Cereal Systems Initiative for South Asia

A Performance Assessment of Agricultural Technology in Odisha and Bihar

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A Performance Assessment of Agricultural Technology in Odisha and Bihar

A program and technology evaluation report that encapsulates the success, failure, performance, benefits, challenges, impacts, and future scope and potential of programs implemented in collaboration with women's groups in the states of Odisha and Bihar under the Cereal Systems Initiative for South Asia (CSISA). This assessment has involved stakeholders such as women technology users, community agents, and implementing partners (primarily women's collectives and their apex organizations).

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List of Acronyms

BMGF	Bill & Melinda Gates Foundation
CBO	community-based organizations
CIMMYT	International Maize and Wheat Improvement Center
CRC	community resource coordinators or cluster resource coordinators
CRP	community resource persons or cluster resource persons
CSISA	Cereal Systems Initiative for South Asia
CWS	Creation Welfare Society
DHAN	Development of Humane Action
DoA	Department of Agriculture
DSR	direct-seeded rice
ESW	early sowing of wheat
FGDs	focus group discussions
HH	household
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
ILSM	improved line sowing in maize
IRRI	International Rice Research Institute
MSF	Mahila Samakhya Society and its Federation
MTNPR	machine transplanting of nonpuddled rice
MTR	mechanical transplanting in rice
NGO	nongovernment organization
ODT	open drum thresher
PH	postharvest
PRADAN	Professional Assistance for Development Action
RRA	rapid rural appraisal
SHGs	self-help groups
SI	sustainable intensification
ToT	training of trainers
USAID	United States Agency for International Development
ZT	zero tillage

Acknowledgments

This study was conducted as part of the Cereal Systems Initiative for South Asia (CSISA), a multi-institutional undertaking of the International Maize and Wheat Improvement Center (CIMMYT), International Rice Research Institute (IRRI), International Food Policy Research Institute (IFPRI), and International Livestock Research Institute (ILRI), with funding support from the Bill & Melinda Gates Foundation (BMGF) and the United States Agency for International Development (USAID).

CSISA is mandated to enhance farm productivity and increase incomes of resource-poor farm families in South Asia through the accelerated development and inclusive deployment of new varieties, the dissemination of sustainable management technologies, the promotion of partnerships, and the formulation and implementation of appropriate policies.

The views expressed in this report are those of the authors and do not necessarily reflect the views of USAID, BMGF, CIMMYT, IRRI, IFPRI, ILRI, or CSISA.

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The authors also express their deepest appreciation to the technical and field-level moderation teams of CSISA Odisha and Bihar to execute, moderate, and manage several rounds of focus group discussions with different stakeholders, and multiple plenary and discussion sessions.

Executive Summary

Phase II of the Cereal Systems Initiative for South Asia (CSISA) had an integrated vision of gender inclusion in its targeted technology delivery program. In two of CSISA's priority intervention hubs, Odisha and Bihar, women-centric technology delivery programs were piloted with women farmers with a broad aim of mainstreaming and inclusion. Since the interventions in both states started in early 2014, the CSISA team decided to conduct a qualitative study in May 2015 to understand the views of women farmers regarding the technologies that they have been exposed to. The aim was to understand their experiences and the potential for future use of technology. A total of 12 focus group discussions were conducted across Odisha and Bihar, focusing on six technologies in each state. Also, focus group discussions were conducted with representatives from different scaling agents (primarily community resource persons and partner agencies, leaders of community-based organizations) to give an overview of actions needed in the future.

In general, the women farmers who have tested the technologies opined that these are time-saving and cost-saving, they reduce drudgery, and they improve crop establishment and yield. However, the major challenges associated with the technologies are the women's lack of experience in handling them and challenges with the operational details involved in using them. Apart from these, other major limitations were a lack of local availability of the machines and a lack of awareness and knowledge of how to procure such machines and equipment through proper channels. Despite the disadvantages, the trend of land area under different technologies showed an increase from 2014 to 2015. This indicates the willingness of women farmers to use the technologies. When comparing the costs and benefits of each technology, it can be seen that the technologies are more cost-effective than conventional methods. The women farmers are exposed to different extension methods for dissemination. Hence, they were asked about the most and least preferred ones. The most preferred extension method is demonstration and the least preferred is classroom training.

Over a period of one year, the women farmers have been exposed to different technologies and training activities. The question arises whether such exposure has any direct or indirect benefits for the lives of the women farmers. The women farmers opined that they have gained knowledge on improved farming, which indirectly has helped them to raise their status in households by becoming involved in decision making related to agriculture. They now have an identity as "farmers."

For technology promotion among women, seven major stakeholder groups in the region are keys to the success of outreach and acceptability: local women-centric NGOs, the Department of Agriculture (government agency for the district), village-level self-help groups, cluster-level women's federations, community resource persons, service providers, and farmers. To involve all these seven important stakeholders in channelizing different resources and opportunities for bringing about sustainability, six initiatives and action points can play a key role: training, demonstrations, field days, seasonal learning exercises, large-scale extension, and awareness creation.

Chapter 1: Introduction

Phase II of the Cereal Systems Initiative for South Asia (CSISA) had an integrated vision of gender inclusion in its targeted technology delivery program. In two of CSISA's priority intervention hubs, Odisha and Bihar, women-centric technology delivery programs were piloted with women farmers with a broad aim of mainstreaming and inclusion. These gender intervention programs designed for the women were participatory and demand-driven in which technologies were primarily selected by the women farmers themselves through needs assessment and prioritization exercises carried out in the inception phase of the program.

Specific approaches and models of partnership were used in two states (Bihar and Odisha). However, this targeted and focused approach of delivering specific technology to women was conceptualized to be through the involvement of women's collectives or community institutions and several grassroots extension agents, working exclusively with these collectives. The representatives of these collectives and several community agents were trained by CSISA scientists as the first step toward a systemic inclusion and mainstreaming of women in a core agricultural development program such as CSISA.

In this context, detailed qualitative research involving various assessment tools and methodologies was conducted in May 2015 for both states where specific models of interventions with women farmers are in progress.

1.1 Research objectives: The two research objectives are described as follows:

1. To analyze the performance of technology and response of women toward the technology (assessment of benefits or losses received from the technology).
2. To know the feasibility of different technologies in local contexts.

The specific objectives of the study appear below:

Activity	Objective	Output
1. Assessment of advantages and disadvantages	To identify – usefulness of the technology – problems of the technology	Lists of technology-specific advantages and disadvantages
2. Assessment of technology use	To identify the land area where farmers have used the technology	Statistics in favor of the result shown
3. Assessment of benefits from the technology	To identify potential benefits of the technology	Costs and benefits of technologies
4. Preference of different extension methods for capacity and knowledge building	To identify most preferred and least preferred methods of extension and knowledge building	List of extension methods and suggestions for improvement
5. Exploring additional contributions of the technology to the livelihoods of farmers	To explore whether the technology interface opened up new opportunities or problems (if any) for the livelihoods of farmers	Understanding of the effect on livelihoods of interfacing of the technology
6. Issues for dissemination, scaling up, and sustainability of the technology	To identify organizational, institutional, technical, social, marketing, gender, and capacity issues	Feedback as to what needs to be done to sustain the technology
7. Suggestions and recommendations	To gather general suggestions and recommendations from the participants on technologies	

1.2 Research design and methodology[1]: The primary methodology involves focus group discussions around different technologies tried and tested by women farmers over the CSISA Phase II period, across various seasons. The technologies selected for the study are region-specific. The key stakeholders targeted in this assessment process are primarily from three categories:

1. Women farmers for each of the technologies
2. Community extension agents (CRPs or CRCs)
3. Implementing partner organizations (federations, government agencies, NGOs)

Focus group discussions with community extension agents and implementing partner organizations were carried out to gain an overview from the perspective of the scaling agents and agencies about possible scale-out strategies and stakeholder mapping for the future sustainability of such interventions in the particular geographic region given different needs to be addressed, infrastructural issues, and challenges lying ahead.

The technology intervention points, the dissemination model followed, and the partners involved in both states were different from each other. However, the broad assessment guideline remained the same for evaluating the overall program.

[1] More details on design and methodology are given in state-specific chapters.

2.1 Background of women's interventions in Odisha

Agriculture in Odisha is a family livelihood. CSISA initiated a technology-dissemination program targeting women farmers in early 2014 in Mayurbhanj District. Through NGOs and available government support programs, the project was linked up with community-based organizations (CBOs) working in the region, initially to reach women farmers from almost five blocks of the district (Jashipur, Karanjia, Betnoti, Badasahi, and Maruda). A rapid rural appraisal (RRA) exercise was conducted in early 2014 to understand women farmers' technical knowledge and agricultural practices, to assess their technical needs, and to identify how they can benefit from CSISA-supported technologies.

Through a participatory planning process, along with leaders from SHGs, CBOs (e.g., women's federations), and facilitating NGO partners, for the first season of intervention, kharif 2014, a five-point intervention (*I: direct-seeded rice (DSR), 2: improved line sowing in maize (ILSM), 3: a drought-tolerant rice variety (Sahbhagi dhan) with better management and seed production practices, 4: mechanical transplanting and nursery management, and 5: improved postharvest practices (storage + threshing)*) entry strategy was designed for women farmers of Mayurbhanj, which was continued in 2015 as well.

This initiative with women farmers of Odisha, since its inception, has shown some encouraging figures for future replication and the way forward:

1. Around 300 SHGs (3,000 individual women membership base) have been included in the program through either targeted capacity building or a technology delivery program.
2. More than 1,500 women farmers applied one or more improved technologies in the first year (2014).
3. Nearly 400 farmers used improved postharvest practices (mechanized threshing, improved storage through Super Bags) in the first year
4. Another set of 500 women farmers, in 2015, used improved practices or technology such as direct-seeded rice, maize line sowing, small-scale mechanization, and drudgery reduction tools.
5. In 2015, in addition to two partnered women's federations (in 2014), one more federation and new CRPs[2] from adjoining areas or districts were successfully brought under the community partnership network.
6. Three agro-service centres owned by women entrepreneurs and managed by groups have been established in the region, investing in different improved agro-machinery and equipment, and their skills are being developed through targeted technical guidance and training.

With the above initial successes on the ground, CSISA entered into its third phase of implementation from December 2015 onward. Prior to this, it was important to evaluate the program of interventions with women farmers in order to explore the further scope and opportunity for replication, scaling out, and sustainability in the coming 4 to 5 years. A qualitative evaluation was carried out through targeted FGDs in Mayurbhanj District of Odisha. The whole evaluation exercise primarily involved six FGDs with women farmers who have used six different technologies.

[2] *CRPs are community resource persons or local resource persons selected from the villages under intervention, responsible for social mobilization, farmers' training, handholding, sensitization, and technology delivery in farmers' fields under the technical backstopping and guidance from CSISA scientists and technical staff. They are the grass-roots-level ToTs in the making by close vigilance and handholding support from technical staff to create a local knowledge mass and service providers' network in the region, always accessible to farmers at their doorstep or within their villages.*

The six different technology intervention points around which the FGDs (9 to 10 members per group) were conducted are as follows:

1. Drought-tolerant rice variety Sahbhagi dhan.
2. Improved direct sowing in rice (DSR in lines + use of hand spreader).
3. Mechanical transplanting in rice (using mechanical transplanter).
4. Improved maize line sowing (scientific line sowing).
5. Improved postharvest technology (storage + threshing).
6. Zero tillage in different postrice crops (line sowing under zero tillage for wheat, mustard, chickpea).

Apart from the above, one FGD was carried out with community extension agents (called CRPs, community resource persons) and representatives from their nodal agencies (implementing partners). Two local partners (PRADAN and DHAN Foundation) have been part of this intervention by involving several CRPs on the ground to mobilize, train, and support women farmers, organized in different collectives (self-help groups and their federations).

2.2 The outcomes of qualitative evaluation (analysis of research outcomes)

The following sections consist of key outcomes of the assessment carried out around different aspects.

2.2.1 Measuring the advantages and disadvantages of different technologies in the post-application stage

The women who have already used different technologies and have observed production as well were able to analyze the performance of different technologies in the field. They were asked to discuss and list the different advantages as well as limitations of each technology in the local context.

Varietal intervention: The introduced climate-smart rice variety (Sahbhagi dhan) has not only shown drought tolerance and given higher yield (with factors observed such as more grains per panicle and more tillers) than some local varieties grown in similar conditions but has also provided an alternative grain that is more palatable and has better cooking quality in the particular local context and food preference in the region. It weighs more than other varieties at equal volume, leading to a marketing advantage if sold. With its short duration, in delayed situations, it can be grown adequately to catch the next-season crop as well. The observed limitation of this variety is lodging in the advanced stage of maturity and suitability for only upland conditions.

Improved direct sowing practices of rice (DSR): This technology shows a clear advantage of savings in cost in terms of reduced seed rate, fewer traditional operations in broadcasted rice, less time, less physical drudgery involved in several manual operations, better establishment, and higher yield.

Mechanical transplanting in rice (MTR): In the case of MTR, the observations are similar to those for DSR, where the clear advantages are the reduction in drudgery, cost of operation, and time, with a better crop stand and higher yield. However, the lack of trained and skilled operators and service providers, the lack of awareness about accessing machines locally on time, and gaps in corner areas of plots while using machines are stated as major limitations. Another limitation of this technology is particularly for the local context, where the women believe that many farmers in the region are marginal, poor, and hold extremely small and fragmented plots in which the use of a machine is not possible. They perceive this machine to be a high-investment technology and suitable only for custom service.

Improved line sowing in maize (ILSM): The major advantage for women is the better crop establishment leading to easier intercultural operations in the later stage, savings of time and drudgery (because of mechanized sowing and proper spacing), and savings of cost by reducing the number of operations required at different stages (such as simultaneous application of seed and fertilizer, and reducing the number of plowings). Because of appropriate spacing and uniform planting, there is uniform cob bearing in plants.

Improved postharvest technology: The women clearly mentioned the reduction in grain or seed damage caused during the process of storage (due to the occurrence of more pests and lack of moisture control in traditional structures) and threshing. Mechanical threshing has a direct bearing on increasing women's efficiency and reducing their drudgery. This technology also saves the cost involved compared with previous methods. The quality of straw is also good for animal feeding. One of the observations shared while assessing the limitations of the technology is the possibility of damage to the conveyer belt of the drum thresher at frequent intervals.

Zero tillage (ZT) in post-rice crops (wheat, mustard, chickpea): Users assessed the technology as time-saving and cost-saving (by reducing operations such as multiple tillage or plowing, separate application of seeds and fertilizer) as well as drudgery-reducing. They also assessed it as a natural resource-conserving technology for which they confirmed that it is practiced under lower moisture conditions and minimal tillage to land. Production was observed to be almost double in the case of mustard in comparison to traditional methods and yield was slightly higher in the case of wheat.

In general, the disadvantages cited for all the technologies mentioned above are the lack of awareness, machine nonavailability, and undulating land topography. More training is required on the technical and operational aspects of the practices (maintenance and operation, seed rate calculation).

2.2.2 Land area under different technologies

In order to understand how much land area has been used for a particular technology by the women farmers, randomly selected representatives from each technology focus group were asked to fill out short forms. They were asked to indicate the area cultivated under one particular technology in the past year and the area planned for the next year.

The use of Sahbhagi dhan shows a potential and significant growth trend for the future (around a threefold increase from 2014 to 2015), for which nearly all the respondents showed interest in increasing the area under this variety by using the grains saved from the past season (Fig. 1). The popularity of the variety among women farmers is quite visible, giving encouragement and hope for the successful spread of this variety in the region with more farmers if targeted properly. Though direct-

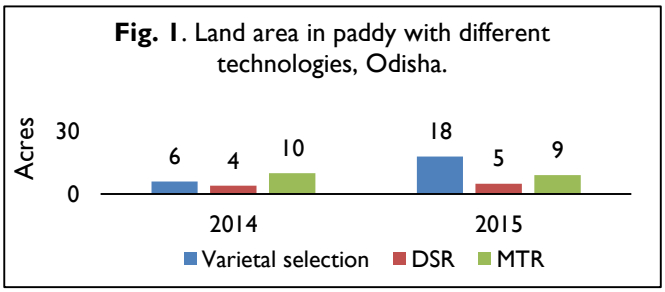


Fig. 1. Land area in paddy with different technologies, Odisha.

seeded rice (DSR) showed an area increase from 2014 to 2015, mechanical transplanting of rice (MTR) showed a decrease in area from 2014 to 2015 (Fig. 1).

For improved line sowing practices of maize, the overall trend is increasing (a 37% increase from 2014 to 2015) (Fig. 2). The popularity of this technology is evident among many women's collectives where they have tried to convert common (mostly fallow) land in the village into cultivation of maize. It is seen that the use of zero tillage is quite popular in the collective farming mode, in which most of the women farmers applied this technology jointly in groups. However, like MTR, zero-tillage technology is in an early stage of spread with women farmers.

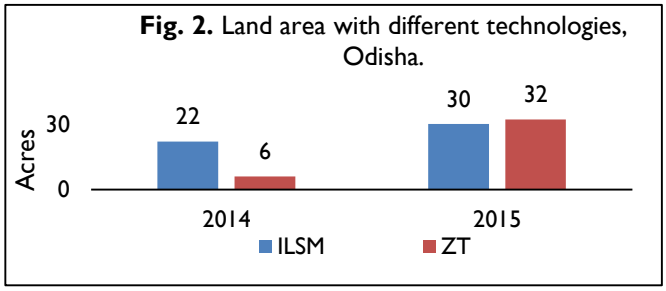


Fig. 2. Land area with different technologies, Odisha.

2.2.3 Comparative analysis of cost economics of applied improved technology versus predominant traditional practices

A detailed comparative benefit-cost analysis of the introduced technology versus predominant previous practices was made by the women's groups. Various major cost components that differed in both practices were compared and the differences in cost incurred were compared to understand the overall financial gain or loss from the use of the new technology. All the financial gain/loss analysis was based on per acre of land as a unit of comparison between traditional technologies and technologies newly applied by farmers (Table 1).

Land preparation is INR 800/acre higher in broadcasting than in DSR, while ILSM is INR 200/acre lower than manual sowing and ZT is INR 400/acre lower than conventional tillage. The seed rate is found to be higher in all the conventional methods as compared with improved technologies. Crop establishment is INR 1,250/acre higher in manual transplanting than in MTR and INR 300/acre higher in manual sowing than in ILSM and DSR is INR 400/acre higher than in broadcasting. Intercultural operations are lower in DSR (by INR 1,800/acre) and in ILSM (by INR 2,000/acre) than with the conventional methods. In fertilizer application, in general, there is no difference except in ILSM, for which the conventional method is INR 300/acre higher than ILSM. Weeding costs are higher in MTR (by INR 1,600/acre) and DSR (by INR 2,100/acre) than in manual transplanting and broadcasting, respectively. Herbicide is required more in MTR and DSR than in conventional methods while harvesting or threshing shows no cost difference except in improved postharvest practices.

Table 1. Comparative analysis of cost economics of applied improved technology versus predominant traditional practices, Odisha.

New technology	Old technology	Land preparation	Seed rate	Crop establishment	Intercultural operations	Fertilizer	Weeding	Irrigation	Herbicide	Harvesting /threshing
Varietal intervention	Previous variety	≈	≈	≈	≈	≈	≈	NA	≈	≈
DSR	Broadcasting	↑	↑	↓	↑	≈	↑	NA	↓	≈
MTR	Manual transplanting	≈	↑	↑	NA	≈	↑	NA	↓	≈
ILSM	Manual sowing	↑	≈	↑	↑	↑	≈	NA	NA	≈
Improved postharvest	Conventional method	≈	≈	≈	≈	≈	≈	NA	≈	↑
Zero tillage	Conventional tillage	↑	↑	NA	≈	≈	≈	NA	NA	≈

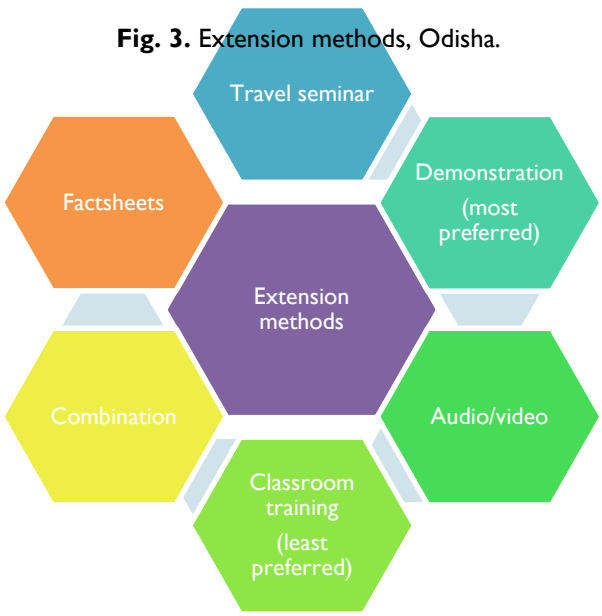
Note: ↑ means old technology costlier than new technology; ↓ means new technology costlier than old technology; ≈ means no difference between old and new technology; NA means not applicable.

2.2.4 Effectiveness of and preference for different extension methods for capacity and knowledge building

Women provided significant feedback on different extension and communication methodologies and tools used in the process of both capacity building and delivery programs. For seed-related interventions, women want more written communication materials, which are extensive in nature, giving a detailed overview of the complete package of practices to use the variety optimally for better performance. They also want materials in pictorial formats for ease in understanding and explaining in case of less educated people (Fig. 3). For technologies such as DSR, MTR, and ILSM, there is a clear demand for more practical demonstration and handholding support in terms of detailed operational training. For postharvest technology, the most effective tool for improvement is perceived as training and more clearly understandable factsheets with better visual impacts and pictorial depiction with fewer technical details.

As zero-tillage practices in post rice crops are applicable for multiple crops, and the requirements with respect to packages of practices and basic prerequisites might vary for different cropping sequences, there was feedback on developing a detailed brochure with the complete package of practices and steps, as well as prerequisites, for multiple and potential crop sequences or combinations suitable and relevant for the geography.

Fig. 3. Extension methods, Odisha.



However, classroom training is the least preferred. Apart from this, the women were asked to recommend alternative ways of reaching out to the people with relevant information on technologies. Suggestions are as follows:

1. More written materials: detailed booklets and brochures on the

complete package of practices, especially for seed production (including details about dosage, time, application of different inputs).
2. More exposure visits while operations are taking place.
3. Visualization of machines by video clips or live demos about machine parts and operations.

2.2.5 The decision-making process at different stages of crop production

Every technology performance and its sustainability depend on the critical decisions made at different stages of crop production. Hence, the decisions to be made were divided into three major stages:

1. Establishment/inception stage input decisions (inputs such as seed, machinery, establishment technology).
2. Post-establishment stage management decisions (management in the crop stand such as nutrient, weed, pest, and water management).
3. Post-production stage output-income decisions (decisions to use the harvest or income from the harvest).

Table 2 shows both the mode of decision making (individual or joint) and key authority of decision making at different stages of crop production for different technologies that were used by women. The responses of individual women within a particular technology group also varied, showing differences in individual social context and perception.

It was observed that in technologies such as varietal introduction (Sahbhagi dhan), maize line sowing, postharvest, and zero tillage, women's role (either as an individual or as a collective) was more pronounced in decision making. This also indicates the significant involvement of women in applying and managing these technologies and a fair amount of involvement in income use as well. Improved line sowing of maize is found to be particularly popular in joint or collective modes, in which a majority of the decisions are made at the group level.

Table 2. The decision-making matrix at different stages of crop production, Odisha.

Technology	**Input decision (inception/establishment stage)**				**Management decision (post-establishment stage)**				**Output/income use decision (post-production stage)**			
	Individual		Joint		Individual		Joint		Individual		Joint	
	Self	Spouse/ other head of HH	Women's group	Members of HH	Self	Spouse /other head of HH	Women's group	Members of HH	Self	Spouse/ other head of HH	Women's group	Members of HH
Varietal intervention	√				√			√	√			√
DSR				√	√	√		√				
MTR		√		√				√		√		
ILSM			√				√	√	√		√	
PH	√		√		√		√					√
ZT	√				√			√	√			

The technologies, which involved comparatively high-end technologies and large-scale mechanization, for example, DSR and MTR (involves the use of a seed drill, mechanical transplanter, and mat nursery preparation), show a lot of involvement of the spouse and other household members in various decision making in all stages.

2.2.6 Direct and indirect benefits for women farmers

The overall benefits of the technology application and its results have several dimensions. They comprise the overall benefits in terms of financial net gain as well as advantages in different contexts. In broad terms, when the overall benefit of each technology is analyzed, three major aspects are

found to be part of the frame from technology application to final production and the postproduction chain. The overall benefits of varietal introduction are that the women farmers observed and acknowledged that this particular intervention led to higher economic gain, a better agricultural option in adverse climatic situations, and a better risk mitigation strategy for them. In addition to this, this variety has given them food value in the food basket of the family, with better eating and cooking quality, especially for some locally preferred food items coming from rice such as puffed rice and rice cakes. Another significant benefit for women has been the higher economic gain. Because of this new intervention introduced by them to their family and locality, it has also positively affected their dignity and status in the family.

Women reported that DSR has economic gains in terms of savings in resources such as seed usage, multiple operations of fertilizer application, land preparation activities, and unnecessary exercises such as thinning, gap filling, and multiple weeding operations followed in the traditional broadcasting system. The removal of traditional operations from the new package of practices for DSR eventually increases the efficiency of the farmers and farming system and gives more time for alternative sources of income, activity, crops, or other activities. This also has a significant drudgery reduction. The traditional thinning, gap filling, and weeding operations are done by women, which is no longer required in this new establishment method of line sowing (supported with precise weed control).

MTR not only provides an option for women to reduce the physical drudgery involved in the tedious work of transplanting and other operations, but also gives them options of dry nursery preparation and unpuddled transplanting and thereby avoiding further drudgery and potential health hazards from working regularly in wet land conditions. One of the major issues, labor shortage leading to delayed operations and poor plant growth in the peak season of transplanting, could be addressed in the concerned geography because of this technology. This technology is also acknowledged as a cost-saving method, in which the total cost of production decreased significantly. The significant savings in time also gives women options for investing more in other income-generating or useful activities such as backyard kitchen gardens and family welfare as well as enhancing their social participation in SHGs and village-level activities.

One of the key benefits of ILSM is addressing an important area of crops in the region by giving alternative cropping options to farmers and alternative food in their food basket. The other significant option is the conversion of much fallow land available in the village to cultivated land through collective efforts of women's groups. Mechanized sowing methods through a seed drill also significantly reduce the time of operations, cost of operations, and drudgery involved in manual practices. The saved time has an indirect benefit for women, especially by giving them a choice for becoming involved in other income-generating, family welfare, or social activities. ILSM also has an impact on alternative livelihood options such as animal husbandry, in which better feed could be made available for dairy animals to boost milk production.

Improved postharvest practices have a direct benefit in reducing the loss of grain quantity and quality during threshing and storage. This gives more net grain or output as well as better quality for consumption and sale, thus having a significant effect on food security as well as possible income enhancement. The use of mechanized threshing practices also reduces the drudgery involved for women in manual threshing practices, and increases their efficiency and saves a lot of time used in this particular operation.

ZT technology has benefited women by significantly saving in various resources used for farming, such as seeds, fertilizer, energy for tillage, and multiple intercultural operations, thereby directly decreasing the cost of cultivation. This also has an ecological benefit by acting as a resource-conserving technology in which water and soil are used or disturbed minimally in the cultivation

process. A low-cost, resource-conserving cultivation option gives more encouragement for cropping system intensification by going for different cropping sequences feasible in the area, such as rice-mustard, rice-chickpea, rice-maize, rice-wheat, and rice-green gram, thus offering a diverse range of crops for the family. Machinery reduces the drudgery involved in previous manual operations. These operations save significant time as well, giving women options to choose different activities.

2.2.7 The challenges and factors for sustainability

The six analyzed technologies are applied under the supervision of three overarching women-centric organizations (two self-help federations and one women-centric NGO) with several self-help groups and women members of these groups applying at least one of the above technologies on their farm land. Women farmers reported that there is a need for establishing an organized production cluster in the region (for seeds especially) as well as a potential marketing channel with required information for the exchange or sale of seeds involving women's federations or collectives; a complete and comprehensively documented package of practices for this particular variety to be disseminated to farmers; strengthening of a locally effective revolving model of seed distribution and exchange involving women's groups or farmers; and developing potential entrepreneurship and a business model around seed distribution, exchange or sale.

2.3 Summary

The FGDs reveal that women farmers have benefited from the technologies that they have been exposed to and are willing to use them in the near future. On the one side, they have revealed how useful the technologies are, but, on the other side, they have confidently identified some limitations. Land area under almost all of the technologies increased from 2014 to 2015. Details were requested from some of the representatives of the group and the data reveal a trend indicating increasing technology use among the women farmers. The cost-benefit analysis results indicate that the improved technologies are efficient in cost and time savings as compared with conventional methods. The women farmers opined that demonstration is the most preferred extension method while classroom training is the least preferred. The women farmers have benefited from the project and they are also exposed to information on new technologies.

3.1 Background of women's interventions in Bihar

CSISA started its intervention from early 2014 (after a detailed pre-intervention stage appraisal and needs assessment) in Muzaffarpur District. The district witnessed two seasons of interventions (kharif 2014 and rabi 2014-15) around different technologies, with a plan for continuation of the same in 2015 as well. A qualitative assessment of the interventions was made through focus group discussions. The key stakeholders targeted in this assessment process were mostly from the following three categories:

1. Women farmers for each of the technology interventions
2. Community extension agents—cluster resource persons (CRPs) and cluster resource coordinators (CRCs)
3. Implementing partner organizations (federations, government agencies, NGOs)

Two local partners (*Mahila Samakhya* Society and its Federation (MSF), a state federation, and the NGO Creation Welfare Society (CWS)) have been part of this intervention by involving several CRPs or CRCs on the ground to accelerate the use of improved technologies that lead to sustainable intensification (SI) of cropping systems, which allows higher productivity.

In Bihar, CSISA began its intervention with the enabling of women to claim their identity as *Kisan Sakhi* (i.e., women farmers). So far, the achievements in Bihar can be summarized as follows:

1. Women farmer-focused capacity-building programs have been launched through in-classroom and in-field interventions. Self-help groups have been the important conduit. From 248 women farmers in January 2014, 3,000 women farmers in 2015 through 200 self-help groups were reached.
2. *The Kisan Sakhi* group has been successfully mainstreaming the technology of machine transplanting of nonpuddled rice (MTNPR) and community nursery.
3. Phase II has seen progress in which 13 acres of mat-type nursery developed by the *Kisan Sakhi* group in 2014 expanded to 30 acres in 2015.
4. The first-ever women farmers' service provider group was developed with Jyoti Mahila Samakhya Federation operational in Muzzafarpur.
5. Thousands of women farmers used improved postharvest technology, the open drum thresher.

A group of 110 women farmers from Muzzaffarpur and Munger districts assembled to participate in the three-day workshop held by the CSISA team in Muzzaffarpur District in Bihar. Six FGDs were conducted with women farmers who have used different technologies and one FGD was conducted with community extension agents and representatives from nodal agencies (Bihar *Mahila Samakhya* Society and Creation Welfare Society, and prospective partners, Aga Khan and ITC).

The different technology intervention points around which the FGDs were conducted are as follows:

1. Mechanical transplanting in rice (using mechanical transplanter) and community nursery
2. Improved direct-seeded rice (DSR)
3. Improved postharvest technology (seed storage technology, open drum thresher, maize sheller)
4. Intercropping
5. Bed planting in maize
6. Zero-tillage wheat (ZTW) and early sowing of wheat

3.2 The outcomes of the qualitative evaluation (analysis of research outcomes)

The following sections consist of key outcomes of the assessment that was carried out.

3.2.1 *Measuring the advantages and disadvantages of different technologies in the post-application stage*

The women who have already applied different technologies and have observed production as well were in a state in which they could analyze the performance of different technologies in the field. They were asked to discuss and list different advantages as well as limitations of particular technologies in the local context. Respective technology groups derived a list of pros and cons of the technologies they tried.

Mechanical transplanting in rice (using mechanical transplanter) and community nursery: The advantage of MTR is that it is a woman-friendly technology and it reduces drudgery. It has potential for enabling the timely sowing of rice. The scope for business establishment and profit generation is high if the use of the machine is well planned. Farmers who cannot afford to hire laborers can now hire the machine for transplanting. The community nursery can earn profit for women farmers as they can sell seedlings to other farmers in peak seasons. However, the machine cannot be used in small plots and transporting it from one area to another is difficult. Apart from this, the machine cannot be used without intensive training for users. Also, gap filling during transplanting needs to be addressed as the machine has difficulty reaching all four corners of a plot.

Improved direct sowing in rice (DSR): Because of minimum tillage, DSR saves water, time, and labor. Also, there is less soil disturbance and soil fertility is maintained because of minimum tillage. Moreover, puddling is not required. However, there is a high chance of weed infestation.

Improved postharvest technology (seed storage technology, open drum thresher, maize sheller): Super Bags have played a crucial role in the timely sowing of rice as seeds can be available on time if stored in Super Bags, which are resistant to rodents and insect attacks. Seed quality is maintained and bags are cost-effective if they prevent farmers from having to purchase seeds. Bags are useful for 3 years. The disadvantage that women farmers mentioned is that bags are not available in the market.

The open drum thresher is a time- and cost-saving technology (it takes one hour to thresh 6 quintals paddy at a cost of INR 250) and reduces drudgery. An additional advantage of using an open drum thresher is that winnowing and cleaning are not required and straw doesn't break. Unfilled grains and dust are removed and clean paddy is obtained. The engine of the open drum thresher can be used for threshing as well as to run an irrigation pump. There is no wastage or loss of grain.

The maize sheller saves time. Earlier, maize shelling was tedious when it was done manually as women used a screwdriver to shell out the kernels and there was a high chance of the woman becoming injured. Now, with the maize sheller, the task can even be done while watching television or during leisure time. However, one has to take care that the harvested cobs are dried properly.

Intercropping: When multiple crops are grown simultaneously, intercropping can be a time-saving, resource-saving (soil and water), and labor-saving technology. Intercropping can increase yield, with possible increase in income. However, there is also a high chance of a decrease in yield because of weeds and diseases as the women farmers mentioned that they found it difficult to carry out weeding and intercultural operations.

Bed planting in maize: Bed planting reduces labor requirements, as well as the need for earthing up. It also helps facilitate uniform irrigation and fertilization. It can reduce lodging and support better plant growth. However, several disadvantages were mentioned as it requires large plots. Machines are unavailable on time, sowing with a bed planter is not uniform (it needs to be tuned for bed planting), and spring maize needs more irrigation when on beds. Low-cost simplified versions of bed planters for smallholder farmers need to be developed so that service provision can become an alternative source of income when supported by developing a business model.

Zero tillage and early sowing of wheat: Zero tillage is a time-saving, cost-saving, and resource-saving (water) technology. However, uneven land distribution acts as a challenge for sowing, especially in small plots. Problems occur during sowing due to the accumulation of soil in the pipe of the machine.

Wheat productivity is high (with high seed weight) if wheat is sown between 1 and 15 November. This saves one irrigation, and the seeds do not dry due to hot and desiccating westerly winds. Because of early sowing, there is early harvesting of wheat and as a result there is early sowing of gram. However, in the same field, early sowing of wheat depends on the time of paddy harvesting.

3.2.2 *Land area under different technologies*

The women farmers were asked to report the total area on which CSISA technologies were applied in 2014, and how much land area they perceived that they would be using in 2015. Representatives from each group were randomly selected to obtain these data.

In paddy, the use of mechanized threshing by the open drum thresher (ODT) increased more than threefold from 2014 to 2015. Direct-seeded rice (DSR) and mechanical transplanting of rice (MTR) were also accepted by the farmers and area expansion by each farmer in 2015 was two- to threefold more than in 2014 (Fig. 4).

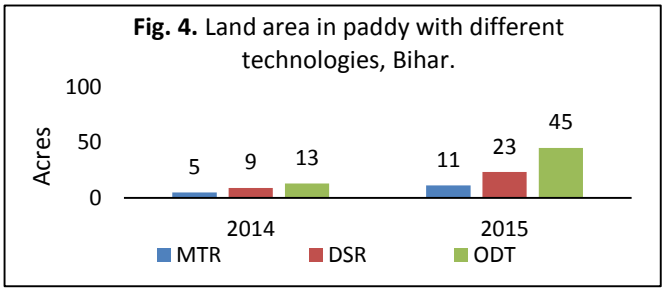


Fig. 4. Land area in paddy with different technologies, Bihar.

In wheat, zero tillage (ZT) and early sowing were widely accepted, with the magnitude almost the same for both technologies. The overall expansion of area was more in ZT. The cost savings and yield enhancement by both technologies are most important motivating factors that influence the decision-making process of women farmers (Fig. 5).

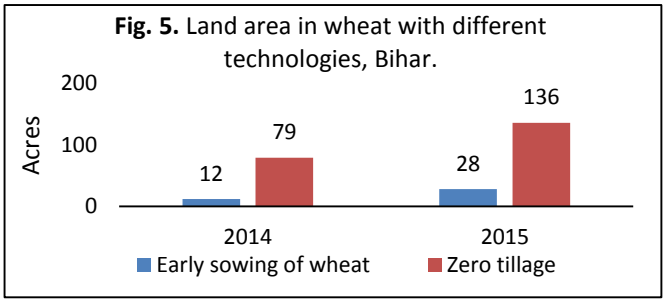


Fig. 5. Land area in wheat with different technologies, Bihar.

Based on three interventions in maize (bed planting, maize sheller, and intercropping), use is more for maize shelling (Fig. 6). Since each intervention is represented by a different group of farmers, the magnitude of inter-cropping is more but the area covered by each group is much less than with maize shelling. This is because the landholding of groups representing intercropping is less than that of the farmers involved in maize shelling. Bed planting in maize by machine did not expand much because the size of holdings is small and the bed planters are not available in the marketplace.

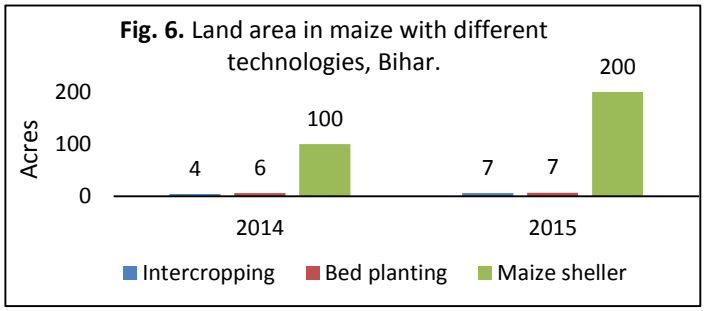


Fig. 6. Land area in maize with different technologies, Bihar.

3.2.3 *Comparative analysis of cost economics of applied improved technology versus predominant traditional practices*

The section below shows a comparative analysis of the different costs and benefits involved in the used new and improved technology vis-à-vis the previously used technology that was predominant for the concerned farmers or region (Table 3).

The farmers using mechanical transplanters for rice have a profit of INR 1,000/acre compared with those who are doing manual transplanting. A similar pattern can be seen among those who are using DSR compared with manual transplanting. Also, manual transplanting required INR 1,000/acre more than DSR for weeding. However, the fertilizer requirement is higher in DSR than in manual transplanting. Intercropping is cost-effective in land preparation, fertilizer use, and irrigation while weeding required INR 200/acre more in intercropping than in sole cropping and there was no difference in harvesting or threshing. In zero-tillage wheat, lower costs were incurred in land preparation and irrigation than with conventional methods while there was more requirement of fertilizer in zero tillage. There was no difference in weeding and harvesting or threshing between the two. Bed planting in maize is more cost-effective than with the conventional crop establishment method, weeding, and irrigation while there is no difference in fertilizer, herbicide, and harvesting or threshing. However, land preparation in bed planting is costlier than with the conventional method.

Table 3. Comparative analysis of cost economics of applied improved technology versus predominant traditional practices, Bihar.

New technology	Old technology	Land preparation	Seed rate	Crop establishment	Fertilizer	Weeding	Irrigation	Herbicide	Harvesting /threshing
MTR	Manual transplanting	↑	↑	↑	≈	≈	↑	≈	≈
DSR	Manual transplanting	↑	↑	↑	↓	↑	↑	≈	≈
Inter-cropping	Sole cropping	↑	≈	≈	↑	↓	↑	≈	≈
Zero-tillage wheat	Conventional-tillage wheat	↑	↓	↑	↓	≈	↑	≈	≈
Bed planting in maize	Conventional method	↓	≈	↑	≈	↑	↑	≈	≈

Note: ↑ means old technology costlier than new technology; ↓ means new technology costlier than old technology; ≈ means no difference between old and new technology.

By using the open drum thresher, one can thresh 5–6 quintals of grain in one hour while manual threshing allows 4–5 quintals in threshing in one day by one person. With the hand sheller, in one hour, 15–20 kg of grain can be shelled. With a double-cob maize sheller, in one hour, 150 kg of maize can be shelled. In one hour, 5–6 kg of grain can be shelled manually. Super Bags, once purchased (at INR 85), can be used for three years and grain quality is not compromised, whereas the conventional method of storage is prone to moisture, pests, and rodents and quality cannot be maintained.

3.2.4 *Effectiveness of and preference for different extension methods for capacity and knowledge building*

Women farmers are exposed to a number of training activities and field demonstrations. The basic idea behind asking about the modes of extension activities they have been exposed to was to understand the most preferred mode of communicating or disseminating awareness about the technologies. The women listed five different extension methods for knowledge and capacity building: classroom training, audio-video sessions, demonstrations, travel seminars, and factsheets. Also, a combination of all these modes is used for better understanding of the beneficiaries. Across all the technologies, the most preferred extension methods are demonstrations and travel seminars while the least preferred extension method is classroom training (Fig. 7).

Fig. 7. Extension methods, Bihar.

The women farmers were further asked to give suggestions on what they expect is the best way to communicate with them. The suggestions follow:

1. Season-to-season training should be conducted and follow-up should be done after the training.
2. Mass media (television, radio, newspaper) can be used.

3. Hoardings (billboards) or banners should be put up in villages with specific messages and the banners should be a combination of pictures and write-ups.
4. Voice messages through mobile phones.
5. Distributing CDs can be another mode of communication as almost all the households have a CD player (if not, they have one in their vicinity).

3.2.5 *The decision-making process at different stages of crop production*

The major decision-makings stages at different stages of crop production are as follows:

1. Establishment/inception stage input decisions (inputs such as seed, machinery, establishment technology).
2. Post-establishment stage management decisions (management in the crop stand such as nutrient, weed, pest, and water management).
3. Post-production stage output-income decisions (decisions to use the harvest or income from the harvest).

Table 4 shows the mode of decision making (individual or joint) and key authority of decision making at each stage of crop production for different technologies used by women. The group shared that, in the case of direct-seeded rice, most of the decisions were made collectively by the women. Here, women themselves played a major role in joint decision making. However, with continuous efforts and results of CSISA intervention activities, household members gradually developed faith and confidence in technology and willingly allowed individual females to make their decisions and manage farming.

For machine-transplanted rice (MTR), the group expressed that, through rigorous discussions in their SHGs about the pros and cons of the technology, they finally decided on the process of purchasing the machine. After this, they discussed the new practices learned with the households, sharing the prospect of benefits. Income was generally spent after joint decisions in the family on education, marriage, land purchase, health, agriculture, business, and purchase of household items. Women made decisions at both the individual and family level along with joint decisions at the SHG level.

Table 4. The decision-making matrix at different stages of crop production, Bihar.

Technology	**Input decision (inception/establishment stage)**				**Management decision (post-establishment stage)**				**Output/income use decision (post-production stage)**			
	Individual		Joint		Individual		Joint		Individual		Joint	
	Self	Spouse/other head of HH	Women's group	Members of HH	Self	Spouse/other head of HH	Women's group	Members of HH	Self	Spouse/other head of HH	Women's group	Members of HH
DSR			√	√			√	√				√
MTR	√			√	√		√	√	√			√
PH	√		√	√	√		√	√	√			√
ZT and ESW			√		√		√					√

In the case of ZT and early sowing of wheat, the women made the decision to use zero tillage on rent. Their decision for both technologies was not supported by household members in the beginning. They were highly challenged by their own households, but they still went ahead with support from their own SHGs.

1. Women first decided among themselves on the use of the machine and hiring the machine in their respective SHGs.

2. They proposed the same to their respective households and a confirmed decision was made, amidst opposition as well.
3. However, the women spent the additional income on education, further savings, and housing renovation, in mutual consensus and agreement with household members.

In postharvest-related decisions at every stage, women played a crucial role either individually or in consultation with their family members as well as women's collectives.

3.2.6 *Direct and indirect benefits for women farmers*

Over a period of one year, the women farmers were exposed to different technologies and training activities. The question arises whether such exposure has any direct or indirect benefits for the lives of the women farmers. Questions were asked of each group. However, the changes that these women farmers experienced over this period are more or less the same across technologies. The women now have an identity as women farmers. Initially, it was difficult to convince the household members of any new technology but, after the first trial (though in a small plot), the household members became supportive and convinced. This has helped the women to earn and contribute to the household economy. As a result, they can initiate seeking health treatment in case of illness as they believe that the money they earn has made them confident and independent.

3.2.7 *The challenges and factors for sustainability*

The women farmers were asked about the sustainability of the technologies introduced in the area. Will the technology dissemination continue even after the project ends? What will be their strategy to make the program sustainable? These questions were addressed for each technology.

The women farmers for *mechanical transplanting in rice (using mechanical transplanter) and community nursery* stated that there is a concern in the community regarding women operating a machine or becoming service providers. Also, people should be well trained to operate the machine. Strategies should be developed for establishing a community nursery as a business for women farmers. Women should be exposed to certain business management skills along with some credit support and linkages with institutions such as IARI and KVKs.

Some women farmers will continue using or applying the technology or information given to them. They will help other fellow farmers to improve their method of farming. Mostly, meetings can be held during *gram sabha*, panchayat meetings, and block meetings and participants will collectively carry forward the CSISA intervention even if the project ends.

Basically, the core requirements for these women farmers to make the program sustainable are that the machine or technology should be available at an affordable price and the women should be trained so that they can become efficient in using the technology as well as disseminating the knowledge and experience to other farmers in their villages.

3.3 Summary

Direct intervention with women farmers, with SHGs being the conduit, has shown positive results where the program encounters farmer-to-farmer expansion. The benefits being experienced by the women farmers as they shared during the FGD reveal that they are satisfied with the technologies. There is a positive trend as far as women farmers are concerned where they have started exploring the possibility of change and innovation in agricultural practices.

Chapter 4: Partners' Feedback

4.1 Background

The overall initiative for women farmers' interventions started in a partnership mode by involving various stakeholders ranging from NGOs to CBOs, SHGs, and CRPs. With close technical backstopping from CSISA technical experts, this intervention showed real success on the ground and established the fact that, with targeted efforts for awareness creation, capacity building, social mobilization, and infrastructural support, the technologies are not only accepted by women but are also disseminated further on a larger scale in their localities. With many positive effects already brought about by these interventions into the overall livelihood basket of women and their families, it is important to explore as well as enhance the future scope and potential of these technologies. The analysis in the previous section showed that the potential (projected) scalability for many technologies varied based on different external factors as well as the stage of intervention of those particular technologies. In case any technology is not well accepted by the farmers, it doesn't necessarily mean the technology is not useful; rather, it gives us scope for exploring the actions needed for increasing its visibility and acceptability through necessary interventions. It is important to connect the important links and stakeholders that are necessary for the scaling up and sustainability of different technologies with women and the community at large. Focus group discussions with representatives from different scaling agents (primarily CRPs and partner agencies, leaders of CBOs) were conducted to give an overview of actions needed in the future.

The discussion brings in two key aspects for sustainability and scalability. Firstly, the important stakeholders who will be keys to the success of outreach and acceptability. Secondly, all the important activities for the stakeholders.

The stakeholders: For the technology promotion with women, seven major stakeholder groups are found in the region to be keys to the success of outreach and acceptability: local women-centric NGOs, the Department of Agriculture (government agency for the district), village-level self-help groups, cluster-level women's federations, community resource persons, tractor owners or service providers, and farmers.

NGOs can bridge community institutions, government department or schemes and CSISA. They are the promoters for many CBOs in the region, engaged in different livelihood promotion and other community development activities. They are also the stakeholders that can directly handhold and support the CBOs for developing the systems and processes and monitor those during a technology promotion program.

The Department of Agriculture (the district-level unit) manages many important support schemes and programs for farmers. It also has a network of village-level extension officers and agents who can be trained and motivated by catalysts such as CSISA for promoting new and improved technologies and integrating potential schemes into such interventions (e.g., linking the "agro-service provider creation scheme" of the government with technologies involving mechanization aspects, linking seed treatment and seed quality training programs with varietal interventions, and linking subsidy provision schemes for machines for mechanized interventions).

The village-level self-help groups are the basic unit of any kind of community institution led by women. It is important to target these SHGs as a point of intervention for both collective interventions as well as individual interventions, because these groups are strong, powerful and socially homogeneous units that have influence in the villages. They possess social capital that can support a successful platform for the promotion of technology and knowledge.

Cluster-level federations or any other form of community-based organizations (CBOs) are basically higher-level federated bodies at the block or district level, comprising several SHGs. They are key strategic stakeholders for any kind of intervention because they are considered as a strong socio-political recognized body for addressing women's agenda. They have their own governing laws and control over all member SHGs and they also lobby at the government level.

Community resource persons (CRPs) are important connecting link between the farmers and technology providers (such as CSISA, government agencies, and NGOs). The CRPs are local resource persons from the communities and villages where farmers and interventions are targeted. They are the group of disseminators working for a considerable time with the village-level SHGs, covering one to three villages. By building the capacity of these CRPs and making them skilled in different technological know-how, they, along with their regular role as social mobilizer, can also play a role of grassroots-level ToTs.

Tractor owners-cum-machine service providers or independent tractor owners are also key stakeholders, and they need to be tapped in this network for promoting technologies such as DSR and maize line sowing. These technologies involve machines such as seed drills, needing to be run primarily by tractors. In the absence of mechanization in agriculture and lack of awareness, many tractor owners in the locality engage their tractors and other attached equipment for nonagricultural purposes, even during the peak agricultural season. Encouraging and motivating tractor owners for the additional purchase of machines such as seed drills or simply linking them to independent service providers owning only a seed drill will create a good business channel during the peak season of sowing. This needs to be done in parallel with farmer-level demand creation.

In addition to all the above key stakeholders, farmers are always important stakeholders for final acceptability, application, and adoption of any technology. They are the stakeholders who need to be made aware and sensitized about the available options, and the scope and advantages of those technology options. They are the stakeholders who have to be the center of strong social mobilization and visible change or impact.

4.2 Activities for necessary convergence and synergy

To involve all the above seven important stakeholders to channelize different resources and opportunities for bringing about sustainability, six initiatives and action points can play a key role. These initiatives can also connect the important stakeholders for necessary convergence and synergy.

Training: Targeted training for particular technology needs to be scheduled/delivered. For example, for technology such as DSR, the two most important aspects are proper weed control and machinery operation. Through direct (delivered by CSISA) training, the target audience could be primarily the Department of Agriculture (extension officers), CRPs, and service providers/tractor owners to a certain extent. For indirect training (delivered by ToTs trained by CSISA), the target audience would be farmers and service providers.

Demonstrations: Demonstrations are important ways of capacity building as they are impactful and more direct by providing more a visible practical application of a particular technology**.** Demonstrations could be organized for stakeholders such as government departments, CRPs, potential SHGs, and tractor owners who will be the key for further dissemination of this knowledge to farmers.

Field days: Field days can create mass awareness and exposure as well as understanding through communication and interaction. Farmers and SHGs could be the best target audience for such

interactive capacity-building initiatives, in the presence of other major catalysts such as government departments.

Seasonal learning exercises: Seasonal learning exercises by the researchers and field technicians with women farmers could be a useful medium for consolidating the learning, outcomes, and feedback for any particular season of interventions. These exercises can be organized after every major season by involving all important stakeholders that are primarily responsible for scaling up, basically the catalysts and higher-level scaling agents such as the DoA, NGOs, federations, and representation from CRPs for field experience sharing.

Large-scale extension: For sustainability, it is important to create visibility. For visibility, we need a better scale and for a scale we need a strong extension network. For this, the important stakeholders will be the DoA (government body) and federations (farmers' body) for which CSISA and promoting NGOs can play the role of catalyst or bridge.

4.3 Learnings from past years

The partners shared their learning and understanding developed in the past few years of their association in working with women farmers in CSISA. This association to work with women farmers has helped to mainstream women in agriculture. They shared the following insights and feedback:

1. The partners developed more in-depth understanding of the extent of women's involvement in agriculture.
2. They also recognize that it is important for poor women to adopt technology for higher production.
3. Though the women farmers contribute immensely in agriculture, their contribution is hardly recognized.
4. With the ongoing interventions with CSISA, women farmers have started obtaining their due recognition as farmers.
5. They are receiving subsidies now from a government department through the support of CSISA.

4.4 Summary

The partner organizations stressed that the need-based interventions by CSISA helped in creating benefits for women farmers' livelihood and social status. For technology promotion with women, seven major stakeholder groups are found in the region to be keys to the success of outreach and acceptability: local women-centric NGOs, the Department of Agriculture (government agency for the district), village-level self-help groups, cluster-level women's federations, community resource persons, service providers, and farmers. To involve all these seven important stakeholders in channelizing different resources and opportunities for bringing about sustainability, six initiatives and action points can play a key role: training, demonstrations, field days, seasonal learning exercises, large-scale extension, and awareness creation.

Chapter 5: Conclusions

Phase II of the Cereal Systems Initiative for South Asia had an integrated vision of gender inclusion in its targeted technology delivery program. In two of CSISA's priority intervention hubs, Odisha and Bihar, women-centric technology delivery programs were piloted with women farmers with a broad aim of mainstreaming and inclusion. Since the interventions in both states started in early 2014, the CSISA team decided to conduct a qualitative study in May 2015 to understand the views of women farmers regarding the technologies that they have been exposed to. The aim was to understand their experiences and the potential for future use of the technologies. A total of 12 focus group discussions were conducted across Odisha and Bihar, focusing on six technologies in each state. Also, focus group discussions were conducted with representatives from different scaling agents (primarily CRPs and partner agencies, leaders of CBOs) to give an overview of the actions needed in the future.

The women farmers are in a position to comment on the advantages and disadvantages of the technologies they have used. The set of technologies addressed in Odisha involved drought-tolerant rice variety Sahbhagi dhan, improved direct sowing in rice (DSR in lines + use of hand spreader), mechanical transplanting in rice (using mechanical transplanter), improved maize line sowing (scientific line sowing), improved postharvest technology (storage + threshing), and zero tillage in different postrice crops (line sowing under zero tillage for wheat, mustard, and chickpea) while in Bihar mechanical transplanting in rice (using mechanical transplanter) and community nursery, improved direct sowing in rice (DSR), improved postharvest technology (seed storage technology, open drum thresher, maize sheller), intercropping, bed planting in maize, zero-tillage wheat (ZTW), and early sowing of wheat were the focus. Group discussions were carried out with women farmers using the technology.

In general, the women farmers who have tried the technologies opined that the technologies are time-saving and cost-saving, they reduce drudgery, and they improve crop establishment and yield. However, the major challenges associated with the technologies are the women's lack of experience in handling them and challenges with operational details involved in using them. Apart from these, other major limitations were a lack of local availability of the machines and a lack of awareness and knowledge of how to procure such machines and equipment through proper channels. Despite the disadvantages, the trend of land area under different technologies showed an increase from 2014 to 2015. This indicates the willingness of women farmers to use the technologies. When comparing the costs and benefits of each technology, it can be seen that the technologies are more cost-effective than conventional methods. The women farmers are exposed to different extension methods for dissemination. Hence, they were asked about the most and least preferred ones. The most preferred extension method is demonstration and the least preferred is classroom training. Apart from these, the women were asked to recommend alternative ways of reaching out to people with relevant information on the technologies. These are as follows:

1. More written materials: detailed booklets and brochures on the complete package of practices, especially seed production (including details about dosage, time, and application of different inputs).
2. More exposure visits while operations are taking place.
3. Visualization of machines by video clippings or live demos about machine parts and operations.
4. Season-to-season training should be conducted and follow-up should be done after the training.
5. Mass media (television, radio, newspaper) can be used.
6. Hoardings (billboards) or banners should be put up in villages with specific messages and the banners should be a combination of pictures and write-ups.

7. Voice messages through mobile phones.
8. Distributing CDs can be another mode of communication as almost all households have a CD player (if not, they have one in their vicinity).

Every technology performance and its sustainability depend on the critical decisions made at different stages of crop production. Hence, decision making was divided into three major stages:

1. Establishment/inception stage input decisions (inputs such as seed, machinery, establishment technology).
2. Post-establishment stage management decisions (management in the crop stand such as nutrient, weed, pest, and water management).
3. Post-production stage output-income decisions (decisions to use the harvest or income from the harvest).

In Odisha, it was observed that in technology such as varietal introduction (Sahbhagi dhan), maize line sowing, postharvest, and zero tillage, women's role (either as an individual or as a collective) was more pronounced in decision making. The technologies that involved comparatively high-end technology and large-scale mechanization, such as DSR and MTR (involving the use of a seed drill, mechanical transplanter, mat nursery preparation), showed a lot of involvement of the spouse and other household members in decision making at all stages. In Bihar, women dominated decision making for almost every technology.

Over a period of one year, the women farmers have been exposed to different technologies and training activities. The question arises whether such exposure has any direct or indirect benefits for the lives of the women farmers. They now have an identity as women farmers.

The partner organizations stressed that the need-based interventions by CSISA benefited the women farmers' livelihood and social status. For technology promotion with women, seven major stakeholder groups are found in the region to be keys to the success of outreach and acceptability: local women-centric NGOs, the Department of Agriculture (government agency for the district), village-level self-help groups, cluster-level women's federations, community resource persons, service providers, and farmers. To involve all these seven important stakeholders in channelizing different resources and opportunities for bringing about sustainability, six initiatives and action points can play a key role: training, demonstrations, field days, seasonal learning exercises, large-scale extension, and awareness creation. The women-focused training programs and season-specific crop-related support to women farmers are helping in the development of women in agriculture. CSISA contributed in demand-led season-specific support, crop-specific training programs, and a women-focused approach at the field level. It was emphasized that the strength of the partnership lies in the autonomy, unique value system, group approach, and bottom-to-top work system.

The Cereal Systems Initiative for South Asia (CSISA) is a regional initiative to sustainably increase the productivity of cereal-based cropping systems, thus improving food security and farmers' livelihoods in Bangladesh, India, and Nepal. CSISA works with public and private partners to support the widespread adoption of resource-conserving and climate-resilient farming technologies and practices. The initiative is led by the International Maize and Wheat Improvement Center (CIMMYT), implemented jointly with the International Food Policy Research Institute (IFPRI) and the International Rice Research Institute (IRRI), and is funded by USAID and the Bill & Melinda Gates Foundation.

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