Adoption and Dis-adoption of SRI: A Study of the Dynamics

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Quantifying the benefits and analysing the factors that encourage farmers to adopt or dis-adopt SRI methods in the four major rice-producing states in India, this study offers policy recommendations for up-scaling in order to attain agricultural sustainability

Rice is the most important staple food in India. The demand for rice has been growing every year and it is estimated that, to meet the projected demand by 2050, the yield of rice has to increase by more than three per cent every year between now and then. However, India's rice yield has improved by only one per cent since early 2000 (Directorate of Economics and Statistics, 2013).

The recent Food Security Bill passed in India, geared to provide cheap food to the poor, will increase the pressure on the country's capacity to produce more food on its own. Estimates show that the country will require five to six million metric tonnes of additional food grains annually, to meet the demands of the growing population and to fulfill the commitment of the Food Security Bill. It has been proven and accepted that sustained technological change is the primary driver of growth in food production.

Among the recent technological changes in agriculture, the System of Rice Intensification (SRI) has been recognized as the innovation capable of achieving the target of producing 'more with less'. SRI is an agro-ecological innovation, appropriate for small and marginal farmers. It has gained popularity and wider acceptance among farmers and other stakeholders due to increased production with fewer inputs, reduced costs, and resilience to the vagaries of the climate.

In order to understand the dynamics of the adoption process, carefully designed longitudinal farm surveys were conducted during 2011–12, and 2012–13 among 715 SRI farmers in selected districts in Bihar, Odisha, Chhattisgarh and Jharkhand. The farmers were selected using the stratified random sampling procedure, representing three distinct groups, that is, practising SRI farmers, including the new adopters (the adopters), farmers who discontinued the use of SRI (the dis-adopters) and farmers who had never practised SRI (non-SRI farmers as control).

The study attempts to quantify the benefits and analyses the factors that encourage farmers to adopt or dis-adopt SRI methods in four major rice producing states in India, and provide policy recommendations for up-scaling in order to attain agricultural sustainability.

The study was conducted with the specific objectives of:

- Examining the trends in the adoption of SRI, and studying the causes and effects of dis-adoption of SRI in rain-fed areas
- Evaluating and assessing the performance of SRI, as compared to conventional methods
- Examining the impact of SRI adoption on household food security
- Analysing farmers' perceptions about SRI methods and their preference for it, the drivers of up-scaling

METHODOLOGY

A longitudinal survey of on-farm practice was planned for three agricultural seasons in 2011–12, 2012–13 and 2013–14, to generate the panel data at the disaggregate village level. The panel data used both the cross-sectional and the time-series data. A multi-layer stratified random sampling design was used to select 705 farmers from rain-fed areas in the eastern Indian states.

The survey was conducted in six districts, covering four important rice-producing states of India—Gaya and Nalanda in Bihar, Sarguja and Raigarh in Chhattisgarh, Khunti in Jharkhand and Keonjhar in Odisha. A total of 88 villages were selected, based on the intensity of adoption of SRI. The villages were distributed in three distinct categories—high, medium and low, as Table 1 shows.

The socio-economic dynamics of the adoption and the dis-adoption processes was analysed, using a survey questionnaire. The factors determining adoption and those constraining it were identified primarily, based on the farmers' perceptions and experiences. The resource-use pattern was also analysed, using the survey information. The Garrett ranking technique was used to examine the importance of the factors behind the dis-adoption of SRI among farmers.

The states and the districts were selected on the basis of the predominance of small farmers in rain-fed areas and the low productivity of rice. The presence of promoting organizations such

Table 1: Percentage of Farmers in Various Categories (High, Medium and Low)

District	No. of Sample Farmers	High Intensity (More than 10% Adopters)	Medium Intensity (5–10% Adopters)	Low Intensity (Less than 5 % Adopters)
Gaya	109	86	0	0
Keonjhar	199	12	12	66
Khunti	104	18	28	41
Nalanda	104	11	28	47
Raigarh	93	34	25	41
Sarguja	97	12	36	42

as NGOs and the state agriculture universities (SAUs) was also taken into consideration. As mentioned, 88 villages were selected based on the intensity of adoption of SRI. Intensity is defined as the percentage of SRI farmers in a particular block of a district.

In order to give a fair representation, the farmers were classified into three groups, that is, old SRI farmers and new SRI farmers, SRI dis-adopters, and non-adopter farmers. A dis-adopter is a farmer who did not continue the practice of SRI voluntarily. If a farmer started the SRI operation in the season but failed to continue it due to socio-economic conditions, a family situation and or sudden climatic variation, it would be not be considered as willful dis-adoption. To identify the causal factors of the adoption as well as the dis-adoption of SRI, a small sample of farmers were also selected from villages that had no access to information about SRI and where no promoting agency was present.

ANALYSES AND INTERPRETATIONS

The participation of women in agriculture was found to be wide and extensive across the sample districts. Barring Sarguja, in all the other districts, more than 50 per cent of the SRI farmers were women. In Keonjhar, 32 male- and 171 female-headed households adopted SRI in their fields whereas, in Raigarh, the adopters were all women.

Across the districts, farmers allotted their holdings under SRI to varying extents. The total area under SRI differed from 88 acres in Gaya to a maximum of 224 acres in Sarguja. The farmers used SRI in their own land, leased land and also in share-cropping. The regions being predominantly rain-fed, most of the farmers used SRI in rain-fed lands, specifically in Keonjhar district, where 207 of the 260 acres of land under SRI were rain-fed. However, in Nalanda and Gaya, farmers used SRI largely in irrigated areas that is, in 94 and 57 acres, respectively.

CULTIVATED AREA UNDER SRI AND CMP (CONVENTIONAL METHOD OF PADDY CULTIVATION)

The average operational area using SRI methods across the districts was 0.72 acres, as compared to 1.29 acres of CMP. Raigarh district reported the lowest area under SRI, that is, 0.42 acres, whereas in Sarguja district, the average land size was 1.05 acres under SRI. The farmers of Sarguja district practised both cultivation practices on almost equal areas of land (1.06 acres).

As far as the SRI practice on the basis of adoption intensity is concerned (Table 2), the average land, in acres, under high adoption intensity, medium adoption intensity and low adoption intensity was 0.72, 0.53 and 0.57, respectively, indicating farmers' increased interest in the SRI method.

Table 2: Average Operational Area under SRI in Different Intensity Categories (Acres)

District	High	Medium	Low
Gaya	0.48	0	0
Keonjhar	0.76	0.50	0.73
Khunti	0.74	0.95	0.80
Nalanda	0.87	0.49	0.75
Raigarh	0.50	0.47	0.29
Sarguja	1.12	0.79	0.84

Table 3: Yield Advantage with SRI

District	Yield with CMP (Quintals/Acre)	Yield with SRI (Quintals/Acre)	Actual Difference	Yield Advantage of SRI in %
Gaya	11.92	23.14	11.22	94.00
Keonjhar	7.90	21.74	13.84	175.00
Khunti	9.16	15.39	6.23	68.00
Nalanda	15.25	24.86	9.61	63.00
Raigarh	15.09	20.56	5.47	36.00
Sarguja	8.65	27.44	18.79	217.00
Average	11.33	22.19	10.86	108.83

YIELD OF PADDY UNDER SRI AND CMP

The average yield under the SRI method was found to be 22.19 quintals per acre (5.55 tonnes/ha) compared to the 11.3 quintals (2.83 tonnes/ha) under the conventional method, a 109 per cent yield advantage over conventional methods. With the yield difference of about 11 quintals per acre under SRI, over the conventional methods of paddy cultivation, the yield of CMP varied from 7.9 quintals/acre in Keonjhar to 15.25 quintals/acre in Nalanda. It varied from 15.39 quintals/acre in Khunti to 27.44 quintals/acre in Sarguja for SRI.

Although Nalanda achieved the second highest yield, the farmers in Keonjhar achieved a higher yield advantage of 175 per cent over CMP. Such a yield advantage may indicate that where the yield is normally low under the conventional practice, the relative advantage of SRI is higher. This is seen in rain-fed districts such as Sarguja and Raigarh. This also shows the wide inter-regional variation in the rice yield.

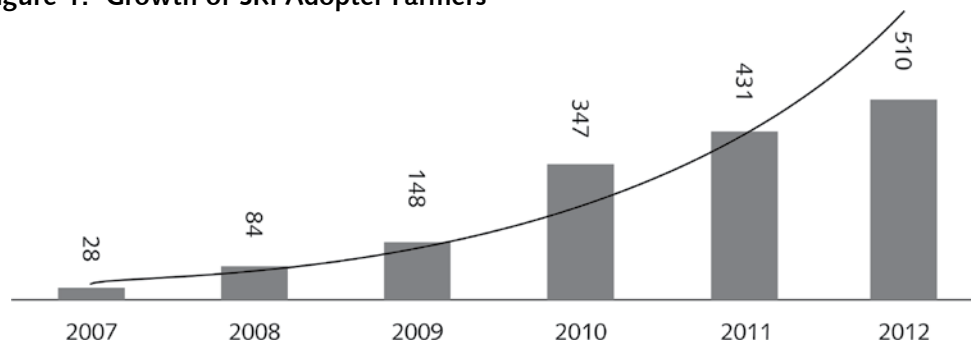
LABOUR COSTS FOR SRI AND CMP

SRI, it is said, is a labour-intensive method (Barrett, et al. 2004). However, some findings reveal that SRI helps save labour when the farmers gain expertise in the new technology. Usually, that stage comes after two to three years of experience.

According to the survey results, three out of the six districts, that is, Nalanda, Khunti and Raigarh, reported high labour usage for SRI compared to CMP whereas farmers in Gaya, Keonjhar and Sarguja reported labour saving for SRI. This could be attributed to the fact that the farmers, who had been practising SRI for two to three years or more, now needed less labour compared to those who were new adopters. However, in Nalanda, where more than 64 per cent of the farmers have been using SRI methods, had a high labour usage—108 labour days/acre compared to only 30 labour days/acre in Sarguja. One factor that could account for the higher labour usage in Nalanda is the availability of more irrigated area, requiring more labour days.

The average (aggregate) labour cost-saving across the six districts is negative, implying that there is no substantial saving in labour, but the average labour usage showed positive results (1.2 per cent). The picture changes when the inter-regional variation due to wage differences from place to place is considered.

Figure 1: Growth of SRI Adopter Farmers



When the district-wise cost of labour was analysed, it was found that Sarguja again accounted for the lowest cost relating to labour with Rs 2,398 and Rs 2,551 per acre for SRI and CMP, respectively. The highest cost for labour was observed in Nalanda and Raigarh, with a difference of Rs 3,900 per acre in SRI as compared to CMP. Farmers in Keonjhar reported the highest labour savings of 7.8 per cent, followed by Sarguja and Gaya. Thus, there is a mixed result of both the positive and the negative labour cost savings in Chhattisgarh and Bihar, which reflect regional characteristics. One of the reasons behind higher labour costs incurred in Nalanda and Raigarh can be attributed to the high wages (Rs 125 and Rs 120 per day, respectively) paid in the district.

It is important to keep in mind that the wages paid are the same in both the cultivation methods in all the districts, but because SRI is cultivated in smaller areas (for example, 10 decimals) as compared to CMP, the wages incurred in smaller plots are higher, due to the economies of scale. Furthermore, looking at the components of the labour costs in various inter-cultural operations, we find that harvesting and weeding incur the maximum costs in the SRI method and, therefore, improvements can be brought about in these inter-cultural operations.

INTENSITY OF SRI ADOPTION

The adoption of SRI techniques among the farmers in the selected districts over the last five years (2007–12) has increased from a mere 28 farmers in 2007 to more than 500 farmers at the end of 2012.

The growing interest in the SRI technique is a result of enhanced productivity. There is an average increase of 200 per cent in the yield using SRI methods in high and medium intensity villages and 170 per cent in low-intensity villages. Overall, this is ten quintals per acre more yield as compared to CMP.

Table 4: Outcomes from SRI (Yield and Labour Cost) in Different Intensity Classes

SRI Intensity	Average SRI Yield (Quintals/Acre)	Average CMP Yield (Quintals/Acre)	Difference in Yield (Quintals/Acre)
High	19.89	10.40	9.49
Medium	20.65	9.03	11.62
Low	17.85	10.50	7.35
Overall	19.77	10.18	9.59

Table 5: Factors Favouring SRI Adoption (Positive Experience as % of Respondent Farmers)

District	Respon-dent	More Yield (%)	Less Seed (%)	Less Water (%)	Less Labour (%)	Less Expense (%)	More Labour (%)	Easy Trans-planting (%)	Other (%)
Gaya	79	68	49	28	28	11	0	0	81
Keonjhar	161	89	46	5	60	57	0	12	16
Khunti	83	86	39	10	22	43	1	6	33
Nalanda	82	88	55	17	5	17	0	1	56
Raigarh	73	38	40	4	34	3	0	1	116
Sarguja	83	43	20	45	0	82	49	1	30

Table 6: Factors Determining Up-scaling to SRI

District	Respondent	More Yield (%)	Less Seed (%)	Less Expenses (%)	Less Labour (%)	Saves Time (%)	Saves Water (%)
Gaya	83	80	66	5	30	5	33
Keonjhar	158	96	58	68	74	1	7
Khunti	91	96	41	45	26	7	13
Nalanda	80	91	74	21	10	16	18
Raigarh	67	73	61	12	64	0	3
Sarguja	39	41	85	55	40	17	13

FARMER'S EXPERIENCES AND PERCEPTIONS ABOUT SRI ADOPTION AND UP-SCALING

Tables 4 and 5 show that the factors leading to farmers adopting SRI and up-scaling it are mainly the high yield and the lower requirement of seeds. Most farmers have a strong preference for SRI because they derive positive benefits from it. This is evident in Gaya, Keonjhar, Khunti and Nalanda, where a majority of the farmers considered the increase in yield as a major contributor for the adoption of and subsequent up-scaling to SRI. Interestingly, the economy of seed use was also a strong factor in the choice of SRI.

Farmers differed in their opinion of less labour usage and expenses incurred in SRI promotion—varying from 68 per cent farmers in Keonjhar thinking that SRI is labour-saving and, thus, a reason for up-scaling to only 10 per cent farmers in Nalanda holding the same view. Similarly, farmers had different views on the assumption that SRI is less expensive.

The principles of SRI emphasize the management of water through alternate wetting and drying (AWD) during (i) the vegetative growth period (VGP), and (ii) keeping a thin layer of water during reproductive growth periods (RGP) (Uphoff et al, 2008).

However, except in Sarguja and Gaya (45 per cent and 28 per cent of the farmers, respectively), the opinion about water saving in SRI as against CMP is mixed among the farmers. This could be attributed to the fact that most of the sample farmers cultivate paddy under rain-fed conditions, where they do not have the experience of water control and have not considered the cost of irrigating their fields.

MOTIVATIONAL DRIVERS FOR UP-SCALING SRI

When the farmers were asked about their opinion about their drivers for up-scaling, other than agronomic practices, the results were interesting. Answers to open-ended questions revealed that about 45 per cent of the farmers in Gaya and Nalanda believed that advertisement and publicity about SRI was a prominent factor in their adoption and up-scaling of SRI. The most effective method of promotion, according to them, was the establishment of awareness camps and regular meetings regarding SRI. This is the most common opinion all across the sample locations except in Nalanda, where the farmers said that visiting successful SRI villages and farmers' fields was more encouraging than advertisements.

However, in Khunti and Raigarh districts, the farmers reported that less investment and more production in SRI was one of the factors that influenced their decision to up-scale further. We can, therefore, infer that efficient extension services continue to play an important role in the adoption of SRI, not only in existing but also in new areas as well. Thus, this could be a useful recommendation for the state to keep in mind when creating policies for the promotion of SRI among farmers and other stakeholders.

FOOD AVAILABILITY AND FOOD SECURITY

Rice is an important staple; therefore, the increased production of grain under SRI will have a positive impact on food availability and a family's food security. Up to 43 per cent of the farmers reportedly produced food that was adequate for nine to twelve months. Approximately 21 per cent of the farmers

Table 7: Percentage of Farmers Achieving Additional Food Availability Due to SRI

Districts	1 to 4 Months	5 to 8 Months	9 to 12 Months
Gaya	22	23	53
Keonjhar	26	24	45
Khunti	12	21	31
Nalanda	11	16	51
Raigarh	33	40	22
Sarguja	0	2	58

reported an additional food availability of one to four months and another 21 per cent reported six to eight months of additional food availability after adopting SRI techniques. A similar picture emerged at the district-level disaggregate analysis (Table 6).

District-wise findings of the survey indicated that 11 to 33 per cent of the farmers reported that they had at least one to four months of additional food for their family because of SRI. In Nalanda, Gaya and Sarguja, more than 50 per cent of the farmers reported additional home-grown food for nine to twelve months for the family, which is evidence in support of SRI. Furthermore, another 16–40 per cent of the farmers in all the districts, except Sarguja, reported five to eight months of additional food, after adopting SRI.

GENDER PERSPECTIVE AND LABOUR-USE PATTERN IN INTER-CULTURAL OPERATIONS

In rural India, women who depend on agriculture for their livelihoods is as high as 84 per cent. Women make up about 33 per cent of the cultivators and about 47 per cent of the agricultural labour. These statistics do not account for work in livestock, fisheries and various other ancillary forms of food production in the country. According to the Food and Agriculture Organisation (FAO), in 2009, nearly 94 per cent of the female agricultural labour force in crop cultivation was involved in cereal production whereas 1.4 per cent worked in vegetable production, and 3.72 per cent were engaged in producing fruits, nuts, spices and beverages.

Considering the importance of the role of women in agriculture, the implications of SRI methods from a gender perspective were evaluated. Varying from a low of two per cent in Sarguja to as high as 100 per cent cases in Raigarh, more and more women are adopting the practice of SRI in their fields. Overall, more than 50 per cent of the women are practising SRI in sample districts except in Sarguja, where the percentage was significantly lower.

The labour-intensive operations in rice cultivation are transplanting, weeding and harvesting. The women's involvement in these three inter-cultural operations is generally higher than that of men. Women work in their own fields and as hired labour in other fields to earn wages.

As seen in Tables 8 and 9, the total labour use in all the three operations is less and saves a significant amount of labour for women when they adopt SRI.

Table 8: Average Family Labour Usage by Gender for SRI and the Conventional Method (in Labour Days)

Average Family Labour Use	Transplanting		Weeding		Harvesting	
	Male	Female	Male	Female	Male	Female
SRI family	10	15	7	10	8	10
CMP family	13	17	11	13	10	12

Table 9: Average Hired Labour Usage in SRI and the Conventional Method (in Labour Days)

Average Hired Labour Use	Transplanting		Weeding		Harvesting	
	Male	Female	Male	Female	Male	Female
SRI family	2	8	2	4	1	4
CMP family	3	10	1	8	1	7

Analysing the data on the average hired labour use in the SRI method and comparing it with the conventional methods in six districts, we find that the hired labour use in SRI is quite low (almost four times lower) for both male and female labour. The female labour used in transplanting, weeding and harvesting in SRI for each acre of land is seven, four, and four, respectively, compared to 14, 10, and 10 in the conventional method.

Looking at both the hired and family labour use in SRI, we find an interesting pattern of labour mobility for females. The female hired labour use is greater than the female family members involved in the fields, in both transplanting and harvesting, but lower in the case of weeding whereas the male hired labour use is lower than male family labour in most operations. This shows the female labour mobility within agricultural operations and illustrates a paradigm shift from conventional methods due to SRI. It can be inferred that the women, who worked as family labourers in their own fields, now work as hired labourers to apply SRI methods in others' fields and were transplanting and harvesting to receive an extra income. It, perhaps, indicates that women labourers acquired SRI skills faster and are being able to reap the advantages.

Furthermore, because there is an increased yield from SRI methods, it would require more hired labour to harvest the produce from the field and, therefore, more women are needed to do the job. However, female hired labour is less than family labour in the case of weeding, which can be attributed to the fact that weeding is done with the help of cono-weeders, mostly operated by men.

Overall, this shows a shift in the traditional work divisions wherein, earlier, women dominated the weeding practices but are now moving towards transplanting and harvesting by which they earn more income.

UNDERSTANDING THE DIS-ADOPTION OF SRI

According to Roger's theory on diffusion of innovations, an innovation will experience an increased rate of diffusion if the potential adopters perceive that the innovation:

- is being tried on a limited basis before its adoption
- offers observable or tangible results
- has an advantage, relative to other innovations (or the status quo)
- is not overly complex and
- is simple and compatible with the existing practices and values

SRI, as a technological innovation, can therefore, be considered a success because it fulfils all the five criteria listed above. Most of the farmers have tried the SRI techniques, albeit in a limited area, to begin with. This new method of rice cultivation does have observable results such as an increased yield advantage and input savings. It has various advantages and is not overly complex and is compatible with the existing cultivation practices.

The survey results show that farmers' acceptance and adoption of the SRI method has increased quite significantly over the last few years. For instance, in Keonjhar, the adoption spread from 14 farmers in 2007, to more than 120 farmers by 2011. In other districts also, the adoption increased from less than five farmers in 2007 to more than 50 farmers by the end of 2011. The reasons for adoption are analysed, based on the farmers' field information and the farmers' perceptions.

The survey results show that farmers' acceptance and adoption of the SRI method has increased quite significantly over the last few years.

However, there are farmers who have dis-adopted SRI and it becomes imperative to understand the pattern of dis-adoption of the SRI over the last five years and analyse the reasons for the abandonment of this new technology.

The percentage of dis-adoption varies across the districts. Figure 2 shows that Keonjhar (a highly vulnerable and disaster-prone district) and Khunti (a resource-poor district, adhering to the traditional production system) show high dis-adoption whereas the lowest dis-adoption was observed in Surguja.

Figure 2: Average Percentage of Dis-adoption in Districts during Various Years

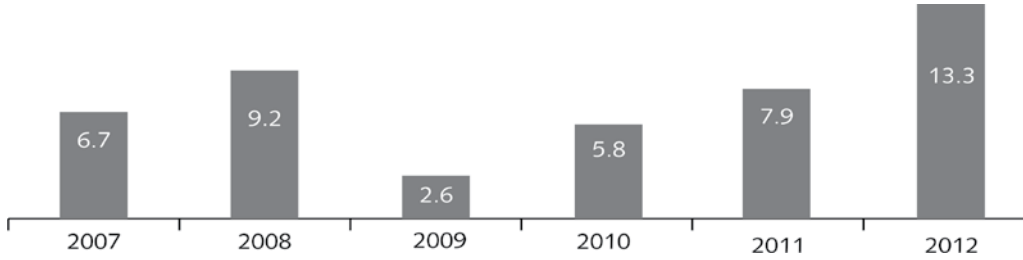


Figure 3: Average Percentage of Dis-adoption in Various Districts during 2007–12

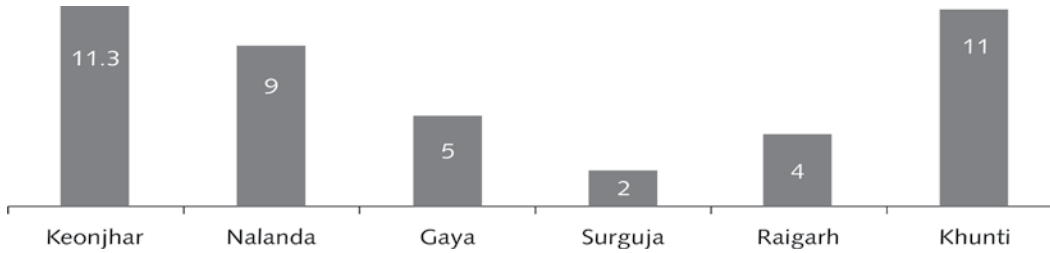


Table 10: Garrett Ranking of Most Prominent Factors of Dis-adoption of SRI

Average Family Labour Use	Failed Rain	Unavail-ability of Major Inputs	Issues of Labour Usage	Irriga-tion Problem	Credit Problem	Personal Health Problem	Lack Of Knowl-edge of Various Opera-tions
Keonjhar	99	96	81	99	88	97	81
Nalanda	99	96	94	-	-	90	-
Gaya	99	99	96	92	85	92	-
Sarguja	-	99	-	95	-	88	97
Raigarh	99	90	94	83	-	-	97
Khunti	-	97	94	99	-	-	85

The Garrett ranking technique is a method to rank the constraints, based on the magnitude of the problems experienced by the respondents. This technique was used to find major problems farmers face, which compelled them to discontinue with SRI methods. Erratic and deficient rainfall (farmers termed it as failed rain); scarcity of skilled labour; lack of timely availability of inputs such as seeds, irrigation, and credit; lack of knowledge; and personal health problems were some of the reasons that compelled farmers to discontinue rice cultivation with SRI methods. Khunti and Keonjhar districts experienced the highest percentage (11 per cent) of dis-adoption, mainly because of the intermittent water supply and the failure of rains during the growing season in the region (with the highest Garrett Score—GS—of 99), which shows the criticality of water management in SRI.

Across all the districts, the failure of rainfall, in terms of the amount and its timeliness, was the major cause for dis-adoption. This was followed by lack of inputs and labour usage-related issues. The farmers also dis-adopted SRI because of personal health problems or sudden family problems. Farmers from four out of the six districts quoted this as a problem. Among other districts, the second highest percentage (ranked 80–96 per cent) of the farmers in Nalanda reported labour scarcity to be the most important problem because of which they were unable to continue SRI in their fields. The problem of irrigation and the lack of inputs also figured as important constraints and were the cause for dis-adoption of SRI in Nalanda. The lack of credit (with GS of 85 and 88) was another problem faced by farmers in Gaya and Keonjhar, which caused them to drop SRI methods in their fields. SRI involves the six steps in cultivation to be strictly followed, in order to get the desired results; lack of proper knowledge of these steps becomes a problem for the farmers leading to dis-adoption.

Clearly, proper training, hand-holding and capacity building are needed so that the farmers stay on course with SRI. Although farmers may know the importance of regular weeding in the SRI method, the unavailability of cono-weeders and the required extension services become major constraints in continuing with this new method in their fields.

Therefore, analysis of the data shows that whereas the adoption of SRI is overwhelming, there is also dis-adoption to some extent. Such dis-adoption may be termed involuntary dis-adoption, which implies that given the appropriate policy protection, SRI practice will be a boon for poor and small farmers.

The district-wise adoption pattern of SRI among farmers clearly outlines that there has been a steady increase in the adoption of SRI methods among the farmers

POLICY IMPLICATIONS AND CONCLUSION

The elaborate farm survey clearly provides the required empirical evidence on a few important policy parameters. The identification of factors such as yield advantage and labour usage strengthen the hypothesis that SRI methods, as an agro-ecological innovation, provide an opportunity of enabling farmers to produce more with less. Farmers with two or more years of experience of practice of SRI and who have acquired the skill were able to gain more input savings than novice SRI farmers in newer areas. An average yield advantage of 108 per cent in SRI over conventional methods portrays a precise picture of the huge potential of this new method of cultivation in rain-fed agriculture. The disaggregate analysis labour-use pattern provides evidence that the doubt on excessive labour use in SRI cannot be generalized. The negative perception of some new farmers on labour saving and reduced labour costs and other savings can be a question for further investigation. However, overall labour costs and savings under the different intensity levels give us enough evidence that the practice is amenable to small farmers. In fact, districts with high intensity of SRI adoption, representing intensity of promotion, show more promising results on their performance. District-wise wage differentials could be one of the reasons for higher cost of labour usage. The district-wise adoption pattern of SRI among farmers clearly outlines that there has been a steady increase in the adoption of SRI methods among the farmers. The motivational and advocacy drivers behind up-scaling to SRI suggests that the sustainability of this new technology will depend not only on its productivity enhancing agronomic characteristics but also on extension services such as advertisements, awareness camps and field visits by farmers.

As mentioned earlier, SRI has the potential to contribute to family food security. It is satisfying that small farmers are able to capture the opportunity to improve their food security. Most respondents have unanimously expressed that the SRI method provides additional availability of food (rice) for the entire year, which has changed the household food security scenario. The results show additional food availability for more than eight months for at least 40 per cent of the sampled families.

The analysis also shows that SRI imparts positive implications on the nature of women's employment, as seen in the shifting of traditional woman-dominated operations such as transplanting, weeding and harvesting. This shift has reduced their workload in labour – intensive agricultural operations. Weeding and transplanting have been seen as a woman's job from time immemorial. These are not only labour-intensive but also involve long working hours. The survey results show that SRI has changed the nature of the work of women farm workers, reduced women's labour and can, in the future, result in women's mobility to hired jobs in the non-farm sector, thereby enhancing family income. A clear transition

is observed from the traditional drudgery of weeding, transplanting and harvesting.

The dis-adoption pattern of SRI among farmers reveals a complex phenomenon. Several factors are responsible for the discontinuation of SRI, albeit in smaller quantum, among which the failure of rain, the unavailability of inputs and issues in the irrigation management are the most prominent. Whereas SRI has been acceptable to a large number of farmers, as depicted by the increasing adoption of the new method, the percentage of those who failed to continue due to various unavoidable reasons is a small proportion, ranging from an average dis-adoption of 6 per cent in 2007 to an increased level of 13 per cent in 2012.

The factors leading to dis-adoption of SRI include prominently failed rains during the critical crop season, irrigation and other input supply problems, etc. The failure of rains being an uncontrollable factor, the farmers can do very little, except to mitigate its impact by adopting methods such as SRI, which enable them to grow rice with less water. Farmers have realized that SRI is a climate-resilient practice; the process, however, requires that the soil be kept moist during the critical stages of growth. In extreme situations of consecutive drought, farmers intend to effectively manage water requirement in their fields. Because the soil cannot be kept moist, they are compelled to discontinue the crop. Therefore, farmers voted this as an overwhelming constraint and it reflected the highest Garret score of 99 per cent.

Farmers also identified other factors such as the unavailability of major inputs, issues of labour usage, irrigation problems, credit problems, personal health problems, lack of knowledge of various operations, etc., for dis-adoption. These factors may be termed desperate involuntary dis-adoption. The extension services using IT for a better understanding and implementation of SRI methods among farmers can solve these problems to some extent.