



Business Model

Sustainable Sugarcane Initiative

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Sustainable Sugarcane Initiative

1. Background

Sugarcane is an important crop in India. In Uttar Pradesh, Maharashtra and Tamil Nadu, sugarcane plays a major role in these states' economy. Sugarcane is grown by 35 million farmers. While another 50 million depends on employment generated by the 571 sugar factories and other industries using sugar (¹ICRISAT, 2009).

In the agriculture sector, during 2006-07, sugarcane's share was about 7% of the total value of agriculture output and occupies about 2.6% of India's Gross Cropped Area (GCA) (²Directorate of sugarcane development, 2013). At present, India ranks second in the world, after Brazil, in terms of area (4.1 m ha) and sugarcane production (355 million tonnes in the year 2007). Despite its long tradition and large area in India, in terms of productivity, sugarcane yields are unimpressive, especially where the crop is irrigated. The average productivity of sugarcane is low with certain regions reporting yields as low as 40 t/ha only. Not only is the cane yield low, the sugar yield - typically at less than 10% of cane weight - is also less than satisfactory. The Australian sugar industry for instance is regularly typified by sugar yields of around 14%, while yields of up to 25 tonnes of sugar per hectare have been reported in Hawaii.

2. Challenges in Sugarcane Farming

Sugarcane cultivation and the sugar industry in India are facing serious challenges due to various internal and external factors. The major challenges with sugarcane farmers (³Chand, Pawar, Krishna, 2016) are:

- Inadequate irrigation facilities
- Non-availability of easy credit facilities
- High labour costs
- Payments not done on time

Apart from this, water availability is unpredictable. The concern is not only the quantity of water required but also the lack of proper water management practices. Due to this, water is either wasted or sometimes not available at the right time. Unpredictable climatic aberrations, improper cultivation practices, negligence in plant protection measures, imbalanced nutrient management and other practices like mono cropping often result in low productivity, fetching a low price in the market. In the future, these challenges will become even more complex with climate change inducing direct and indirect effects on crops, water, pests and diseases, and volatility in the international market (ICRISAT, 2009).

1 Training Manual on Sustainable Sugarcane Initiative: Improving Sugarcane Cultivation in India, an Initiative of ICRISAT-WWF Project, ICRISAT

2 Status paper on sugarcane by Directorate of Sugarcane Development, 2013

3 Research article "Constraints faced in production and marketing of sugarcane in Parbhani district of Maharashtra"



3. Sustainable Sugarcane Initiative (SSI)

3.1 Brief Overview of SSI

SSI is a method of sugarcane production which involves using less seeds, less water and optimum utilisation of fertilisers and land to achieve more yields. Driven by farmers, SSI is an alternate to conventional seed, water and space intensive sugarcane cultivation.

The major principles that govern SSI are:

- Raising nursery using single budded chips.
- Transplanting young seedlings (25-35 days old).
- Maintaining wide spacing (5X2 feet) in the main field.
- Providing sufficient moisture and avoiding inundation of water.
- Encouraging organic method of nutrient and plant protection measures.
- Practicing intercropping for effective utilisation of land. (ICRISAT, 2009).

3.2 Comparison between Conventional Farming and SSI

SSI follows improved cultivation practices. Instead of planting a large number of seeds/setts directly on fields, SSI recommends to grow buds in the nursery and thereafter, transplant plant young seedlings (25-35 days old) on the field. Due to this practice, the better growth of plants is ensured. Increased spacing (5 ft between rows) enhances the scope of intercropping and also plant obtains abundant sunlight, moisture and nutrients. It results into a large number of tillers, almost two times than the conventional method. Selection of healthy seedling, nurturing them in nursery and availability of sufficient nutrient and water in SSI makes plant healthy and reduces mortality of plants across various stages from transplantation to full grown plant. The below table illustrates the differences between conventional farming and SSI.

Table 1: Difference in Cultivation Practices between Conventional Farming and SSI

Aspect	Conventional	SSI
Seeds/Setts	48,000 buds (16,000 three budded setts/acre)	5000 buds (5000 single budded chips/acre)
Nursery preparation	No	Yes
Measures to maintain uniformity among plants	No Grading	Grading is done during nursery
Planting	Direct planting of setts in the main field	Transplanting of 25-35 days old young seedlings raised in a nursery
Spacing	1.5 to 2.5 ft between rows	5 ft between rows
Water requirement	More (flooding of field)	Less (maintenance of moisture in the furrows)
Mortality rate among plants	High	Low
No. of tillers per plant	Less (10-15)	More (20-25)
No. of millable canes achieved per clump	4-5	9-10
Accessibility to air and sunlight	Low	High
Scope for intercrop	Less	More

Source: Training Manual on Sustainable Sugarcane Initiative: Improving Sugarcane Cultivation in India, an Initiative of ICRISAT-WWF Project, ICRISAT.



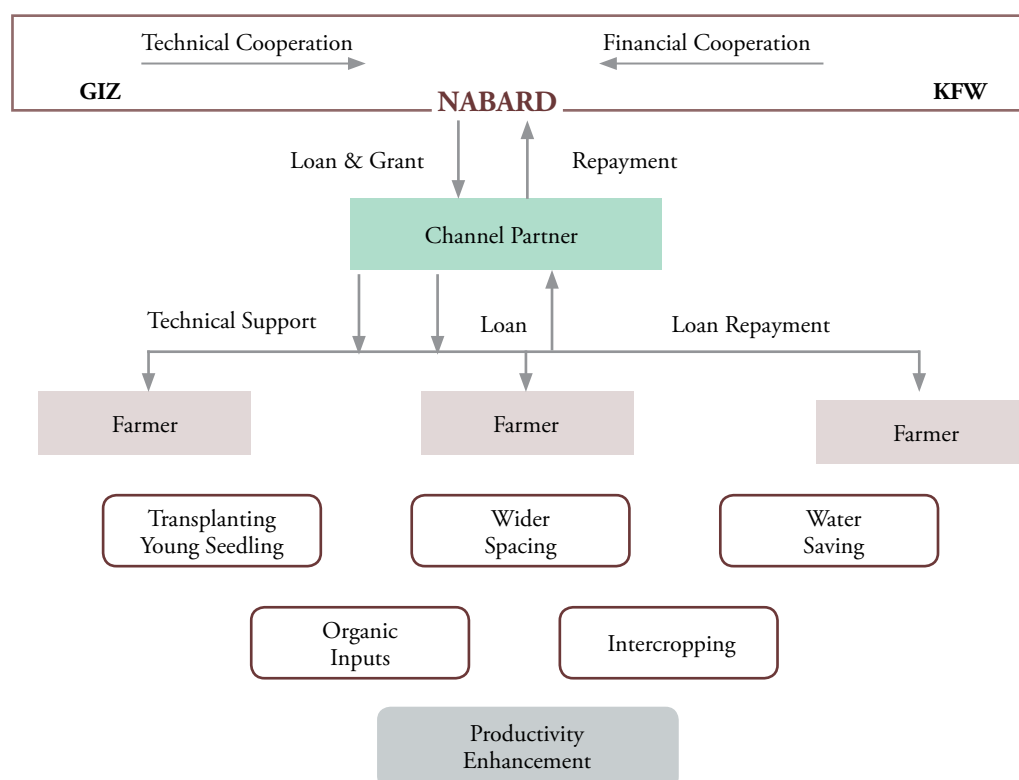
4. Case Example: Pilot done under Umbrella Programme for Natural Resource Management (UPNRM)

UPNRM is a joint venture of ⁴National Bank for Agriculture and Rural Development (NABARD), ⁵GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) and ⁶KfW (Kreditanstalt für Wiederaufbau) which extend the loan with need based grant to Non-Governmental Organisations (NGOs), Community Based Organisations (CBOs), Producer Organisations (POs), banks, private companies etc for promoting natural resource based livelihoods and enterprises across India. GIZ being a technical agency provides technical support to NABARD and implementing agencies/channel partners. KfW provides soft loan and grant as accompanying measure to NABARD. NABARD extend finance to channel partners and oversees the entire programme through its regional offices and regional coordination units. So far, 320 projects have been sanctioned across 22 states and one Union Territory (UT) with investments of over Rs. 600 crores.

Under UPNRM, SSI is one of the most successful business models. Shri Datta Shetkari Sahakari Sakhar Karkhana Ltd (SDSSSKL) – a sugar cooperative in Kolhapur, Maharashtra received fund from NABARD under UPNRM. Further, SDSSSKL on lended the loan to its member farmers for taking up SSI along with drip systems. The sugar cooperative used the grant assistance to promote SSI cultivation among the farmers. It repays the loan to NABARD from the cane sold to them by the member farmers.

Project Overview	
Project location	Cluster of 20-25 villages of Shirol, Hatkanangle, Kagal and Athani Talukas of Kolhapur district.
UPNRM support	Loan: Rs 1.80 crore, Grant: Rs 0.06 crore
Duration	3 years
Number of participants	300-400

Figure 1: Illustration of UPNRM Financing Model



⁴ National Bank for Agriculture and Rural Development

⁵ Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

⁶ Kreditanstalt für Wiederaufbau (Reconstruction Credit Institute)- German government-owned development bank

4.1 Impact

Around 260 acres of land has been brought under drip irrigation along with SSI cultivation under UPNRM in Maharashtra. The impact observed by the SSI farmers is described below:

4.1.1. Economic

Interaction with a farmer of UPNRM project shows that there are visible economic advantages of SSI cultivation over the conventional practice of sugarcane farming. Farmers realised a major advantage in the reduction of external inputs (fertiliser, pesticide, labour and water for irrigation) where farmers saved a great amount of money. Interestingly, the seed quantity was reduced by approximately 90% in SSI, but the cost of seedling was slightly higher as compared to conventional farming. This happened because in SSI the cost of nursery preparation was added which is a new activity. Farmers normally procured seedling from the nursery that cost them Rs 2.25/seedling. Through reduction in cost of weedicide (37%), pesticide (60%), irrigation (40%) and labour (42%) farmers were largely benefitted. Farmers used vermicompost instead of chemical fertiliser. However, the cost remained the same for activities such as land preparation, use of tractor for earthing up and tying of clumps that are same for both conventional cultivation of sugarcane and SSI.

Yield of sugarcane in SSI has increased by 30%. Both increase in yield of sugarcane and ground nut grown as intercrop, SSI farmers received 72% more profit than conventional sugarcane farmers.

Table 2: Cost and Benefit Analysis-Conventional Cane Cultivation and SSI Cultivation

S.No	Particulars	Conventional Cane Cultivation (in Rs)-Pre Seasonal	SSI Cultivation-with DripSystem (in Rs) (Spacing 5*2)	SSI Cultivation (in Rs) (Spacing 5*2)	Remark
1	Land Preparation	5000	5000	5000	2 times ploughing and harrowing once
2	Seed/ Seedling	10500	9801	9801	4356 seedling @ Rs 2.25/seedling
3	Labour for Plantation	4500	2600	2600	
4	Vermicompost	0	10000	10000	2 MT of vermi compost (Rs 5000/MT)/acre
5	Fertiliser application (NPK)	14500	10150	10150	
6	Tractor (for earthing up - 2 in no.) and tying-up of clumps	4000	4000	4000	
7	Weedicide	4000	2500	3000	
8	Pesticide	2500	1000	2000	
9	Irrigation	15000	9000	13200	15-20 irrigation in conventional cane farming
10	Intercropping of Groundnut		5000	6000	
11	Mother Shoot Cutting	0	1000	1000	
12	Interest	2400	7602	2870	Interest on crop loan and drip
13	TOTAL	62400	67653	69621	

Projected Benefit per Acre					
1	Yield per acre (in MT)	50	65	56	Minimum 30% increase in yield under SSI
2	Cane Income (Rs 2500 / MT)	125000	162500	140000	
3	Income from inter-cropping		16000	16000	4 Qn of ground-nut @Rs 4000/Qn
	Total Income	125000	178500	156000	
	Net Profit	62600	110847	86379	

Source: SSI Farmers of Project Area at Kolhapur, Maharashtra

4.1.2. Social

Seeing the success of the SSI farmers, other cane farmers are coming forward to take up SSI farming. Around 1000 farmers in project villages have adopted SSI cultivation, post-UPNRM's intervention in the project area of sugarcane cooperative. This shows a change in the mind set of farmers with regards to the scientific cultivation practices of SSI. The workload of women has decreased as weed growth is minimal in SSI cultivation as compared to the conventional sugarcane cultivation. Furthermore, encouraged by the success of SSI nursery, around 8-10 women are now earning a livelihood by nursery raising and supply of quality seedlings.

4.1.3. Environmental

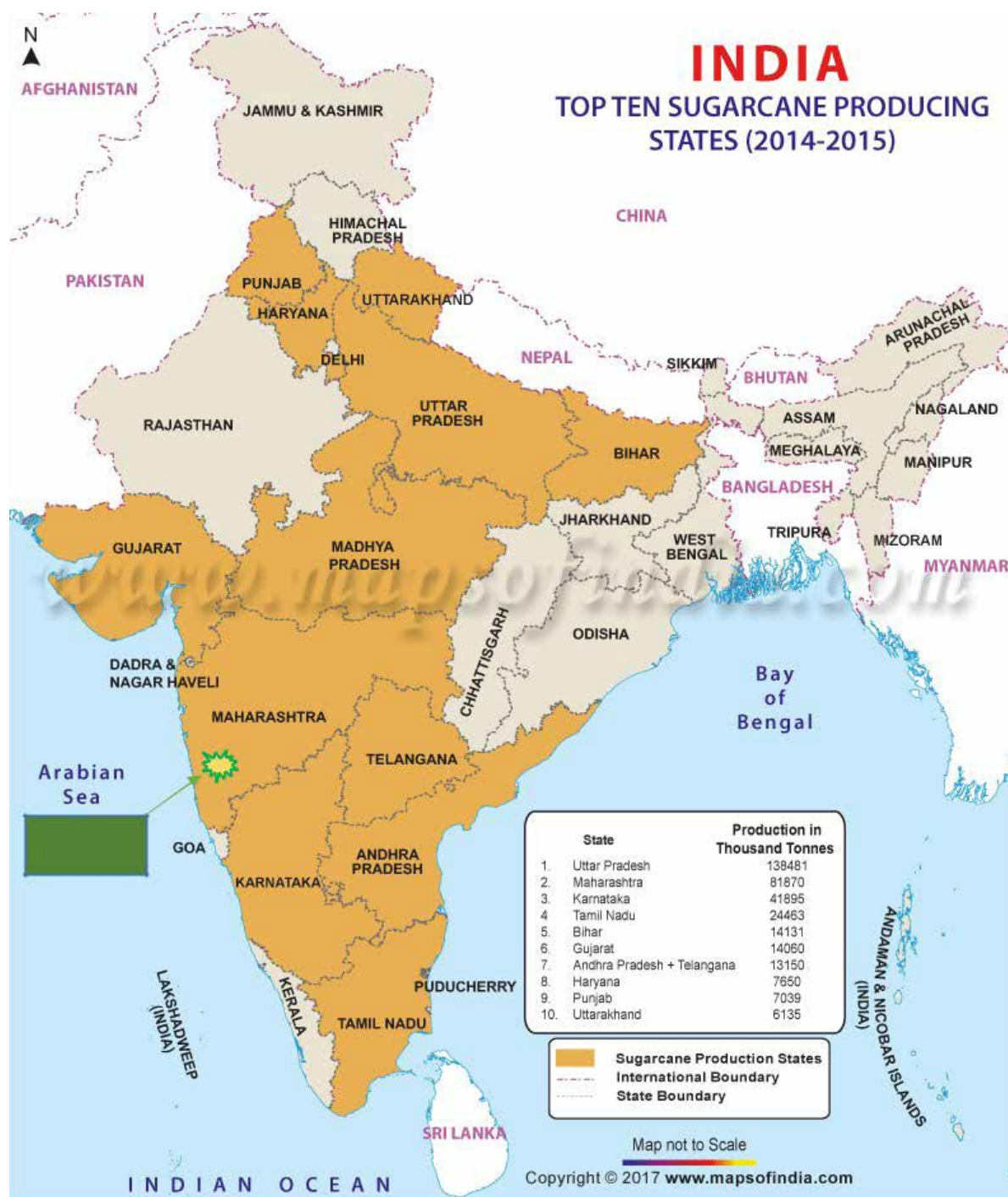
Major environmental benefits observed are hereunder:

- Approximately, 25,000 kgs of water is utilised for producing 10 Kgs of sugarcane (⁷ICRISAT, 2010) in conventional cane farming. It means in one acre of sugarcane plantation, conventional flood irrigation method consumes 12.5 million kgs of water. Water saving techniques applied in SSI such as drip irrigation saves 40% water, therefore, total water saved in one acre in the SSI model is approximately 5 million Kg.
- SSI has helped arrest soil erosion and soil salinity while also maintaining moisture in the root zone.
- SSI decreases weeds by 60%, therefore, per acre cost reduction in weedicide application is 35 to 40%.
- Use of vermicompost and other organic inputs has reduced application of chemical fertiliser in the SSI field. There is 30% reduction in the cost of fertilisers in SSI.



5. Proposed Institutional Models for Mainstreaming SSI

High economic returns, as described in table 2 (Cost and Benefit Analysis- Conventional Cane Cultivation and SSI Cultivation), of SSI, makes it financially viable for institutional funding, especially from banks. Low rate of mortality of plants in SSI as compared to conventional sugarcane farming reduces the probability of bank loan turning non-performing assets (NPAs). It is therefore recommended to upscale SSI in major sugarcane growing states of India such as UP, Maharashtra, Karnataka, Tamil Nadu etc. The top ten sugarcane growing states are mentioned in the below map.



Source: <http://www.mapsofindia.com/top-ten/india-crops/sugarcane.html>

As a strategy to mainstream SSI with formal financing mechanism, two institutional models are proposed herewith with an objective to enhance investments in the domain of SSI.

5.1 Bank-NGO/Cooperative Model under NABARD's financing

Bank-NGO model can be financed directly by NABARD under UPNRM, Producer Organisations Development Fund (PODF) or NABKISAN funding lines. In this model, banks such as District Central Co-operative Bank (DCCB), commercial banks can lend to the farmers directly or through sugar cooperative for as a bundled package for SSI cultivation including drip irrigation. The farmers could be identified by the sugar cooperative in their cane production area. The sugar cooperative would play the role of the technical implementing agency providing implementation, technical and monitoring support for the intervention.

Grant support for awareness generation and capacity building may be availed from the following options:

5.1.1. Cane Development Fund

The sugar cooperatives have their dedicated fund for carrying out cane development activities which primarily constitute extension activities, nursery development and supply of seedlings, promoting demonstration plots and promoting usage of organic inputs through subsidised sale of vermicompost and bio-fertilisers.

Therefore, technical support for training and capacity building-cum-exposure visit on SSI nursery development and adoption of the principles of SSI cultivation could be undertaken through dedicated cane development funds of the sugar cooperatives.

5.1.2. NABARD's Schemes

NABARD's various schemes can be explored for accessing grant support for trainings and capacity building of farmers and the implementing agency/channel partner.

i. Farm Sector Promotion Fund (FSPF)⁸

FSPF has been created for supporting innovations in agriculture and allied sector leading to enhancement of farm income and farm productivity. The schemes supports:

- Promotion of Farmers' Clubs for technology transfer.
- Capacity Building/ exposure visit for adoption of modern technologies/ best practices.
- Productivity improvement, aggregation, innovations and market connectivity, etc.
- Awareness building on improving water use efficiency.

ii. Capacity Building for Adoption of Technology (CAT)⁹

NABARD's CAT scheme facilitates adoption of technology by farmers/ entrepreneurs through promoting institutions/ agencies like banks, corporates, NGOs, Self Help Group (SHG) and Farmers' Clubs.

iii. Rural Innovation Fund (RIF)¹⁰

Rural Innovation Fund (RIF) is a fund designed to support innovative, risk friendly, unconventional experiments in farm, non-farm and micro-finance sectors that would have the potential to promote livelihood opportunities and employment in rural areas. The guiding principle for operating this fund are:

- The activities must have the rural poor in their focus and must be innovative, experimental and demonstrative in nature leading to replicability and commercial viability.
- The activities funded may involve the development of new products, processes, prototypes, technology, patenting and extension support.
- Appropriate actions such as research and studies contributing to a better understanding of rural development issues, policy and process implementation may be undertaken.

⁸ <https://www.nabard.org/demo/auth/writereaddata/File/Farm%20Sector%20Promotion%20Fund%20Objectives.pdf>

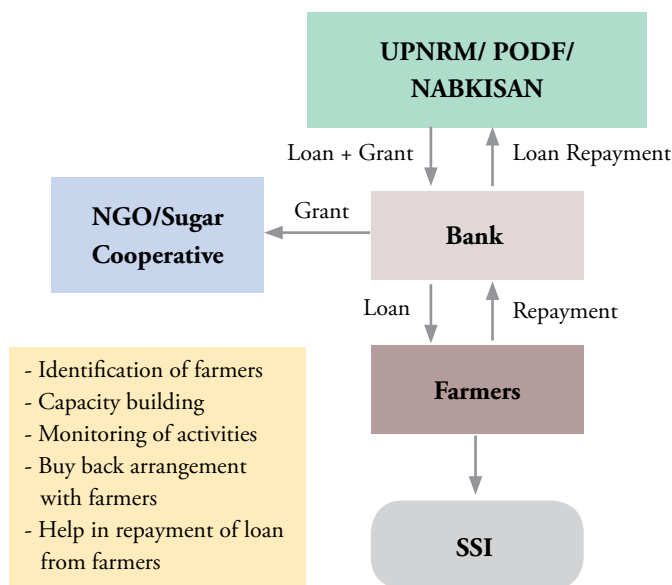
⁹ [http://www.nabard.org/auth/writereaddata/File/Support%20for%20Capacity%20Building%20for%20Adoption%20of%20Technology%20\(CAT\).pdf](http://www.nabard.org/auth/writereaddata/File/Support%20for%20Capacity%20Building%20for%20Adoption%20of%20Technology%20(CAT).pdf)

¹⁰ <https://www.nabard.org/demo/auth/writereaddata/File/Rural%20Innovation%20Fund%20FAQS.pdf>

iv. Livelihood Enterprise Development Programme (LEDP)¹¹

LEDP is a project based approach encompassing the complete value chain for offering end to end solutions to the SHG members in a cluster of villages. Skill development and capacity building are the main part of this programme.

Figure 2: Bank-NGO/Cooperative Model under NABARD Financing



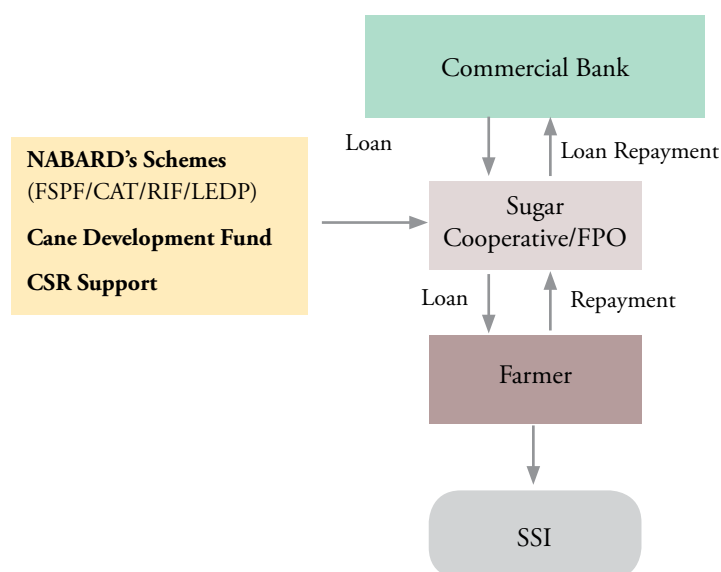
5.2 Sugar Cooperative/Farmer Producer Organisation (FPO) Financing by Commercial Banks

In this model sugarcane FPOs/ or sugar cooperatives can take a loan from commercial bank of their region. These sugarcane FPOs/ sugar cooperatives will further give loan to farmers after keeping a fixed margin on interest rates to meet its administrative cost. Capacity building support fund that is currently integral part of UPNRM financing, can be obtained from NABARD's scheme (details of the schemes are mentioned above), cane development fund, state government scheme, Corporate Social Responsibility (CSR) programme for sugarcane farmer. The capacity building fund may be used in trainings, exposure visit for farmers and/or FPO/sugarcane cooperative staff members, demonstration infrastructure etc. This can also be used for meeting administrative expenses where interest margins for FPO/cooperative are low. Additionally, bank's demand for collateral securities can also be fulfilled with this fund. All these conditions should be mentioned in the project design itself to ensure smooth flow of fund during the project implementation phase.

NGOs, resource institutions, donor agencies, sugar cooperatives and other support institutions should facilitate mobilisation of farmers to form FPOs and help them to connect with the banks for availing credit for SSI.

¹¹ http://subhutech.in/wp-content/uploads/2016/10/NABARD_Status_of_Microfinance_in_India_-_2015-16.pdf

Figure 3: Illustration of Sugar Cooperative/FPO Financing by Commercial Banks



6. Way Forward

The adoption of SSI by financial institution such as banks will increase investment in natural resource sector. This will lead to higher uptake of credit in agriculture sector and thus will help them in meeting the targets of Priority Sector Lending (PSL). The economics of SSI shows high profits which will make banks credit portfolio healthy with minimum chances of NPA.

NABARD through its various funding lines (PODF, NABKISAN, UPNRM) can support SSI as a model project. Increase in income of sugarcane farmers by SSI practices will contribute to the mandate of Government of India (GoI) regarding doubling of farmers' income by 2022.

Access to finance for SSI through institutional models will not only enhance farmers' economic status but it will also increase water and input use efficiency in agriculture at a wider level.

Farm Model of SSI in Sugarcane (1 acre)

Sl. No.	Particulars / Years	Amount in Rs				
		I Year	II Year	III Year	IV Year	V Year
I	POST DEVELOPMENT					
1	Post Development Cost					
a	Cost of Drip System + Accessories	50000				
b	Cost of Cultivation Estimated / Acre	67653	74418	81860	90046	99051
2	Total Post Development Cost	117653	74418	81860	90046	99051
3	Post Development Yield and Income					
a	Yield of sugarcane	65	65	65	65	65
b	Income from cane	162500	162500	162500	162500	162500
4	Total Post Development Income	162500	162500	162500	162500	162500
5	Net Post Development Income	44847	88082	80640	72454	63449

II Pre Development						
1	Pre Development Cost					
a	Cost of cultivation	62400	68640	75504	83054	91360
2	Total Pre Development Cost	62400	68640	75504	83054	91360
3	Pre Development Yield and Income					
a	Yield of sugarcane	50	50	50	50	50
b	Income	125000	125000	125000	125000	125000
4	Total Pre Development Income	125000	125000	125000	125000	125000
5	Net Pre Development Income (4-2)	62600	56360	49496	41946	33640
III	Incremental Income(I 5-II 5)	-17753	31722	31144	30508	29809

Financial Analysis for Micro Irrigation Unit (Drip)						
Sl. No.	Particulars	I Year	II Year	III Year	IV Year	V Year
1	Capital Cost	50000	0	0	0	0
2	Recurring Cost	67653	74418	81860	90046	99051
3	Total Cost	117653	74418	81860	90046	99051
4	Total Benefits	162500	162500	162500	162500	162500
5	Net benefits	44847	88082	80640	72454	63449
6	Incremental Benefits	30508	29809	31144	30508	29809
6.1	Discounting Factor@15%	0.57	0.50	0.66	0.57	0.50
6.2	NPV of Incremental Benefits	17443	14820	20478	17443	14820
7	Discounting Factor	15%				
8	NPW of costs	313132				
9	NPW of benefits	544725				
10	BCR	1.74				

Assumptions	
Sensitivity Analysis	The cane gate price of sugarcane is considered to be constant as Rs 2500/ Quintals during period of analysis.
	The cost of production is assumed to increase at the rate of 10% per annum (YoY)
	The income from intercropping is not accounted for to represent generic case where intercropping is still limited by the farmers mostly due to labour issues and also depends on the adequacy of rainfall during the season





