Socio-Technical Innovation Bundles for Enhancing Women's Resilience and Empowerment:

A Case Study of SSCOP's Interventions in Cooch Behar, West Bengal, India

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Socio-Technical Innovation Bundles for Enhancing Women's Resilience and Empowerment: A Case Study of SSCOP's Interventions in Cooch Behar, West Bengal, India

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Abbreviations and Acronyms

ACIAR	Australian Center for International Agriculture Research
CA	Conservation Agriculture
CASI	Conservation Agriculture-based Sustainable Intensification
CIMMYT	International Maize and Wheat Improvement Center
CSA	Climate Smart Agriculture
DFAT	Department of Foreign Affairs and Trade
DOA	Department of Agriculture
EGP	Eastern Gangetic Plains
FGD	Focus Group Discussion
FPC	Farmer Producer Company
FPO	Farmer Producer Organization
IRRI	International Rice Research Institute
KII	Key Informant Interview
LMIC	Low- and Middle-Income Countries
MCP	Multi-crop planters
MTR	Machine transplanting of rice
NGO	Non-Government Organization
RTP	Rice transplanter
SDIP	Sustainable Development Investment Portfolio
SHG	Self-Help Group
SRFSI	Sustainable and Resilient Farming Systems Intensification
SSCOP	Satmile Satish Club "O" Pathagar
STIB	Socio-Technical Innovation Bundle
UBKV	Uttar Banga Krishi Vishwavidyalaya
ZT	Zero Tillage

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1. Introduction

Climate change has major implications for food security and the livelihood of smallholder farmers, especially in low- and middle-income countries (LMICs). In South Asia, a higher proportion of women (71%) than men (47%) work in agri-food systems. Agri-food systems are a major source of employment for young women aged between 15 and 24 years (FAO 2023). The impact of climate change is not gender-neutral. Women are more vulnerable than men due to restrictive social norms and constrained access to resources, as evidence points out. Compared to their male counterparts, women have limited ability and safety nets to respond to, adapt to, or mitigate the impact of climate shocks.

Technological innovations can boost productivity and make agri-food systems climate smart. However, not everyone has equal access to these technologies due to entrenched sociocultural norms. Moreover, technology alone cannot solve complex problems. The adoption of technologies and their contribution to sustainable and equitable impacts depends on social, cultural, economic, and technical factors as well as the policy environment.

Therefore, there is a need to supplement and bundle technological innovations with other social and technical innovations. While many organizations bundle innovations, not many have done so systematically, nor have the impacts of the bundling as a social process and how it impacts farmers' livelihoods been documented.

The CGIAR Initiative on Gender Equality aims to address these unique challenges by documenting cases of organizations bundling innovations in an ad-hoc manner. The aim is to learn from these experiences as they set up their own learning labs across Africa and South Asia. The Socio-Technical Innovation Bundles (STIBs) approach does not take a compartmental approach. It is built on the needs, priorities, and preferences of the end-users, i.e., farmers, with women as the main drivers.

This study is a part of the CGIAR Gender Equality Initiative, being led by IRRI with funding support from the CGIAR GENDER Impact Platform. It was based on the Sustainable and Resilient Farming Systems Intensification (SRFSI) project. The SRFSI project was implemented in the Eastern Gangetic Plains (EGP) of India (Bihar and West Bengal); North-West Bangladesh; and the Eastern Terai of Nepal. SSCOP was a field-level implementing partner of this 5-year project (May 2014 – September 2021). It was a collaborative undertaking between more than 20 partners across Bangladesh, India, Nepal, and Australia dedicated to improving the livelihoods of about 300 million residents engaged in agricultural occupations in the EGP. The project was funded by the Department of Foreign Affairs and Trade (DFAT) via Australian Center for International Agriculture Research (ACIAR) as part of the Sustainable Development Investment Portfolio (SDIP) in South Asia. The project led by International Maize and Wheat Improvement Center (CIMMYT), aimed to reduce poverty in the EGP by improving the productivity, profitability, and sustainability of small farmers while safeguarding the environment.

The project's objective was to promote Conservation Agriculture-based Sustainable Intensification (CASI) systems among smallholder farmers in the EGP and build the evidence base of its potential benefits for smallholder farmers. The promotion of CASI was supported by on-farm participatory agronomic trials and demonstrations. Capacity development was also a key feature of this project, with over 60,000 people receiving training. This led to increased knowledge and investment in CASI-related initiatives, with knowledge and capacity developed through collaboration with academic and non-academic partners.

This case study was specifically carried out in the district of Cooch Behar in West Bengal, where SSCOP conducted primary research on women farmer stakeholders of the SRFSI project. The aim was to understand the bundling of social, technical, and technological innovations to enhance women's empowerment and resilience. It analyzes the demographics of women farmers in the SRFSI project, identifies gender-responsive interventions, outlines multi-stakeholder processes, and provides insights into their impact on women's empowerment and resilience. Additionally, it highlights the gaps in this bundling process that need to be addressed to create a scalable impact.

2. Methodology

2.1 Study Area

This study was conducted in the district of Cooch Behar in the state of West Bengal in India. Within the district, 8 blocks were selected for the study: Cooch Behar I, Cooch Behar II, Dinhata I, Dinhata II, Mathabhanga II, Mekhliganj, Haldibari, and Tufanganj I. A total of 17 villages were identified within these blocks for data collection.

2.2 Research Design

The SSCOP team collected data through a field survey carried out over four weeks. Fifty women who were part of the SRFSI project were interviewed through semi-structured questionnaires. Further, 5 Focus Group Discussions (FGDs) were conducted with a few of them in women-only groups to triangulate the information collected. Interviews were also conducted with the male partners in the households and 2 FGDs were organized with a few of them.

Key Informant Interview (KIIs) were carried out with Self-Help Group (SHG) leaders, Farmer Producer Organization (FPO) Board members, agricultural officials in the blocks, representatives of farm equipment/custom hiring centers, agriculture input sellers, and Village Panchayat (village council) leaders to obtain information about the SRFSI project and its impact. Professors and faculty members of Uttar Banga Krishi Vishwavidyalaya (UBKV) who worked on the SRFSI project were also interviewed. Detailed field notes were taken on the farm practices of the women farmers.

The interviews were recorded, and photographs were taken for visual documentation, following ethical approval from the SSCOP ethics committee. Secondary data on the SRFSI project was obtained from different sources, such as the agriculture census, agriculture offices, published and unpublished reports, and journal articles. The tools used for the research are presented in Table 1.

Table 1. Tools used for data collection.

Tools	Participants
In-depth interview	Women and men farmers
Focus Group Discussions	Women and men farmers
Key Informant Interviews	SHG leaders, FPO board members, Gram Panchayat leaders, other government officials, agricultural officials, representatives of equipment/custom hiring centers, agri-input dealers, faculty of UBKV
Field notes	

Five researchers (two with experience in conducting research surveys) were chosen to lead the data collection team that trained field surveyors/enumerators in collecting data accurately. The survey questionnaire was translated into the local language to avoid any misinterpretation of questions and to minimize variation across enumerators.

Gender disaggregated data was collected to ensure that both men's and women's responses related to the household, farming activities, non-farm activities, access to inputs, resources (land, labor, capital), information sources, assets, technology access, coping strategies, decision-making ability, barriers/ challenges encountered, and goals and priorities were accurately documented.

3. Description of the Case: The SRFSI Project

The SRFSI Project aimed to address the vulnerabilities of more than 30,000 smallholder farmers spread across three countries in the EGP through the adoption of more productive, profitable, and lower-risk farming systems and climate-smart agriculture. SRFSI aimed to trial innovative farming technologies such as conservation agriculture (CA), Climate Smart Agriculture, and water-efficient production methods and connect these with policy and institutional mechanisms to improve the lives of men and women in the EGP.

3.1 Reasons for Selecting the SRFSI Project

The SRFSI project in the district of Cooch Behar was selected for this case study due to its gender-inclusive approach and the manner in which it bundled various innovations. The project recognized the necessity of ensuring gender equity in agricultural development efforts, particularly given the prevalence of small and fragmented landholdings (usually one bigha or less) and the significant outmigration of men from the region in recent years. This situation has amplified the importance of women's roles in agriculture. Although more women are spending time in the fields, this has not necessarily translated into a proportional increase in their agency concerning farm management or financial decision-making.

The SRFSI project therefore felt the need to bundle CSA technologies that were being introduced to the women with gender-responsive training. The emphasis was also on understanding women's needs and preferences.

Possible trade-offs of introducing CSA interventions were also taken into account. For example, while the availability of machinery certainly reduces the drudgery and time women spend on transplanting and weeding, such innovations could also reduce the daily wage offered to them. Hence, the introduction of mechanization in such tasks needs to be complemented by other employment opportunities for women farmers. The project endeavored to maintain such a balance by integrating the needs of both men and women farmers when evaluating the potential benefits of technologies.

3.2 Strategies Used for Gender Inclusion

A large number of women were trained through SHG collectives as a part of the SRFSI project and multistakeholder partnerships were forged. The Department of Agriculture (DoA) and Uttar Banga Krishi Viswavidyalaya (UBKV) provided training on Conservation Agriculture technologies to women. Word-of-mouth communication and social media stories helped mobilize a large number of women.

The following steps were taken to ensure a gender-inclusive approach:

- Identifying women farmers/SHGs already involved in agriculture and allied activities
- Building convergence with DoA and UBKV
- Face-to-face meetings and briefings on CA technology and its benefits at their locations
- Organizing exposure visits to the SSCOP facility and carrying out demonstrations
- Residential training on CA technologies, protocols, and crop diversification
- Carrying out field trials on CSA technologies on farmer's land and following up.

4. Results and Discussion

This chapter highlights the key findings of this case study in terms of the Socio-Technical Innovation Bundles (STIBs) that were implemented in the SRFSI project.

4.1 Technical and Technological Innovations

The benefits of conservation agriculture-based sustainable intensification (CASI) such as cost savings, yield gains, irrigation water efficiency, increased profits, increased biodiversity, improved soil moisture, and so on have been well documented (Baudron et al., 2015 Wall, 2007), including in the EGP (Chaudhury et al. 2022; ACIAR 2021). This case study documented the following technical and technological innovations implemented during the SRFSI project as part of CASI practices in the project area.

Mechanical Transplanting of Rice (MTR)

SSCOP introduced mechanical transplanting of rice which is economically feasible for higher productivity and reduced farming costs and a viable alternative to traditional methods that require more workforce. On an average, transplanting operations require one-fourth of the labor compared to rice production under the traditional system.

Zero Tillage and Multi-Crop Planters

Farmers were introduced to zero tillage (ZT) practices and multi-crop planters (MCPs). Zero tillage is an agronomic technique of growing crops without disturbing the soil through tillage. This practice is also called direct drilling. It helps farmers save on cost, labor, and energy while growing crops; up to 15% yield increase and 30% cost reduction have been reported compared to conventional tillage. MCPs are used for ZT or other tillage and fertigation operations, mainly for wheat, and sometimes in maize, jute, and lentil.

Technical Training

Women and men farmers received training in mass production of rice seedlings using mat technology, business operations, and the implications of using ZT, MTR, and MCP. The training included weed management, protocols for fertilizer application, and irrigation water management under ZT conditions.

4.2. Social Innovations

Acknowledging that these technological and technical innovations would have little impact on farmers without creating a more holistic enabling ecosystem, the project introduced some social innovations, described below.

Self-Help Groups (SHGs)

Economic empowerment among women can be institutionalized through SHGs, whose members usually have a common social background, heritage, caste, or traditional occupation and come together for a common cause to raise and manage resources.

The SRFSI project in Cooch Behar tried revitalizing existing SHGs by organizing training and capacity building programs. The collectivization process increased their self-esteem and decision-making power in the household and community. All the women respondents covered in the study were part of locally constituted SHGs.

Farmer Producer Organizations (FPOs)

FPOs played a pivotal role in the project by helping scale out CA (CSA) technology and protocols among smallholder and women farmers. With NABARD's support, SSCOP, which was an extension partner in the project, formed 51 FPOs in Cooch Behar district, covering 10 blocks.

Members of these FPOs were trained in modern farm practices and CSA technology, including zero tillage and rice transplanting. With government support, some FPOs also became Custom Hiring Centers, providing low-cost farm machinery. A number of FPOs facilitated the SSCOP team in finding out the right women stakeholders for this study.

Awareness of Land Rights

Women's empowerment is influenced by land ownership. However, customary practices and gender-biased inheritance laws affect their land rights. In Cooch Behar, only a small percentage of women, usually in women-headed households with single women (widowed/divorced) running the family, own land in their name.

Gender-selective outmigration has led to a labor shortage on farms and in households in Cooch Behar. As illustrated in this study, this situation has increased women's involvement in fieldwork. Nearly 50% of the respondents interviewed for the project reported that their husbands and other male members work in other cities, leaving women to take on additional work in agriculture alongside their usual household chores.

Recently, under the SRFSI project, the Promila Bahini Farmer Producer Company, primarily composed of women farmers, facilitated the transition of 20 women from tribal habitats into becoming landowners of their own land.

Supporting Women Entrepreneurship

SRFSI also promoted individual women farmers interested in taking their seedling business further. SSCOP introduced a rental model to raise mat paddy seedlings to serve as a timely and profitable alternative to traditional methods. Most of the mat paddy businesses are carried on by women, contributing to their economic freedom and helping them bring the household out of poverty. Since women have traditionally played a major role in handling rice seedlings, this creates an opportunity for them to produce more seedlings to fulfill increased demand due to the introduction of mechanical transplanting of rice by the SRFSI project.

4.3 Case Study Research Findings

This section discusses how these innovations worked for the women farmers.

4.3.1 Demographic and Other Details of the Respondents

Of the 50 respondents, 28 (56%) belonged to Scheduled Castes (SC), 14 (28%) belonged to Other Backward Castes (OBC), and 8 respondents (16%) belonged to the general category (Figure 1).

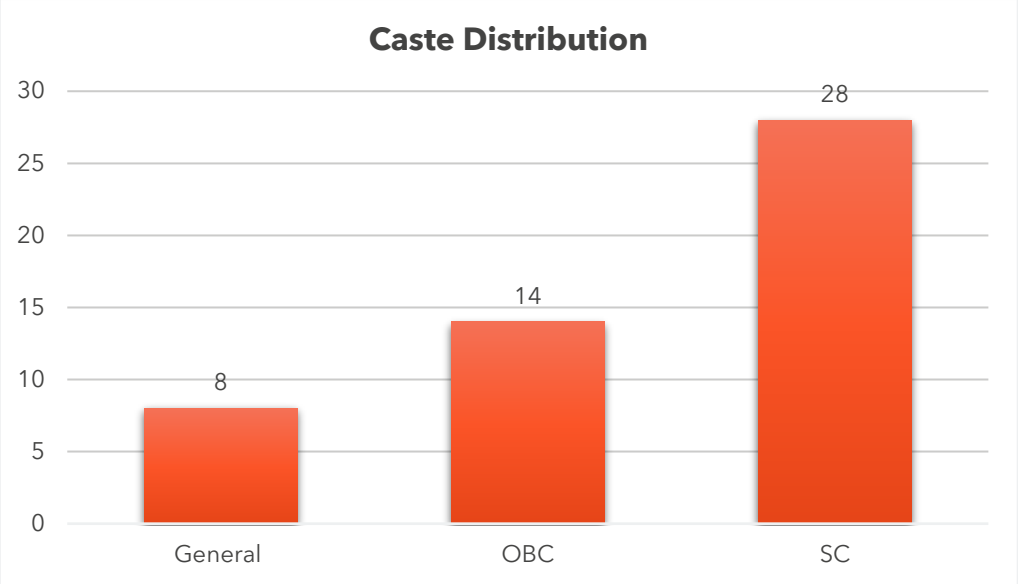

Figure 1. Caste distribution of the respondents.

It was observed that among the male members of the families included in the study, 31 (62%) were employed in the non-agricultural sector. Of these, almost 70% migrated for work to other cities. On the other hand, 17 of them were engaged in agriculture while the remaining two households were headed by single women.

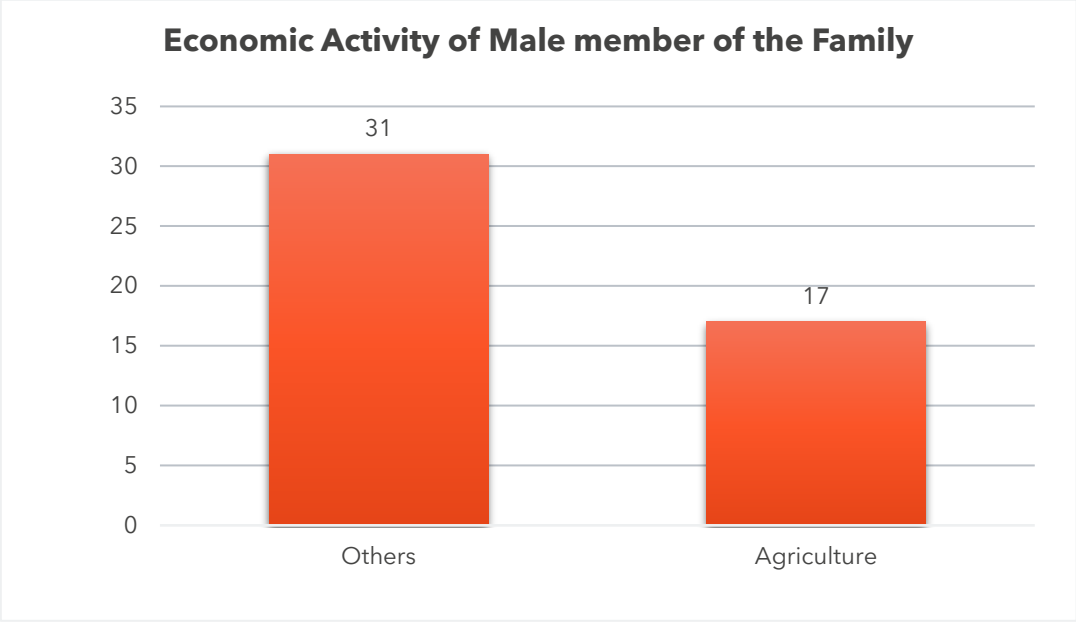

Figure 2. Economic activity of the male respondents.

4.3.2 Project Impact on Technology Adoption

All the 50 women farmers selected for this case study were part of the SRFSI project. Of these, 29 (60%) were using one or more technology and innovation from the beginning (Figure 3). Two respondents used ZT and Rice transplanter (RT) once but discontinued it for some reason, and 19 women farmers never used it due to financial constraints and a reluctance to embrace new technology.

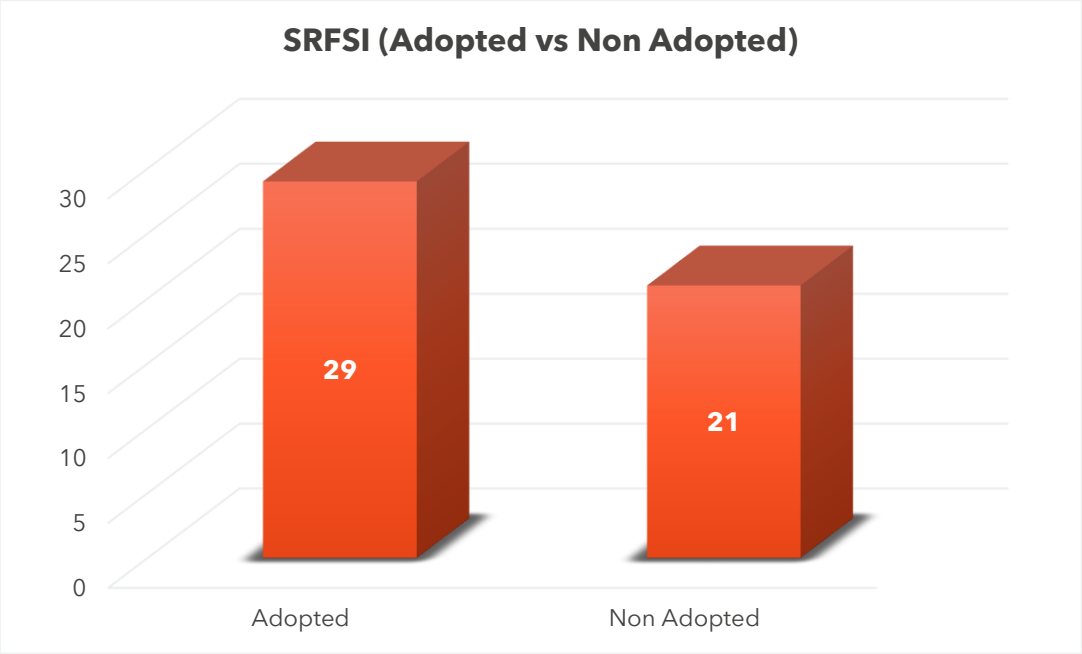

Figure 3. Adoption and non-adoption of technologies and innovations by respondents.

Of the 50 women respondents who gained knowledge and skills from the project, 43 were in the 25-40 years, while the remaining respondents belonged to the age group of 40-55 years age group, as highlighted below.

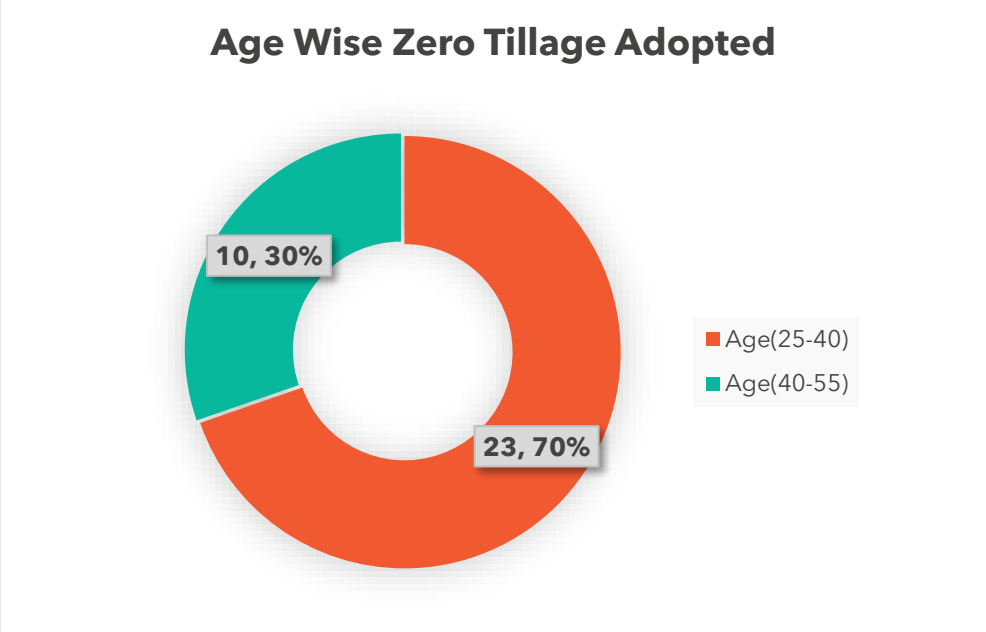

Figure 4. Age profile of respondents who adopted zero tillage.

Zero tillage was the most widely adopted technology for maize, mustard, and jute. Its use helped farmers save time between two crops, enabling them to grow an additional crop in the same year.

Further analysis suggests that age played a significant role in the adoption of zero tillage practices. Among the 33 zero tillage users, approximately 70% fall within the age group of 25-40, while the remaining 30% are from the age group of 41-55. This suggests that younger women farmers are more receptive to new technologies.

4.3.3 Impact on Women Farmers' Decision-Making Ability

The SRFSI project has had a positive impact on women in agriculture by providing them valuable knowledge and skills that not only boosted their confidence but also empowered them to make better decisions.

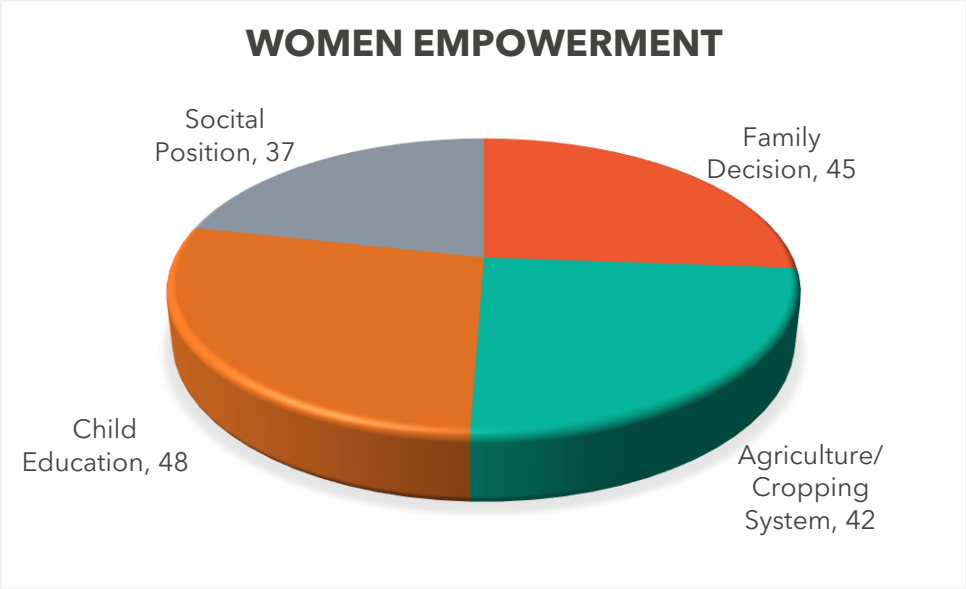

Figure 5. Project impact on women's decision-making ability.

Figure 5 indicates that 48 out of the 50 women respondents felt that they independently make decisions on their children's education. Further, 45 of them stated that they were given importance during joint family decisions. Thirty-seven of them have been identified as progressive women farmers and role models in the community. Additionally, 42 women are now having increased decision-making power around cropping systems and agricultural practices.

Coming to group membership, it was found that collectivization through SHGs and FPCs have helped women in the study area gain access to resources like training, credit, and other financial services. Data collected shows that all the respondents in the study area have benefited through these SHGs, either by way of easy access to loans or revolving funds. Additionally, 46% of the respondents admitted that SHGs had been instrumental in facilitating their journey towards advanced agricultural practices and technology adoption.

It was observed that 21 women farmers (42%) were members of an FPC or farmers' club while 29 were not direct members; nevertheless, they received benefits as they are part of an SHG.

Notably, more than 60% of the women farmers were confident about the advantages of conservation agriculture, such as lower cultivation cost and water requirement, improved yields, enhanced product quality, increased market price, and improved net farm income.

5. Reflections

The SRFSI project successfully demonstrated CASI's potential to enhance net income and the standard of living with less investment. It also showed the way towards solving the labor crisis, especially during peak seasons, and restoring soil health. However, the study highlights that there were still a few challenges in convincing farmers to adopt CASI. This is because CA requires expensive machinery, which not all farmers can continue renting from FPCs. Hence, there is a sustainability issue. Further, farmers face challenges with zero tillage as it sometimes increases weed infestation, reduces yield, and leads to soil compactness.

Capacity-building and awareness campaigns can help farmers overcome their apprehensions about using new technology. Experienced operators can calibrate machines based on soil conditions and seed size.

The state government is supporting farm mechanization, including machinery for CASI, through financial schemes and farmer groups. However, progress has been slow, and proper monitoring and evaluation is needed. Adoption hinges on timely availability of machinery, implements, fertilizers, herbicides, insecticides, and pesticides. Local input dealers must be involved in such initiatives and provide timely guidance.

The study suggests that the shift to CASI allowed women to save time for livelihood activities, reduce workload, and enjoy leisure time. Financial independence enabled them to address family needs independently, contributing to economic empowerment and greater respect within the community.

6. Conclusion

This qualitative study provides an understanding of the implementation of STIBs, highlighting the success and failure of the initiative and suggesting potential for wider regional up-scaling.

The active participation of women in community groups highlights the critical role of empowerment through social networks in enabling inclusive technology in agriculture. Women's social networks and groupings are crucial to encourage technology adoption. Women who used technology and innovations and were members of community groups (SHGs/FPCs) were more likely to feel confident speaking up in public and engaging with policymakers about infrastructure such as roads, technologies, and other issues. In addition, these women were generally more confident about being change agents in the community.

The study suggests that the convergence of a policy approach focusing on increased access of technology for women and capacity development within collective institutions can enhance women's empowerment in the study region. Participation in community institutions and other social support can also contribute to empowerment, suggesting that coordination across these actions is crucial.

The study showed that interventions were mostly implemented in silos rather than as bundled solutions, which either deterred individual women farmers from adopting the technology or caused them to discontinue its use over time. Additionally, the lack of financial resources and small land parcels also contributed to the non-adoption of technology.

This study suggests that access to women-friendly technologies and expanded SHG/FPC activities, along with increased policy convergence at district and state levels, could significantly boost women's empowerment in rural Cooch Behar, West Bengal.

7. Ethics Statement

The questionnaire and other tools used for the survey were reviewed by Tapan Chowdhury, Team Leader of the project and approved by the Internal Review Ethics Committee of SSCOP.

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Annexures

Annexure 1. Details of stakeholders interviewed.

Sl. No	Farmer Name	Block	Location
1	Ratna Modak	Cooch Behar I	Cooch Behar I
2	Abeya Bibi	Cooch Behar I I	Hawargari Ghugumari
3	Mamuni Bibi	Cooch Behar I I	Hawargari Ghugumari
4	Lalita Barman	Cooch Behar I I	West Ghugumari
5	Sunity Roy	Cooch Behar I I	West Ghugumari
6	Sonamuni Karjee	Cooch Behar I I	Balagaram, Chandamari
7	Munni Bibi	Cooch Behar I I	Hawargari Ghugumari
8	Hosnera Bibi	Cooch Behar I I	Hawargari Ghugumari
9	Jahanara Bibi	Cooch Behar I I	West Ghugumari
10	Bina Barman	Dinhata II	Dinhata
11	Adori Bibi	Dinhata II	Dinhata
12	Dipti Roy Barman	Dinhata II	Dinhata
13	Doly Sen	Haldibari	Haldibari
14	Minu Roy	Haldibari	Hudumdanga
15	Amrita Das	Haldibari	Daspara
16	Jyotshna Das	Dinhata I	Unmesh FPC, Bhetaguri
17	Parboti Barman	Dinhata I	Unmesh FPC, Bhetaguri
18	Bina Barman	Dinhata I	Unmesh FPC, Bhetaguri

19	Dharitri Barman	Dinhata I	Unmesh FPC, Bhetaguri
20	Sabitri Roy	Mekhliganj	Jamaldha Smart FPC, Jamaldha
21	Lalita Barman	Mekhliganj	Jamaldha Smart FPC, Jamaldha
22	Minoti Roy Dakuya	Mekhliganj	Jamaldha Smart FPC, Jamaldha
23	Namita Roy	Mekhliganj	Jamaldha Smart FPC, Jamaldha
24	Anindita Barman	Mekhliganj	168 Dhulia Baldiahati
25	Kunti Roy	Mekhliganj	Ratanpur Jamaldha
26	Farida Begum	Mekhliganj	Mekhliganj
27	Noor Jahan Bibi	Mekhliganj	Mekhliganj
28	Golapi Barman	Mekhliganj	Mekhliganj
29	Niyati Roy	Mekhliganj	Mekhliganj
30	Mamata Barman	Mathabangha II	Unishbisha
31	Sikha Bhakat Mitra	Mathabangha II	Unishbisha
32	Rumpa Barman Sarkar	Mathabangha II	Unishbisha
33	Malati Roy	Cooch Behar II	Pundibari Krishi Ratna
34	Pratima Sarkar Das	Cooch Behar II	Pundibari Krishi Ratna
35	Sukla Modak	Dinhata I	Dinhata I, Batasurkuthi
36	Rinku Modak	Dinhata I	Dinhata I, Batasurkuthi
37	Babli Modak	Dinhata I	Dinhata I, Batasurkuthi
38	Namita Modak	Dinhata I	Dinhata I, Batasurkuthi

39	Bandana Modak	Dinhata I	Dinhata I, Batasurkuthi
40	Sachi Rani Deb Barman	Dinhata I	Dinhata I, Barasakdal
41	Chirata Das	Tufanganj I	Andaran Fulbari
42	Pramila Das	Tufanganj I	Andaran Fulbari
43	Roshna Bibi	Dinhata I	Dinhata I
44	Ashed Bibi	Dinhata I	Dinhata I
45	Mojida Bibi	Dinhata I	Dinhata I
46	Fatema Bibi	Dinhata I	Dinhata I
47	Mamuni Bibi	Dinhata I	Dinhata I
48	Basanti Roy	Cooch Behar I	Cooch Behar I
49	Swagata Bhowmik	Cooch Behar I	Cooch Behar I
50	Manora Bibi	Dinhata I	Dinhata I

Annexure 2. Service providers and FPOs interviewed and supported.

Sl. No	Block	Service Provider
1	Cooch Behar I	Jhinuk agri FPC
2	Cooch Behar I	Ajgar Ali, individual service provider
3	Cooch Behar I	SSCOP
4	Dinhata II	Dhisari FPC
5	Dinhata II	Dhisari FPC
6	Dinhata II	Dhisari FPC
7	Haldibari	Bara Haldibari FPC
8	Dinhata I	Unmesh FPC
9	Mekhliganj	Jamaldah Smart FPC
10	Mekhliganj	Haribasar FPC
11	Mekhliganj	Rabindra FPC
12	Mathabangha II	Unish Bisha FPC
13	Cooch Behar II	Krishi Ratna FPC
14	Dinhata I	Sabuj Mitra Women Agricultural Club
15	Tufanganj I	UAFTRSWO Seed FPC
16	Dinhata I	Pramila Bahini FPC

Annexure 3. Location of the FGDs.

Venue	Block
Patchara	Cooch Behar I
Hawargari	Cooch Behar I
Barasakdal	Dinhata II
Pundibari	Cooch Behar I
Andaran Fulbari	Tufanganj I
Gitaldaha	Dinhata I

Annexure 4. Images from the field.


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Annexure 5. Stories of Women Farmers from the Project

Ratna Modak

Ratna Modak, a 46-year-old widow and mother of one, has emerged as an important figure in the farming community of her village. After her husband's demise, Ratna took to farming as a means of livelihood, despite criticism. Through her involvement in SHG and Farmer Interest Groups (FIG), she not only overcame social challenges but also adopted innovative agricultural practices to enhance her farm's productivity.

Ratna's familiarity with agriculture has its roots in her youth, working in her father's fields. After her marriage, she continued farming, facing initial societal backlash. Undeterred, she prioritized the sustenance of her family, leading to her active involvement in the village SHG.

Ratna transitioned from traditional paddy harvesting to a rice transplanter machine, reducing the cost of cultivation from Rs. 3000 to Rs. 1700-1800 per bigha. The adoption of this technology also saved time and reduced drudgery. She also uses a battery-charged sprayer which has increased crop yield and reduced post-harvest losses.

Although she is aware of technologies like shade net, Ratna has faced challenges in using it due to lack of availability and limited knowledge on its usage. Ratna and members of her SHG have ventured into incense stick making but lack of market linkages led to losses.

The adoption and use of modern farming practices has significantly increased Ratna's income, ensuring financial stability. It has also minimized physical strain, allowing her more time for the household. Ratna's increased earnings from farming have enabled her to invest in a battery-operated rickshaw, contributing to further income generation.

Abeya Bibi

Abeya Bibi, a 43-year-old widow from Howargadi village in Cooch Behar, has seen how adopting sustainable and resilient farming practices can empower women farmers like herself.

After her marriage, she and her husband leased farmland. Her husband supported her endeavors despite criticism. Following his demise, she became the primary breadwinner of her family consisting of a son, daughter, and daughter-in-law.

That is when Abeya turned to farming, leasing 2.5 bighas of land to grow paddy, and supplemented by maize and vegetables. She has also been involved in poultry farming for the past 20 years. Abeya's familiarity with agriculture stems from the time her family-owned agricultural land.

Abeya joined Mukta SHG in 2016, benefiting from various government schemes, training, and loan facilities. With low-interest loans from the SHG, she expanded her crop season to two per year. The SFRSI project, led by "Satmile Satish Club O Pathagar," introduced Abeya to paddy cultivation protocols, seed treatment, and preparing mat paddy seedling. The adoption of rice transplanting technology increased paddy production from 4.8 to 8.8 quintals per bigha. She also uses weeding machines and combined harvesters for efficient farming. However, challenges such as land preparation for transplanting rice in low-lying areas persist, posing a hurdle to optimal technology utilization.

The SHG's support and Abeya's newfound confidence showcase the transformative power of sustainable farming practices.

Annexure 6. Questionnaire Administered to Women Farmers

1. Personal details

I. Name of respondent:

II. Caste:

III. Family size:

IV. Education:

2. Agricultural land

I. Total land holding:

II. Agricultural land:

III. Soil quality: fertile/semi-fertile/ non-fertile

IV. Did you test soil? Yes/No (If not, mention the reason).

V. Do you have suitable irrigation facility? If yes, then mention the mode of irrigation.

3. Livestock ownership

I. Type of livestock:

II. Number of livestock:

4. Details of cropping system followed in the last 3-5 years

Season/year	Kharif	Rabi	Pre-Kharif

5. Details of crop grown, production, uses, sale and earnings.

Season	Crop	Production /bigha	Cost of production /bigha	Quantity of crop used for consumption	Quantity of crop sold	Selling price/kg
Kharif						
Rabi						
Pre-kharif						

6. Adoption of innovative technologies

1. How long have you been farming?
2. What technologies have you adopted: (1. Zero tillage in maize/wheat/mustard/jute/lentil; 2. Happy seeder in maize/wheat/mustard/jute; 3. Rice transplanter)
3. When did you start using the technology/innovation?
4. Where did you learn about the technology/innovation?
5. What traditional practice did it replace?
6. Has the area under crop(s) increased/decreased/stagnated since you first adopted it? What could be the reason for it?
7. What are the reasons/key factors that inspired you to adopt the technology/innovation?
8. Is it necessary to learn new skills (like cultivation practices, sources of inputs, markets, post-harvest processing, etc.) or attend trainings to use these technologies/innovations?
9. How did you learn the skills? Were any external agencies [government, private, or NGOs/FPOs] involved?
10. What new knowledge/information/skills did you learn through this process?
11. Have you been on exposure visits/field demonstrations of this new technology/ innovation? If so, where?
12. What are the critical inputs required to use the technology/innovation? When did they become available to you?
13. What are the benefits of these new technologies compared to the previous ones used?
14. What were the important impacts (positive/negative) of using these technologies in your family?
15. How has technology/innovation changed your life? (In terms of social security, social status, standard of living, child education, decision-making power, share in income from agriculture, leadership quality building)
16. Will you continue to use the technologies/innovation in the future?? Give reasons for this decision.
17. What challenges or constraints did you encounter while using these technologies or in increasing the area under these technologies?
18. Have you encountered any safety concerns related to the machinery used?
19. What could the possible solutions be to these?
20. Did a neighbor or other women inspire you to use these technologies? Did other women adopt it from you? Why were they interested in it?
21. When did you become a part of an SHG? How did you hear about it?
22. How did you know about the FPC and what was your involvement in it?

23. Did you attend any training/skill developing workshops conducted by the FPC? If yes, what were they on?
24. What are the biggest challenges you face as a woman farmer in the agri-allied sector?
25. Have you used any innovation/technology in the allied sector? If yes, what were the changes after adopting it?
26. Did you receive any training for the allied sector? What was it on?
27. How do you see the role of women in the allied sector evolving?
28. Is there any other experience you would like to share as a woman farmer in the allied sector?

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INITIATIVE ON
Gender Equality

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