SMART AGRICULTURAL PRACTICES

SEWA's Approach to tackle Agricultural Vulnerability of small holder farmers

Abstract

Some of the major challenges faced by the small and marginal farmers in India, are the frequently increasing climate shock & market shocks and the changes in the land and affiliated acts. Due to these, despite putting in financial investment and labor in agriculture, the small and marginal farmer in India remains hungry. What does it entail to address the burning question of "Why does the Farmer Remain Hungry?"

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Contents

Introduction

Informal sector is on the rise in India with over 94% for its workforce in the informal sector with hardly any access to social security[i]. India is largely an agrarian country. Over 60% of its total workforce is engaged largely in informal work in the form of agriculture and allied trades.

Majority farmers in India are small and marginal landowners who are resource-poor. Women are the backbone of such small and marginal farm-holder families and since they typically put the family before themselves, they are the worst affected during crises.

Additionally, contrary to other developed countries, India is facing a challenge of growing young generation of worker – especially in rural areas and in informal sector. The profile of these young workers is completely different than their older generation. While these young workers do not have the necessary skill-set and technical knowhow to avail the modern tech-savvy off-farm jobs in the urban areas, they do have a strong affinity towards technology.

Having grown-up in rural areas where agriculture, animal husbandry and allied trades are the major employment areas, these workers already have basic skills in these trades. However, lack of exposure, awareness and affordable access to modern technology-based smart-agriculture, prevents them from making their agriculture sustainable, viable and profitable.

The present paper aims to present the challenges in agriculture faced by over 2 lakh small holder farmer members of Self-Employed Women's Association (SEWA) and SEWA's various agro-smart initiatives to tackle these challenges, thus improving the livelihoods and lives of its members.

Challenges in Agriculture

Agriculture has been one of the most prominent sectors of Indian economy since independence. Although contribution of agriculture and allied activities like forestry, logging and fishing in GDP has declined from 35% in 1980's to around 18% in 2006-2007, still almost 60% of the population, mostly in rural India, continues to depend upon it for livelihood (73% of India's rural employment is through agriculture as per the August 2007 Report of the National Commission for Enterprises in the Unorganized Sector (NCEUS) on Conditions of Work and Promotion of Livelihood in the Unorganized Sector).

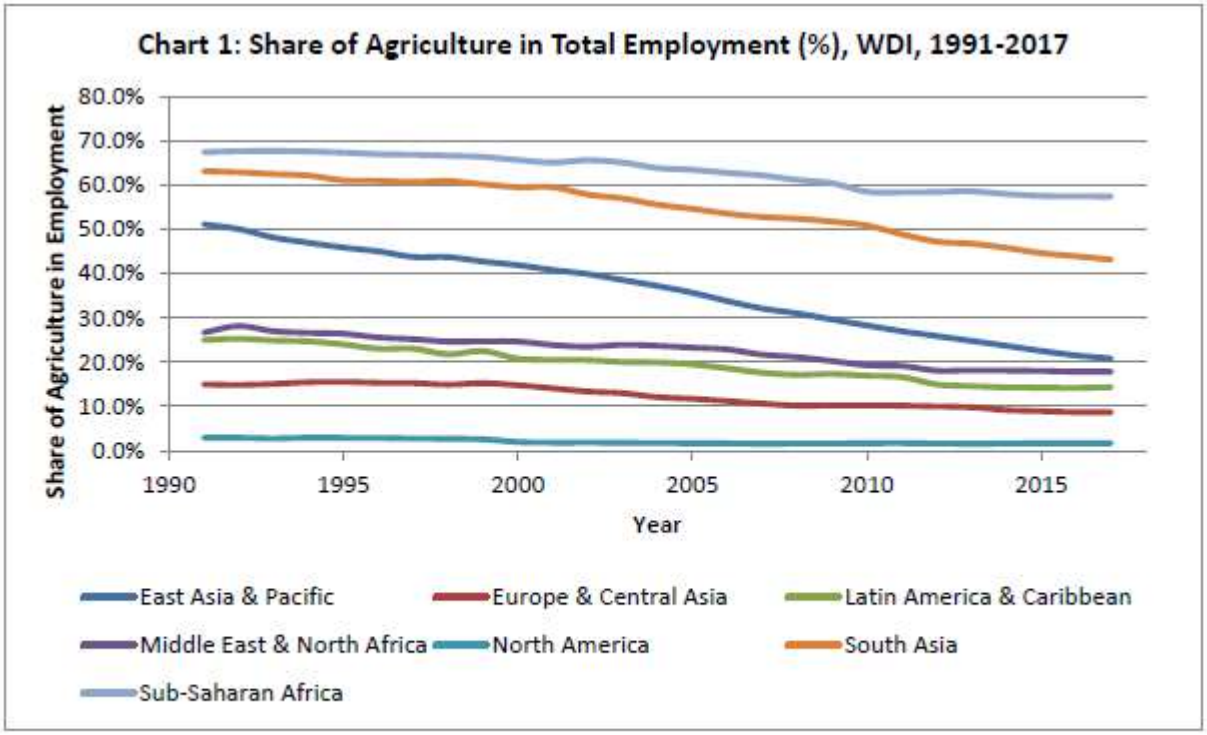
No	Country	Share in Employment %	Share in GDP %	Average Productivity
1	China	35	10	0.29
2	Korea	7	2	0.29
3	Thailand	39	12	0.31
4	India	47	18	0.39
5	Indonesia	39	14	0.36
6	Pakistan	45	25	0.56
7	Malaysia	13	10	0.77

Table 1: Asia Defies Structural Transformation, 2015

The Lewis model of economic development stated that there was a substantial difference in the average per worker productivity levels in agriculture and non-agriculture sectors. This provides a powerful impetus for industrialization. However, due to pre-mature de-industrialization in India and other countries of Global South, the shift of surplus labor from Agriculture to non-agriculture sector has slowed down to almost stagnation. Table-1 shows the same in context of countries of Asia[1].

One consequence of this process of "delayed structural transformation" is the accelerating difference in labor productivity in agriculture and non-agriculture sectors (Binswanger, 2012). It also leads to an increase in the demographic pressure on land, falling land-man ratios and a proliferation of small and marginal size landholdings (landholding size equal to or less than 2 hectares).

The following chart shows that while indeed there has been a decline in the workforce engaged in agriculture in various regions world over, agriculture still accounts for about 40-50% of the workforce in both South Asia and Sub-Saharan Africa regions. The share of agriculture in the workforce in all other regions is markedly lower (Chart 1).



Source: World Development Indicators, www.worldbank.org

It is estimated that out of the 475 million smallholder farmers in the world in 2010, nearly 80 per cent were located in Asia, with China (35%) and India (24%) together accounting for more than half of the total (FAO, 2016). Smallholder farmers constitute over 85 per cent of the total farmers in India and they operate about 45 per cent of the net sown area and produce at least half of India's food (Agriculture Census, 2011).

[1] Source: World Development Indicators, www.worldbank.org

		No of Holdiings (000)		Area under Holdings (000 ha)		Average Size of Holding (Ha)
1	Marginal (<= 1 ha)	92826	67%	35908	22%	0.39
2	Small (1-2 ha_	24779	18%	35244	22%	1.42
	Total Smallholders (<= 2 ha)	**117605**	**85%**	**71152**	**45%**	**0.61**
3	Semi-Medium (2-4 ha)	13896	10%	37705	24%	2.71
4	Medium (4-10 ha)	5875	4%	33828	21%	5.76
5	Large (<10 ha)	973	1%	16907	11%	17.38
	Total	**138349**	**100%**	**159592**	**100%**	**1.15**

Source: Agriculture Census, 2011

Table 2: Size Distribution of Landholdings in India, 2010 - 11

Though many studies have shown that small holdings are more efficient in terms of resource utilization compared to larger sized holdings (Chand, et.al. 2011), smaller holdings require a lot of support to remain viable.

India's agricultural production has more than tripled between 1960 and 2015. However, in order to double the income of farmers by 2022, the total number of cultivators need to come down by 2.4% each year. According to NSSO, number of cultivators declined from 166.1 million during 2004-05 to 146.2 million during 2011-12. This number needs to fall further to 119.5 million by 2022.[ii]

However, this increased agricultural production has led to a significant expansion in the use of land; with the net sown area increasing from 91.5 million hectares in 1928 to 141 million hectares in 2017[iii]; in addition to water and other natural resources for agricultural purposes, putting enormous strain on the natural resource base of the economy (land, water and biomass) and is proven to be unsustainable in the long run (FAO, 2017).

Assessments and studies (Vijayshankar et.al. 2011) indicate that nearly 50% of India is facing problems of either quantitative depletion of groundwater or qualitative decline or both. There have also been several studies showing high land degradation, decline in soil organic matter levels and loss of soil fertility. As food grain production increased with time, the number of elements deficient in Indian soils increased from one (N) in 1950 to nine (N, P, K and micro-nutrients) in 2005–2006.

It is clear, therefore, that the Green Revolution pathway cannot be adopted for raising productivity of smallholder farmers. The alternative path of development has to take Techno-Agro-Ecology as its core.

The impact of climate change is also becoming more and more starkly visible on the global temperatures, rainfall patterns and thereby on water security. In many parts of India, climate itself is a source of great vulnerability in Indian agriculture. The late onset and early withdrawal of monsoon as well as "gaps" (long spells of dry period without rain) in the rainy season are known sources of vulnerability. It has also led to rise in extreme climate events, high rainfall/floods as well as deficient rainfall/droughts. Climate change related events and conditions also include price shocks that can be linked to lower agricultural production; natural disasters that destroy poor people's assets; and health shocks that worsen with changed climate conditions (World Bank 2016).

Another big source of risk for the smallholder farmers is from the market. While smallholder farmers are efficient producers, they face major problems while accessing organized markets. These include "low volumes of produce to sell, variable quality, seasonality and limited storage, high transactions costs, poor market information and contacts, and limited ability to meet the high credence requirements of many high value outlets" (Hazell, 2011). Additionally, smallholder farmers usually operate in situations where commodity, credit and input markets are closely interlinked and often function in a highly exploitative manner (Bardhan, 1989; Bhaduri, 1983). Even when they have surplus to sell, they may be forced to exchange that with the trader-moneylender as repayment of loans taken at usurious rates of interest. Exposure to global markets have also resulted in price movements unrelated to national or local conditions, thus making it difficult for small farmers to anticipate market conditions.

The issues and challenges discussed above indicate that unfavorable market conditions, high climate risks and rising cost of cultivation together seem to be adversely affecting the growth in real farm incomes. This particularly increases the vulnerability of smallholder farmers in particular. A recent study showed that the rate of growth of real income per farmer was 7.46 % per annum between 2004/05 and 2011/12. However, between 2011/12 and 2015/16, it has rapidly declined to only 0.44% (NITI Ayog, 2017).

Workers in Indian agriculture comprise of cultivators (non-waged small-holder farmers, unpaid family helpers, tenants, sharecroppers) and agricultural laborers (waged permanent workers, casual seasonal and temporary workers, casual migrant workers)[2]. The line between them has been thinning over the years with number of agricultural landholdings increasing from 71 million in 1970 to 120 million in 2000-01and 138 million in 2010 (Agricultural Census report[3]) which has led to a decline in average land holding size from 2.28 ha in 1970-71 to 1.33 ha in 2000-01 and further to 1.15 ha in 2010-11. Many cultivators who operate small landholdings also work as agricultural laborers.

While the aforesaid challenges hold true for these agricultural laborers, they also face many other problems like irregularity of work, lowest and unequal wages (based on season, gender etc.), lack of social security, unskilled labor force, lack of employment opportunities, lack of skill development, degradation of the soil and other natural resources, lack of access to direct market and no income and food security despite working for long hours.

Structural changes in agriculture over time like decreasing landholding size, changing technology, outmigration by men and increased incidence of women farm management, changing nature of contracts towards tenancy, contract farming, corporate farming, increased volatility of agricultural prices and lastly climate change all are bound to have effects on demand for agricultural labor, their wages and hence overall income security.

When it comes to women's employment in India the above grim picture becomes even more pronounced since the contribution of agriculture to women's employment is the highest in India with a greater part of the women's workforce (approx. 80%) in rural India employed in agriculture. Apart from the specific effects on agricultural workers discussed above, climate change has independent effects on time use of women in water and firewood collection and on their health.

[2] These categorizations are fluid, with a worker falling in more than one category. Permanent workers form less than 5% of agricultural employment in India (National Sample Surveys)

[3] http://agcensus.nic.in/document/analysis01natasg.htm

Introduction to SEWA

The Self-Employed Women's Association (SEWA) is a trade union of poor self-employed women workers from the informal sector. With a membership base of over 1.5 million women workers, SEWA has spread it wings in 16 states of India and also neighboring countries like Nepal, Pakistan, Sri Lanka, Myanmar and Afghanistan. Approximately 6,63,632 members are from the agriculture sector.

SEWA's main objectives are **full-employment** – i.e. food-security, income-security, work security and social security and **self-reliance** which encompasses healthcare, child-care and shelter. With Gandhian philosophy at the core of its activities and initiatives, SEWA has been working for almost 5 decades with its rural members to help them improve their livelihood through various initiatives in fields like but not limited to advanced technology, technical training, microfinance, market linkages, natural resource management etc. across number of trades.

SEWA's experience with Small Farmers

From SEWA's experience working with over 6.3 lakh small holder farmers across 14 states of India for over 45 years, a general cash-flow scenario of a typical small holder farmer having a landholding of 1 Acre for 1 cropping season is as shown in the table below.

Month	Activity / Description	Income (USD)	Expense (USD)
April	**Arranging Finances for the Season**		
	Seed Money (from personal saving)	27	
	Crop Loan taken at 4% interest rate	400	
	Crop Insurance premium		40
	Rainfall insurance premium (PMFBY)		20
	Soil preparation and Sowing		
	Cow-dung manure		54
	Deep Ploughing		26
	Rotovator		14
	Making V-groves		7
June	Sowing		6
	Fertilizers		
	DAP		24
	Urea		9
	FoS		12
	Zinc		5
	Seeds		
	Loose Seeds (3 bags @ 450 gm each)		22

Month	Activity / Description	Income (USD)	Expense (USD)
	Intercrop planting labor charge		3
Jul – Oct	Weedicides		16
	Intercrop Weeding Labor charge		11
	Irrigation		
	Cycles of Irrigation		28
	Electricity		27
	Pesticides		
	Medicines		20
	Labor		32
Nov-Dec	**Harvesting**		
	Labor		64
	Refreshment		4
	Transportation		4
	Total Expense		448
	Total Harvest per acre (in kg)	800	
	Cost / kg (for cotton crop)	0.75	
	Income per Acre	600	
	Loan repayment with Interest		416
	Gross Income (A)	1027	
	Expenses (B)		864
	Profit / Acre (A)-(B)	**163**	

The above table shows how after toiling day-in and day-out for almost 6 months, the poor small holder farmer earns USD 163. A small farmer having access to irrigation facility, generally takes 2 crops per year, thus barely having an earning of USD 350 annually, which is hardly sufficient to sustain a family of 4- 5 members.

The above table is a representation of financial situation of small-holder farmers growing cotton which is one of the most important cash crops in Gujarat. In addition to cotton, these small farmers also grow crops like wheat, millet, castor, cumin, sesame, groundnuts, sorghum, mung beans, gaur, tobacco, pulses, mustard, vegetables and rice.

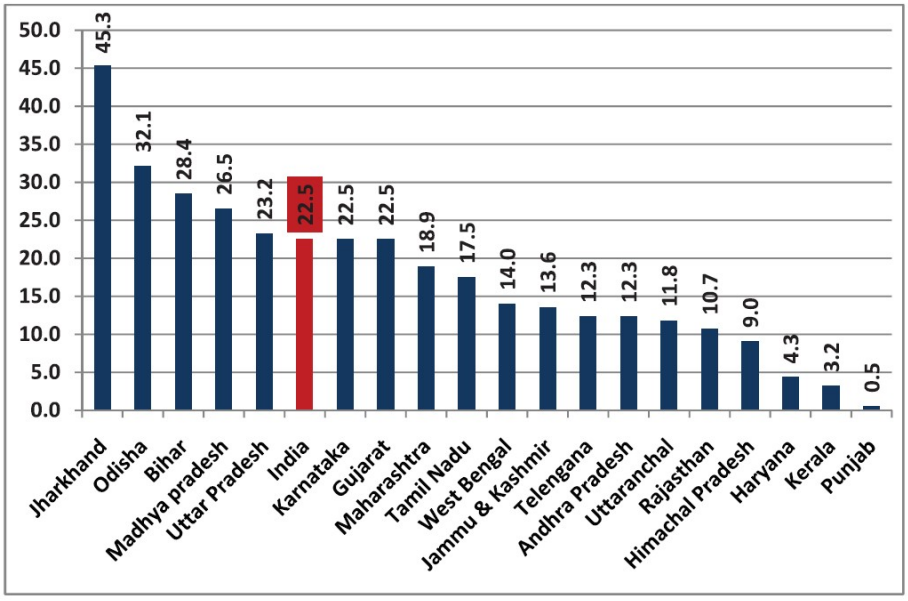
Due to lack of access to finance, many farmers are unable to take a 2nd crop in a season. In such situation, Animal Husbandry which is the next major source of employment, comes to their rescue. Most of the small farmers (over 85% of SEWA's members) at least rear 2 cattle in their home earning a net income of USD 75 per month.

SEWA's Agriculture Campaign

Most of the SEWA members depend upon agriculture for their livelihood. They include not only small and marginal farmers, but landless agricultural sharecroppers and casual laborers as well. They are among the most vulnerable and needy groups in agriculture sector. Women are the worst affected as in spite of contributing so much to the work, they do not have any recognition.

A small and marginal farmer needs market information, linkages, and access. The small and marginal farmers are also required to develop bargaining power to get a fair price. Currently, they are devoid of all of these. Thus, despite putting in financial investment and labor in agriculture, the small and marginal farmer in India remains hungry.

The NSSO data on Consumption Expenditure survey for year 2011-12 reveals that more than one-fifth of rural households with self-employment in agriculture as their principal occupation[4] were having income less than the poverty line.



Source: Estimated from unit level Consumption Expenditure Survey data 2011-12, NSSO.

Figure 1: Farm Households in Indian States with income below poverty line, 2011-12

SEWA has realized that problems of a small and marginal farmer are not limited to unavailability of credit or financial services only. They face various challenges like lack of support services such as capacity building, healthcare, market information, technical education, access to tools and equipment, organizing, and market linkages. Lack of these services, rather than unavailability of micro-credit, is often responsible for financial exclusion of a small and marginal farmer.

[4] Such households fit into the definition of farmers

Especially, in the recent years, some of the major challenges in front of the small and marginal farmers in India, that are becoming more and more serious are the frequently increasing climate shock & market shocks and the changes in the land and affiliated acts.

The rainfall pattern is becoming more and more irregular year on year. Since most of the agriculture in India is rain-fed, poor small farmers have to continuously adapt to these changing rainfall patterns and change their cropping patterns.

Understanding this, SEWA initiated agriculture campaigns, nationally and regionally and based on its extensive experience of working with small and marginal farmers, etched out a working model of agriculture development for its small farmer members which emphasizes on – developing the farm as an enterprise and shifts the focus from mere subsistence to viability and profitability.

To address the dire need for resilience building against the frequent and intense climate shocks and market shocks faced by these rural workers, the campaign focuses on developing and facilitating adoption of a climate-smart agricultural model that interweaves climate-resilient agricultural practices.

SEWA launched its agriculture campaign in 1995 and today the campaign has successfully spread across 7 Countries (India, Afghanistan, Sri Lanka, Nepal, Bhutan, Maldives and Myanmar); 14 States of India (Gujarat, Bihar, Delhi, West Bengal, Rajasthan, Kerala, Uttaranchal, Madhya Pradesh, Uttar Pradesh, Maharashtra, Assam, Meghalaya, Kashmir and Nagaland); and 14 Districts of Gujarat (Ahmedabad, Mehsana, Banaskantha, Surendranagar, Kutch, Kheda, Vadodara, Sabarkantha, Gandhinagar, Rajkot, Panchmahal, Surat, Silvassa and Tapi). To address the issue of food security, through its agriculture campaign, SEWA has also taken a national lead in "Family Farming"

Given the grave situation of agriculture, motivating the second generation of the farmers to take up agriculture as a sustainable livelihood is one of the major challenges faced by small and marginal farmers. The profile of these young workers is completely different from their older generation and they have a natural affinity towards modern tech-savvy jobs.

Therefore, facilitating affordable access to modern tools, equipment and techniques in agriculture would not only improve the productivity but also intrigue the youth workers, thus curbing their out-migration to urban areas in search of modern tech-savvy jobs.

Climate resilience practices by SEWA

At SEWA, we strongly believe that advanced technology if tactfully applied can, not only help in improving the productivity and thus the profitability and viability of agriculture for the small holder farmers, but also generate smarter and decent employment opportunities in the rural areas. Additionally, converting villages to smart villages by deploying advanced technologies in various areas in a rural setting would have several allied benefits like but not limited to:

- Accessibility to information related to rural trades through mobile phones / radios would ensure the workers could access it at any time without compromising their daily livelihood activities.
- Creation of smart tech-savvy employment opportunities in village would lead to curbing of out-migration of rural youth in search of modern tech-savvy jobs

- Converting traditional rural jobs to smart decent jobs would imbibe a sense of dignity in rural youth towards their traditional trades.
- Preserve traditions and culture
- Reduce / mitigate risks related to climate and market shocks, thus making agriculture sustainable and viable
- Increase agricultural productivity and thus ensure food security.
- Reduce input cost and increase output thus leading to increase in overall profitability of rural trades thereby ensuring a better lifestyle and nutrition security for rural workers, etc.

However, the major set-back is the awareness, accessibility and affordability of such technological advances in the rural areas; especially for the small and marginal farmers. The govt. of India does provide subsidies and schemes for farmers in this context time and again, however, due to lack of awareness regarding such schemes and programs, the small and marginal farmers are hardly able to take advantage of such programs.

Therefore, SEWA realized that in order to safeguard the farmers against climate shocks and market shocks, there is a need to have an integrated farm planning and management package that includes technological interventions at multiple stages like but not limited to:

- Providing access to technical trainings and agri-advisory inputs
- Establishing tools and Equipment library
- Spot and future-prices
- Offering Customized Rainfall Insurance Product
- Affordable access to farm-top renewable energy
- Access to finance and credit, market support etc.
- Incorporating digitization
- Generating smart secondary source of employment to supplement traditional livelihoods

The present paper aims to explore the impact of implementation of SEWA's initiatives for agro advisory services, Spot and Future prices advisory, Customized rainfall insurance, Establishing tools and equipment library, Affordable access to Renewable energy and Access to finance and credit, market support.

1. Providing Voice/SMS based Agro-advisory

Agriculture in India is predominantly rain-fed; especially in case of smallholder farmers. Scientific studies of climate and meteorology focusing on India show significant increase in the variability and frequency of extreme climatic events. The increased variability of weather patterns places a huge constraint on farmer's ability to make strategic agricultural practice decisions. Agro-advisory services have played a significant role in addressing this issue for big farmers in different parts of the world.

Even in rural India, affluent big farmers have been availing such services. However, the poor small holder farmers hardly had access to such services. They would simply follow the actions of neighboring big farmers without understanding the logic / reasoning behind these actions. This would often lead to over application of pesticides / fertilizers, over / under irrigation, early / late sowing etc. resulting in increased

input cost, reduced productivity, reduced soil fertility and in many case losses of crop – thus pushing the poor small farmer into a vicious circle of debt and poverty.

To address this challenge, SEWA in collaboration with agricultural experts and agricultural institutes designed a voice based agro-advisory system in year 2016. Since most of SEWA's members were illiterate / semiliterate, providing SMS-based agro-advisory was not feasible and hence SEWA designed this customized agro-advisory system wherein information regarding weather forecasts, the correct time to put fertilizers and pesticides on the crops, the prices of these products and various other information required by the farmers to make a sound judgment, was provided daily in pre-recorded voice. The pilot of the service was rolled out with 200 registered small farmers in Bayad district of Gujarat.

Jahuben from Sedla village in Surrendranagar district had a standing crop of wheat in her field. One night in March 2017 (a week before her planned harvest), she received agro-advisory about unseasonal rains from SEWA. Despite ridicule from her neighbors, she harvested 1400 tonnes of wheat overnight, with help of her family and stored it in her home.

As informed in the voice message, it rained heavily next morning and most of the villagers lost their standing crops.

"I have complete faith in my SEWA. As soon as I received message from SEWA about unseasonal rain, I acted and saved my crop. Thanks to the voice message, we sold our harvest, paid off our debts and made good profit. These agro-advisory messages are like boon for us. Now all the fellow villagers have subscribed to this service."... says Jahuben

Some of the key benefits of the pilot are as below:

- Daily weather forecast information helped farmers take informed decisions about application of fertilizer / pesticides – thus reducing wastage and hence saving in cost of fertilizer / pesticide as well as labor.
- Information about viral pest infestation in the area alerted the small farmers of possible pest infestation / attack on their fields, thus providing them with lead time to respond to the pest attack and save their crop.
- Information about market prices helped farmers decide when to sell their harvest and in which market – thus fetching optimum price for their produce. It also reduced exploitation of small farmers at the hands of middle-man and traders

Based on the success of the scheme, SEWA expanded the agro-advisory services to 3 districts in Gujarat and provided agro-advisory to over 4500 registered small farmers. The topics covered were also increased to include information about Govt schemes and subsidies, health information, important announcement etc.

With the passage of time, the level of education of the rural youth has improved. Access to smart phones has also become affordable and common in the rural areas, with every household having at least one smart-phone. Therefore, to facilitate better access to information for its members, SEWA has also started

linking its farmer members having access to smart-phone to Govt's "Khedut Mitra App" which provides complete information from land preparation to harvesting phase, covering areas like land preparation, seed selection, seed rates, fertigation schedule, weed control, pest and disease control, market rates of selected Market Yard along with that Agriculture News, Weather etc.

Year	District	No. of members registered to receive message	Pick-up rate	Details
2016	Arvalli	1500	52%	Messages provide information on (1) Weather forecast (2) Spot prices for agricultural produce (3) Information about prominent crops in the region (4) Advisory on Animal Husbandry (5) Govt schemes and subsidies related to Agriculture and Animal Husbandry
	Chota Udaipur	1500	75%	
2017	Arvalli	1500	45 - 50 %	
	Chota Udaipur	1500	60 - 65 %	
	Surrendranagar	1500	70 - 75 %	

Table 3:SEWA's Voice-based SMS user data

Today, SEWA has successfully linked over 60% of its small farmer members in 14 districts of Gujarat to the Govt's "Khedut Mitra App".

2. Establishing Tools and Equipment Library

Most members of SEWA are poor small farmers who have a small piece of land and cannot afford to incur expenses on buying tractors and other required tools. Therefore, they generally follow traditional farming practices resulting in low productivity and long hours of drudgery.

As a part of technical trainings in Agricultural, SEWA advocates deep ploughing as well as mud and sand filling in the fields. Deep ploughing increases soil fertility and reduces need for fertilizer & pesticides. Similarly, mud and sand filling improve the land quality, increases moisture retaining capacity and decreases salinity. Thus, deep ploughing along with mud and sand filling increases the productivity and the yield by 2-3 times per acre of land.

This kind of agricultural practices mandate use of mechanized tools, which these small farmers have to rent from the well-established farmers for high rent. Many a times, despite willingness to pay high rent, they do not get access to these tools & equipment on timely basis. As a result, they are not able to reap a good yield from their farms, thus making their agriculture non-sustainable and non-profitable.

Understanding these challenges in terms of access to modern tools and equipment, **SEWA has implemented** an environment – friendly initiative through the practical approach of **pooling of agricultural equipment – The Agriculture Tools and Equipment Library**.

Figure 2: A member operating a Tractor borrowed From SEWA's TOOLS & EQUIPMENT LIBRARY

This library is centrally located and run by the village level farmer development group. Library is equipped with modern agricultural tools and equipment as per the members needs. Members can borrow these tools by paying a nominal service charge to the library – which is much lower than the rent they paid to the big farmers.

Some of positive impacts of this initiative are:

- Members can borrow costly and/or infrequently used tools whenever they are needed in their field by paying only a nominal rent rather than spending money on buying them.
- The library is owned and managed completely by the members themselves through their own collectives / cooperatives – thus creating joint asset in the name of the women.
- The library is managed by the villagers' groups themselves and the rent for the same is also set by them in such a way that it covers the cost of repairs and maintenance of the tools and equipment library. This ensures sustainability of the tools and equipment library. The surplus income from the library is used to invest in more and better tools and equipment.
- It also creates an additional employment opportunity for maintaining and operating of these tools and equipment
- The easy access and affordability of modern tools & equipment has helped improve the agricultural yield to a great extent.

- Access to modern mechanized agricultural tools and equipment has led to awareness about the benefits of mechanized farming.
- The rural youth has a natural affinity to modern tech-savvy jobs. Affordable access to mechanization in agriculture has helped re-kindle their waning interest in agriculture and has led to curbing of out-migration.

In year 2006, farmer members of SEWA from Surrendranagar district of Gujarat, built a tools and Equipment library by taking out a loan from SEWA district federation.
Using the library, small and marginal farmers in Surrendranagar district were able to efficiently cultivate 500 to 800 bighas of land and even the salt farmers in the district benefitted out of the diesel pumps.
The farmer group running the library earned net profit in the amount of Rs. 2 lakhs in a year which was used towards paying off the loan and maintaining the library.
"This library has been beneficial to a lot of small farmers like me. Once the loan is completely paid off, we plan to purchase many more advanced tools like drones for sprinkling pesticides, Sprinkler irrigation systems etc. in the library" ... says Ansuyaben from Ajitgadh village in Surrendranagar district of Gujarat.

Responding to its members' needs, in 2016, SEWA establish its 7th Tools and Equipment library in Thada village of Surrendranagar District. The table below (Table 4) shows the number of members using the library per cropping season since past two years and the hourly savings per tool availed by the members using the library. For farming on a field of 1 acre, a small farmer has to use each of this tool for an approximate duration of 1 hour. Therefore, if a small-holder farmer avails all of the 5 tools/ equipment from the library instead of the marker; for 1 hour each during a cropping season; she will be able to save INR 1150 per crop.

		Name of Tool / Equipment				
		Rotovator	Orani	Thresher	Tractor	Trolley
2016	How many members used	120	147	190	110	110
	Market rate (INR/Hour)	800	1000	800	500	500
	Library rate (INR/Hour)	650	700	500	300	300
	Savings per hour	150	300	300	200	200
2017	How many members used	140	150	200	150	150
	Market rate (INR/Hour)	850	1200	1000	700	700
	Library rate (INR/Hour)	700	900	700	500	500
	Savings per hour	150	300	300	200	200

Table 4: Usage data of SEWA's Tools and Equipment Library at Thada, Surrendranagar

As of date, ***7 tools and equipment libraries are being run benefitting 15000 farmers from three districts.*** Both, agriculture laborers who do not have small equipment for labor work and small farmers can garner benefits by getting the equipment on time and at a reasonable rent.

A study on SEWA's Tools and Equipment library has revealed that ready availability of tools and equipment through the library has increased the income of farmers by 30%. For example, seed-sowing machines permit more efficient use of inputs (such as seeds / fertilizers) thus reducing the overall input cost. Additionally, the direct cost of renting tools and equipment has come down by 20%. Members of SEWA have invested the additional income in better nutrition, children's education, reducing debts, asset creation and other activities.

3. Spot and Future Prices

One of important challenges faced by the small farmers in India is the lack of access to direct market and awareness about the current market trends and demand-supply in the market; especially in case of commodities. Since the market yards for commodities are mostly located in larger towns, small farmers have to either endure hefty transportation charges to transport their harvest to the market yard or sell their produce to the middle-man visiting their villages. Due to lack of knowledge about the spot prices, these small farmers are therefore forced to sell off their produce at whatever price is offered by the traders or the middleman – thus getting exploited to a large extent.

Additionally, due to lack of knowledge and awareness about future market trends and demand-supply, the small-farmers choose the crops for season, based on previous years market demands and hence many-a-times end up with crops that are not in demand at the time of harvest and hence not getting significant price advantage. This also adversely affects the small farmers financial situation. The small farmers usually do not have surplus cash and hence have to rely on cash advances from traders and loans for cultivation. In case of low commodity prices at the time of harvest, the small farmers are not able to pay-back the loans and hence get trapped in the vicious circle of debt and poverty.

Price Board		Updated on Date:				
Crop	Breed and Place	Last years price		Spot Price	Futures Market	
		Month	up / down		Month	Price
Kapaas	Shankar Cotton (Villages in 20 km radius of Rajkot, Gondal, Kadi, Vijapur)					
	V797 Cotton (Villages in 20 km radius of Surrendranagar)					
Castor	Aranda Disa (Villages in 20 km radius of Disa)					
	Aranda Bhabhar (Villages in 20 km radius of Bhabhar)					
	Aranda Rajkot (Villages in 100 km radius of Rajkot)					
Gaur seeds	Jadhpur (Villages in 100 km radius of Jadhpur)					

Table 5:Typical Price board for posting spot and Futures prices

Realizing these challenges faced by its members, in 2007, SEWA collaborated with NCDEX to study the effectivity of disseminating spot and future prices for commodities in crops like cotton, castor and gaur to over 108 villages. Since the concept of spot and future prices was completely new for the small farmers, SEWA and NCDEX conducted several awareness creation and training sessions for about 200 grass-root leaders from these villages. These leaders were trained on the importance of spot and future prices and how to use futures prices to guide their price expectations and make more efficient sowing decisions.

Two grass-root women were trained an appointed as price-poster in each village. Futures Prices obtained from NCDEX were sent out to Price-posters weekly through SMS. They in turn would post these prices on boards displayed in each village, often on the side of walls by frequented spots: milk cooperatives etc.

Multiple survey conducted over the decade to analyze the impact of these initiatives indicate that in the initial years, the farmers were very skeptical about the validity of the spot and future prices and hence deferred from using it. However, with passage of time, their confidence on this information has increased and they have started using it profitably. Some of the positive impacts of the initiative are as below:

- Majority of small farmers in Surrendranagar district of Gujarat grew cotton as their main crop. After monitoring the future prices, over 60% small farmers in of Surrendranagar district have started alternating between Castor and Cotton. This has led to an increase in their income by almost 30 – 40 % per harvest season.
- Small farmers select varied crops every year based on Futures market. This variation / rotation in crop has led to improvement in soil health and thus increase productivity leading to increased income
- Availability of Spot prices helps small farmers take informed decision on when to transport their produce and also to which market yard – thus curbing exploitation to a great extent
- Knowledge of spot prices have helped strengthen the bargaining power of small farmers, thus reducing the extent of exploitation by traders and middle-man
- Information of future market trends help small farmers in efficiently taking financial decisions, thus reducing their financial burdens and increasing profitability.

Two years after SEWA started posting the spot and futures prices, a short survey covering 1080 farmers across 54 villages where spot and futures prices were displayed was carried out which showed the following results.

Question	Yes	No
Have heard about Spot and Futures Prices	89%	11%
Do you feel these prices are trustworthy	65.1%	34.9%
Percentage using futures prices to decide which crops to plant	39.8%	60.2%
Did future price affect your decision to cultivate • Cotton • Castor • Gaur	 55.64% 56.64% 27.27%	 44.36% 43.36% 72.73%
What information do you use to decide which crop to plant? • Futures Prices • Recent Spot prices	 35.1% 64.9%	

Table 6: Impact of Spot and Futures Price information dissemination

The above table clearly shows that ***over 50% farmer-members in study-villages used the Futures information to decide which crop to grow in their fields. Also, 35% of farmers used the future price information to decide which crop to sow.*** Since gaur is a robust crop requiring hardly any care or irrigation and since it is used for cattle-feed, there was no impact of spot and futures prices on decision regarding its cultivation.

As the information spread through word of mouth, in addition to the villages where the Spot and Futures prices were posted, the effect of this information on sowing decisions and crop choice was also reflected in neighboring village where the information was not displayed. ***About 16% cotton-farmers members in villages where the spot and future price information was not displayed, switched to castor after receiving the information through word of mouth from neighboring villages where the information was actually displayed***. SEWA also started receiving numerous requests from its farmer members in non-pilot villages to initiate such information dissemination in their villages.

Safinaben from Patadi taluka in Surrendranagar district says… "SEWA started providing us with Spot and Future prices in 2007. I was in-charge of posting these prices in my village and 15 other neighboring villages. Initially, no one cared for these prices and even mocked me for wasting my time in posting them.

I had strong belief in SEWA and therefore, I decided to experiment on my own field. During that period, no one cultivated castor in our region. Everyone grew Cotton. The Futures prices indicated Castor as a high-income crop – the labor involved in growing castor was also very less as compared to Cotton and the chances of pest infestation were also low.

In 2010, I cultivated castor in my field. The price of castor was 600 INR/ton more than that of cotton. Also, I hardly spent anything on labor and pesticides. Thus, with low input cost, I reaped a bountiful harvest. Looking at my experience, more members started believing in the Spot and Futures prices. Today almost 30 – 40 % members in our region are cultivating castor. Now SEWA has stopped posting Spot and Future prices, but we continue monitoring them through our smart phones and internet. SEWA has helped us to use technology for our benefit"

As a part of the study-program, SEWA posted spot and Futures prices for 5 years and discontinued posting this information in 2015. However, the study created awareness amongst the small-farmers regarding the benefits of information regarding spot and future prices. Owing to this awareness, the small farmers have continued monitoring these prices by their own means (internet or enquiring at SEWA's district office) till date and take informed decisions accordingly. This is a solid example of the fact that **if apt technology is placed in the hands of the poor rural workers, the rate of adoption and adaptation is very high.**

4. Customized Rainfall Insurance

Farmers face floods, drought, pests, disease, and a plethora of other natural disasters. Especially in case of small and marginal farmers, these risks are magnified. Therefore, the government of India started offering widespread crop insurance in 1985 with the comprehensive crop insurance scheme which was then replaced by the National Agriculture Insurance Scheme. However, the scheme has run at huge losses while not delivering an effective product.

In 2005, SEWA organized a workshop on Disaster Mitigation involving farmers from around Gujarat. The main topic of discussion was on crop insurance programs. The workshop found interesting results; farmers were suffering crop losses due to abnormally high levels of rainfall. This elevated the importance of finding a way to mitigate rainfall risk and **promoted rainfall insurance at SEWA.**

An irregular distribution of rainfall not only affects crops directly but also affects agriculture as a whole directly as well as indirectly. Without insurance, a failed monsoon may force a household to sell productive assets, forgo medical care, or reduce food consumption. Moreover, anticipating this probable risk, many small and marginal farmers defer from planting high-yield crops which produce more but are more vulnerable to rain shortfalls.

To study the feasibility of reducing the vulnerability of small holder farmers and agriculture workers through insurance, ***SEWA initiated a pilot initiative offering "Rainfall Insurance" to its 1500 members across 33 villages in 3 districts (Anand, Patan and Ahmedabad) of Gujarat***. SEWA collaborated with ICICI Lombard in 2006 to offer rainfall insurance, which offered protection not only against rainfall deficit but also excess rainfall to small and marginal farmers. For a premium of INR 144 to INR 259 per acre, the policy provided a cover of INR 1500 per acre.

Looking at the popularity of the pilot and the members uptake, the area of study was expanded to cover 60 villages across the 3 districts in 2007. Till date over 3000 small and marginal farmers and agricultural workers have been regularly purchasing rainfall insurance.

A study to analyze the impact of rainfall insurance on the financial activities of the members indicate the following:

- The amounts borrowed by members who have availed rainfall insurance have decreased steeply since 2010 as compared to the amounts borrowed by the families who haven't availed rainfall insurance.
- Following a productivity shock due to excess / deficit rainfall, members availing the insurance were in a more financially comfortable position and were even able to lend money to peers.
- Poor small farmers hardly have cash-in-hand and hence had to rely on crop loans for cultivating their fields. In such cases, many members who have not availed rainfall insurance have found themselves in extremely vulnerable situations forcing them to migrate in search of livelihood.

Rukhiben from Patan district says… "I and my neighbor Labhuben always cultivate our fields together. SEWA has always advised us about the importance of rainfall insurance. So, this year when we applied for crop loan, I paid INR 450 for insurance cover, but she didn't. We both took out a loan on INR 25000 each.

We used a considerable amount of the loan in field preparation and cultivation. However, there was hardly any rainfall this year, so all our money is lost.

The govt has declared draught this year. Therefore, I got an interest subsidy on my loan and also got INR 18000 as insurance cover. Although, it will be difficult year, I was atleast able to pay back the loan.

Poor Labhuben, she didn't take insurance cover. So, she will have to repay the entire loan by herself. I was really sad to see that she and her entire family had to migrate to Morbi

where they works as construction worker. I wish she would have joined SEWA and understood the importance of Rainfall insurance."

Although the farmers have been availing crop insurance through various govt / private schemes, the rainfall insurance offered a better safety net due to its various features as shown in table.

Crop Insurance	Rainfall insurance
It is crop specific	It is completely based on rainfall
There is no transparency in claims disbursement decision	Since the disbursal is completely dependent on amount of rainfall, it ropes in complete transparency
Crop Insurance premium is available at a subsidized rate through Govt.	Despite no Govt. subsidy for Rainfall insurance, the premium is affordable to small-farmers.
Only small-holder farmers can avail this insurance	Agricultural laborer, Share-croppers, tenant farmers as well as small-holder farmers can avail this insurance.
Claim disbursal takes over 1 year	Claim disbursal is done within 2 months

Table 7: Benefits of Rainfall Insurance over Crop Insurance

The table below shows the number of policies purchased over the span of the study (10 years), premium paid and the amounts received in claims. Although the rainfall insurance has come to the rescue of the poor farmers in calamities like rainfall deficit or excess rainfall however, as we can see from the table, the amount received as reimbursement is not as significant as expected.

Details	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
No. of villages	32	52	52	60	60	60	60	60	65	68
No of members buying policy	92	984	603	765	1725	1212	724	812	191	200
Total no of policies bought	908	1026	603	1442	1775	2226	1264	1529	191	200
Premium paid	144 - 247	86	190	145 - 250	150	190	200	200	200	200
total claim disbursed	-	-	-	81077	500498	26623	82920	13650	85778	66941
Average claim per policy	-	-	579	169	487	144	193	52	449.15	334.7
No of members receiving claims	-	-	184	566	1381	195	255	80	153	200

Table 8: Rainfall insurance data

While the rainfall insurance has been beneficial to the small farmers in many instances, there are a few discrepancies in the product that may be addressed to design a better product which could benefit small farmers more effectively such as –

- No of consecutive dry-days for the insurance to trigger is fixed. If the rainfall occurs one day prior to the dry-day, the insurance doesn't trigger in, however, the crop has already been affected. In order to address this issue, the no of dry-day needs to be decided based on the crop.
- The villages in district are spread apart far and wide. Therefore, the rainfall data collected at the weather stations may not be accurate for all the villages in any given district. This can be addressed by collecting rainfall data at village-level.

Owing to the aforesaid discrepancies in providing effective safety-net to its members, SEWA discontinued its Rainfall insurance initiative in 2015 and re-initiated a search for a better insurance product.

In 2016, Govt of India introduced a newer modified crop insurance scheme – the "Pradhan Mantri Fasal Bima Yojana (PMFBY)", which provides comprehensive risk coverage from pre-sowing to post harvest losses due to non-preventable natural risks. Adhering to its policy of not running parallel programs, SEWA started facilitating its members in availing the insurance cover under the PMFBY. SEWA also helps its members in the process of claim reimbursement under the PMFBY.

Till date, SEWA has facilitated crop insurance cover to over 75% of its small holder farmer members under the PMFBY. **SEWA has also worked diligently with its 366 members, to help process their claims reimbursement under the PMFBY.**

5. Affordable access to farm-top renewable energy

A need assessment study conducted by SEWA revealed that women spend 40% of their time and up to 25% of their incomes on accessing energy mainly for lighting, pumping and running small tools.

Rekhaben, from Arvalli district says… "This solar water pump has come as a boon for me and my family. With the savings in irrigation cost, transportation cost and the increased income due to increased crop yield, I have purchased more land and thus almost doubled my land holding. Now I can irrigate the fields at my convenience – thus saving a lot of time. I use the time thus saved rearing cattle thus earning an additional income.

I am very happy to have this solar pump. In addition to financial security, it has brought me dignity and respect. I am very thankful to SEWA for thus changing my life and helping me secure a better future for my children"

While majority of villages in India are now electrified, the supply of electricity is very irregular, with power cuts ranging from a few hours to few days. This absence of electricity translates into difficulty in lighting, pumping, running small tools and accessing water for drinking and irrigation. Difficulty in lighting means women have less time to finish their household chores and have to finish it during day-light hours – thus less time to work. Difficulty in pumping and running small tools means women have to depend on costly diesel oil, thus increasing their agricultural input cost and reducing their overall profit. Difficulty in

accessing water for drinking and irrigation means, women have to walk long distances to fetch water – thus again less time to earn a livelihood.

When women have less time to work, it impacts the income of the family. Women have a natural tendency of putting their family first. As the family's income shrinks, it impacts their daily needs like food and clothing. With less money to spend, food supply diminished and as the women gives priority to male members and children of the family, often there is hardly any nutritious diet left for the women – thus affecting their health. This is an example of the nexus of women, water, energy and food.

Figure 3: Solar pump-set in a SEWA member's field in Anand District, Gujarat

It is an undeniable fact that many villages in India face the acute problem of inaccessibility to water and energy. It is the root cause of the burning issue of very low agricultural yield faced by smallholder farmers. This in combination with frequent climate-shocks and market-shocks resulted in agriculture becoming more and more unsustainable for these poor farmers, forcing them to work as unskilled casual labor.

An average small farmer ends up spending 800 - 1000 INR per day in purchasing diesel to run pump-sets for irrigating his field and for running other small tools. Lack of access to pump-sets forces many of these farmers to purchase water for irrigation from large farmers at highly inflated price. Unavailability of funds prevents these farmers from cultivating more than one crop per year on their fields thus affecting their households' income.

Therefore, to address this nexus of Women, water, work, food and energy, SEWA launched its integrated energy initiative "Hariyali" that focuses in facilitating affordable access to clean, green farm-top renewable energy solutions such as solar pumps for agriculture, farm-top solar for electrifying homes and running small tools, facilitating access to solar lanterns and solar-powered fans as well as facilitating access to clean cooking solution – thus, strengthening the agriculture and livelihood of poor small farmers.

While the implementation of activities under the Hariyali initiative saw many challenges in terms of awareness creation regarding the efficacy of renewable energy solutions, the end results are highly encouraging. Some of the positive outcomes of the initiative are:

- Savings in cost of irrigation by about **INR 45 / hour translating to approximately INR 2200 per crop per acre** and increase in the cultivated area as well as cropping intensity **up to as much as twice**, due to easy and affordable access to irrigation led to strengthening the livelihoods of small farmers
- Farm-top energy solutions provide support to allied activities like Animal Husbandry leading to an **increase in income / savings amounting to INR 3000 - 4000 per year**.
- Scope of additional income due to time-savings leading to more time for earning livelihood.
- Saving in time and Reduction in hassle in accessing energy.
- Reduction in drudgery
- Reduced environmental pollution due to use of renewables
- Asset creation in name of Women
- Contribution to UN's SDG's and India's NDC by reducing carbon footprint – till date SEWA's members have contributed in **reducing approximately over 75 tons of CO_2** by switching over to renewable sources of energy – **a minor yet firm contribution towards SDG 13**.

6. Developing customized Mobile Apps for small Farmers

India and many other south-Asian countries have a growing young workforce. With the changing demographics, SEWA's membership profile is also changing. Today, almost 35 - 40% of SEWA's membership comes from the young generation. The profile of these workers is completely different. They have a natural affinity to modern, smart tech-savvy jobs.

SEWA realized that the advanced digital technology, if tactfully employed, can play a significant role in combating rural poverty and in fostering sustainable development by generating modern smart tech-savvy employment opportunities for the rural youth, thus leading to overall growth and development of not only individuals but the community as a whole.

However, the current ICT tools and apps available in the market are all designed for the educated urban users. There are hardly any tools or apps that are geared towards needs of the poor informal sector workers who are generally illiterate to semi-literate. SEWA strongly believes that if the technology implementation is in form of customized apps and tailor-made initiatives; is need-based, is linked to their trades and is designed to overcome the challenges & barriers faced by poor informal women workers in their day-to-day lives and livelihood, then the up-take of such technology is much faster.

Our experience working with poor women workers from informal economy also shows that the poor do not want charity – they need enabling policy frameworks and financial tools that can facilitate easy,

affordable access to modern tools and technology. Any initiative / programme including the Digital tools and initiatives when made contributory, brings in a sense of ownership amongst the workers towards that initiative along with dignity, self-confidence and respect from community and society.

Figure 4: Grass-root leader showing members their up-to-date savings balance on m-Bachat app

Thus, understanding the need of the hour, SEWA decided to develop in-house customized apps for its members involving them in all phases from design to implementation. SEWA successfully created a very unique process of incorporating digitization in its various on-going programs and initiatives through the Membership App, the RUDI Sandesha Vyavahar (RSV) App and the savings / Credit App (m-Bachat) by developing the apps based on the need and demands of the members and also implementing and monitoring it through the members – all the while focusing on preserving the traditional value-based organizing process, thus creating a confidence amongst the users - majority of whom are poor illiterate / semi-literate women who had never even used a smart-phone in their lives.

With SEWA's multiple initiatives and programs migrating to mobile platform, purchasing and using a smartphone / tablet would help members by saving their time and energy, making them more efficient and productive and yet be cost effective. Incidentally, the price of smartphones has also dropped to @ 4000 – 5000 INR. The children of SEWA members can also use this tablet / smartphone in their academics. And, it also facilitates asset creation in the name of the women which we, at SEWA believe, is the surest way to fight poverty.

Therefore, to enable easy and affordable access to smart-phones and tablet computers, SEWA also facilitated easy-repayment loans to its members.

Figure 5: Rudiben shows-off booked orders using RSV3 app

At SEWA, we agree that none of us have a monopoly on all the competencies. Expertise in technology which IT companies represents, is the competency that NGO's like SEWA needs and SEWA has access to women who are change-makers in their societies. Coming together will make extraordinary work happen. Such NGO-Corporate collaborations need to be considered as not just CSR but an investment for the overall growth of the nation. Working on these lines, SEWA has partnered and collaborated with several corporates like (but not limited to) Microsoft, Google, Sasken Technologies Pvt. Ltd, Vodafone India, etc. for designing, developing and implementing several of its technology-based initiatives.

7. RUDI – Access to Direct market

To address the issue of direct market access for the small and marginal farmers, SEWA established RUDI – Rural Distribution Network - a for-profit agri-business company fully owned and operated by over 250000 small scale women farmers – connecting farmers to the end-users. The company has its own procurement channels, processing centers, packaging units and a distribution network.

The smallholder farmers sell their produce to RUDI, which is then graded, processed and packaged into affordable small packages and then redistributed into the villages by SEWA's sales-force - called Rudi-ben's or Rudi Sisters. It brings nutrition and food security to over a million households today. In this process, the farmers get fair returns and the landless laborers get employment. RUDI has been a great

success in transforming the grave agriculture situation of smallholder farmers into favorable and sustainable agriculture, providing sustainable food and nutrition security to the farmers household.

Today, approximately 15,000 small and marginal farmers sell their produce to RUDI, at their doorsteps for rates that are 20% to 30% better than those offered by traders. RUDI has generated employment opportunity for over 300 marginalized women at RUDI processing centers, earning between INR 5000 to INR 8000 per month.

No	District / State	No. of Rudiben using RSV3
1	Ahmedabad	324
2	Anand	285
3	Gandhinagar	315
4	Kheda	95
5	Kutch	262
6	Mehsana	481
7	Patan	251
8	Dungurpur, Rajasthan	109
9	Sabarkantha	373
10	Surrendranagar	493
	Total	2988

Table 9: District-wise no of RUDI sales women using tablets for sales in 2017

Additionally, it has also generated employment opportunities for over 2000 landless laborers in form of saleswomen taking RUDI products to rural households, thereby earning a monthly income between INR 2000 to INR 5,000.

Thus, RUDI helps farmers adopt modern agricultural practices, and links them with various other initiatives of SEWA that help farmer's practice sustainable cultivation and realize better yields.

Rudiben's travel door-to-door in villages assigned to them to take orders from customers. These orders are then conveyed to the PC where they are processed and handed over to the Rudibens' for delivery to the customer. Till 2011, this entire process was done manually leading to a lag of almost a week between the customer placing the order and receiving the products. Lots of time and effort was wasted in travelling back and forth multiple times between villages and PC. In absence of real-time information interchange, PC's were struggling to manage inventory. The time lag in order-delivery led to RUDI losing many orders and thus loss of income.

To overcome these challenges, in Jan 2012 SEWA developed a mobile app – RSV1 – a java-based app that could be used on any basic feature mobile phone, which was soon replaced by a better version RSV2 in Jan 2013. By 2016, more than 90% of Rudibens were efficiently using RSV2 on their mobile phones. Again,

with most of Rudiben's migrating to smart-phones by 2016, SEWA launched RSV3 – a smartphone-based app – RSV3, in Jan 2017.

- Developing RSV:

To tackle the aforesaid challenges faced by RUDIben's there was a need for real-time information interchange, which necessitated ICT penetration at field level. Back in 2011, this was a herculean task in itself as the poor SEWA members couldn't afford expensive gadgets like smart-phones and laptops. Studies indicated that mobile technology had good penetration in rural areas in terms of network coverage and many rudibens had access to basic feature phone. Thus, SEWA's ICT team decided to leverage this mobile technology using basic feature phone as a vehicle to enable real-time information interchange in RUDI.

Various solutions were tried to enable this information interchange such as: Voice calling, Text messaging – SMS and Toll-free calls. However, these solutions were not viable due to various challenges like high operational cost, poor network connectivity, illiteracy of members etc. Therefore, a tailor-made solution to address this issue was needed.

SEWA collaborated with Madurai based company – Ekgaon technologies pvt ltd to design a java-based application for basic feature phone to address this issue. This led to the development of Rudi Sandesh Vyavahar – RSV1 in 2011, which was succeeded by a better java-based, improved and robust version – RSV2 in Nov 2013.

By 2015, all of SEWA's over 2000 Rudibens were using RSV2. The sales of RUDI had significantly stabilized with a minimum of 3 – 4 orders per Rudiben per day. RSV2 was increasingly becoming ineffective in handling this kind of volume. This paved the path for smart-phone based RSV3 application which was launched in Jan 2017.

To make the apps relevant to the members, SEWA created a unique participatory development process for all the apps wherein the data-base creation, forms design, web application requirements etc. was done by members themselves with support from SEWA's ICT team. Only the coding was outsourced to different IT companies.

The application developer for RSV1 and RSV2 was a non-Gujarati company who is unaware of the culture, and local behavioral pattern of rural Gujarati natives. This made it very difficult for SEWA to explain its requirements and expectation from RSV. Language barrier was also a major hurdle faced by SEWA during the first-user trainings which are imparted by the developer and help of an interpreter had to be taken for the same. To avoid repeating such situation, a Gujarat-based developer was selected for developing RSV 3.

Today, more than 4000 Rudibens are using RSV3 with most of them earning an average monthly income of INR 8000 – 10000. RSV3 has also helped streamline RUDI's inventory management and sales. RUDI sells over 131 products, and its annual turnover is currently over INR 12 crores. The use of RSV not only helps RUDI in efficiently managing its inventory, but has also eased the process of taking order for the RUDIben's, thus increasing their monthly income manifolds.

8. Incorporating Digitization

Almost 2/3rd of SEWA's membership belongs to the rural areas with agriculture and animal husbandry as one of their primary occupation. At SEWA, we have always believed in keeping ourselves and our members abreast with the latest technologies. SEWA has understood that for its rural members to be benefitted by the advancing technology of the 4th IR viz. AI, IOT etc., these technologies need to be adapted to suit the needs of these poor small and marginal farmers. And to do so, there is a need for relevant, authentic and accurate data.

Figure 6: Renewing membership online using SEWA's Membership App

Year on year, SEWA generates a lot of such relevant data from its membership renewal process. Also, as a part of its agricultural campaign, SEWA has initiated several trainings, capacity building initiative and other programmes specifically for strengthening the livelihood of small and marginal farmers, which generates a lot of data related to members themselves as well as their agriculture. However, since the data is being captured manually, its usability is limited. Lack of a common digital platform also makes integration and analysis of this data difficult.

Therefore, SEWA embarked on a journey to digitize its membership data by developing a "SEWA Compass" – a common platform where data of all the members from all trades, generated through all the varied initiatives is integrated. This integrated data, could then be used for data analytics to design programs relevant to the needs of the members. It can also be used for making enabling policy level interventions & implementing various developmental initiatives and programs.

Kapilaben from Anand district says… "Till last year, we were collecting all the members data manually. Therefore, when needed, it was very difficult to derive any information from this data. This year, we have digitally recorded all the members data. In one village, while I was renewing membership, I came across a family where there was a decrease in number of family members. Upon inquiry, we found that one of the family members met with an accident recently and passed away.

Our data reflected that the member's husband had availed life insurance for the entire family through Govt. scheme, but she wasn't aware of it and hence we immediately facilitated her compensation. Within a month she received life cover for the deceased member.

This is the power of real-time data availability. This is just the beginning. We now realized the importance of data and the benefits of data digitization."

As a first step towards this, in May 2017, SEWA designed an app for its membership enrollment and renewal that enabled membership data digitization at the source. A cadre of 1500 grass-root leader were facilitated with internet-enabled tablet computers with the Membership app installed in it. These leaders personally visited the members to renew their membership as usual – however, this year instead of manually renewing the membership, they did it digitally using the app and also uploaded a picture of the member and their Aadhaar number. By end of 2018, 60% of SEWA's membership would be digitized.

Simultaneously, SEWA has also started integrating the data generated from its other apps like RSV, m-Bachat (Savings and Credit app) and MIS into a common master data base.

9. Generating smart secondary source of employment to supplement traditional livelihoods

Under its Climate-smart agricultural practices, SEWA always advocates its members to pursue a secondary source of livelihood that can supplement their income from the primary livelihood and also provide a safety-net to its members to withstand the effects of the increasingly frequent climate shocks and market shocks.

In this context, with an objective of generating newer employment opportunities for its rural members using their own assets, SEWA launched its e-hospitality initiative – "Hum Sab Ek Hai" in January 2017 - using the unused portions of members' homes – converting them into Home-stays.

Sixty-five-year-old Valiben from Vadu village in Mehsana District of Gujarat says… "I have listed my home as rural hoe-stay since past 2 years and have been able to earn more than INR 18000 per month.

But additional income is not the only benefit. "Hum Sab Ek Hai" has brought some very positive changes in our lives. Interaction with educated guests from other parts of our country and world has motivated my grandchildren to take their education seriously and they now aspire to pursue higher education and tech-savvy jobs.

Youth workers in my neighborhood have started working on their communication and linguistic skills to take-up jobs as interpreters. Travel service operators have started getting more business for airport pick-up /drop as well as car-rental services. We also get an opportunity to revive and propagate our culture, tradition and food in front of people from different parts of the world."

Some of the direct and indirect benefits of this e-retailing initiative of SEWA are as below:

- Generating secondary source of Income using their existing assets thus leading to improvement in the quality of lives of hundreds of rural non-members as well as members of SEWA.
- Development of Rural Tourism while preserving the rich cultural and traditional heritage of villages.
- In addition to providing an additional source of income for the home-owners, this model also generated an array of allied employment opportunities for the younger generation such as tourist guide, travel / transport service providers, local artisans, interpreters etc. Thus, digital technology has opened up a Pandora box of smart tech-savvy employment opportunities accessible to the rural youth in their local community.
- Availability and accessibility of newer forms of employments in their own areas prevents youth workforce from out-migrating to cities in search of jobs.
- Home-stays offer the rural younger generation an opportunity to interact with people from varied culture, fields and regions. These interactions help in broadening their knowledge about the world outside their villages and thus their outlook. It inspires and motivates the youth to explore newer career-paths and employment.
- Rural Home-stays enable direct interaction between both ends of the food-supply chain viz. the producers and the consumers. The first-hand knowledge and experience of the hardships endured by a small farmer in growing the food-grains, reinforces the importance / value of food amongst the consumers, thus promoting responsible consumerism.

District	Year	Homes	Nights Booked	Total Income	No. of Guest
Mehsana	2017	5 Home Stay	24 Nights	123077	59
	2018	9 Home Stay	45 Nights	129306	102
Surrendranagar	2017	4 Home Stay	50 Nights	133076	130
	2018	7 Home Stay	27 Nights	54710	59
Patan	2017	3 Home Stay	33 Nights	128700	87
	2018	6 Home Stay	18 Nights	47293	44
Chhota Udaipur	2017	2 Home Stay	4 Nights	17654	20
	2018	3 Home Stay	3 Nights	5384	9

Table 10: Earnings of member households listed online on e-hospitality websites (from Jan 2017 to May 2018)

SEWA launched this e-hospitality initiative in Jan 2017. Till date ***39 members properties have been listed online*** on e-hospitality websites, thus ***generating employment opportunities for 39 families as well as hundreds of their fellow villagers in hospitality-allied trades like travel & tourism, pottery, traditional art & craft, clothing, culinary etc. The hosting members have noted*** 8 - 10 guests per month from all over the world staying for an average of 3 – 5 days each and ***a marked net increase of approximately INR 18000 – 25000 per month in their income. It has also helped revive old traditions and cultures of the village.***

Figure 7: Rural e-hospitality host Gauriben giving embroidery demo to guests

Conclusion and Way Forward

Through years of experience, SEWA has demonstrated that women are the best agents to engineer change and address new aspects of development in a society. With Indian agriculture becoming more and more unsustainable due to the increasingly frequent and intense climate shocks and market shocks, the problems of a farmer are getting closely intertwined with the challenges her family faces. In such situations, if armed with the right tools and technology, women are best placed to tackle such problems and work towards economic and social security of their families.

The successful implementation, adoption and sustained use of SEWA's various technological initiatives reaffirms that "technology when put in the hands of the poor, they know exactly how to use it to their benefit".

Some of the key attributes of the strategy adopted by SEWA while implementing technological initiatives under its climate resilient practices in agriculture, which can be kept in mind and followed elsewhere, are enumerated below. These attributes can serve as guiding principles for interested NGOs, Financial Institutions, Government Agencies, and Policy Makers:

- **Research Rural-Oriented technology:** All the hardware / software available in the market currently have been designed keeping the educated formal sector in mind. SEWA's experience with digital enterprises shows that modern technology can be used to generate smart and better-quality employment opportunities for the rural youth on a large scale. To enable this, thorough research needs to be undertaken to design and develop hardware / software specifically for the rural communities so that they can access and adopt these technological advancements seamlessly in their lives and livelihood.
- **Research accessibility and affordability of advanced technologies in Agriculture:** Looking at the scenario of agriculture; especially from the stand-point of a small holder farmer, it is clear that the agricultural productivity is largely dependent on the availability as well as affordability of irrigation facility. In order to address this issue, there is a need for extensive research on accessibility and affordability of newer irrigation techniques and technologies like sensor based precision irrigation technology – which will not only regulate the amount of water needed but also optimize the water usage thus decreasing the irrigation cost, improving the soil and plant health and also lead to increase in the agricultural productivity.
- **Encourage Digital Enterprise Formation:** Policy shift encouraging formation and sustenance of digital enterprises equipped with necessary infrastructure and environment to facilitate awareness, access and education of modern digital technology to grass-root communities especially poor women from rural areas to make their livelihoods smart and sustainable
- **Promote Collective Farming:** Uptake of several new techniques / technologies and government schemes is low amongst small farmers. Given that the size of land-holding of small farmers is less, the procedures needed to access these schemes / technologies is too high as compared to the perceived benefits. Therefore, to improve uptake of these schemes and realize economies of scale, SEWA advocates promoting collective farming by encouraging farmers with contiguous land holdings to form Farmer Interest Groups (FIGs). SEWA has successfully piloted such a model in the "Vanlaxmi Tree-growers Cooperative" in Ganeshpura, Gujarat that can serve as an example in encouraging and facilitating more such collective initiatives.

- **Technology Education:** Through our experience working with women from various age-groups, we have learned that the young grass-root leaders were able to adopt modern technology immediately but it took several months of perseverance to get the older generation of grass-root leaders to adopt it. These older generation workers have a strong reluctance / fear of learning and using the modern technology. They find it very difficult adapt to and adopt this technology.

  To overcome this challenge, Government needs to design and implement technology education programs for adults on large scale similar to the adult education programs carried out in past. These programs will help remove the complex in minds of older generation workers against modern technology and prevent them from becoming marginalized. Additionally, these programs need to adopt the traditional hands-on classroom teaching methods using tools like videos, charts and pictorial presentations instead of e-learning modules to effectively reach out to the older generation rural communities.

- Advanced technologies like AI, Blockchain, IOT etc. are now coming to the global south and hence there is a need to focus on how to shape the process. In this context:

  - There is a need for training and capacity building by developing tool-kits for AI, block-chain, IOT etc. This will enable it to turn it into an advantage for the rural workers and prepare them to collectively adopt AI in agriculture, animal husbandry etc.

  - Similarly, how do small farmers, rural workers and their organizations use block-chains in building worker owned and managed supply chains and in scaling it up?

  - In the global south, where there is surplus of labor, which are the labor augmenting technologies? How can the technology revolution create more dignified jobs for the poor and women as workers?

  - A need for a regulatory framework, to ensure that the global south doesn't become the dumping ground for cheap or junk AI and robotics.

  - The regulatory framework should enable the small-farmers to access platforms, strengthen their collective bargaining power by negotiating contracts that enable them access to the data – personal data as well as customer data, from the platforms

  - There is also a need to set-up a special skills fund that will enable the workers, including the rural workers and small farmers in the informal economy for the readiness to this transition.

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