to 1997, CIMMYT and the Nepal Agricultural Research Council (NARC) began a PTD/FSR&E in agricultural research stations of the Bhairahawa *terai*. The farmers were not convinced with the usefulness and viability of the PTs being demonstrated because they were not allowed to participate in the experiments.



The government is wary of losing control of state-owned machinery, while NARC engineers and scientists are risking government-financed experiments by walking on unfamiliar theoretical grounds. The NARC was at first reluctant to participate in the new PTD program because discourses still support a typical agricultural engineering approach to research and development which:

- ✍ is centralized, top-down and works in isolation;
- ✍ considers itself all-knowing;
- ✍ has static program designs and fixed packages;
- ✍ views unexpected outcomes as mistakes and failures; and
- ✍ belittles, criticizes and formally punishes transgressors; and interprets as poor performance of scientific duty the admission that a farmer, local

This paper published by the National Agricultural and Environmental Forum, Nepal www.naef-nepal.org is primarily intended for fieldworkers seeking to learn and apply participatory approaches in their agricultural mechanization and research activities.

agricultural district officer or machinery owner with no formal education might have answers to some problems. Engineers and scientists now have a layer of protection that the normal NARC system lacked, by working with an outside agency like CIMMYT in a special project mode. Overcoming personal and institutional issues and uncertainties was no minor feat, as the team was going into an uncharted area.

The Research Approach

The previous project in 1989-1996 utilized a farming systems orientation to technology transfer. It was expected that by simply taking the machinery to the fields of small farmers for demonstration would create demand. Working with different partners over the years have changed the approach at three levels:

- ✍ The farming systems transfer of technology (TOT) approach became a more interactive participatory technology development (PTD) approach. Farmers experiment with the machinery alongside scientists and engineers. Trained farmers are also used as resource persons for new groups.

- ✍ The project now focuses on poverty reduction and gender equity issues.

- ✍ The project became an umbrella or coalition project, with many linkages to other projects and government

programs. This recognizes partners who are also committed to poverty reduction and gender equity goals, but are not formally part of the projects. It is also a recognition that a project cannot entirely stand on its own inputs, outputs, monitoring and evaluation.

The following field-level methodologies gave birth to methodological innovations:

- ✍ The key features at the field setting were mostly around group formation. New groups identified and included the poorest in the village. At least two were in each formal management committee of five members. Each group nominated two village motivators, one of which had to be a woman. Two new farmers' groups had 60% or more women as members.

- ✍ Promotion and evaluation of a group management approach to increase



the number of farmers gaining experience with the power tiller and rotovator.

✍ Training and orientation of scientists and practitioners in the project on participatory research and development (PR&D) concepts, principles and management at different time intervals.

✍ Six monthly review and planning meetings where the scientists and practitioners share experiences and plan for the next six months.

Management and monitoring tools for project actors, like the Actor Linkage Maps, Linkage Matrix, Time Lines, and Learning and Response Tables, helped track changes in relationships and activities.

✍ Yearly stakeholders meetings of scientists and practitioners, NGOs, government agencies, farmers, businessmen, machine operators and mechanics, machinery owners, bankers, donors, etc.. The direct interaction discusses problems and possible solutions.

✍ Power tillers in Kathmandu and Pokhara valleys and in Bhairahawa *terai* are already being used without any project intervention. Studies on these existing systems are evaluated for possible application or adaptation in other areas.

Key Outcomes

The approach generated the following key outcomes.

Equitable Access

Equitable access was not limited to group formation where only members can sue the power tillers. A survey conducted at the end of one winter cropping season showed that almost equal, if not more, non-members also used the power tillers. Depending on their financial status, users of power tillers were not always made to pay immediately because it could be hired on credit and paid after selling the harvest. This financial arrangement is a traditional system in the villages.

Gender

Men helped women in household chores and parenting because of reduced time and labor in plowing using the power tillers. Women assisted men in farming because they prepared and took the food to the field less often.

Increased Production

Farmers reported an increase of 5-15% in wheat harvest, which is enough for six months instead of less than three months.

Multi-Cropping

Some farmers planted maize after harvesting rice and before planting mustard. No cultivated land is left without crops for a long time.

Increase in Sales of Power Tillers

After four years of poor sales, current estimates are at more than 1,000 power tillers sold.

This paper published by the National Agricultural and Environmental Forum, Nepal www.naef-nepal.org is primarily intended for fieldworkers seeking to learn and apply participatory approaches in their agricultural mechanization and research activities.

Buyers and Entrepreneurs

Many buyers are small farmers cultivating less than two hectares. Rural entrepreneurs are selling tillers with optional trailers for hauling and transport services to other small households as well.



Group Management of Technology

The group management approach, although in its evaluation stage, succeeded in demonstrating the technology to a wider audience, which may be impossible under single owner management.

Linkages

The project became an umbrella project, with many linkages to other projects and government programs.

Lessons

A major rationale for using power tillers in this area was for zero and minimum tillage operations. Hiring power tillers for haulage as the main reason for viability and profitability in other existing innovations in Nepal was not the major part of the approach in this PTD plan.

Its importance was realized when researchers were getting frustrated because farmers were not buying the power tillers as expected. When a trolley or trailer was added to power tillers or rotovators, farmers immediately signed the loan package. Farmers and rural entrepreneurs are well aware of the high returns in using them for tillage, transport, hauling and other activities.

The project became aware of the major differences in the usual way men and women utilized saved time. Women used all this time in doing work in the field, household chores, caring for children, looking after the poultry, and fetching water, fuelwood, etc. Men spent time in farming, repair and maintenance of the house, looking after children, watching television and playing cards.

These differences in time management between men and women may not last very long. Having more leisure time may be a new and novel experience for farmers, such that abusing it may lead to family conflict. However, as the farmers continue using the power tillers they begin to learn managing saved time in a positive way.

Project partners remarked that openness to the overlapping but complementary nature of projects is useful in adopting a flexible approach. The project is also monitoring and learning from rural mechanization innovations that followed suit in the region, especially in Bangladesh and India.

Conclusion

This PTD approach could be useful in many types of research and development and extension work. Up-scaling or outscaling by seeking partners would be useful in areas where funds are limited and projects are concentrated in few small sites. The synthesis of applied agricultural engineering research and PTD methods in the project is still evolving and striving to be more participatory and meaningful to users and others in the overall innovation system. Actual poverty and equity outcomes are now being monitored as the project goes along.



References

Biggs, S.D., A.P. Kelly and G. Balasuriya. 1993. Rural Entrepreneurs, Two-Wheel Tractors and Markets and Services: A Case Study from Sri Lanka. Discussion Paper #242. School of Development Studies, University of East Anglia, Norwich, UK.

Biggs, S. and S. Smith. 2002. Paradox of Learning in Project Cycle Management and the Role of Organizational Culture. School of Development Studies, University of East Anglia, Norwich, UK.

Gass, S. and S. Biggs. 1997. Stakeholders, Science and Decision-Making for Poverty - Focused Rural Mechanization Research and Development. *World Development* 25:1:115-126.

Gasper, D. 2000. Evaluating the "Logical Framework Approach" Towards Learning-Oriented Development. Vol 20, 1, 17-28.

Islam, R. and H.N. Jin. 1994. Rural Industrialization: An Engine of Prosperity in Post Reform Rural China. *World Development (Oxford)* 1994.22 (11). 1643-1662.

Justice, S.E. 2000. Farmer Participatory Research in Agricultural Machinery R&D: A Case Study from Nepal. A Practicum Report submitted in partial fulfillment of the requirements for the degree of Master of Arts, University of Kentucky.

Mandal, Sattar M.A. 2002. Agricultural Machinery Manufacturing and Farm Mechanization: A Case of Rural Non-Farm Economic Development in Bangladesh. A Case Study Paper Presented at the International Workshop on "Fostering Rural Economic Development through Agriculture-based Enterprises and Services" organized by GTZ, World Bank, DFID, IFAD and CTA in Berlin, Germany, 19-22 November 2002.

Rolling, N.G. and J. Jiggins. 1998. The Ecological Knowledge System. (Chapter 16, pp. 283-31). *In*: Rolling, N. and M. Wagemakers (eds). 1998. *Facilitating Sustainable Agriculture: Participatory Learning and Sustainable Management in Time of Environmental Uncertainty*. Cambridge, UK: Cambridge, University Press.

Starkey, P. 1989. Animal-Drawn Wheeled Tool Carriers: Perfected Yet Rejected: A Cautionary Tale of Development.

This paper published by the National Agricultural and Environmental Forum, Nepal www.naef-nepal.org is primarily intended for fieldworkers seeking to learn and apply participatory approaches in their agricultural mechanization and research activities.