76338

Enhancing Agricultural Livelihoods through Community Institutions in Bihar, India

Debaraj Behera, Arvind Kumar Chaudhary,Vinay Kumar Vutukuru, Abhishek Gupta, Sitaramachandra Machiraju & Parmesh Shah

INSIDE

RURAL DEVELOPMENT & LIVELIHOODS
SOUTH ASIA REGION
Participation, Empowerment, Poverty Reduction

Bihar's agriculture sector employs more than eighty percent of the labor force and more than four-fifths of these farmers are small and marginal. They have one of the lowest agricultural productivity in India that has not increased due to several constraints. *Jeevika,* a project jointly supported by the World Bank and the Government of Bihar, has piloted, customized and eventually scaled-up several innovative livelihood interventions to improve the well-being of poor households in Bihar. A number of innovative aspects account for the success of these livelihoods programs in the state. Foremost among these is the fact that it was implemented through community-driven and community-owned institutions. The institutional platform that was facilitated by the project has enabled the creation of a single-window system at the doorstep of small and marginal farmers. Farmers can now demand better services from the public sector, access credit from commercial banks, and experiment and customize various technologies. This note will focus on System of Crop Intesification' (SCI), which has evolved from a well-known farming methodology called System of Rice Intensification. It has been customized and adopted for wheat, green gram, oil seeds and vegetables in Bihar. The participant farmers have witnessed 86% increase in rice productivity and 72% increase in wheat productivity. The profitability of rice cultivation has increased 2.5 times and has almost doubled for oil-seeds. Since 2008, implementation of SCI has contributed to an additional income increase of around US$10.7 million.

103,028 farmers practiced SCI for rice in 2012

86% yield increase in rice

72% yield increase in Wheat

250% increase in profits of rice cultivation

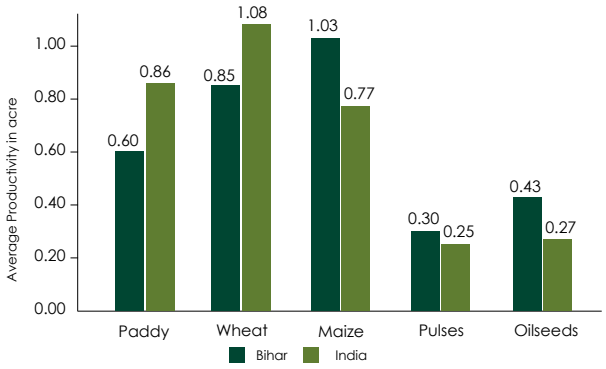
86% increase in profits of wheat cultivation

US$5.2 million additional income generated in 2012

Context

Bihar is the third most populous state in India with over 100 million inhabitants. The state's economy is dominated by agriculture: it constitutes 19.2 percent of state's GDP[1] and employs nearly 75[1] percent of the labor force. 92.8 percent of the farmers in Bihar are small and marginal(small holders), which is much higher than the all India average of 83.5 percent[2]. In addition, only 29% of households own any land and the average landholding size is approximately 1 acres[3]. Furthermore, Bihar's agriculture productivity is one of the lowest in India. For instance, the average productivity of paddy and wheat, the two major crops of the state, is much lower than the national average (See Figure 1). The productivity of smallholders is further lower than the state average. Agriculture productivity in Bihar also affects food security as 88 percent of Bihar's poor depend on farming for subsistence.

Figure 1: Agricultural productivity in Bihar compared with other states[3]



Low agriculture productivity is a multi-dimensional problem and following factors can partly explain some of its causes:

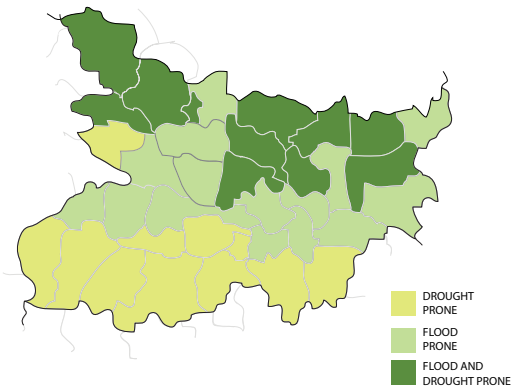
First, **poor households don't have sufficient 'voice' and lack collective bargaining power** to improve their access to credit, better inputs and public services. The supply side institutions such as commercial banks, public extension services and urban markets, **are geographically dispersed**, which further restricts their access. Bihar has one of lowest membership ratios of farmer organization in India; only 9.1% of farmers are members of any farmer organization, which is much lower than the all India average of 37%.

Second, **small holders can't invest in higher quality inputs due to poor access to credit**. Bihar has lagged behind in increasing access to finance in rural areas. The Credit-Deposit (CD) ratio[5] of Bihar is just 34 percent, far below the national average of 75 percent, and much lower than the CD ratio of other states. The baseline study of '*Jeevika*' estimated that less than 10% of farmers in the state have borrowed money from institutional sources. Most of these households borrow money from informal sources at a very high interest rate or sell their land to raise money.

Unavailability of good quality seeds is the third biggest constraint faced by the small and marginal farmers in Bihar. Even in nearby urban district centers, it is difficult to find good quality seeds. The prevalence of fake seeds further exacerbates the problem. These problems have resulted in only 33 percent of smallholders using improved seeds compared to an all India average of 43.9 percent[6]. Most of the poor and marginal farmers use grains from the previous year to sow their crop. Seed replacement rate in Bihar is only about 30 percent in paddy and wheat, 17 percent in pulses, 50 percent in oilseeds[1]. In addition, most of the existing varieties used are over 15-20 years old.

Fourth, **the extension facilities are not customized for smallholders**. This has resulted in only 0.4 percent of farmers in Bihar accessing extension services, which is much lower than the all India average at 19 percent.

Figure 2: District-wise flood and drought in Bihar



1 (Government of Bihar - Finance Department 2007-08)(Government of Bihar - Finance Department 2010-2011), (Government of Bihar - Finance Department 2011-2012), (Government of Bihar - Finance Department 2009-2010)

2 (National Commision for Enterprises in the Unorganized Sector December 2009)

3 There is no estimate of average size of land under cultivation as each farm could possibly be leased out to multiple farmers.

4 Productivity figures for 2003. Source: Department of Agriculture, Government of Bihar.

5 CD ratio is an indicator of outreach of institutional credit in states

6 (National Commision for Enterprises in the Unorganized Sector December 2009)

Frequent floods and droughts in Bihar have worsened the problem. There are 28 districts in the state, mostly in north Bihar, which are affected by floods almost every year while many districts in south Bihar are drought prone. See Figure 2 for more details.

Currently, programs that have not customized and adopted technologies for smallholders, have met with limited success. Other programs that are administered in a top-down manner have had a very slow adoption rate and limited long-term impact. These interventions have neither addressed the root of the problem nor the intergenerational nature of landlessness and poverty.

Implementation Strategy: Key Innovations

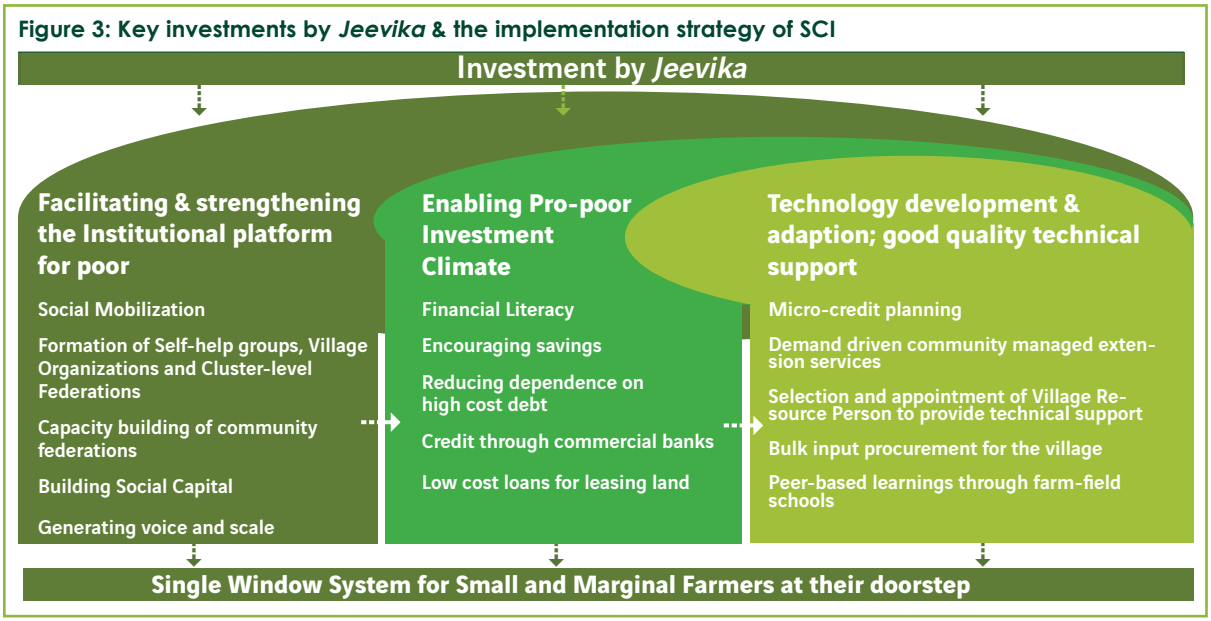
Bihar Rural Livelihoods Promotion Society (BRLPS), an autonomous society supported by the Government of Bihar and the World Bank, has been working with community institutions since 2007. BRLPS is the implementing agency of the livelihoods project in Bihar, popularly called '*Jeevika*[7]'. Key investments of the project include: building and strengthening institutions of the poor and investing in social capital; developing financial services for the poor; promoting and diversifying livelihoods; and improving last mile delivery of public services.

A number of innovative livelihood initiatives for small and marginal farmers have been piloted and scaled-up under '*Jeevika*'. However, building strong community institutions is a necessary precondition before implementing any livelihood intervention. The social mobilization should also be accompanied with lowering the cost of credit for poor households. The social and economic mobilization is critical for the sustainability and scalability of livelihood interventions. The primary agriculture intervention facilitated by *Jeevika*- System of Crop Intensification (SCI)-was implemented through these community institutions and the following innovations in the implementation strategy were crucial to the success of its scale-up:

- '*Jeevika*' facilitated the creation of an '**Institutional Platform**', which is owned and supervised by communities.
- The institutional platform with support from the project staff enabled a '**pro-poor investment climate'** in the state, which lowered the cost of credit
- Community professionals, technical agencies and '*Jeevika*' staff also helped smallholders customize and **adopt the methodology of System of Crop Intensification** for small landholdings.
- A **single-window system for small and marginal farmers** at their doorstep built on the social infrastructure was facilitated by the project

Figure 3 provides the process at a glance, as well as the key investments by the project.

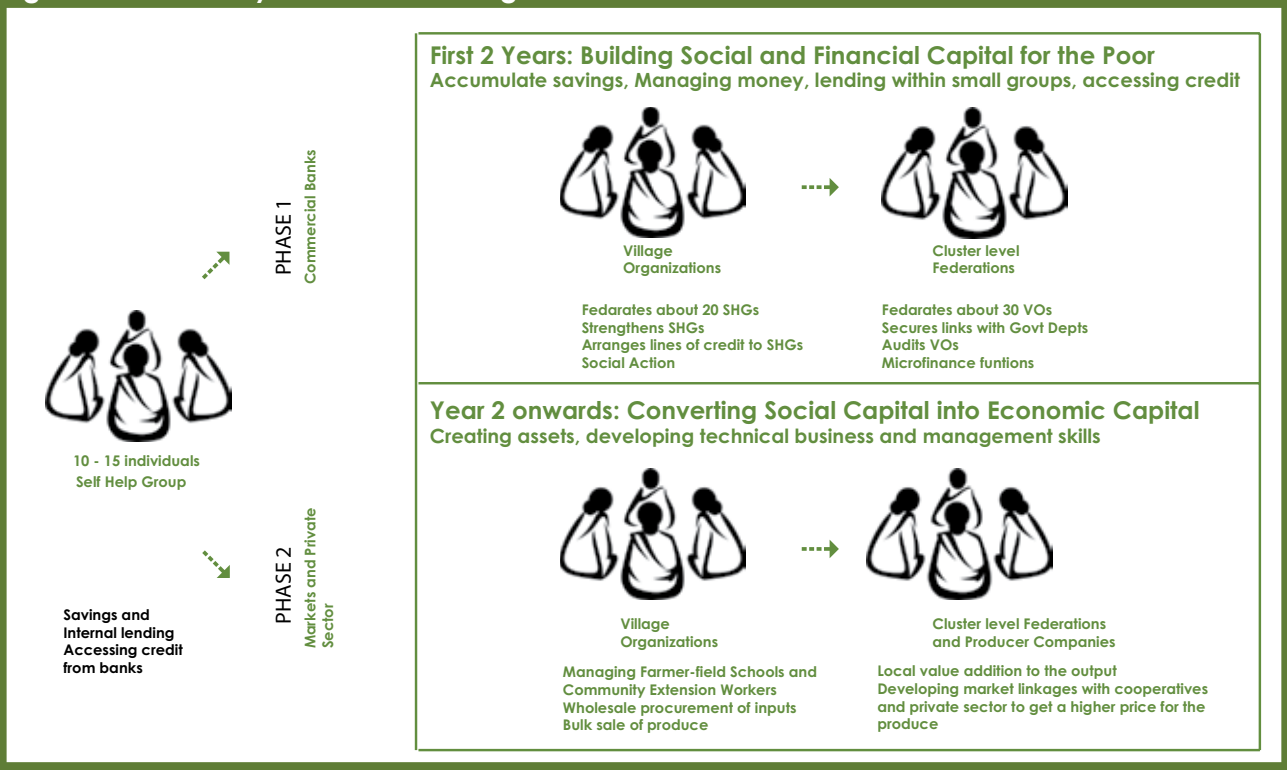
Figure 3: Key investments by *Jeevika* & the implementation strategy of SCI



7 *Jeevika* is a statewide community-driven poverty reduction project jointly funded by the World Bank and Government of Bihar.

Institutional Platform of Poor

Figure 4: Community Institutional Arrangements and Mobilization



Since 2007, *Jeevika* has supported the formation of three tiers of institutions. It has mobilized 850,000 rural women into 67,000 self-help groups (SHGs)[8] in 141 blocks and 21 districts. The affinity based SHGs have been federated into 4500 village organizations (VOs) at the village level, and 42 cluster level federations (CLFs) at the sub-block level. It has also been able to cover nearly 70 percent of the SC and ST[9] households in the coverage area[10]. BRLPS will soon be expanding to all 38 districts of the state by March 2013 and to all 534 blocks in the next 2 years. Figure 4 provides key roles and responsibilities of community organizations.

After these self-managed community institutions reached scale, they have enabled both state and the market to work for poor households and become a effective institutional platform that has created demand side stimulus for investment and services. Furthermore, they have enabled poor to create social, human and financial capital.

8 A typical self-help group comprises 10-15 women from the poorest of the poor and the poor. The members meet atleast once a week, collect savings and maintain books of accounts. Representatives from several groups are further federated into village organizations.

9 Scheduled Caste and Scheduled Tribe

10 (The World Bank 2009)

Pro-Poor Investment Climate

Institution building was accompanied with the creation of an ecosystem of social capital based financing, which enabled the formation of a **favorable investment climate for poor**. The project established a Community Investment Fund[11] (CIF), which was managed by Community-based Organizations (CBOs)[12]. CIF acted like a revolving risk fund and fostered experimentation at the community level. The management of CIF has strengthened financial capacity of CBOs. *Jeevika* also facilitated strategic partnerships with commercial banks and insurance companies. These efforts significantly improved access to credit in participant households and the CBOs have become attractive credit-worthy clients for the mainstream financial sector.

Since 2007, US$36.4 million has been disbursed as CIF and these communities have US$8.2 million savings. The total cumulative credit flow from commercial banks to these groups was US$31.8 million till Dec 2012 and around 400,000 households have accessed credit multiple times. The communities have revolved these funds for inter-loaning purposes. Since 2007, the total financial turnover of households, which have accessed credit multiple times, has been US$94 million, which is approximately US$234[13] per household.

Figure 4: Multi-tiered Community Institutions in '*Jeevika*'

Table 1: Financial turnover of communities

US$36.4 million disbursed as CIF
US$31.8 million: Cumulative credit flow from commercial banks
US$8.2 million: Savings of community institutions
US$94 million: Total financial turnover
US$234: Cumulative household financial turnover since 2007

11 The Community Investment Fund is sanctioned as a grant or revolving fund to the village organizations for undertaking livelihood interventions. The first disbursement is given as a grant to the VO, but subsequently CIF is given as credit and SHG members are responsible for repayment.

12 CBOs refer to self-help groups and higher level federations

13 For calculating this figure the households that have accessed credit multiple times has been taken (approximately 400,000)

System of Crop intensification – the Technologies and Practices

'*Jeevika*' has introduced several livelihood interventions in the last five years based on the demands of the communities. Most communities were keen to productively use credit and enhance their agricultural income. The project also recognized that enhancement of agriculture income can significantly impact poverty incidence in the state and improve food security. A well-known methodology called System of Rice Intensification was introduced under the project in 2007. It was chosen for two primary reasons. First, it is not capital intensive but focuses on intensification of knowledge, skill and management. Second, it has successfully demonstrated improved yields for small and marginal farmers in the past. After the success of initial pilot in rice, it was scaled-up for wheat, green gram seed, rapeseed and vegetables, and is called System of Crop Intensification (SCI). Another initiative called Zero Budget Natural Farming is also being piloted in Bihar. Figure 5 has the comparison of various agricultural interventions.

SCI is not a high cost technology intensive solution but a mix of scientifically proven methods, indigenous knowledge, and better management of soil, water, plant and nutrients. The core principle of this methodology is to ensure adequate development of roots to enable greater access to nutrients in the soil. Thus SCI emphasizes on nurturing the growth of a larger and a more robust root system through

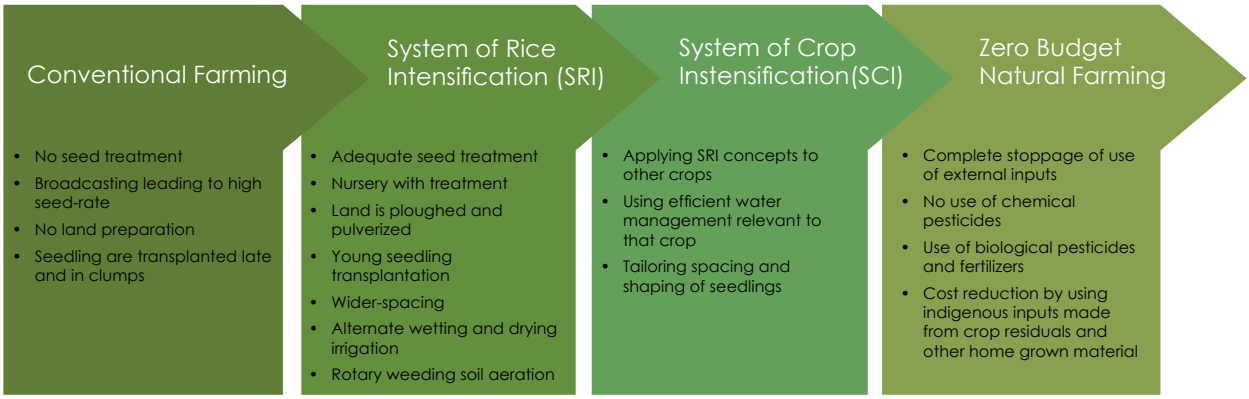
Seed treatment under SCI

early establishment and sufficient spacing for roots to grow. SCI is different from the conventional method in the following ways[15].

Seed treatment: The seed rate[16] under SCI is a fraction of the seed rate in conventional farming e.g. seed rate for rice is 90 percent lower through the SCI method. For a low seed rate, the seeds need to get adequate treatment, which helps in good growth of the plant and provides strength to it.

Nursery Preparation[17] : The nursery bed created for sowing the treated seeds in a SCI farm is much smaller than the conventional method. The area of the bed usually depends on the spacing to be maintained in the main field and the preparation is different for each crop, as individual seeds need customized intensive treatment.

Figure 5: Comparison of conventional Farming, SRI, SCI and ZBNF[14]



14 ZBNF is still in pilot stage.

15 (Cornell University n.d.), (SDTT-SRI Secretariat n.d.), (Bihar Rural Livelihoods Promotion Society n.d.), (Bihar Rural Livelihoods Promotion Society n.d.)

16 Quantity of seed needed to plough 1 acre of land

17 Only relevant for transplanted crops

Nursery preparation under SCI

Transplantation in the conventional method

Transplantation through the SCI method

Line sowing in wheat under SCI

Weeding under SCI

Land preparation: In SCI, land needs to be ploughed well so that the soil is pulverized for easy root growth, and appropriate soil moisture should be maintained by adequate irrigation.

Transplantation[18]: In the SCI method, seedlings from the nursery that are transplanted into the field are younger compared to the conventional method. Younger seedlings have a higher potential for tillering and rooting. Furthermore, it is important to plant seedlings quickly after removal from the nursery as swift transplantation helps in avoiding trauma and shock, which can impede growth. For example, rice seedlings that are 8-15 days old are transplanted directly in the field within 15-30 minutes of gentle removal.

Wider spacing in a uniform manner: In conventional farming seedlings are not transplanted in a uniform manner, which limits the growth of the plant. However, the SCI methodology has crop-specific recommendations for spacing and shaping. Adequate spacing improves the aeration of the roots of the plant and gives them sufficient area for nutrient absorption. For instance, wheat and rice are transplanted in the shape of a square, while rapeseed is transplanted in "L' or "I" shape.

Efficient water management: The optimal water management for SCI is alternate drying and wetting, which minimizes the water requirement for that crop. Continuous flooding or long intervals between irrigation should be avoided. SCI methodology has water efficiency compared to the conventional method.

Rotary weeding and soil aeration: The field is not hoed in the conventional farming method but in SCI the land is weeded at regular intervals. This ensures lesser wastage of soil nutrients and better aeration and thus enables profuse growth of the roots.

Use of organic fertilizers: Under the SCI method, there is an emphasis on the usage of organic fertilizers like Farm Yard Manure and Vermi compost to sustain the high fertility of the soil. SCI follows the principle – 'feed the soil, and soil will feed the plants.'

18 This is only relevant for crops that are transplanted

Carrot farming under the conventional method

Carrot farming by SCI

Table 2: SCI comparison for Rice

	Conventional method	SCI for Rice
Seed Treatment	None	Treated with salt solution & fungicide
Seed Rate (Kg / acre)	20 – 25	2
Nursery Area (Sqft / acre)	4350	325
Seedling age for transplantation	21 – 35	8 – 14
Spacing	No Spacing	25 cm * 25 cm in square shape
Weeding / Hoeing	No Weeding	3 times

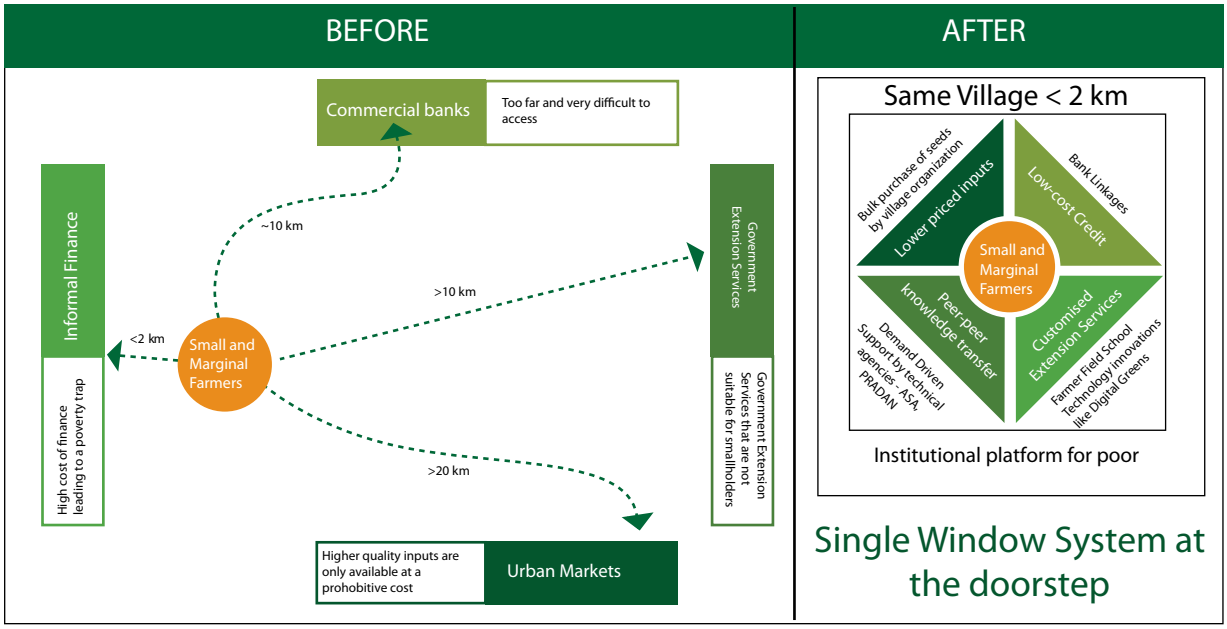
Table 3: SCI Methodology for various other crops

	Rice	Wheat	Oilseeds (Rapeseed)	Vegetables
Seed treatment	salt solution & fungicide	warm water, cow urine, jaggery, vermi-compost & fungicide	Warm water, cow urine, vermicompost, jaggery, tricoderma	Warm water, cow urine, vermicompost, jaggery, tricoderma
Seed rate (per acre)	2 kgs	8-12 kgs	2 Kg	Depends on the crop
Age of transplanted seedlings	8-12 days	NA	NA	8-10 days
Method of crop establishment	Nursery raising	Line Sowing	Line Sowing	Nursery raising and then transplanting in an organic environment
Spacing and shaping of seedlings	25 cm x 25 cm in square shape	20 cm x 20 cm in square shape	45cm x 45 cm in "L" or "I" shape	Depends on the crop
Weeding/Hoeing	3 times in the season	3 times in the season	3 times in the season	3-4 times in the season
Water Management	Alternate dry and wetting	Ensuring irrigation during critical stages	Ensuring Irrigation during critical stages	Ensuring Irrigation during critical stages

Single Window System at the Doorstep of Small and Marginal Farmers

The most innovative aspect of *Jeevika's* implementation has been the creation a single-window system for small and marginal farmers at their doorstep, which provided all services within 2 kilometers of the farmer's house, building a single-window system. Figure 6 explains the key elements of the single-window system.

Figure 6: Creation of a "Single Window System at the Doorstep"

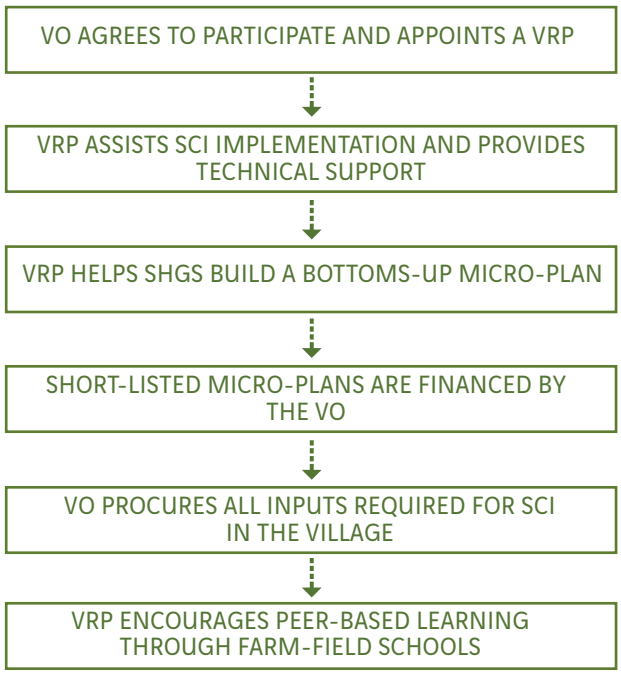


Implementation of SCI through community based organization led to the creation of a single-window system. Figure 7 provides SCI implementation through community organizations at a glance.

SCI is implemented based on the expressed demand of the village organization. The project staff presents the concept of SCI to the VO after it reaches a certain level of maturity(typically 4 to 6 months old). Members of the VO democratically decide if SCI should be implemented in their village. After the VO has expressed the demand for SCI, a village resource person (VRP) is hired to assist with the implementation.

The role of Village Resource Person (Community Extension Worker) is critical for the successful adoption of SCI amongst communities as it builds technical capacity in the village[19]. Every VRP typically covers 40 to 60 households and is responsible for convincing farmers for implementing SCI, providing technical support and training the community members about SCI.

Figure 7: SCI's implementation through community-based organizations in *Jeevika*



19 The VRP is mostly from the same village and is usually a farmer or an unemployed youth. Preference is given to households that have been mobilized by the project, as they can convince and motivate small and marginal farmers to adopt this intervention faster. The selected VRP immediately undergoes a three-day residential training given by the technical agency and two additional trainings are given during the crop cycle.The project and technical agency staff provide technical support to the VRPs on a weekly basis.

Self-help groups (SHGs) mobilize the farmers and help in formulation of a village level micro-plan based on farmers' requirements. The micro-plan consists of the following: list of farmers interested in SCI, consolidated list of all the input requirements, and a request for land leasing on loan basis as per the need. The micro-plan only includes members who have saved regularly, attended weekly meetings, and repaid loans regularly to encourage financial discipline. The VRP visits the plots of all interested farmers and identifies gaps in crop management such as water management, gap filling, vermi-compost application, weeding and hoeing, and fertilizer application. The findings of this assessment and the solutions to overcome these gaps (based on the SCI methodology)are shared at the next SHG meetings. In addition, the benefits of SCI -higher productivity and improved incomes – are also explained at this meeting.

Village Organization is responsible for the financing of the micro-plans and procurement of inputs in an efficient manner. The final micro-plans of all SHGs are consolidated at the VO and SHGs are appraised based on the regularity of SHG meetings, regular savings by the members, and repayment rates of the SHG. These micro-plans are evaluated and approved by the internal project staff at the block level and CIF is disbursed to the relevant VO. In addition to CIF, the micro-plans are co-financed by commercial banks and internal savings of the communities.

VO also facilitates significant savings by aggregating demand and procuring inputs at the village level. A three-member village level procurement committee appointed by the VO, maps out the nearby areas for the prices and quality of the agriculture inputs and procures them based on it. The centralized procurement at the VO level has significantly improved access to better quality inputs at a lower cost.

Figure 8 summarizes the roles and responsibility of community organizations.

Farmer field schools (FFSs) facilitate the transfer of peer learning and act as a platform for experimentation. The VRP is entrusted with the responsibility of identifying plots in the village that have successfully implemented SCI. These plots become a local platform for demonstration of best practices and training. Exposure visits for the SHG members from nearby villages are organized to demonstrate best practices in these identified plots. In addition, interactions between practicing households are also facilitated during the crop cycle to enable cross learning. Farmer Field Schools have also been a major platform for farmers to experiment SCI's methodologies and technologies. This method of extension has been very effective as farmers observe and learn about intervention first-hand. This ensures greater believability and quicker internalization of the new agriculture practices. The ability to experiment helps farmers customize various technologies according to their requirements.

Box 1: Whats Innovative?

- Implementation of SCI through strong community institutions that own and manage the program
- Scaling-up with Village Resource Person (VRPs) which has helped build technical capacity in the village
- Communities have adapted and experimented the technology, which was facilitated by the farmer field schools.
- Partnership with technical service agencies

Figure 8: Roles and responsibilities of SHGs and VOs

Self-Help Groups	Village Organizations
■ Mobilises farmers for SCI	■ Appoints, remunerates and supervises VRPs
■ Helps VRP in the preparation of micro- plans	■ Aggregates and shortlists micro-plans
	■ Finances Micro-plans
	■ Monitors SHG progress
	■ Procures all inputs for the village

The project partnered with several technical agencies, which were selected by a unique selection method of Bihar Innovation Forum (see Box 3). These

Box 2: Use of technology in extension systems

Jeevika has also integrated ICT with its current extension mechanism to make it more robust and effective to meet its increasing communication needs. It has collaborated with Digital Green to create a locally generated video database of various interventions. Digital Green is a Delhi based non-profit, which has been at the forefront of digital technology with community driven extension programs.

Digital Green videos feature community members and provide a reliable and comprehensive information package on various agricultural practices. These videos have helped in faster and cheaper dissemination of information. Furthermore, it has created a sustainable system, which can exist even after Digital Green withdraws support from the project. The project started as a pilot in 100 villages of one district and has been scaled up to 5 districts.

agencies[20] had prior experience in implementing similar interventions at large scale. The partner agencies have been crucial in helping the project build up the capacities of the project staff, village organizations and the community para-professionals associated with the intervention.

Jeevika aims to make this extension system self-sustainable in the long run. Two years ago a concept of "fee based extension services" was introduced. Under this initiative, the farmers are encouraged to pay 50 percent of all expenses (approximately US$1.8 per season) to the Village Resource Persons. These charges are collected by the village organizations at the beginning of the season.

A recent study also found out that technical agencies can gradually withdraw from villages after three-four years. The monitoring of the field implementation in these areas is usually main streamed and is carried out by the block level staff after the agency withdraws. Eventually SCI becomes a standard practice in mature community organizations, which significantly reduces project expenditure and further improves the ROI.

Box 3: Bihar Innovation Forum (BIF)

Bihar Innovation Forum was organized in 2007. One of the technical service agencies of SCI -PRADAN – was selected from BIF. It provided a platform for innovators, social entrepreneurs and private sector companies to show case their innovative ideas in livelihood and related sectors. It also gave an opportunity for the innovators to partner with BRLPS and other agencies in Bihar government to pilot the idea at a large scale. BIF encourage participation of innovative solutions that addressed both the supply and demand issues. BIF – I focused on last-mile service delivery of public and private services, health and nutrition, education, energy, clean drinking water, financial services, rural markets and technology for small/marginal producers. BIF – II will soon be held in Bihar in 2013

20 Professional Assistance for Development Action (PRADAN) and Advance for Social Advancement (ASA) are the national resource organizations that provided technical assistance for initiating the model in Bihar

Key Benefits and Impacts

SCI was piloted in 2007 with only 128 farmers and 30 hectares. The project's innovative implementation strategy helped it scale-up rapidly in Bihar. Figure 9 has the crop-wise details of the scale-up of SCI. Table 4 has the details of land under SCI cultivation in 2012.

Figure 9: Scale-up of SCI in Bihar

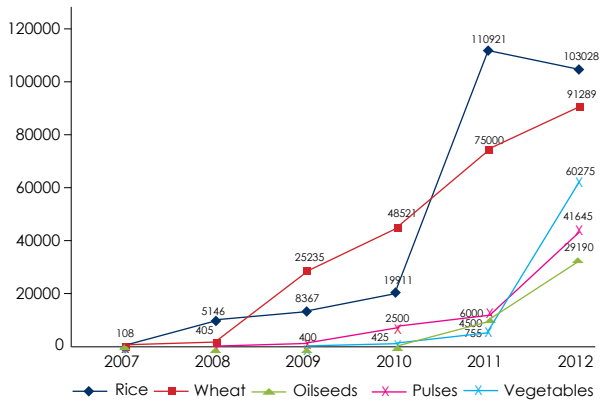


Table 4: SCI in '*Jeevika*' in 2012

	Land under cultivation in (acres)	No of households
Rice	20,139	103,028
Wheat	11,790	91,289
Oilseeds	1,898	29,190
Pulses	15,590	41,645
Vegetables	5,244	60,729

Table 5: Scale-up of capacity through VRPs

Year	Villages	Farmers	VRPs
2007	15	128	3
2008	194	7753	250
2009	322	25235	510
2010	892	68432	1095
2011	1288	197176	1361
2012[21]	1278	348759	2086

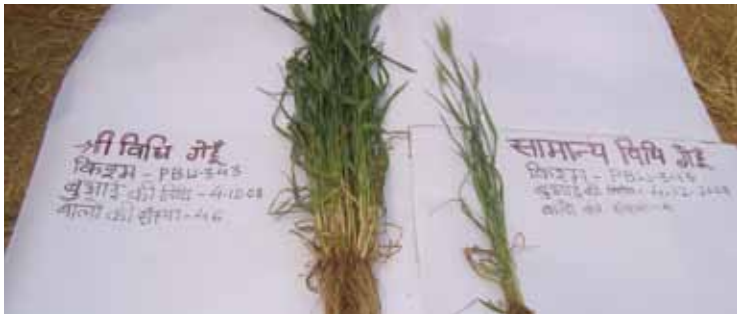
The communities adopted SCI rapidly because farmers witnessed a visible improvement in plant and grain growth, and a significant improvement in yields. The productivity increase was achieved at minimal cost, which has resulted in significant income increase leading to wide ranging systemic impact and policy changes. Following are the key impacts of SCI amongst participant farmers:

Higher Plant and Grain Growth

Agriculture practices based on SCI methodologies have systematically improved the quality of the plant and grain. Participant farmers have witnessed a higher ratio of tiller to mother seedlings, an increased number of effective tillers per hill, enhanced panicle length, and bigger grain size. Table 6 compares plant and grain size before and after SCI. These improvements have resulted in higher yields for small holdings at minimal additional costs.

Panicle length - Conventional Method versus SCI

Tiller - SCI versus conventional method



Roots of a wheat plant - SCI versus Conventional method

21 Till June 2012

Potato cultivated using chemical pesticides

Potato Culivated through ZBNF

Table 6: Higher Productivity after the adoption of SCI

	Before SCI	After SCI
Ratio of tiller to mother seedlings	8:1	20:1
Effective tillers per hill	4-6	15-17
Enhanced Panicle Length	9 cm	14 cm
Grain Size	45-55	70-85

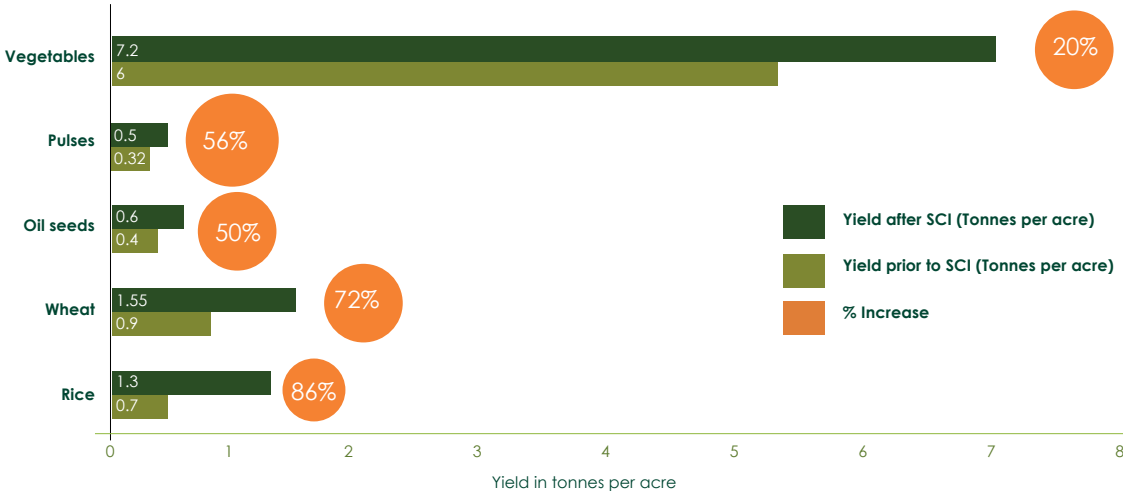
Higher Productivity

The higher plant and grain growth, better soil management, and implementation of other SCI methodologies have contributed to a major productivity increase for many crops in Bihar. The participant farmers in *Jeevika* have witnessed a productivity increase of approximately 86 percent in paddy[22] and 72 percent in wheat[23]. Figure 10 has the crop-wise comparison of productivity increase under SCI.

Increased household income

The net-income of participant farmers has increased significantly[24]. Although input costs under the SCI method are marginally higher than the conventional method due to higher labor costs, the household incomes have still increased for three primary reasons: First, the farmers have witnessed a significant increase in yields by adopting SCI. Second, higher labor cost under SCI has been offset by reduced input costs such as seeds. Third, improving access to finance has lowered the cost of credit and reduced vulnerability of these households. Eventually, farmers have witnessed a manifold increase in profits. For

Figure 10: Crop-wise increase in yields after SCI

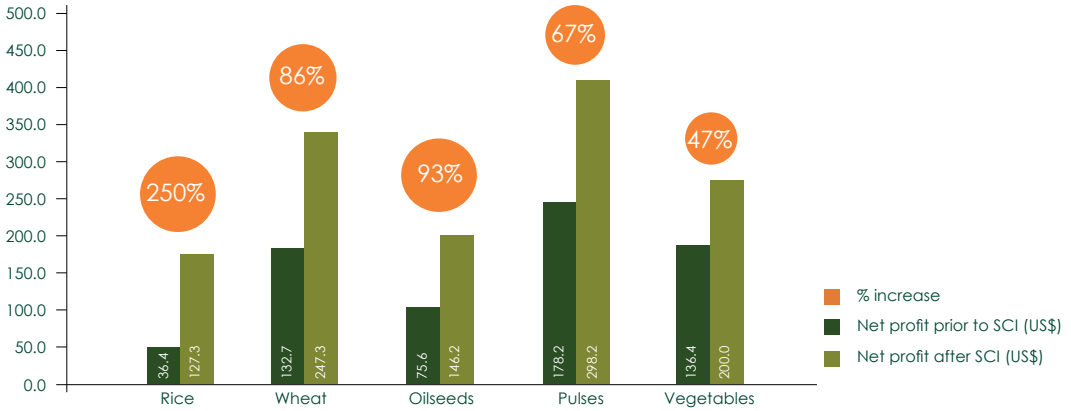


22 (Krishnagopal 2011), (Palanisami, Karunakaran and Amarsinghe Feb, 2013). Yields are based on a combination of internal MIS and estimates of the external impact assessments that have been referred later. These yield increases are achieved after farmers have fully adopted the SCI methodology. A detailed 13 state agricultural study conducted under the IWMI-Tata Water Policy program showed a similar increase of productivity for famers that adopted System of Rice Intensification. Although the study hasn't included Bihar but Madhya Pradesh, which has similar landholding pattern, witnessed a 68% increase in productivity for rice amongst full adopters of SRI.

23 (Sinha 2009)

24 Although external studies compare the increase to non-participants but this note has not factored in non-participant performance for the calculation. A detailed randomized trial of this intervention is underway to get more robust results.

Figure 11: Profits per crop before and after SCI



instance, the profits of rice have almost increased 2.5 times. In 2012, the overall increase in income for all participant farmers was US$5.2 million, which is approximately US$31[25] per household. Cumulatively an additional income of US$10.7 million has been generated since 2007. Table 8 in Annexure has more details about the profitability of farmers in SCI. Figure 11 above has the crop wise summary of increase in profits due to SCI.

Systemic Impact

The agriculture and economic outcomes were achieved at a very small investment by *Jeevika*, which invested only US$2.8 million in SCI[26]. The overall financial turnover of member households in the last 6 years has been approximately US$94 million. The economic benefits on this turnover and investments are around US$10.7 million making the intervention highly efficient for communities as well as *Jeevika*.

Table 7: Investment versus Benefits

US$2.8 million: Total Investment in SCI
US$10.7 million additional income generated since 2007
US$34 - additional household income per annum per household since 2007
US$4.5: average investment per farmer per annum

Improved Food Security

The increase in productivity of various crops has also improved the food security in poor and vulnerable households. According to an independent study conducted in 2012[27], a significantly higher proportion of participant households that faced food shortage in 2007 became food secure in 2010. The participant households have witnessed a 27 percent higher reduction of food shortage compared to non-participants. Although many factors have contributed to this improvement, but the SCI intervention has played a major role.

Inclusion of the Poorest

The focus on the poorest at every stage of the planning and monitoring of the intervention has resulted in the inclusion of the the vulnerable and socially excluded population like the Scheduled Castes and the Backward Caste farmers. External studies commissioned by the project revealed[28] that nearly 25 percent of the farmers belonged to the SC or ST category and 65 percent of them belong to the other backward castes.

Policy Impact

Based on the success of BRLPS, the Department of Agriculture, Government of Bihar has scaled up the SCI intervention across all districts in Bihar for rice and wheat. The department aims to cover 20 percent of rice and 15 percent of wheat area in the state by the end of 2012. Several of the VRPs promoted by the project were used as resource persons during this process of scaling up. The agriculture department is also keen to leverage the institutional architecture created by the project for expanding irrigation coverage and scaling up cultivation of vegetables and other horticulture crops amongst the small holders. In the latest economic survey, Bihar government has also recognized the successful increase in rice productivity due to the adoption of SCI[29]. The production of rice in Bihar increased to 8.2 million tonnes in 2011-12 compared to 3.1 million tonnes in the previous year.

25 Calculations some participant farmers under the project. This is assuming that SCI is practiced by farmers for both seasons. Currently many participant farmers are partial adopters.

26 Investment figures are calculated from 2008-2012. The increase in income has been adjusted accordingly to calculate the correct ratio.

27 (Dutta 2012)

28 (Krishnagopal 2011), (Sinha 2009)

29 (Government of Bihar - Finance Department 2012-13)

Lessons Learnt and Issues for Wider Applicability

Building strong community institutions and investing in human capital are a necessary pre-condition before any livelihood interventions are implemented through community institutions. There is adequate evidence from Bihar and other projects in South Asia supporting the importance of appropriate sequencing.

Strong institutions need to be accompanied by lowering the cost of credit. Vulnerability of poor households to high-cost debt needs to be reduced for livelihood interventions to be successful.

The **community managed extension system is critical for a large-scale agricultural intervention.** The community managed extension system was highly successful in Bihar for three reasons. First, peer learning is the most effective extension methodology. Second, capacity building at the community level significantly reduces dependence on external sources for inputs. The intervention was able to achieve such a large scale because it invested heavily in building a foot army of VRPs. Third, accountability to federations considerably improved efficiency. In case of SCI, VOs monitor and pay the VRPs, which ensures smooth functioning of this community-based extension system.

External technical support agencies played a crucial role in the success of SCI in Bihar. During the initial two years of the intervention, these agencies provided intensive technical support and training to the project staff and village resource person. This brought down the cost of implementation from INR 2000 per farmer to INR 700. As the community-based system matures these agencies gradually withdraw support and extension system will become self-sustainable.

The project built monitoring systems and provided incentives such that **landless were included in the interventions**. A special focus was placed on designing the intervention such that it encouraged participation of landless farmers. For instance, the landless families are encouraged to take land on leaseright from the micro planning stage in BRLPS. Similarly VRPs get a higher fee for working with the poorest.

Challenges

SCI is not effective in extreme climatic conditions such as floods and drought. Further research on the interface of SCI with climate variations like drought and flood needs to be conducted. Similarly, greater experimentation and adaptation needs to be carried out to transfer the SCI methodology to even more crops. The current agriculture research community has not adequately invested in improving the SCI methodologies. Thus the existing research on this methodology is scant and not enough evidence has been built on the productivity gains that SCI has already achieved. In addition, more funding should be directed towards sponsoring and facilitating doctoral studies and fellowships related to SCI. These investments will further build evidence about the methodology and create a larger pool of trained professionals.

The results on the ground need to be backed-up by robust impact evaluation to get a buy-in from the wider academic and technical community. The project is currently conducting a randomized evaluation of the intervention to enable wider dissemination and acceptance of the methodology.

Project would need to identify professionals and technical service providers that could provide vital technical backstopping to the VRPs for scaling up. It would also need to adopt innovative technologies faster (e.g. Digital Greens) to ensure cost-effective dissemination of knowledge.

Way Forward

Horizontal Integration: The project will focus on increasing the adoption rate of SCI methodology for several other crops to achieve wider scale in Bihar. Successful adoption of SCI for commodities and cash crops can also generate higher profits and significantly improve the incomes of small and marginal farmers.

Vertical Integration: Horizontal integration will be accompanied with vertical integration amongst the current participants. Partial adopters of SCI will be encouraged to move to full adoption. In addition, smallholders will be encouraged to graduate to organic farming techniques such as ZBNF, which can get them a higher premium in the market place. Other similar technologies that can improve farming systems will also be introduced through community institutions.

Move up the agri-value chain. The project will facilitate setting-up more producer organizations to enable farmers to gradually move up the agri-value chain. These organizations will lead to a higher market share for the poor, improve market linkages and build community-owned infrastructure.

Self-sustainability: As farmers move up the value chain and earn higher incomes, the extension system can become self-sustainable. Communities can self-finance this extension and the government can gradually withdraw financial support.

SCI in Action: Case study of Ghazipur Village

Ghazipur, a small village in Nalanda District, is one of earliest adopters of SCI in Bihar. Agriculture is the major occupation of the village and the average land holding of famers in the village is approximately 1.54 acres, which is slightly higher than the state average. SCI was first introduced in 2008 by *Jeevika*. However, most farmers in the village were not aware of SCI and were very reluctant to adopt it. Project staff convinced the members of self-help groups to experiment with SCI in 0.3 acres. The SCI farmers witnessed a yield improvement of more than 100% on the land under SCI cultivation in the first season itself, surpassing their expectations. These results encouraged 20 farmers to adopt SCI for vegetables in the second season of 2008. Subsequently, SCI adoption for rice, wheat and vegetables has gradually increased. Figure 12 below has the details of the adoption rate of SCI in Ghazipur and Figure 13 has the details of year-wise land under cultivation for rice and wheat.

Figure 12: Adoption rate of SCI in Ghazipur

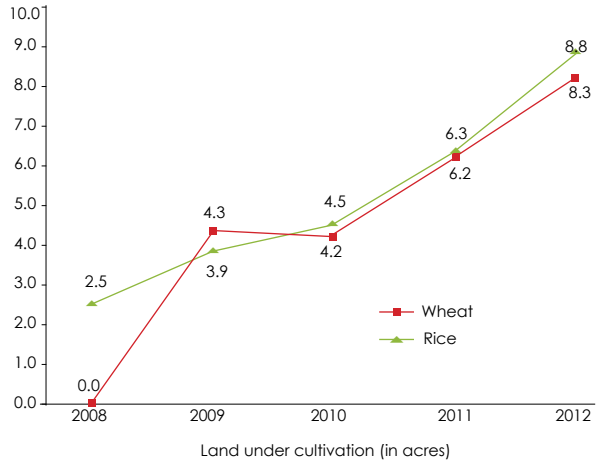


Figure 13: Land under SCI cultivation

Furthermore, higher yields and increased profits from SCI have encouraged farmers to lease extra land and cultivate it under the SCI method. Women farmers who are members of community organizations have increased the size of leased land from and more than 70 farmers in the village have adopted SCI. Improved access to finance and internal loans of CBOs have played a major role in facilitating this land lease. These factors have contributed to the rapid increase of land under SCI cultivation from 0.30 acres to 6.175 acres in the village. 10 out of 60 farmers have leased land to cultivate vegetables using the SCI method last year.

The success of SCI has also reduced the resistance to experimentation and adoption of new technologies in Ghazipur. Villagers have actively taken-up vermi-composting, which gives them extra income by selling their surplus produce to village organizations. Ghazipur is also one of the first villages to adopt Zero Budget Natural Farming (ZBNF). 20 women farmers' were given training about ZBNF in Gaya (nearby district) in 2011 and all farmers cultivating rice in Ghazipur partially or fully adopted ZBNF that year. Other farmers have been gradually adopting ZBNF for other crops as well since then. Initial observations show that farmers can command a higher price from urban markets for ZBNF produce by branding them as organic produce. Ghazipur is a perfect example of the success of the institutional model of Jeevika and ways it can assist farmers to adopt new technologies.

Annexure

Table 8: Profitability of SCI farmers[30]

Commodity [31]	Rice		Wheat		Oilseeds		Pulses		Vegetables	
	Before SCI	After SCI	Before SCI	After SCI	Before SCI	After SCI	Before SCI	After SCI	Before SCI	After SCI
Revenues[32] (**INR** / USD)	**7000** *127.3*	**13000** *236.4*	**10800** *196.4*	**18600** *338.2*	**10160** *184.7*	**15240** *277.1*	**12800** *232.7*	**20000** *363.6*	**30000** *545.5*	**36000** *654.5*
Costs[33] (**INR** / USD)	**(5000)** *(90.9)*	**(6000)** *(109.1)*	**(3500)** *(63.6)*	**(5000)** *(90.9)*	**(6000)** *(109.1)*	**(7200)** *(130.9)*	**(3000)** *(54.5)*	**(3600)** *(65.5)*	**(22500)** *(409.1)*	**(25000)** *(454.5)*
Net profit (**INR** / USD)	**2000** *36.4*	**7000** *127.3*	**7300** *132.7*	**13600** *247.3*	**4160** *75.6*	**8040** *146.2*	**9800** *178.2*	**16400** *298.2*	**7500** *136.4*	**11000** *200*
Increase in profits (**INR** / USD)	**5000** *90.9*		**6300** *114.5*		**3880** *70.5*		**6600** *120*		**3500** *63.6*	

Table 9: Total increase in income[34]

	Total increase in income (2012)	Total increase in income (2007-12)
Rice (**INR** / USD)	**100.7** *1.83*	**241.9** *4.4*
Wheat (**INR** / USD)	**74.3** *1.35*	**195.6** *3.56*
Oilseeds (**INR** / USD)	**7.4** *0.13*	**8.6** *0.16*
Pulses (**INR** / USD)	**102.9** *1.87*	**124.9** *2.27*
Vegetables (**INR** / USD)	**18.4** *0.33*	**18.7** *0.34*
Total (**INR** / USD)	**304** *5.53*	**590** *10.73*

30 All prices in US Dollars and INR. 1 US$ = 55.0 INR

31 Price data is based on internal MIS. It is usually 15-20 percent lower than the minimum support prices announced by the government

32 Yields are based on a combination of internal MIS and estimates of the external impact assessments that have been referred later.

33 Cost calculations are based on a combination of internal MIS, data from Indian Agricultural Statistical Institute and www.Indiastat.com

34 All figures in millions

References

Bihar Rural Livelihoods Promotion Society. "SRI Manual." *Bihar Rural Livelihoods Promotion Society*. n.d. http://brlp.in/admin/Files/SRI_Manual_Hindi.pdf (accessed Nov 15, 2012).

—. "SWI - Manual." *Bihar Rural Livelihoods Promotion Society*. n.d. http://brlp.in/admin/Files/SWI_Manual_Hindi.pdf (accessed Nov 15, 2012).

Cornell University. *System of Rice Intensification (SRI)*. n.d. http://sri.ciifad.cornell.edu/ (accessed November 15, 2012).

Dutta, Upamanyu. "Socia-economic Impacts of Jeevika, a project by the BRLPS, A retrospective Study." 2012.

Government of Bihar - Finance Department. *Economic Survey*. Patna: Government of Bihar, 2011-2012.

Government of Bihar - Finance Department. *Economic Survey*. Patna: Government of Bihar, 2010-2011.

Government of Bihar - Finance Department. *Economic Survey*. Patna: Government of Bihar, 2007-08.

Government of Bihar - Finance Department. *Economic Survey*. Patna: Government of Bihar, 2009-2010.

Government of Bihar - Finance Department. *Economic Survey*. Patna: Government of Bihar, 2012-13.

Krishnagopal, G V. "Assesement of SRI in Bihar." 2011.

National Commision for Enterprises in the Unorganized Sector. *A special program for Marginal and Small Farmers*. National Commision for Enterprises in the Unorganized Sector, December 2009.

Palanisami, K, K R Karunakaran, and Upali A Amarsinghe. "Doing Different Things or Doing It Differently? Rice Intensification Practices in 13 States of India." *Economic and Political Weekly*, Feb, 2013: 51-58.

SDTT-SRI Secretariat. *System of Rice Intensification (SRI) Programme*. n.d. http://sdtt-sri.org/ (accessed Nov 15, 2012).

Sinha, Manu. "Performance Review of System of Wheat Intensification Program." 2009.

The Registrar General & Census Commissioner. *Census of India 2000*. New Delhi, India: Government of India, 2001.

The World Bank. *Mid-term Review of Jeevika*. Washington DC: The World Bank, 2009.

Uphoff, Norman. "System Intensification Towards Food and Enviornmental Security." Keynote presentation for International Symposium organized by the Crop and Weed Science Society and Bidhan Chandra Krishi Viswavidyalaya, in collaboration with NABARD, Kalyani, World Bank, February 24-27, 2011.

Phool Kumari Devi, Muzaffarpur, had a small farm of 0.17 acres. After she started practicing SCI for wheat on her farm - the output went up from 0.15 tonnes to 0.35 tonnes. The increased income after SCI enabled Phool Kumari to recover an additional 0.67 acres, which was a collateral for a loan. Now her landholding has increased to 1.25 acres and she grows wheat through the SCI method on the whole field.

During the pilot phase in 2007, Barti Devi,a member of a SHG from Gaya, had difficulties convincing her husband, Dilu Yadav to practice SCI for rice. After four rounds of heated arguments and negotiations at home, Barti Devi convinced her husband and started implementing SCI on her land. Due to the SCI methodology, her productivity increased to 4 tonnes per acre. She is now a role model for many SHG women. She travels across several project villages, before the start of season, to assist the project staff in recruiting new SHG members for the SCI intervention.

Voices from the Ground

South Asia Livelihoods Learning Note Series 3 Note 1

Debaraj Behera is the State Project Manager (Livelihoods) at the Bihar Rural Livelihood Promotion Society, Patna, India
Arvind Kumar Chaudhary is the CEO of Bihar Rural Livelihood Promotion Society
Vinay Kumar Vutukuru is a Consultant at the World Bank
Abhishek Gupta is a Consultant at the World Bank
Sitaramachandra Machiraju is a Senior Rural Development Specialist in South Asia Sustainable Development at the World Bank
Parmesh Shah is a Lead Rural Development Specialist in South Asia Sustainable Development at the World Bank.
Photo Courtesy: Bihar Rural Livelihood Promotion Society, Patna, India

This note is a joint publication of the World Bank and Bihar Rural Livelihood Promotion Society
South Asia Livelihoods Learning Note Series is facilitated by the Rural Development and Livelihoods Unit in the South Asia Sustainable Development Department of the World Bank, 1818 H Street NW, Washington DC 20433, USA. The findings, interpretations, and conclusions expressed in this note are entirely those of the author(s) and should not be attributed in any manner to the World Bank, to its affiliated organizations or to members of its Board of Executive Directors or the countries they represent.
The authors would like to thank the Department for International Development, Government of the UK, for their generous contribution that made the research, writing, and production of this note possible

For further details or additional copies of this note contact **agupta20@worldbank.org** or **debaraj@brlp.in**

BIHAR RURAL LIVELIHOODS PROMOTION SOCIETY
Vidyut Bhawan,
Annexe-II 1st Floor (Southern Wing),
Bailey Road Patna - 800021
T : 91 - 612-2504980 | w: https://www.brlp.in | f: https://www.facebook.com/jeevika.brlps

WORLD BANK INDIA
70 Lodi Estate
New Delhi, India
T 91 011 4924 7000 | **f** https://www.facebook.com/WorldBankIndia | **w** http://www.worldbank.org/india

Design: www.digitatemedia.in