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# BUSINESS MODEL

## for Rice cultivation using

# SYSTEM OF RICE INTENSIFICATION (SRI)

**Published by:**
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

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Bonn and Eschborn

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GIZ

**On behalf of the**
German Federal Ministry for Economic Cooperation and Development (BMZ)

GIZ is responsible for the content of this publication

New Delhi, India
May, 2020

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# CONTENTS

# LIST OF TABLES

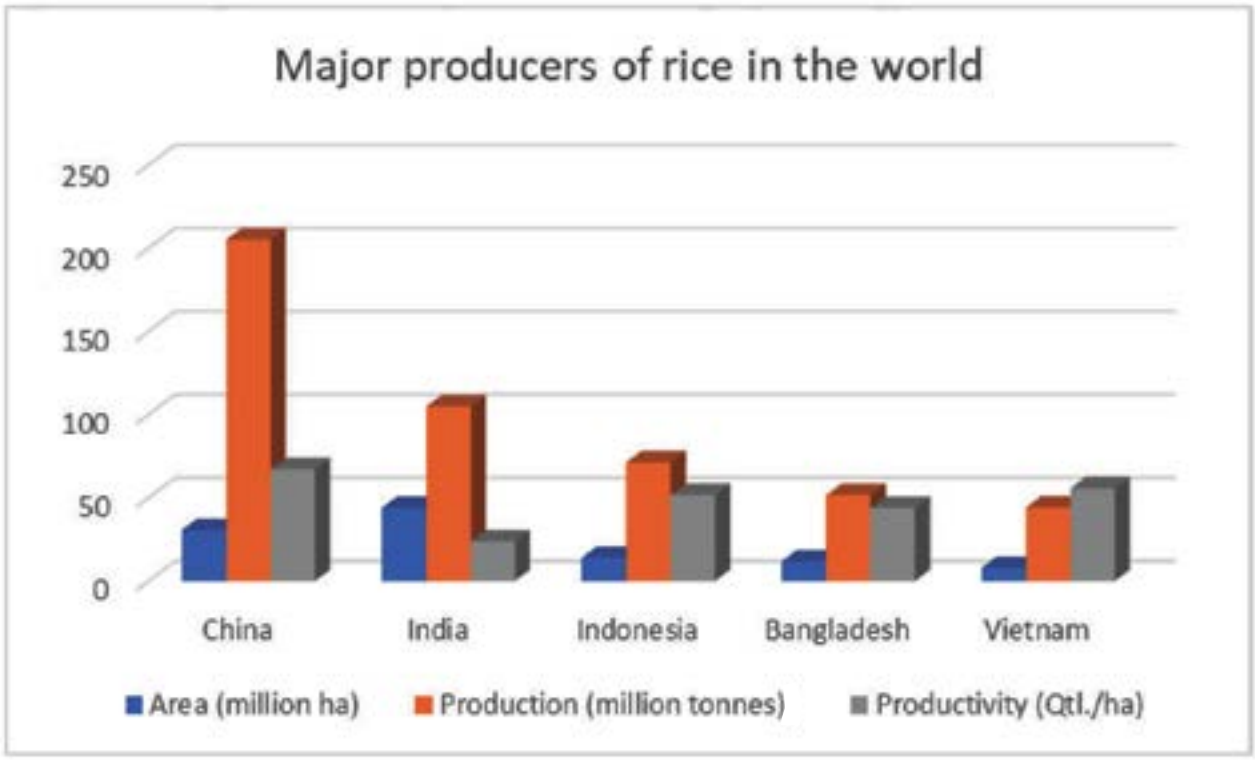


# LIST OF FIGURES

# 1 BACKGROUND

Rice is a major agricultural crop being cultivated by a large number of farmers in India. In fact, 90% of the land area under rice belongs to marginal, small and medium farmers in the country. Currently, rice is grown in 43.86 million ha with per ha productivity of 2390 kg with the total production being 104.80 million tonnes[1].

Figure 1: Area, production and yield of rice in major producing countries




*Source: Adapted from JMP's 2019 report Progress on Household Drinking Water, Sanitation and Hygiene, 2000-2017.*

Although India has the largest area under cultivation of rice in the world and is the second largest producer of rice, the per ha productivity of rice in India is quite low compared to productivity levels in other countries. Among the major rice producing nations, China has the highest productivity per ha (67.10 Qtl.) followed by Vietnam (55.73 Qtl.), Indonesia (51.52 Qtl.) and Bangladesh (43.75 Qtl.).

Although rice is cultivated across the country, the major rice producing state in India is West Bengal, which accounts for about 15% of the total rice production. Other major rice producing states are Uttar Pradesh, Andhra Pradesh, Punjab and Tamil Nadu.

[1] Agriculture Statistics at a Glance (2015)

## System of Rice Intensification (SRI)

Considering the low yield of rice in India, there is an urgent need for adopting suitable practices for enhancing the per ha productivity of rice. The adoption of improved techniques and practices for rice cultivation could benefit millions of small and marginal farmers across the country.

The System of Rice Intensification (SRI) is a viable methodology for enhancing the low rice yields in India. SRI is a climate-smart, agro-ecological methodology for increasing the productivity of rice by changing the management of plants, soil, water and nutrients[2].

SRI is based on the following principles:

- Early, quick and healthy plant establishment
- Reduced plant density
- Improved soil conditions through enrichment with organic matter
- Reduced and controlled water application

SRI does not necessarily require or depend on the use of improved or new varieties of rice or on the use of synthetic fertilisers and agro-chemical crop protection to get higher outputs, although such inputs may be used in conjunction with SRI management practices.

However, by reducing farmers' needs for seeds and water, SRI results in higher returns for farmers from their landholdings. SRI therefore contributes towards higher incomes for farmers while also being beneficial to the environment. SRI plants are less affected by water stress, storm damage, pests, and diseases as they demonstrate a resilience that is increasingly necessary with the growing hazards of climate change.

[2] SRI Methodologies (http://sri.ciifad.cornell.edu/aboutsri/methods/index.html)

# 2 CHALLENGES OF RICE CULTIVATION

The constraints of rice production vary from region to region across the country. For example, the major rice growing areas are concentrated in the Eastern region, which generally experiences high rainfall and severe floods almost every year, due to which large amounts of rice crops are affected. Similarly, in upland areas, the crops face setback either from high rainfall or drought-like conditions. However, some generic constraints/challenges in cultivation of rice are being discussed in this section.

## 2.1 Water availability and quality

Availability of water is critical for the cultivation of rice. However, farmers in the country are gradually experiencing water scarcity due to climate variations, change in precipitation, high evaporation, floods, continuous droughts and the competing demands of water among different sectors. In the near future, Indian farmers in general and rice cultivators in particular are expected to witness a substantial fall in the availability of water for irrigation. Moreover, farmers are also facing issues relating to degrading water quality and water pollution due to the overuse of fertilisers and pesticides, industrial pollution, and saline water intrusion in coastal regions.

## 2.2 Insect and pest management

In order to ensure productivity of rice farms, it is essential to ensure insect and pest management. However, the introduction of semi-dwarf varieties of rice and increased use of fertilisers and insecticides have led to a high incidence of several plant diseases and pest infestation. The incidence of diseases like blast, blight, and sheath rot has been on the rise in recent years on one hand, while on the other, attacks by pests such as brown plant hoppers, stem borers, and leaf folders are also troubling rice farmers across the country.

## 2.3 Degrading soil health

Farms across the country have been experiencing a decline in soil health. Some of the major factors causing declining soil health are a decline in soil biodiversity, salination; water-logging, soil contamination due to metals and pesticides, and soil erosion. Moreover, the practice of monoculture is also believed to result in micro-nutrient deficiencies in the soil. Declining soil health is a major constraint of rice cultivation.

## 2.4 Impact of changing climate

The changing climate is resulting in increased temperatures, reduction in rainfall and water stress, frequent droughts, and floods which pose a major challenge to rice cultivation. There is a need for developing climate-resilient varieties of rice and for changing existing cultivation practices.

## 2.5 Improving cultivation practices

Linked to the above factors is the fact that there is a relative lack of awareness and capacities among farmers regarding improved cultivation practices of rice. There is a need to improve cultivation practices at the farm level, as well as for the adoption of practices such as SRI that have the potential to enhance farm productivity.

## 2.6 Post-harvest management

Post-harvest management practices that include proper de-husking, grading, and storage are critical for rice cultivation. However, a majority of farmers presently sell their produce without de-husking, owing to lack of facilities. Even when de-husking is done, it is not of the desired quality, thereby reducing the market price of produce. There is thus a need for the capacity building of farmers and also for the provision of suitable de-husking infrastructure.

## 2.7 Financial support

Marginal and small farmers require financial resources to introduce improved seed varieties and for farm mechanisation, improved irrigation practices etc.

# 3 PROJECT IDEA

India has the highest area under rice cultivation, and is the second largest producer of rice in the world. However, the per ha production of rice in India is much lower than that of other leading rice producers. Low productivity of rice means low returns for farmers.

SRI as a methodology for rice cultivation has been developed since the 1980s. It is believed to contribute towards higher productivity, optimum use of capital labour, less input costs, and lesser water requirements (Mohammed, 2018[3]).

Research across several countries has revealed that SRI techniques are not only more productive, but also use less resources while being environmentally benign as compared to conventional or traditional rice production techniques (Sinha and Talati, 2007[4]).

In fact, SRI not only uses lesser quantity of seed per ha but also uses lesser quantity of water for irrigation. SRI alternative water management methods can reduce water use by 25-50%, while raising yields by 50-100% or more (Mohammed, 2018). Moreover, farmers can also reduce the use of costly and environmentally damaging chemical fertilisers and pesticides, thereby lowering their production costs.

The project idea is to support groups of rice growing farmers in adopting the SRI method of rice cultivation that will result in higher yields for them while reducing their input costs. The project seeks to build capacities of farmers in SRI methods while simultaneously providing them with the financial support to adopt improved irrigation and post-harvest technologies.

It is envisaged that at the village level, farmers will be organised in the form of Producer Groups (PGs), Joint Liability Groups (JLGs), or Farmer Interest Groups (FIGs). These groups will be federated in the form of cluster level organisations or Farmer Producer Organisations (FPOs) of smallholders to promote rice cultivation using SRI.

## 3.1 Intervention Strategies and Convergence

This project is based on the surmise that a local competent NGO will take the lead in collectivisation of farmers/ producers at the village level, while also facilitating the setting up of an FPO. The proposed project seeks to intervene at two levels i.e. at the farmer group level and at the FPO level. The following is the nature of intervention/support envisaged under this project idea:

### For support to farmer groups

The support may be provided through a local competent NGO or an established Farmer Producer Organisation for the following interventions.

[3] Mohammed, D. T. (2018). System of Rice Intensification: A review. International Journal of Innovative Agriculture & Biology Research April-June, 2018.

[4] Sinha, S. K. and Talati, J. (2007). Productivity impacts of the system of rice intensification (SRI): A case study in West Bengal, India. Agricultural Water management.

a. Farmer mobilisation and sensitisation for adoption of SRI techniques.
b. Formation of farmer groups i.e. PGs, FIGs, JLGs or SHGs.
c. Training and extension services on package of practices for SRI techniques.
d. Loans for purchasing implements that aid improved cultivation- inputs, facilities for irrigation etc.
e. Facilitating farmers' access to good quality seeds.
f. Facilitating farmers to get crop insurance.
g. Facilitating farmers to develop linkages with FPOs for processing (de-husking) of rice and also connect with markets.

A cluster approach will be followed and around 1000 acres (400 ha) of area is proposed to be taken up under SRI in one cluster.

### For support to FPOs

a. Establishment of office and processing unit of FPO.
b. FPO to support farmer mobilisation and sensitisation for adoption of SRI techniques.
c. FPO to provide machinery on rent to farmers.
d. Procurement of quality seeds and supply to members.
e. Provision of credit to farmers for cultivation costs – need based.
f. Promote crop insurance and ensuring farmers get crop insurance.
g. Processing (de-husking) paddy for the farmers.
h. Assisting the farmers in marketing their produce.
i. Agreements with the buyers and obtaining pre-finance from the buyers.
j. Convergence with various enabling schemes.

The funds can either flow directly to the FPO or through an NGO, which will have the overall responsibility of achieving the project objectives.

It is proposed that the FPO will be provided financial support (through loans) for establishment of infrastructure (capital costs) for processing rice. The FPO will also engage in capacity building of farmers and this can be done through subsidy/grant provision or through surplus revenues generated by the FPO.

## 3.2 Potential for upscaling

SRI model of rice cultivation has the potential for wide applicability. It can be replicated across West Bengal, Punjab, Uttar Pradesh, Tamil Nadu, Bihar, Karnataka, Andhra Pradesh, Telangana, Odisha, and in the north-east.

Table 1: Major rice growing areas in India

| State | Major rice growing area |
|---|---|
| West Bengal | Medinipur, Bardhaman, 24 Parganas, Bankura, Birbhum, West Dinajpur, Howrah, Hugli, Jalpaiguri, Coochbehar and Malda districts. |
| Punjab | Patiala, Firozepur, Ludhiana, Sangrur, Amritsar, Faridkot and Jalandhar districts. |
| Uttar Pradesh | Gorakhpur, Bareilly, Muzaffarnagar, Kheri, Faizabad, Barabanki, Banda, Varanasi and Pilibhit districts. |
| Tamil Nadu | South Arcot Vallalar, North Arcot Ambedkar, Nellai Kattabomman (Tirunelveli), Tiruchirapalli, Perumpidugu, Muthuraiyar, Coimbatore, Ramnathpuram and Salem districts. |
| Bihar | Rohtas, Bhojpur, Purnea, Paschim Champaran, Purab Champaran, Aurangabad, Gaya, Bhagalpur, Patna and Gopalganj districts |
| Karnataka | Tumkur, Dakshina Kannada, Shimoga, Mandya, Uttar Kannada, Mysore, Raichur and Kodagu districts |

*Source: http://www.yourarticlelibrary.com/rice/district-wise-distribution-of-rice-production-in-india/20925*

## 3.3 Comparison with traditional or conventional methods

Rice cultivation using the SRI method is believed to be less input intensive while resulting in higher yield for the farmers.

Studies reveal that per acre input use in paddy cultivation using SRI method is less costly than traditional or conventional methods. According to field surveys done by Aggarwal et. al. (2018)[5], the use of inputs per acre in paddy cultivation using SRI technique is less costly than traditional paddy cultivation. One of the major savings for farmers under SRI is in the cost of seeds. Under conventional practices, around 60 kg seeds per ha are required, whileonly 7 to 8 kg seeds per ha are required under SRI[6].

Under SRI, it is also believed that less expenditure is required on fertilisers and plant protection using chemicals. Scientists believe that under SRI, there is a reduction in the use of inorganic fertilisers by 50% if coupled with organic fertiliser, or some combination of organic fertilisers and biological fertilisers. However, labour costs are believed to be slightly higher under SRI due to the additional labour involved in transplantation and weeding.

As far as yields are concerned, studies report that average rice yields are much higher under SRI as compared to traditional or conventional methods. Uprety (2004[7]) reported that the average rice yield with SRI is 8 tonnes per ha as compared to a yield of 3 tonnes per ha under conventional paddy.

Studies also reveal that in addition to economic benefits, SRI also has environmental and ecological merits as compared to conventional cultivation systems. One of the most important advantages is that under SRI, there is significant water conservation while there is also a reduction in the use of inorganic fertilisers, since a combination of organic and inorganic fertilisers is generally used under SRI.

## 3.4 UPNRM Case example: Shri Kshethra Dharmasthala Rural Development Project (SKDRDP)

This project idea is based upon the model established by Shri Kshethra Dharmasthala Rural Development Project (SKDRDP) under the Umbrella Programme for Natural Resource Management (UPNRM). SKDRDP is a trust which works in various districts in Karnataka with significant contribution in the areas of rural and agriculture development. SKDRDP also has a microfinance programme and is regarded as one of the biggest microfinance providers in the country. The project was undertaken in 8 districts of Karnataka.

Table 2: Project area, farmers and acreage

| Sl. No. | Particulars | Phase I 2010-12 | Phase II 2012-14 | Total |
|---|---|---|---|---|
| 1 | Project Area (districts) | Uttara Kannada, Dakshina Kannada, Udupi, Haveri, Shimoga, Chikmagalur, Dharwad and Coorg | Uttara Kannada, Dakshina Kannada, Udupi, Haveri, Shimoga, Chikmagalur, Dharwad, Coorg | 8 districts |
| 2 | Total No. of farmers | 29108 | 17737 | 46845 |
| 3 | Area (acres) | 38379 | 19478 | 57857 |
| 4 | Total no. of trainings | 1350 | 936 | 2286 |
| 5 | Participant farmers | 54000 | 19000 | 73000 |

[5] Agarwal, P.K., Yadav, P. and Mondal, S. (2018). Economic Analysis of Cost and Return Structure of Paddy Cultivation under Traditional and SRI method: A comparative study. International Journal of Agriculture Sciences, Vol. 10, Issue 8, 2018

[6] http://www.agritech.tnau.ac.in/expert_system/paddy/riceecosystem.html#SRI

[7] Uprety, R. (2004). Performance of System of Rice Intensification in Morang District. Available at:http://ciifad.cornell.edu/sri/countries/nepal/nepalrptuprety041.pdf

The highlights of this pilot are as follows::

- The project to promoted rice cultivation using SRI method was implemented across 8 districts of Karnataka during the period 2010 to 2014.
- 46845 farmers having a cropping area of more than 57857 acres were directly covered under this programme.
- A total of 2286 capacity building training sessions were organised in which about 73000 farmers participated.
- At each taluka/block level the organisation has a Block agriculture officer (who looks after microfinance as well as the SRI programme). These Block officers are guided by district coordinators.
- To mobilise farmers, build their capacities and facilitate microfinance linkages, the organisation appointed SRI promoters. There are 60 SRI promoters under each Block Officer.
- At the village level, the farmers were organised into Joint Liability Groups (JLGs).
- The identified beneficiaries were provided financial support to take up SRI practice. The SRI promoter personally supervised the initial cultivation practices.
- The SRI promoters and SRI supervisors ensured that the farmers became adept in SRI methodology and practices. In fact, the handholding support was provided for four paddy cycles so that the farmers became fully aware of the SRI practice.
- In order to assist the farmers in cultivation and harvest of SRI rice, SKDRDP also provided modern tools and equipment to farmers. These are run and managed by the farmer groups.
- Farmers are using markers for transplanting, power tillers for levelling, tilling and ploughing purposes.
- Weeding may be done manually or through the use of motorised 'Conoweeders' provided by SKDRDP. Harvesters and threshers are also provided.
- Each farmer is encouraged to adopt the SRI method at least on an acre of land.
- The farmers are provided loans, which are generally repaid on a weekly basis. Farmers had to repay the loan across 4 crops spread across two and a half years. The interest on loan is a reasonable 14%. This loan is provided by a microfinance institution being managed by SKDRP.

## 3.5 Business model with flowchart representation

Under this model, it is proposed that an established NGO – like the Shri Kshethra Dharmasthala Rural Development Project (SKDRDP), can take the lead in facilitating this business model. The NGO/facilitating agency would provide support in mobilisation of farmers into SHGs/PGs/FIGs and later collectivise them in the form of an FPO.

For establishing the enterprise, the NGO would facilitate the FPO in obtaining a loan (along with grant/subsidy - if applicable) from NABARD or commercial banks for establishing an office-cum-processing centre, setting up of enabling infrastructure for storage and processing of paddy/rice, and for the establishment of systems for collection of produce from farmers. In addition to the capital loan, the FPO could also obtain a loan for meeting working capital requirements and operational costs of the processing centre.

This model would operate on the premise that the FPO would not purchase the produce from the farmers, instead working as a service provider. It would engage in capacity building of farmers/producer groups in SRI techniques and provide handholding support to the farmers during the cultivation period. The FPO would also assist the farmer groups in business planning, and facilitate crop insurance for the farmers.

Once the produce is harvested by the farmers, the JLGs/PGs would aggregate the produce and the FPO would get the produce collected and processed (de-husked). In return, the farmers would pay per quintal processing fee to the FPO which would be used for meeting the operational expenses of FPO. Moreover, the FPO would generate additional revenues through the sale of rice powder (that is generated at the mill at the time of processing).

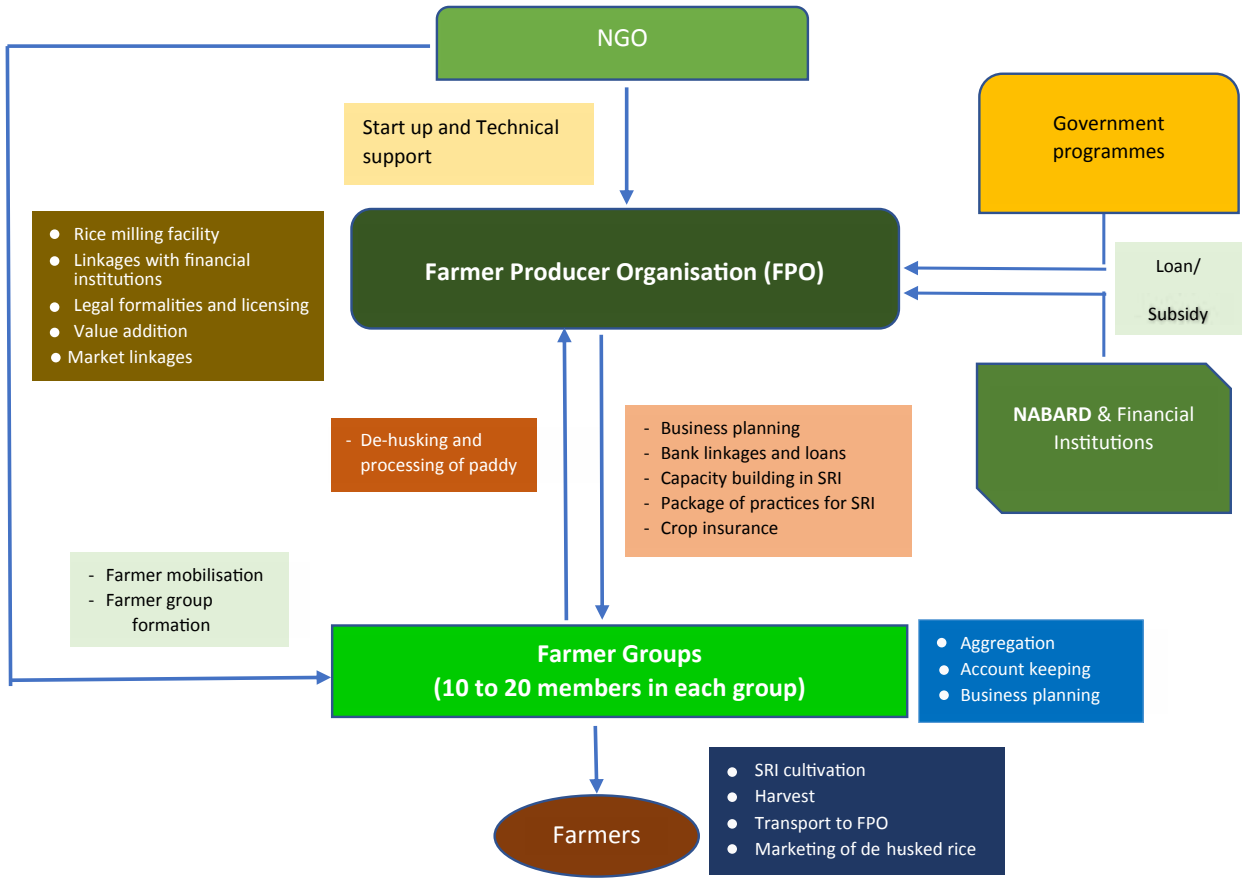
After the farmer produce is processed, the FPO would establish linkages with buyers to sell the produce at remunerative prices. The sale proceeds would be transferred to the JLGs/PGs (after deducting the milling costs). The farmer groups would distribute the revenues from sale amongst the farmers based on the quantity of produce supplied by them.

The NGO or the FPO can also channelise loans for the farmers (through banks) after keeping a fixed margin on interest rates to meet its administrative cost. These loans would be utilised by the farmers to meet cost of production or for developing irrigation facilities.

It is expected that the FPO would become self-sustaining after an initial period of 1 to 2 years.

The following flow chart represents the role of various institutions within the business model and also depicts the flow of inputs and outputs:

Figure 2: Diagrammatic representation of the proposed business model



# 4 IMPACTS AND SUSTAINABILITY

## 4.1 Impacts – Social, Economic and Environmental

### Social impacts

a. Building social capital and social cohesion through organisation of farmers.

b. Federating the farmer groups into FPOs thereby creating a socio-economic network of farmers at the cluster level.

c. Building capacity of individual farmers and also farmer groups.

d. Generating additional employment for a number of people through the FPO and other business activities.

e. Facilitating farmers to buy enabling equipment for time and cost saving.

### Economic impacts

a. Ensuring higher yields for farmers per acre.

b. Reducing input costs for farmers (reduced use of seeds, chemical fertilisers, pesticides, insecticides etc.)

c. Reducing economic risks for farmers by facilitating crop insurance.

d. Assisting farmers in value addition to paddy (de-husking) for enabling them to get higher prices.

e. Linkages with buyers to ensure higher prices for farmers' produce and eliminating intermediaries.

### Environmental impacts

a. Reduction of soil, water, and air pollution because of reduction in the use of chemical fertilisers, pesticides and insecticides.

b. Conserving water - SRI method uses less water than conventional paddy cultivation.

## 4.2 Mainstreaming Options

This model has a high potential to be replicated, in rice growing belts of the country, particularly in the states of West Bengal, Uttar Pradesh, Punjab, Tamil Nadu, Bihar and Karnataka. This model could be promoted through financial support from banks and other financial institutions while technical agencies and NGOs may take the lead in popularising and mainstreaming this model.

## 4.3 Sustainability

Based on the experiences of SKDRDP, which has been implementing a similar model in Karnataka, it can be seen that the present model has the potential to become self-sustainable after support for the initial 3 to 4 years.

In fact, while designing this model, certain key components have been incorporated that will help ensure that it will become self-sustainable. These are:

1. Facilitating agency to provide initial facilitation, startup and handholding support.
2. Capacity building of farmer groups and FPOs in governance, business planning and financial management.
3. Farmer groups to be linked with banks and bank loans provided to farmers.
4. Convergence with ongoing government schemes to be achieved.
5. The economics of this model indicate good returns from the farmers and the FPO.
6. FPO to provide machinery to the farmers on reasonable rent for performing all major agricultural operations.
7. The farmers are able to get the services of FPO for processing of their produce while only paying a very nominal fee.
8. The cost-benefit calculated under the model does not include any grant or subsidy for the FPO.
9. This model factors in the cost benefit of rice cultivation only, and that too for one crop per year. However, in case of farmers having irrigated land, SKDRDP is encouraging them to cultivate 2 to 3 paddy crops per year that would result in higher revenues. Even in other geographical areas, farmers would take up at least one more crop (in addition to paddy) per year, thereby resulting in higher economic gains for the farmers.

# 5 FINANCIAL DETAILS

## 5.1 Scope of financing and subsidy

Although farmers generally do not usually require financial support in the case of rice cultivation, they may require some financial support in case of rice cultivation using SRI in order purchase equipment that aids in enhancing crop productivity.

It is suggested that in addition to getting bank loans, the farmers may also access various schemes at the state level that provide subsidies for rice cultivation using the SRI method. FPOs may also facilitate the farmers to obtain loans for meeting their cultivation costs. These loans would be sourced from NABARD or other banks. It is estimated that individual farmers may require loans up to INR 20000, although a majority of them may seek lesser amounts as loans.

Under this business model, the FPO would require a loan of up to INR 98.25 lakhs for meeting capital costs, and a working capital loan of INR 53 lakhs for meeting the operational costs. However, the capital requirements of the FPO could be reduced in case they decided to keep less machinery. Working capital requirements would primarily be met through loans from NABARD and other banks, while capital costs would be met partially through loans and partially through grant assistance from NABARD.

**NABARD:** NABARD provides financial grants of up to INR 10 lakhs per FPO to meet the initial expenses of each FPO. In addition to this, NABARD also provides loans of up to INR 1 crore to FPOs to meet working capital requirements. These loans are provided directly by NABARD or routed through other banks.

**Custom Hire Service Centres (CHSC):** The Department of Agriculture, Government of Karnataka is setting up a CHSC at Hubli (cluster level) to assist small and marginal farmers, and to provide agriculture machinery at their doorstep. SKDRDP has collaborated with the Government of Karanataka to set up various CHSCs. The objective of this programme is to provide machinery to the farmers at affordable rental rates to help reduce labour costs as well as to enhance farm productivity. FPOs could establish such centres whereever applicable.

For individual farmers, there are a number of schemes of the central government as well as respective state governments that provide grants and subsidies that they can access. The individual farmers may be supported by their FPO (through farmer groups) to access such schemes. The details of some of the schemes are given below:

**Pradhan Mantri Krishi Sinchai Yojana (PMKSY):** Irrigation is critical for paddy cultivation and under the PDMC component of PMKSY, financial assistance is available up to 55% for small and marginal farmers and 45% for other farmers for the adoption of micro irrigation systems.

At the state level, there are a number of schemes that give financial assistance to farmers for paddy cultivation, including assistance for seeds, demonstration on SRI, incentives on Conoweeder and other farm equipment, subsidy on rice transplanters, subsidy on farm mechanisation etc. Such schemes can be accessed by the farmers through the FPO.

## 5.2 Cost Economics

The proposed business model provides estimates of cost-benefits at two levels i.e. at the level of individual farmer and at the level of the FPO for rice cultivation through SRI method, processing and marketing.

### 5.2.1 Cost-benefit for farmers

The following table provides details of the expected cost of cultivation and the expected net revenue for individual farmers engaged in rice cultivation using SRI method on one acre of land.

Table 3: Cost-benefits for individual farmers engaged in SRI rice cultivation (1 acre landholding)

| S.No | Particulars | Unit | Quantity | Unit cost (INR) | Cost to farmer | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **A.1** | **Sowing practices** | | | | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| 1.1 | **Land preparation** | | | | | | | | |
| 1.1.1 | Paddy field preparation using machines (machine hire cost given separately) | | | | -- | -- | -- | -- | -- |
| 1.2 | **Cost of planting material** | | | | | | | | |
| 1.3 | **Cost of raising paddy nursery for 1 acre** | 1 | | | | | | | |
| 1.3.1 | Paddy seed | Kg | 10 | 40 | 400 | 420 | 441 | 463 | 486 |
| 1.3.2 | Manure | L/S | | 600 | 200 | 210 | 221 | 232 | 243 |
| 1.3.3 | Seed Bed preparation using machines (machine hire cost given separately - material cost considered here) | L/S | | 400 | 400 | 420 | 441 | 463 | 486 |
| 1.4 | **Transplantation using machines** (machine hire cost given separately) | | | | -- | -- | -- | -- | -- |
| | **Total (A.1)** | | | | **1000** | **1050** | **1103** | **1158** | **1216** |
| **A.2** | **Main field cultivation-Paddy** | | | | | | | | |
| 2.1 | **Cost of Manure, irrigation, fertilisers etc.** | | | | | | | | |
| 2.1.1 | Manure (Trolley) | Nos | 0.5 | 3000 | 1500 | 1575 | 1654 | 1736 | 1823 |
| 2.1.2 | Irrigation | L/S | | 600 | 600 | 630 | 662 | 695 | 729 |
| 2.1.3 | Fertiliser | L/S | | | 1100 | 1155 | 1213 | 1273 | 1337 |
| 2.2 | De-weeding using machines (machine hire cost given separately) | | | | -- | -- | -- | -- | -- |
| 2.3 | Plant Protection | L/S | | | 680 | 714 | 750 | 787 | 827 |
| 2.4 | Harvesting using machines (machine hire cost given separately) | | | | -- | -- | -- | -- | -- |
| | **Total (A.2)** | | | | **3880** | **4074** | **4278** | **4491.6** | **4716** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **A.3** | **Post-harvest expenses** | | | | | | | | |
| 3.1 | Milling (de-husking) cost | Per quintal | 35 | 75 | 2625 | 2756 | 2894 | 3039 | 3191 |
| 3.2 | Primary packing | Per quintal | 22 | 60 | 1320 | 1386 | 1455 | 1528 | 1604 |
| | **Total A.3** | | | | **3945** | **4142.3** | **4349.4** | **4566.8** | **4795.17** |
| **A.4** | **Other Expenses** | | | | | | | | |
| 4.1 | Cost of hiring machines (land preparation, seed bed preparation, transplantation, de-weeding, harvesting and baling straw) | Per crop cycle | | 12000 | 12000 | 12600 | 13230 | 13892 | 14586 |
| 4.2 | Crop Insurance per acre | Per annum | 1 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| | **Total A.2.4** | | | | **13700** | **14300** | **14930** | **15592** | **16286.1** |
| | **Total Cost (Total A.1+A.2+A.3+A4)** | | | | **22525** | **23566** | **24660** | **25808** | **27013** |
| **B** | **Productivity** | | | | | | | | |
| B.1 | Production per acre Paddy Rice | Qtl. | 35 | | | | | | |
| B.2 | Sale of rice | Qtl. | 22 | 3500 | 77000 | 80850 | 84893 | 89137 | 93594 |
| B.3 | Sale of husk | L/S | | | 1000 | 1050 | 1103 | 1158 | 1216 |
| | **Gross returns (Total B)** | | | | **78000** | **81900** | **85995** | **90295** | **94809** |
| | **Net Returns (B-A)** | | | | **55475** | **58334** | **61335** | **64487** | **67797** |

## Assumptions

- All agricultural operations (such as land preparation, seed bed preparation, transplantation, de-weeding, harvesting and baling straw) would be performed using machinery. The machinery would be hired on rent from the FPO.
- Under this model only one paddy crop per year has been considered under irrigated conditions, although SKDRDP is enabling farmers to take two to three paddy crops per year.
- FPO may facilitate a loan for farmers of around INR 20000 to enable them to meet initial production costs.
- Convergence with existing schemes of government for getting subsidy on equipment such as power tiller could be availed by interested farmers.
- Inflation at the rate of 5% per annum has been factored in while calculating all costs as well as revenues.
- This model is based on yield estimates from Uttara Kannada district of Karnataka. In case of other regions, the yield may show slight variations.
- The FPO would charge a processing fee from the farmers for de-husking and polishing of rice.
- The FPO would offer farm equipment on rent to the farmers.
- The revenue from sale of husk would be given by the FPO to the farmers.

## Economic analysis

Under the proposed model, farmers are able to get a return of around INR 2.85 lakhs – annualised over 5 years. The net annual returns are around INR 0.35 lakhs (Year 1) to INR 0.72 lakhs (Year 5) – assuming a capital cost of INR 20000 in Year 1 for meeting operational costs.

The Benefit Cost ratio for an individual farmer is calculated to be 1.82 which is quite good.

Table 4: Economic analysis of rice cultivation using SRI method in one-acre landholding

| Particulars | Amount (INR) | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| Capital Cost | | 20000 | 0 | 0 | 0 | 0 | 20000 |
| Recurring Cost | | 22525 | 23566 | 24660 | 25808 | 27013 | 123572 |
| Total Cost | | 42525 | 23566 | 24660 | 25808 | 27013 | 143572 |
| Total Benefits | | 78000 | 81900 | 85995 | 90295 | 94809 | 430999 |
| Net benefits | | 35475 | 58334 | 61335 | 64487 | 67796 | 287427 |
| | | | | | | | |
| Net present worth of cost @15% | **99198** | | | | | | |
| Net present worth of benefits @15% | **285061** | | | | | | |
| Benefit Cost Ratio | 2.87 | | | | | | |
| IRR | >150 | | | | | | |

IRR for a farmer taking one paddy crop per year from one acre land is greater than 150 over a period of 5 years.

### 5.2.2 Cost-benefit for FPOs

Details of cost-benefit of FPOs engaged in processing and assisting in marketing of rice is provided is as follows:

Table 5: Cost-benefits for FPOs engaged in processing of rice and assisting in marketing (1000 acres)

| S. No | Particulars | Unit | Quantity | Cost (Rs.) | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|---|---|---|
| **A.1** | **Capital Cost** | | | | | | | | |
| 1.1 | Land | Bigha | 0.5 | 500000 | 2.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1.2 | Shed and godown construction | sq. ft | 1000 | 400 | 4.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1.3 | Office equipment (weight machines, chairs, table, shelf, desktop computer, printer etc.) | Lumpsum | 1 | 75000 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1.4 | Paddy transplanter | Per unit | 1 | 1200000 | 12.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1.5 | Tractor (including rotovator and cultivator) | Per unit | 1 | 1000000 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1.6 | De-weeder | Per unit | 5 | 30000 | 1.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1.7 | Combine harvester | Per unit | 1 | 2000000 | 20.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1.8 | Paddy bailer | Per unit | 1 | 250000 | 2.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1.9 | Paddy de-husking, polishing and packaging unit- (including installation and license fee) | Nos | 1 | 3000000 | 30.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1.10 | Vehicle for transport of paddy from farmer fields | Nos | 1 | 1500000 | 15.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Total capital cost | 98.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| A.2 | Recurring cost | | | | | | | | |
| 2.1 | Mobilisation of farmers, training and technical guidance on SRI (per year for 3 years) | Acre | 1000 | 2000 | 20.00 | 20.00 | 20.00 | 0.00 | 0.00 |
| 2.2 | Operational and maintenance expenses of processing unit | Quintals | 35000 | 50 | 17.50 | 18.38 | 19.29 | 20.26 | 21.27 |
| 2.3 | Operations and maintenance expense of machinery | Per month | 12 | 500000 | 60.00 | 63.00 | 66.15 | 69.46 | 72.93 |
| 2.4 | Staff, administration, travel, coordination, marketing etc. | Month | 12 | 100000 | 12.00 | 12.60 | 13.23 | 13.89 | 14.59 |
| 2.5 | Interest on loan for working capital (12%) | Per annum | 12 | | 6.36 | 5.39 | 4.31 | 3.09 | 0.00 |
| 2.6 | Interest on loan for capital cost (12%) | Per annum | 12 | | 11.79 | 13.20 | 12.33 | 11.35 | 10.26 |
| | | | | Total recurring cost | 127.65 | 119.37 | 122.98 | 106.70 | 108.79 |
| | | | | Total cost - capital and recurring | 225.90 | 119.37 | 122.98 | 106.70 | 108.79 |
| A.3 | Income/ Benefits | | | | | | | | |
| 3.1 | Income from rental of machinery | Acre | 1000 | 12000 | 120.00 | 126.00 | 132.30 | 138.92 | 145.86 |
| 3.2 | Income from processing/de-husking of rice | Quintals | 35000 | 75 | 26.25 | 27.56 | 28.94 | 30.39 | 31.91 |
| 3.2 | Income from sale of rice bran | Quintals | 2450 | 900 | 22.05 | 23.15 | 24.31 | 25.53 | 26.80 |
| | | | | Total Income | 168.30 | 176.72 | 185.55 | 194.83 | 204.57 |
| | | | | Gross Profit | 40.65 | 57.35 | 62.57 | 88.13 | 95.78 |

## Assumptions

In the above analysis, the following assumptions have been made:

- The above analysis assumes that the FPO is promoting cultivation of rice using SRI method with about 500 to 1000 farmers cultivating an aggregated area of 1000 acres.
- Under the above analysis cost-benefit from only one crop of paddy has been considered. Although as per SKDRDP under irrigated conditions 2 to 3 crops of paddy are taken in one year.
- The available subsidy from various sources has not been factored in this model which has been prepared on the basis of maximum cost in order to assess economic viability.
- The storage infrastructure will be made of low-cost materials.
- The machinery for farm mechanisation would have a capacity of being used in 2000 to 3000 acres in one year.
- The FPO would obtain loan for meeting capital costs as well as another loan for meeting working capital requirements.
- An increment of 5% each year for price escalation has been factored in.
- An increase of 5% each year in the cost of processing has been factored.
- FPO would charge INR 12000 per acre from the farmers for renting the farm machinery and equipment.
- Operation and expenses of machinery include salary of drivers for operating the machinery and equipments as well as cost of fuel and maintenance.
- The staff of FPO will coordinate the entire business operation including capacity building of farmers in SRI methods.
- The FPO would provide free transport to farmers/farmer groups for bringing the produce to the milling centre.
- The FPO would charge per quintal cost from farmers for de-husking and polishing of paddy.
- The rice bran left with the rice mill (FPO) after polishing would be sold by FPO.

## ECONOMIC ANALYSIS

Under the proposed model, the FPO is expected to generate profits from the first year onwards (excluding capital expenditure). From the second year onwards, the gross profits of the FPO are expected to be around INR 57 lakhs per annum while in Year 5, the FPO is projected to generate a gross profit of around INR 96 lakhs.

The projected interest on loans for capital expenditure and also for working capital have also been included while calculating the gross profit. The Benefit Cost ratio is projected to be 1.27 which is quite encouraging and shows the viability of the model. In fact, the strength of this model is that the FPO is taking very nominal charges from farmers for providing various services.

Table 6: Economic analysis of operations of FPO

| Particulars | Amount in INR Lakhs | | | | | |
|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| Capital cost | 98 | 0 | 0 | 0 | 0 | |
| Recurring cost | 128 | 119 | 123 | 107 | 109 | |
| Total cost | 226 | 119 | 123 | 107 | 109 | 684 |
| Total benefits | 168 | 177 | 186 | 195 | 205 | 930 |
| **Net benefits** | **-58** | **57** | **63** | **88** | **96** | **246** |
| Net present worth of cost @15% | **483** | | | | | |
| Net present worth of benefits @15% | **615** | | | | | |
| Benefit Cost Ratio | **1.27** | | | | | |
| Debt Service Coverage Ratio | **1.80** | | | | | |
| Payback period | 2.004 years | | | | | |

## LOANS

It is envisaged that for meeting capital expenditure, the FPO would require a loan of INR 98.25 lakhs in the first year of operation, while it would require a loan of INR 53 lakhs in the first year for meeting the working capital requirements.

The working capital loan would be repaid over a period of 5 years.

Table 7: Working capital loan for FPO

| Working Capital Loan | INR in Lakhs | | | | |
|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| Working Capital loan | 53 | | | | |
| Repayment | 14.43 | 14.43 | 14.43 | 14.43 | 14.43 |
| Interest on net working capital Loan (Diminishing) @ 12% per annum | 6.36 | 5.39 | 4.31 | 3.09 | 0.00 |
| Total loan outstanding (at beginning of year) | 53 | 44.93 | 35.89 | 25.77 | 14.43 |
| Repayment | 14.43 | 14.43 | 14.43 | 14.43 | 14.43 |

The repayment of loan for capital expenditure would be initiated from the second year onwards, and it is expected to be repaid over a period of 10 years.

Table 8: Term loan for FPO

| Term loan | INR in Lakhs | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Y 1 | Y 2 | Y 3 | Y 4 | Y 5 | Y 6 | Y 7 | Y 8 | Y 9 | Y 10 |
| Capital expenditure | 98.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Interest on capital loan (Diminishing) @ 12% per annum | 11.79 | 13.20 | 12.33 | 11.35 | 10.26 | 9.03 | 7.66 | 6.12 | 4.40 | 0 |
| Total loan outstanding (at beginning of year) | 110.04 | 102.76 | 94.62 | 85.49 | 75.27 | 63.82 | 51.00 | 36.64 | 20.56 | 0 |
| Repayment | 0.00 | 20.48 | 20.48 | 20.48 | 20.48 | 20.48 | 20.48 | 20.48 | 20.48 | 20.56 |

# 6 RECOMMENDATIONS AND WAY FORWARD

Rice is an important crop for Indian farmers, a large majority whom are engaged in paddy cultivation. Unusually low yields from paddy have a significant impact upon the economic well-being of the farmers. Rice cultivation using the SRI method has the potential to significantly enhance crop yields for farmers while also reducing input costs.

The present model has been developed with an aim to popularise rice cultivation using the SRI method. Based on the concept of farmer groups federated at the cluster level, the proposed model requires adoption by NGOs who will facilitate the implementation of this model.

Financial institutions need to get an opportunity to analyse this business model and, if found suitable, they may support such a model.

Technical support groups or other enabling agencies need may consider developing publicity materials (printed as well as audio-visual) that may help publicise and popularise this model.

The channel partner of GIZ India i.e. SKDRDP, Dharmasthala may be roped in to conduct exposure visits for organisations that take up this model/are interested in taking up this model.

# NOTES

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