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Agriculture Development Beyond Food and Nutrition Security

Journey in Agriculture Development: 1987 to 2017



Preface

Starting from primitive agriculture to scientific and economic to total welfare are the milestones achieved.

It gives me immense pleasure to document and publish the journey of Agriculture, as it is very near to my heart and my team. It is exciting to look back and recollect the memories of the journey. Starting from primitive agriculture to scientific and economic to total welfare are the milestones achieved. At this point I remember my colleagues who made my journey joyful, my Gurus (Agriculture Scientists and Experts) who not only trained me but built my confidence to undertake such a huge mammoth task. I am also thankful to thousands of farmers for putting trust in Foundation, who adopted the strategic interventions, and worked hard to achieve the results.

The year 2015-16 was the year of up scaling of successful experiences in transformation phase of Agriculture and it is a matter of satisfaction that the farmers have started adopting the natural ways of agriculture. A document on "Best practices in agriculture" is jointly published by Tata Institute of Social Science (TISS) and SFT. It has been appreciated by Ministry of Rural Development, New Delhi and widely circulated at national level.

The Social Research and documentation cell has conducted baseline and impact studies of ongoing projects. The Value chain study of eight commodities of Chhotaudepur has been conducted in collaboration with Institute of Rural Management (IRMA), which will provide new insights for agriculture development programs. I am sure further institutional collaboration will add new horizon for development process.

The journey has been eventful; coming together for water and soil conservation/water harvesting and than staying back on their farms for harvesting a better yield from Kharif crop, resulting in investment of their labor to further improve farm productivity and look for Rabi crop, was a stepping stone to adopt, crop change, better seeds and improve agriculture practices to get better economical returns. A great promises building in converting local biomass and animal waste scientifically in to crop input products; reducing input cost and ensuring better productivity by increasing soil moisture and promoting a conducive ecosystem for micro-organisms to work for land productivity. As we embark on our journey from elementary level to diversified agriculture practices started from Vadodara to Chhotaudepur; we have tried to document Foundation's experience in agriculture development.

I invite you to join in our endeavor to achieve better living standards of the Tribal farming communities, through your contribution to the agriculture development.

Shruti Shroff
Managing Trustee



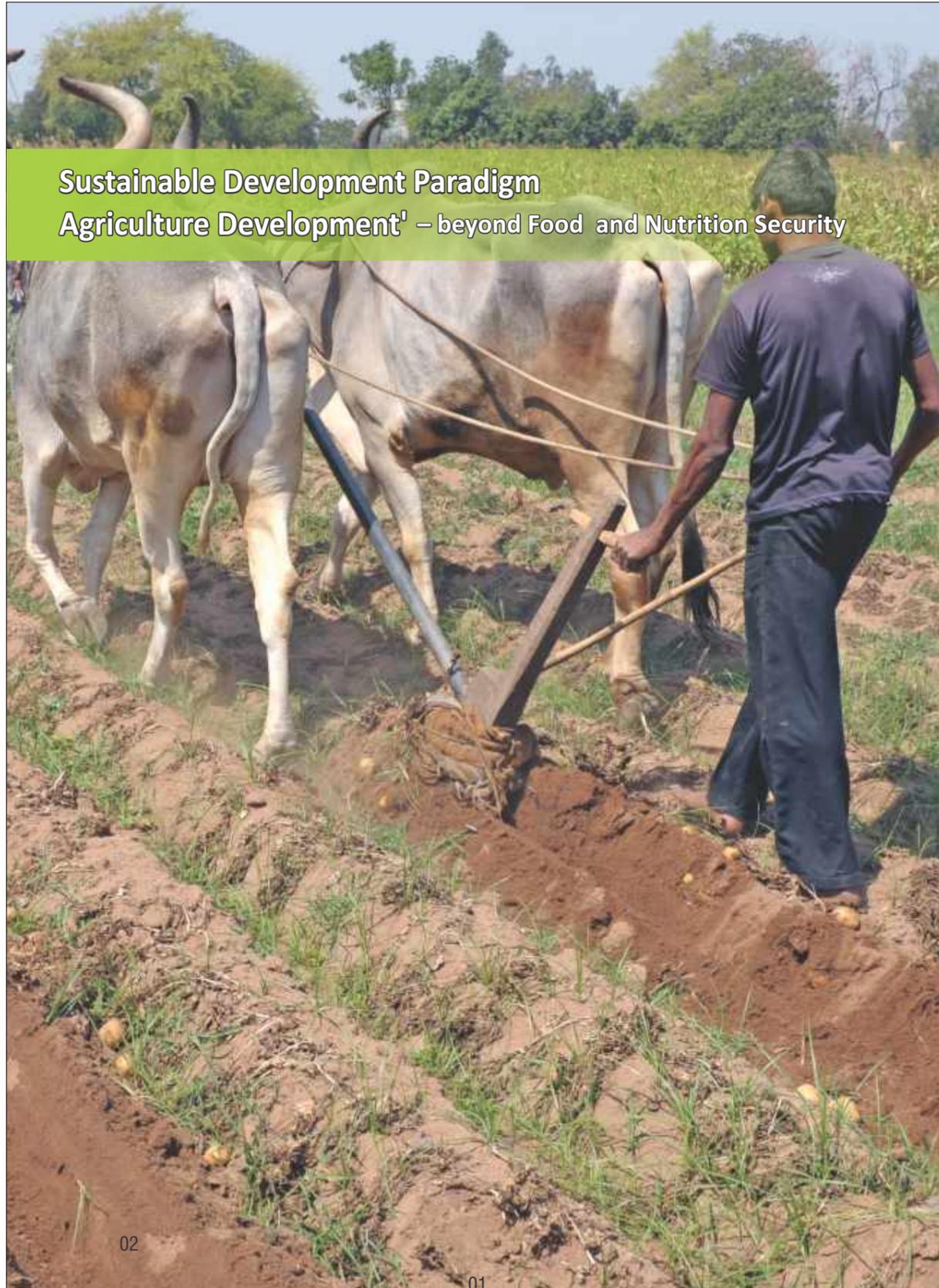
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**Sustainable Development Paradigm
Agriculture Development' – beyond Food and Nutrition Security**

1

**Agriculture Sector in Sustainable Development Goals (SDGs):
Indian Outlook**

In September 2015, United Nations adopted the Document titled 'Transforming Our World: 2030 Agenda for Sustainable Development'. To facilitate above, a set of global Sustainable Development Goals to be achieved by 2030 are developed. There are 17 universal Sustainable Development Goals (SDGs), which are devised through integration and balancing of three dimensions of sustainable development viz; Economic, Social and Environmental.

In this context the *Ministry of Agriculture and Farmers Welfare, Government of India* has committed and designed ambitious goals and set indicators to achieve it by 2030.

End hunger: Achieve food and Nutrition securities and promote sustainable agriculture by 2030 is an ambitious goal. It aims at to double the agricultural productivity and incomes of small-scale farmers, in particular women, indigenous peoples, family farmers, pastoralists and fisher's community. It includes to secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non- farm employment.

Target – 2030: Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production. That helps maintain ecosystems, strengthen capacity for adoption to climate change, extreme weather; drought, flooding and other disasters and that progressively improve land and soil quality. The indicators proposed are, % of agricultural area under sustainable agricultural practices, % of agricultural households using irrigation systems, eco-friendly fertilizers, pesticide and maintain the genetic diversity of seeds with equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge. Further to ensure the fair returns, the goal is set to adopt measures to ensure proper functioning of food commodity markets as well as measures helping timely access to market information to avoid situation of food price instability.

SFT's Approach & Journey

Shroffs Foundation Trust (SFT) had started the journey in agriculture from understanding the basic issues of farming, to find out answers and link the knowledge with the farmers. SFT joined hands with academic institutions like Agriculture Universities, Corporate, Scientists and Experts. In late 80's, the journey was started with the farmers of Vadodara and Padra blocks focusing plant growth and protection

management in vegetable and cash crops - cotton and castor. This relationship further paved way to expand the agriculture and animal husbandry as core area of interventions in SFT.

In the year 1995, SFT began its journey in tribal area of Chhotaudepur with watershed area development program. The agriculture development initiative started hands in hands with watershed development program as there is strong link between natural resource development, agriculture and rural livelihoods. The tribal farmers and their farming practices were primitive in nature as compared to the farming in mainstream areas. The main source of livelihood of the tribal communities was rain fed farming and collecting and selling of minor forest produces. The cultivation of food crops (Grains & Pulses) was primitive and primarily for sustenance, which was insufficient for whole years food need. The distress migration in search of work which got stretched in drought years further deteriorated the socio-economic conditions. Migration also did not allow any investment in improving land productivity and availability of water for supporting irrigation. Thus, agriculture development did not reach them for a very long period.

SFT's outlook

Regions affected by degradation of natural resources cannot sustain land productivity. SFT dealt with these impacts on agriculture by addressing land degradation, soil health, irrigation and dwindling plant genetic resources. The major focus was on boosting agriculture productivity by introducing new and high yielding varieties of crops to balance food and nutrition security along with cash income. The increase in agriculture production has helped in achieving food and nutrition securities and reduced dependency on forest resources. The achievements rain water harvesting, soil conservation and improved irrigation management combined with use of improved crop varieties have further contributed in sustaining the productivity.

The adoption of modern agriculture practices has increased the production of food crops, which brought food securities and balanced nutrition to certain extent with strengthening of household economy. Injudicious uses of synthetic inputs had degraded the soil health, products and productivities and threaten human health.

Recent years are experiencing major changes in rainfall pattern, especially onset of monsoon, unseasonal rains, reduction in frequency and intensity of rain is affecting the agriculture practices resulting in crop failure and production. Similarly increase in winter and summer temperature has consequences on crop-water demand leading to serious vulnerability to farming practices.

SFT responded by sensitization, awareness creation and knowledge transfer among farming community through establishing farm schools at village level and developing a cadre of women agriculture entrepreneurs, so as to be a leaders to work as change agents. This system is playing a pivotal role in educating farmer communities. In addition to that the sustainable agriculture practices are introduced to reinstall the traditional farming methodology. Soil health, Crop health and growth management are addressed by educating farmers, conducting demonstrations and up-scaling of the successful models. To address the climate vulnerabilities, resilient varieties of major crops are demonstrated and introduced. The farmers are educated on agriculture contingency planning and adopting climate change measures for saving their crops.

SFT vision built in 2014 matched with the “target 2030” spelled by ministry of agriculture and farmer's welfare, GOI. Actually, we are eager to achieve its ambitious goals by 2020-21 in the area, we work. In our vision, we have targeted “No poverty” and “Zero hunger” through gender equality and climate action. We have also ensured that environment and biodiversity protection becomes a by-product of raising the productivity of land and water. It is to build capacities of communities for collective action through empowering farmers, especially women farmers to access knowledge, material, demonstrations for land and crop productivity. It also includes linkages with market by building capacity of semi-processed or processed farm products. We believe that self help groups federating in cluster and then to a co-operative is very important step to realise the objectives set in “target-2030”.

Impact:

These efforts have impacted in food and nutrition securities of small and marginal land holders forming 90% families of the area. Improved farming practice like; adoption of complete package of practices, high valued and or high yielding crops and the techniques like System of Rice Intensification have increased the productivities in many folds. The shift in utilization of sustainable sources for soil and crop health as well as growth management have reduced the input costs and helped in improving quality of products. The adoption of climate resilient farming practice along with Mix and Multi cropping has reduced risk of crop failure resulted in strengthening of household economy. The farming has become full time engagement giving way to carry out other nonfarm livelihood in form of animal husbandry development and allied services. These have generated more employment opportunities within the villages, reducing distressed migration to large extent.

The integrated approach combined with end to end solution has helped in achieving the national vision well before set timeframe in this tribal area.



Agriculture a Backbone of Rural Economy

2

the population directly involved in farming; the agriculture sector also play a vital role in generating large number of employment through agro-based inputs, processing and marketing activities. Apart from employment generation and rural economy, agriculture is also important for country's food security and earning foreign currency by exporting rice, wheat, tea, coffee, spices, fruits, vegetables, sugar, cotton and many more. Thus Agriculture plays a vital role in India's economy.

The scope and dependency of Agriculture based industries has also significantly increased due to increase in consumptions of external inputs such as fertilizer, pesticide, seeds, tools and machines. At the same time the growth of many industries like; food processing, textile, jute, sugar and many more are depends on agriculture. It is very clear still agriculture remains the backbone of the Indian economy because it affects 54.6% of the population.

The factors influencing agriculture growth

The agriculture sector gets influenced by climatic factors, social-economic, knowledge and access and at the same time it also influences the market as well as allied sectors. The major identified factors are;

1. Instability of Crops:

The decision of cultivation of specific crop depends on market rates. And hence in case of abundant output of crops if the rate goes down, farmers refrain from farming of same crop next year. It results in acute shortage and market instability of income and employment opportunities.

2. Sub-Division and Fragmentation of land Holding:

Due to breakdown of the joint family system, results in fragmentation of family land holding. The reducing land holding size restricts investments in farming which ultimately makes farming uneconomic. It further prevents the feasibility of mechanization in various farm operations, leading drudgery and hardship

3. The risk factors in farming

- a. Neglect of crop rotation leading to soil degradation.
- b. Neglect of soil health due to reduction in use of manures and natural fertilisers
- c. Poor knowledge and access about quality seeds leads to poor production.
- d. Inadequate Irrigation facility:
- e. Lack of proper knowledge for crop and practice to minimize the climate

change impacts.

- f. Small quantity of production makes Agricultural Marketing difficult.
- g. Poor infrastructure for Value addition and Processing leads to price fluctuation.
- h. Failure in Repayment of credit leads to loss of credibility and negligence of banks.

Since the Agriculture sector remains the major contributor of livelihood in rural communities, it is imperative to educate the farmers on scientific and resilient agriculture practices to ensure food and nutrition securities and ensure livelihood for whole year. Control credit system and stabilize market by setting up of backward and forward linkages with End to End Solution Concept.



Agriculture - an integral part of rural society

Agriculture in rural society is not just a form of livelihood; it is also a way of life. Many of cultural practices and patterns can be traced to the agrarian backgrounds. The farmers have range of festivals at each phase of the season, beginning of a new agricultural season to harvesting. There is a close connection between agriculture and culture. The celebrations of social events and festivals depend upon successful completions of farm works.

Situation of Agriculture

In spite of being a major source of livelihood most of the farmers have not been successful in cultivating their land economically. They have been treating agriculture as a family tradition following age old practices. The chances of crop failure in small land holdings, mostly owned by the poor and tribal families are very high.

The variation in climatic factors and degradation of land resources are increasingly derailing Rain fed agriculture economy. Ultimately this vicious cycle affects the living standards of the rural society. Poor economic conditions of the families do not allow them to access quality education for the children, quality medical services, nutritious food to the family and overall well being of the family and society. Many activities that support agriculture and village life are also sources of livelihood for people in rural areas. A large number of artisans and skilled people are the part and parcel of the village economy.

The agricultural land utilization further provides scope to strengthen rural economy. Currently about 65-69% of land is under rain fed agriculture which remains unutilized during major part of the year due to lack of irrigation facilities.





Tiny steps for Giant leap

3

Planting Seeds of Commitment

It was a winter of year 1987; the roots of SFT were just started establishing with nourishment of great enthusiasm to serve the human beings. As a general belief; a healthy person will create opportunities for livelihood to stabilize the standard of living. This was just a beginning of addressing the issues of a rural society like seeing only the top of an iceberg. The vulnerability was exposed when, Dashrathbhai, the sarpanch of village Kalali approached SFT with disease affected vegetable plants and asked for help to save the crop. At the time Shrutiben was playing with the children as part of her daily routine and she could not answer. She asked to give her those plants and promised to find out some solution. It was a surprise to her that the agriculture crops also have disease like human beings!!!

Dada, Shri Govindjibhai Shroff laughed when Shrutiben showed the plants and asked to guide. He only replied, Shrutiben we have Agriculture University near to us, why don't you go there and get solution from the Agriculture scientists? Shrutiben visited and interacted at Anand Agriculture University. She spent a whole day in various departments and with the scientists. When she came back; she had not only the solution of disease attack on vegetable, but had lifelong backup support and friendship with the Agriculture scientists!!! Later, a senior entomology scientist Dr. J. R. Patel, became a member of SFT and contributed in shaping up the agriculture services of the Foundation.

Thus, the seed of commitment to address the community needs affecting their life standards was sown!!!

A cluster of eight villages surrounding Kalali were growing Vegetable and flowers as major crops in all three seasons. The farmers were having advantage of nearby market of Vadodara offering bulk marketing for their produces, which was helping them to keep regular cash flow. This was the only source of livelihood for farmers and dependent landless labourers of these villages.

Disease and pest attacks on crops had started shattering their economy. The historic drought for three



consecutive years during 1985 to 1987 had resulted in open wells to dry. It became imperative to intervene to improve both these problems impacting the economy of the village. SFT built a team of Agriculturist, Geo-hydrologist and a social worker to understand and address the issues. About 650 farmers of eight villages adopted the scientific farming, benefitted by field clinics and problem solving interventions for successful cropping. About 45 irrigation wells were revived by installing rain water recharge systems.

Expanding the outreach

SFT realized these issues of crop disease and water depletion have geographically spread and more severe in adjoining villages of Padra block. Hence SFT decided to expand the outreach in 37 villages of Padra block with focused interventions in Agriculture and animal husbandry.

The farmers had practice of imprudent use of chemical inputs and over exploitation of soil and absence of soil and crop health management measures. Because of shortage of labourers and input costly practices the agriculture became non viable economic activity.

In absence of irrigation infrastructure the farmers were forced to use effluent water of industries creating serious threat for human health. This was the serious issue and not easy to tackle as it was concerned with the livelihood of farmers.



The interventions

The multi-disciplinary team under guidance of agriculture scientist started educating these farmers on soil, water and plant health related issues. Later, a fully equipped Khedut Mahiti Kendra was established with corporate support having facilities of plant clinic, Agri equipments, seed and fertilizers to cater the emerging farmers' needs for scientific

knowledge and services. Additionally the farmers were facilitated to avail the benefits of government programs

In mid nineties, SFT adopted focused intervention approach by forming 45 farmers' clubs. Farmers clubs conducted 158 crop demonstrations for scientific



farming practices as well as balance use of organic and inorganic inputs and 570 Khedut Goshti's were conducted , covering soil and crop health measures, harvesting and post harvesting techniques. The farmer's access to the Agriculture University and Corporate Knowledge was enhanced by organizing 10 seminars on different themes of major crops and agriculture seasons and sharing of *lab to farm and farm to lab* concept.

The impact:

Agricultural extension is the application of scientific research and knowledge in to agricultural practices through farmers' education. Generally, agricultural extension is defined as the "delivery of information and inputs to the farmers". But SFT's role for extension services was invaluable in teaching farmers how to improve their productivity. Extension is also critical to move research from the lab to the field and to ensure translating new knowledge into innovative practices. During the decade long journey, the extension services rendered by SFT can be classified into three major categories.



Technology transfer - Backward and Forward linkages - Facilitation

As part of technology transfer new techniques were introduced such as, integrated crop management (ICM) to inculcate the habits of balanced farming. SFT began with the concept of Soil health, including soil testing and natural compost fertiliser. New and high yielding varieties of seeds and scientific equipments to reduce the hardship of farm operations were introduced. These interventions have impacted in reducing the input costs up to 40% and increase the yield by 50%. The farmers have stopped using polluted water for irrigation as part of soil and crop health measures.

SFT could build strong relationship with the Agriculture University, Experts and Corporate to bring the modern technologies on the field. During the period more than 4000 farmers of Padra and Kalali blocks were served with the quality inputs to ensure increase in yield.

Animal Husbandry: Victim of community dynamics

Surprisingly, in spite of being located near the city of Vadodara, the animal husbandry was not developed in an organized and structured manner. The farmer families had good quality animals but, in absence of organized milk collection cooperatives at the village level, the milk was sold through the middle man. The enquiry to the problem revealed that the milk cooperatives were sabotaged by community dynamics and politics.

Women led Cooperative Societies:

The women are having close association with maintaining milch animals. Recognizing women's role and contribution in animal care, SFT facilitated formation of women milk cooperative societies in Kalali, Talsat and Khalipur villages. SFT continued nurturing these societies and established them as a strong source of revenue generation. Presently these societies together have association of 185 families and annual turnover of ₹ 78.00 Lakhs contributing to sustainable income for their livelihood. These societies have emerged as real examples of women empowerment.

The tiny steps had laid strong foundation of Trust by increased knowledge, rich experience, confidence and relations with experts and scientists for a giant leap!!!! .



Creating enabling situation for Agriculture in Chhotaudepur



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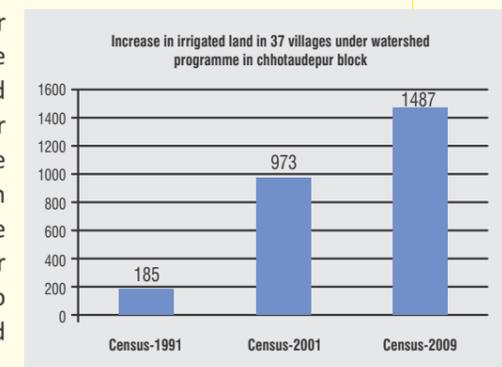
Watershed development: the beginning of Agriculture transformation

It was month of April, 1995. The festival of Holi was just over which also indicate arrival of another hot season. It was the first visit by SFT team (including Smt. Shrutiben Shroff and accompanied by Shri Atulbhai Shroff) to Chhotaudepur. The purpose was to take decision about Director DRDA-Vadodara's invitation to be project implementation agency (PIA) for watershed development program in "Rath" area. All the members were eager to reach Rangpur (Zoz) village- a project village and Haat (weekly market) centre located about 22 Km. from Chhotaudepur town.

Just after travelling about 100 KMs. from Vadodara, the capital of iconic princely state known for development and modernization since early 30's, It was a cultural shock for all to see men and young boys walking with bow & arrow and sickle (locally called "Paliya") and wearing cloths barely covering their bodies.

The journey from Chhotaudepur to Rangpur Zoz village was pathetic. The main highway connecting *Chhotaudepur* with *Alirajpur* in Madhya Pradesh was full of big potholes; there was hardly any person in undulating landscape on the road sides. The winds were strong with spiralling dust storms eroding the soil from agriculture fields already marked by gully erosion done by rainwater. The only green colour visible to far reaching eyes was numerous dots of Mahuva trees standing like "Bhishmapitha" as witness of gradual disappearance of rich forest and perennial streams resulting in barren, undulating land with stone and boulders lying everywhere and streams and wells without water.

The helplessness of the people was reflected in discussions with some people gathered at Rangpur *Khedut Mandali* for meeting. It was probably for the first time the local people were waiting for somebody who wanted to know about the villages and their problems. They had very little faith in people coming from city area, but one of the elderly and wise man Bhavsingbhai-President of Rangpur farmer co-operative expressed that "Since generations we are living with same struggle in life and we have not seen any change. He conveyed, those who had come from outside for doing development work, they left because no one was found in the village except old and infirm.





On the same day Shrutiben and team visited several villages to understand the root causes of the situation and poverty. She made up her mind to accept the challenge to initiate transformation process of the area. The local youth and positive leaders were identified to start the community messaging process. As per program guideline watershed development committees were formed and strengthened on watershed development techniques with overall area development approach.

A multidisciplinary team of SFT with social and technical members facilitated the committees in preparation of watershed treatment plan after several participatory appraisals followed by technical surveys and transacts. The Committees owned up responsibilities and Implemented the activities of action plans by ensuring beneficiary contribution, material and labour management along with supervision for quality control. The people realized the importance and started demanding watershed development program in their villages.

Watershed programme was implemented with a simple approach of increasing bonding of the tribal families with their land by protecting land from erosion and increasing access to irrigation water by means of water harvesting. During period of 1995 to 2012, the watershed programme has helped in building 249 water harvesting structures resulting conservation of 6.74 Lakh cubic meter of water. The programme has benefited 15000 hectares Land and increased irrigation from merely 185 ha to 1484 hectares in 37 tribal villages.

The watershed activities were so convincing for ensuring soil moisture for agriculture crop to grow, and farmers started investing in land development (levelling, bunding, gully plugs) and well construction. Thus access to water resulted in exploring possibilities of second crop during Rabi season. This started process of moving from subsistence farming to income generating farming to create opportunities for their cash needs. This was a move from watershed to watershed plus! The farmers have further accessed irrigation water by developing group wells and lift irrigation projects. As per benchmark data there were 110 irrigation wells, which are increased up to 1000 plus after watershed area development program.

As a result of all the above efforts, while, the irrigated area in entire block had declining trend during 2005 to 2010, the irrigation facility in Rath area increased by 514 ha. Rise of 57% in a decade.

The watershed development programme in Chhotaudepur had established that the natural resource management is a pivotal activity in providing solution to the problems of migration, food security and nutrition among the tribal villages in Chhotaudepur.

OJAS- Micro planning for land and water

The watershed learning's were incorporated in the Tribal area development programs. As a result programme named "OJAS"- Orsang Jal Ane Samruddhi- was initiated since 2011. The OJAS programme is aiming at regional level river basin

management by identification of scope for land and water resources conservation through micro-planning at the micro-watershed level. During period of 2013 to 2015, 70 micro-plans for land and water resource development with detail treatment were ready for use for funding under MGNREGA and CSR funds. The Gram



Panchayat found micro-plans of their respective villages as handy and ready plan for using MGNREGA funds. During 2013 to 2015, 17 Gram Panchayats have linked micro-plan activities under MGNREGA approval. The micro-plans have become a sellable plan ready to be implementing under any funding.

The micro-plans with options of pre-determined funding requirement has facilitated the donors to choose a village depending on the funds availability.

SFT experimented complete treatment and end to end solution concept in two villages last year which has made two seasons farming possible, creating livelihood opportunity round the year.

Understanding the tribal agriculture



There is a general perception that the tribal areas are rich in resources, while the fact is, the tribal communities of Chhotaudepur block were living in all adverse conditions i.e. land was scarce and undulating; high rate of soil erosion and inadequate irrigation facilities. In such adversities, it was very difficult to be self-reliant from land based livelihood activities. The high rate of distressed migration was leading to disturbing family life including child education, health care. People were leaving with acute poverty and deprivation for the years.

Vulnerability in agriculture of tribal area

Almost all Tribal families own the land but only singly crop during Kharif season was possible in case of good rainfall. The Kharif crop would fail due to absence of irrigation facilities. The crop saving during such situation was only possible by bringing water from streams or river, which was highly drudgery prone and cost intensive. Over the years, illiteracy and lack of exposures resulted in poor access and adaptation of scientific farming practices; resulting in low productivity and acute shortage of food grain.

The annual average rainfall in Chhotaudepur region is more than 900 mm, higher than the state average. The hilly and undulating terrain coupled with high rain fall was leading to degradation of fertile soil by very high rate of erosion. In turn, lower moisture holding capacity of land did not allow them growing long duration crops.

In mid 90s,

SFT had observed that Maize with Black Gram and Tur were the only crops grown in this area as they were main part of their food habits. Majority of households were practicing Kitchen garden, Poultry and Goat farming in backyard. These were the means of their food security.

With rain fed farming, the cropping practices were also of elementary level. They were neither having knowledge for scientific farming nor modern equipments. Broadcasting of mix seeds (Maize, Tur and Black Grams), after satisfactory rainfall, was the sowing methodology. The mix cropping has advantage of ensuring some production of either crop. Additionally applications for growth and protection and cleaning of the farm were not in practice. These were the reasons of low productivity.

The agriculture was never considered as sustainable source of livelihood. The people had target to spend three-four months of monsoon and then migrate in search of livelihoods.

Identification of Gaps

The ongoing agriculture practices were understood by a team of agriculturist and



social workers guided by managing trustee and experts. The discussions with the farmers led to developing understanding about basic issues and practices preventing agriculture becoming as a viable economic activity. The scientists of Agriculture University and Corporate closely monitored the team and exercise and guided the team. This has brought realization that agriculture development could become one of the sustainable solutions for improving their livelihoods.

Major Constraints:

It was observed that the non-access to knowledge and technologies have not created opportunities for exposure to enable them to adopt it. As a result the tribal farmers were never realizing investment for agriculture development as viable livelihood option. This was further strengthening by myths and beliefs around agriculture practices preventing them from diversification and adoption of new crops.

Myths and Beliefs:

The agriculture practices were strongly influenced by the religious beliefs and guidance of Bhuvu's. The tribal farmers were strongly following the religious myths and beliefs as they fear the crop failures if not done so. On occurrence of disease or pest attacks, they were seeking and following Bhuvu's advice; which prevented them from taking scientific remedial measures for crop protection.

Practices which affected the productivity

- 1. Soil Health Management:** The concept of soil health was completely missing; absence of animals prevented them in establishing ecosystem of natural way of farming. The long period of idle land reduced the fertility of soil and increased threat of termite and root based disease. They were unknowingly sowing along the slop leading to higher rate of soil erosion.

- 2. Seed Management:** Traditionally tribal farmers use preserved grain of previous crops as seeds. This was good practice, but seed treatment, seed rate and spacing methods were not at the place. It resulted in consumption of more seed, malnourished plants and ultimately lowers productivity.
- 3. Crop Growth and Protection Management:** The tribal farmers did not have knowledge even to identify the disease and pest attacks. The growth was completely depending on nature conditions; hence no preventing or proactive measures were being taken from the farmers.
- 4. Harvesting and Post Harvesting:** There was practice of mix crops; Maize is sown with Black Gram or Tuar. They did not have practice of separate harvesting and cleaning.

Animal Husbandry: A neglected option of livelihood- In Chhotaudepur region

The animal husbandry was not established as livelihood in tribal areas. The facilities of veterinary services, milk collection, chilling centres were lacking in the area. The investment for the facilities was not feasible as there was not enough quantity of milk. Because of regular migration the tribal families did not use the animal husbandry services and keep high yielding milch animals.



Positive aspects of tribal beliefs

The tribal community recognizes nature as their religion. They conduct rituals for good rains, good germination and timely completion of each phase of farming. They have festivals to celebrate successful completion of sowing and transplanting.

Their agriculture practices and beliefs are in consonance with ecological farming to make agriculture sustainable. The practices restricted the exploitation; exhaustion of nutrition from soils and preservation of biodiversity. They hardly over-harvest anything from the nature.

To manifest the positivity and divinity of individual or society is the basic philosophy of SFT, it became way of life in each and every intervention planned and executed with the tribal communities.

Knowledge building and adoption



The Watershed Area Development Program and Treatment had started impacting positively on agriculture by minimizing the crop failure risks during Kharif and providing opportunity for Rabi cropping. It was the time to educate the farmers on scientific and diversified agriculture practices. In addition to knowledge, there was a need to change mindsets for the transformation process.

Exposure:

Following the principle of “seeing is believing”, SFT organized exposure visits of the farmers from Chhotaudepur to the Anand Agriculture University (AAU). The farmers visited the demonstration plots of improved varieties of seeds and modern practices. Total 1200 farmers during the period of 1995 to 2005; trained at “Sardar Smruti Kendra” with specially designed modules on tribal agriculture and as a result they successfully adopted the new crops and modern agriculture practices.

Demonstrations:

To demonstrate the scientific agriculture practices, beginning from soil preparation to crop harvesting, crop demonstrations were conducted in 37 villages. Adoption rate was very high; within four years, more than 80% farmers started following demonstrated techniques.

Introducing new crops

The cropping pattern in tribal area was limited to food grain and pulses. With changes in agriculture practices and seeds the production Maize and Black Gram attained up to 6 and 1 quintals per acre respectively but the nutrition security was still not achieved.

Establishing agriculture as viable economic enterprise for enhancing household economy was important. It was also necessary to enable the farmers to invest in agriculture development.

Paddy farming needed a change from sowing in rain-fed to planting in irrigated method. The transplantation method of Paddy cultivation was introduced and thus the production of rice increased three folds and it generated surplus.

Cotton, Gram and Ground nut were introduced as cash crops. The farmers were trained and motivated for vegetable crops and introduced improved and high yielding



varieties of seeds of Tomato, Brinjal, Chilly and Okra. Initially the crops were demonstrated with the progressive farmers where other farmers of the villages were trained.

Need to Sustain and accelerate the transformation process

Considering the need and to sustain the process of knowledge and technology transfer, a “Krushi Sewa Kendra” programme was started with structured interventions for achieving objectives of lowering the production cost and yield enhancement through providing scientific knowledge.

This included Khedut Mahiti Kendra, extension activities, field monitoring and problem solving as regular interventions with catering emerging needs of agriculture inputs, services and information. The field training programs included subjects like; Tillage techniques and soil amendment, Growth monitoring, Protection measures, Harvesting and scientific Storage Techniques including marketing of Agriculture products at right times for better returns.

To bring scientist and farming community closer, Khedut Seminars were organized regularly for transferring latest farming technology in the farmers' field.

Impacts – Shift in cropping pattern

Maize is the largest growing crops in tribal areas. The market rate of Maize is lower compare to other crops. Also it consumes more water and exploits the nutritious contents of soil. The agriculture experts believe that, “Unless reducing Maize in cropping pattern, tribal farming cannot be economically viable”. So it is advised to cultivate Maize considering the food habits and soil health. Thus replacement of maize with other economic crops was practiced.

Item/Detail	Unit	Census Years		
		1991	2001	2009
Agriculture				
Area under Cultivation (Gross Cropped Area)	Hac	36384	36177	38513
Net Cropped Area	Hac	36384	36177	38513
Gross irrigated area with Double crop	Hac	6260	10873	11173
Area of largest crops				
(1) Maize	Hac	12100	11107	8284
(2) Paddy	Hac	7800	9500	11286
(3) Tur	Hac	3700	4705	5469
(4) Cotton	Hac	850	1550	2194
(5) Groundnut	Hac	1150	2250	3015
(6) Area under Vegetable	Hac	0	370	1000
(7) Area under Fruits	Hac	0	150	1115

The comparison of last three census data shows that, over a period of last 20 years the gradual shift is observed in crop selection, Paddy, Cotton, Tuar, Groundnut and Vegetable are increasing while area under Maize is reducing.

This trend indicates that farmers have understood and adopted balance of food, nutrition and cash crops. The cropping pattern also reveals that the coverage of irrigation facilities is remarkably increased.

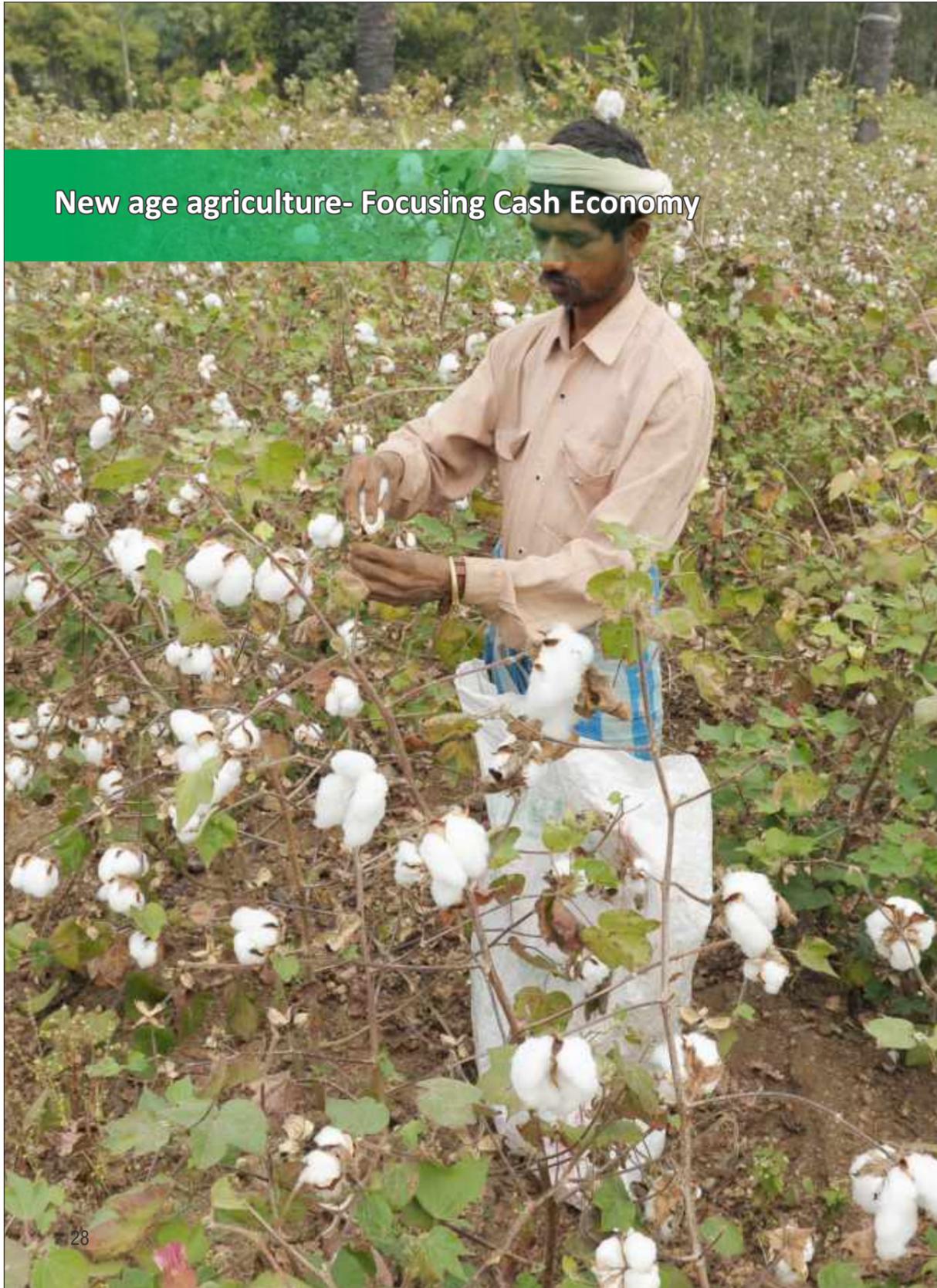
Increase in Yields:

Ultimate goal of Agriculture extension services is to increase the production per acre with diversified practices. Periodic data was compiled and analysed to measure the production growth. It is a matter of satisfaction that the growth rate of production in all crops has been increased remarkably. It reveals that systematic efforts, focused interventions and local wisdom can get desired results in development programs.

Sr. No.	Crops	Production per acre kgs			% of Growth
		1998-2005	2006-11	2012-14	
1	Maize-Kharif	850	1150	1207	29.6
2	Maiz-Rabi	1000	1333	1333	25.0
3	Wheat	425	733	1200	64.6
4	Paddy	700	1133	1720	59.3
5	Tuar	200	317	460	56.5
6	Gram	150	200	233	35.7
7	Green Gram	0	0	358	
8	Groundnut	275	323	378	27.3
9	Tomato	6000	7500	7833	23.4
10	Cotton	60	5	625	4.0

This was not the end of the story; in 2014 a three days intensive vision exercise was conducted at Chhotaudepur in presence of national and global experts for tribal area development. An opinion emerged that, in case of agriculture production we should compare the best of other states and countries to set benchmark!!!

We were far behind and more efforts needed with focused interventions.



New age agriculture- Focusing Cash Economy

7

One and half decades of journey for transforming tribal agriculture was completed. The tribal farmers had started planning of their land balancing food, nutrition and cash flow for house hold requirements. They had started adopting new crops, but the entire cropping cycle is yet to be achieved. It had prevented them in getting optimum yields. The time had come to adopt new age agriculture with adopting complete package of practices, i.e. Seed management, Soil health management, growth, protection and harvest management with scientific approach.

Convergence and facilitation

One of the major objectives of the Agriculture service centre was to facilitate the tribal farmers to avail benefits of government programs and welfare schemes. The National Food Security Mission (NFSM) has national policy to achieve food and nutrition security. Considering the fact that the Chhotaudepur (Then Vadodara) is seriously facing the issues of nutrition deficit, the state government had identified Gram (Chana) under NFSM program. SFT implemented the program in Chhotaudepur and Jetpur Pavi blocks benefitting 414 households. The effort was to make Gram (Chana) available in the area and can be added in daily food habits. To make available Gram (Chana), the efforts were made to propagate cultivation of Gram(Chana) with demonstrations among 414 families.

To reinstall the seed conservation practice in the tribal farmers SFT implemented Seed village program for Paddy seeds. Similarly Wadi program was implemented with about 380 tribal farmers as part of developing new age agriculture practices.

Thus the journey to achieve optimum yields, food and nutrition securities were steadily progressing but quantum jump was required to overcome the situation rapidly.

Projects: Sun Shine and Jeevika, Complete transformation of tribal Agriculture

The opportunity in form of projects Sun Shine and Jeevika came in the year 2009. These projects were conceived by Tribal Development Department, Gujarat with an objective to 'double' the income of tribal farmers.

This was a five years program, SFT participated three years reaching out to 72965 farmers in Chhotaudepur and Jetpur Pavi blocks. It was a quantum jump in a history of tribal area; more than 73000 tribal farmers were able to receive authentic crop kits well in time for sowing.

The complete package of Agri inputs were provided for the crops of Maize, Cotton, Pigeon pea and Horticulture for one acre package; consisting of certified and high yielding seeds, fertilizers, crop insurance and education to farmers on farming techniques.

Details of Coverage of farmers up to 2013

The complete package of practices has impacted in bumper production in the

Programs	Chhotaudepur	Jetpur-Pavi	Total Farmers
SVKSK-TAL-Agri inputs	14,485	1,380	15,865
Wadi & Horticulture	331	50	381
Sun Shine	46,577	26,388	72,965
Jeevika	0	563	563
NFSM	352	62	414
Seed Village	8,500	1,500	10,000
Total Farmers	70,245	29,943	1,00,188

selected crops. Annual income of the farmers has increased up to 80%; horticulture farming became part of regular practices and has played an important role to strengthen the financial condition of the tribal farmers by providing ensured income.

As a result of multi dimensional approach the farmers have developed habits of advance crop planning to ensure optimum yield. It has now become a regular practice.

Removing the subvention mindset: Farmers' Contribution in Sun Shine and JIVIKA programs

SFT strongly believes that the ownership cannot be established with freebies and hence always insist on beneficiary contribution. Both these programs were having provision of 100% subsidy however SFT insisted on making provision for beneficiary contribution to value the package. During the first year it was not possible, but second year onwards 10% contribution was made compulsory. In next two years SFT set example of cash contribution, daily reconciliation with bank accounts, justified, honest and transparent distribution system. Though the approach taken up by SFT was not favoured for the farmers, the timely distribution with transparency has played big role in winning farmers' trust to up-scale this approach in future programs.

The tribal farmers gradually started moving from age old practices to new age practices. This enabled the tribal farmers to become partner in agriculture transformation process initiated by SFT.

Need of End to End Solution concept:

The concept of resource development is extremely important for successful farming and improves the life standard of the farmer community. Piece meal efforts cannot achieve the desired outcome and ultimately results in wastage of resources. Adopting complete package of practice has helped in achieving the yields to a greater extent, minimizing non-scientific farming practices. However apart from cropping practices there are many other factors which impact the agriculture yields and income.

The assured backward and forward linkages are identified as the most important factor for sustaining agriculture and make it economically viable. Land improvement, assured irrigation, package of crop practice, scientific knowledge and marketing of the produces are important factors of agriculture cycle. None of these factors can be ignored in successful farming.

Experiment of a Village Nani Kanas

Village Nani Kanas consists 50 schedule tribe families, depending on Agriculture and animal husbandry. These families are collectively holding 145 acres of cultivable land under small and marginal categories. Main crops grown are Maize, Paddy and small amount of vegetables.

Though there were about 35 irrigation wells, due to geological conditions the yield of ground water was not adequate to support assured irrigation for full-fledged Rabi season and hence the farmers were able to utilize only part of their land for Rabi season. There were few damaged check dams and a village pond, having potential of repairing and using them for water harvesting and ground water recharge.



The repairing of existing check dams, village pond and irrigation well with installation of Micro irrigation systems under government scheme.

Thus all the cultivable land was used for Rabi crop and part of it for summer crop. This was followed by providing a package of high valued vegetable crops, knowledge on

scientific cropping and support for marketing. It was assumed that bulk production of single commodity will be feasible for collective marketing with reasonable profit margin.

Impact:

Irrigation area has been increased by 65% (82/145 acres) during Rabi season.

Income of 41 Targeted Farmers	
Base Line Income 2015-16 Rs.	14,44,910
Income from Kharif & Rabi-2016-17	35,84,158
Incremental Income Rs.	21,39,248
Project Investment Rs.	45,00,000
Return on Investment	2.10

Protective irrigation have become possible to whole command area (145 Acres) by networking of existing wells, repaired check dams and micro irrigation technique. The targeted families could gain incremental income of ₹ 52,000/- in two cropping seasons. Sustainable assets are created for livelihood.

The result shows that this is the long lasting solution to lead the village to 'Swavlamban' and free from poverty.

Gujarat CSR authority, the funding agency published this experiment as Case Study of Poverty Alleviation to replicate in other tribal villages.

Village Katarwant: Free from Poverty and Distressed Migration

Village Katarwant consist of 148 tribal families owning 167 acres of land under small and marginal land holdings. The potential area for treatment for soil and water conservation along with developing irrigation facilities was covered during 2014-15. The objective was to enhance farm based livelihood through round the year production.

Crop Season	Crop	Average cultivated Area/Farmer/Acre		
		Pre-Project	Post-Project	Increase in the cultivated area/farmer
Kharif	Maize	0.7	1.6	0.9
	Paddy	0.8	2.7	1.9
	Blackgram	0.5	1.3	0.8
	Tuar	0.5	0.8	0.3
	Cotton	0.6	2	1.4
Rabi	Maize	0.9	2.5	1.6
	Wheat	0.9	2.8	1.9

Increase in cropping area in Kharif and Rabi Seasons

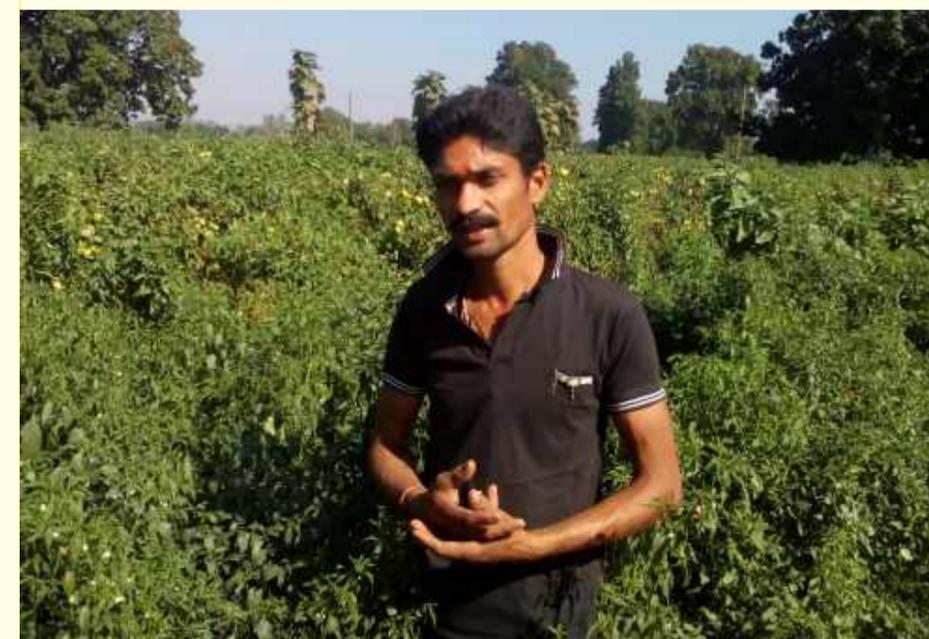
The land and water conservation led to increase in use of agriculture land. In Rabi season of 2016-17, the cropped area was more than doubled compare to (85 to 157 acres) previous year. It indicates almost up to 100% of cultivable land brought under irrigation.

Savings in seeds expenditure and increase in production:

Shifting to irrigated farming of paddy from rain fed with improved technology of irrigated Paddy cultivation has reduced the seed rate and expenses. The yield has increased from 720 kgs/ acre to 1800 kgs/acre due to irrigation facility and adoption of farming practice.

Increase in Food security and house hold income:

100% utilization of land in all three seasons due to irrigation facilities have created food security and improved the house hold economy, enabling them to make further investments like instalation of micro irrigation and vegetable farming. The farmers faith strengthened in agriculture and many of them have started venturing in Animal husbandry as income generating activity.





Challenges for next era

The popular proverb “When I found answer, they changed the question” equally fits to the agriculture development programs in tribal area. The development process of finding agriculture solutions always comes with new sets of challenges depending on pace of development. The upsurge in growth of agriculture sector during last one and half decades has also created in new challenges.

The production and productivity oriented growth model adopted in agriculture sector has spurred issues of degradation of soil, production quality, increasing cost of cultivation, market glut and drop of prices. The farmers across the country are facing similar challenges.

The tribal farmers of villages in Chhotaudepur successfully achieved higher production and land utilisation in journey of agriculture development during 1990 to 2010 for achieving food securities as it was national priority. Subsequently new sets of challenges emerged for next era of agriculture. The increase in utilisation of land for double season cropping, shift from using natural and homemade inputs to external inputs have posed threats to sustainable farming practices.

The challenges in new era of agriculture in tribal areas are arising out of four main reasons.

Use and adoption of new technologies

During the 90s, the tribal areas were facing acute scarcity of food. The agriculture practices were not advance enough to meet the livelihood requirements for whole year. Hence the first milestone was to achieve food securities. Government also had started supporting policies and programs to accelerate the production. As a part of the policy government supported the farmers in form of subsidies to use costly inputs. Since last one and half decade it has become a regular farming practice.

The illiterate farmers have adopted all the external inputs simply driven by the higher production and profitability without questioning about the consequences of using these inputs. Also lack of adequate new knowledge and trustworthy markets (selling of spurious seeds & pesticides) have created exploitative practices by the local suppliers and traders. This has resulted in imbalances in natural ecosystem damaging soil health and production. Thus agriculture of tribal farmers is also started showing symptoms of challenges in maintaining productivity, increasing production cost, soil health deterioration.

Impact of changing socio-economic status

With increased farming income and up-gradation of the rural infrastructure, the families have started educating their younger generation including girl child outside the village to have quality education. The educated youth preferred to get settle in urban areas for employment rather than adopting farming as livelihood at village. This has impacted negatively on availability of the labour in family as well as at village level. This along with Govt. schemes like MGNREGA has lead to shortage of labour force & increase in wages. The double season cropping with higher production resulted in higher work load on women in the families.

Since the engagement of educated youth is low in agriculture, the agriculture cropping decision, production system and market exploration- is remaining in domain of illiterate persons. As a result, the decisions regarding selection of crop, input management and marketing are highly driven by advice and guidance received from the market players.

Changes in climatic conditions

The rapid increase in concentration of Green House Gasses (GHG) in atmosphere is impacting agriculture sector the most. The global climate changes are also impacting the tribal area equally. The last decade has seen higher intensity of delay in on set of monsoon, increasing temperature during Rabi season and events of concentrated rainfall. The resultant impacts of climate change are resulting in incidences of re-sowing of seeds, crop failure and pest attacks crop loss, reduction in production.



The farmers are not having access to knowledge and technologies which can help them in adopting climate resilient farming.

Incomplete value Chain

The increasing agriculture production is leading to need for access to market, which is a newly added link for the tribal farmers who were earlier producing just enough for self subsistence. Thus the market and marketing of agriculture produce is relatively new domain for

illiterate farmers. As a result the farmers are not able to get proper access to the markets for their produce. Though farmers have started taking their produce collectively to the markets, they are unable to do bargain with the traders who create syndicate/cartel to help them procure the produce at lower rates.



The value chain study conducted for the eight main crops grown in the Chhotaudepur region

reveals two important facts about agriculture produce marketing. Firstly, that almost 80% of the farmer sells their agriculture produce to local traders (generally moneylenders) who purchase the produce at fix rate irrespective of market and premium for quality. The vegetable growers have to sell their produce outside the district as there is not adequate local market, which compel them to transport the produce to nearest cities located at distance of more than 100 Km. Due to long distance, perishable nature of produce and transport cost, the farmers have no choice but to sell produce at rate offered in the market. Secondly, there are no value processing units located within radius of 100 Km. As a result no local market exists to sell the produce. Both the situations are negatively affecting the achievement of increase in production.



Response

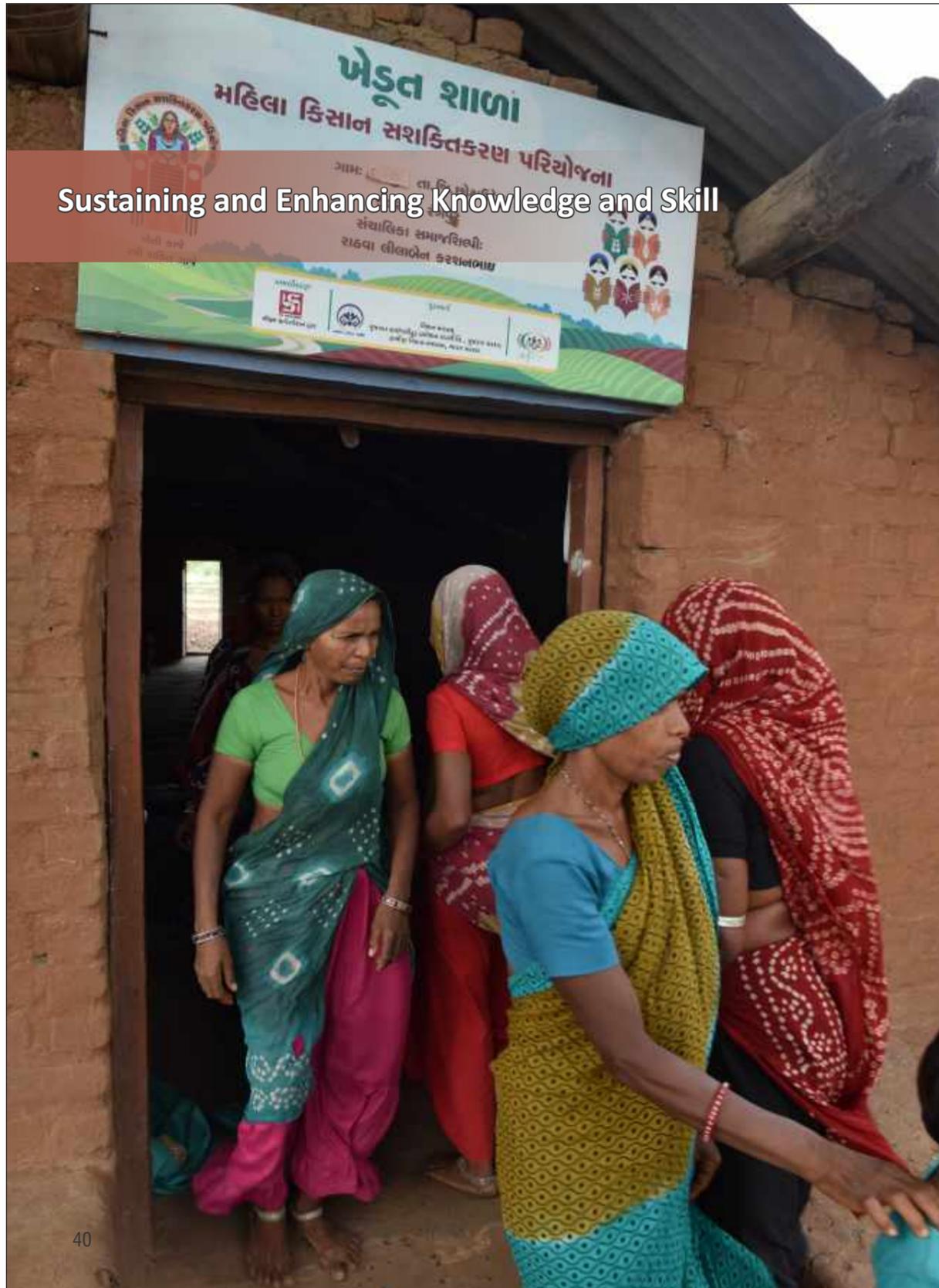
The challenges of new era of agriculture are understood proactively by SFT and started integrating and orienting farmers towards addressing the future challenges. Some of the key aspects of agriculture program, incorporated for future challenges are as bellow.

1. **Door step facilities of soil testing-** This has helped in justified use of chemical fertilisers and other inputs to maintain soil health. More than 6000 farmers have done soil testing.
2. **Promotion of bio-pesticides and Vermi-Compost and farm Yard Manure:** These activities are being promoted on large scale through farmer to farmer learning by doing concept. These products are validated by Anand Agriculture University. During last two years 4700 farmers have used these inputs.
3. **Increase access to agriculture mechanization** through entrepreneur services for agriculture operation and post-harvest management for major crops of Maize and Paddy. Total 34 entrepreneurs are operating in the blocks.
4. **Market oriented production of crops-** The emphasis are on understanding the market demand for quantity and quality of the produce and doing backward

integration of processes in to farming system to produce quantity and quality as per market demand. The experiment with bulk production of chilly and tomato was done in village Nani-Kanas with 40 farmers with marketing support.

5. **Value chain study of major crops.** This study conducted with collaboration with IRMA would help in addressing the gaps in value chain to increase feasibility of crop production.
6. **Climate resilient agriculture practices:** SRI, use of drip irrigation, use of biogas and biogas slurry as manure, plantation of drumstick, creating additional water resources by repairs. These practices are introduced for reducing green house Gases and climate proofing of the agriculture.
7. **Value processing of the fresh produces vegetables and fruits:** Experiments for production and marketing of value added products from the fresh fruits like mangoes and custard apple is being carried out successfully since last three years. The small intervention revealed large scope of value added product market and use this mechanism to influence the rates offered by the local traders and buyers.





Sustaining and Enhancing Knowledge and Skill

Healthy soils, water and plant genetic resources are key inputs into agriculture production, however their degradation and growing scarcity makes it imperative to use and manage them sustainably. Increasing agriculture production by boosting yields on existing agricultural lands and bringing degraded land under cultivation through sustainable agricultural practices would lead to sustainable livelihood. Management of scarce water through improved irrigation and storage technologies, combined with development of new drought-resistant crop varieties can strengthen and sustain the productivity.

There is large segment of rural communities are practicing agriculture based on traditional knowledge which are often lacking in scientific base. This makes it imperative to look into the training needs for productivity enhancement and better outcomes sustainably and based on scientific practices.

The traditional system of knowledge transfer from one generation to second generation by collective field observations has been vanished.

The new inventions and technologies development in agriculture sector is happening rapidly, and thus only traditional ways of knowledge transfer may not be enough to meet the knowledge demand. To cater the knowledge demands on technologies and emerging issues- farmers' trainings remains one of the core interventions in Agriculture at SFT.

Farm School- A Knowledge and Resource hub at Village level

To bridge the knowledge gaps and its applications between scientific and farming communities and to fulfil the needs of agriculture inputs and services, the concept of Farm school was emerged in 2013-14. SFT envisioned the Farm School as knowledge, Resources and service hub to train the farmers and enhance their skills in agriculture domain. 72 farm schools servicing 91 villages are established with area and crop specific training material and trained extension workers to help the farmers in accessing latest knowledge inputs and services at their door step.

Apart from crop based exhibitions, input supply and services available at the Farm schools; the farmer school also conducts demonstrations addressing emerging challenges such as increased input costs, decreased productivity, degradation of soil health and ground water and climate change. The demonstrations on various aspects of issues affecting agriculture transformation had acts as a tool of "learning by doing" for the farmers. Thus these demonstrations allow the scientific community to check practical feasibility of research along with taking it from lab to field.

To educate the farmers on emerging subjects, various demonstrations are conducted on the farm schools, this included, Integrated Crop Management (ICM), Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) techniques, Mix/Multi/Vegetable farming, System of Rice Intensification (SRI).

The demonstrations also included various bio inputs such as, Vermi-Compost, Farm Yard Manure, Amrut Pani, Brahmashtra and Vermi wash.

The acceptance of the Farm school as village level node for knowledge, input and services by the farmers has prompted SFT to convert the farm schools model in to self sustained model of agriculture enterprise providing support for livelihood initiatives and quality agriculture inputs to the farmers.

The Farm Schools are also playing role in formation of coherent society by becoming a community meeting place to discuss social issues and to gain the knowledge on modern agriculture, animal husbandry and other livelihood activities. It has helped in strong social bonding among the women.

The Samaj Shilpi- A social capital

Building capacities of local leaders is the key to sustain the development process. After continuous efforts during last three years 120 young women from the villages were established as role models and service provider to address movement of agriculture transformation. These cadre of 120 women named as Samaj Shilpi are identified from the women in the village who are young, literate and enthusiastic. They were groomed and equipped with the knowledge and skill on agriculture, animal husbandry and life skills to emerge as leaders of the area to disseminate knowledge, inputs and services through backstopping support and facilitation by SFT team.



The trainings related to latest knowledge in agriculture, animal husbandry, soil and water management and personality development were imparted along with soft skill trainings related to leadership, communication and control on emotions, behaviour and etiquettes.

Knowledge transfer process

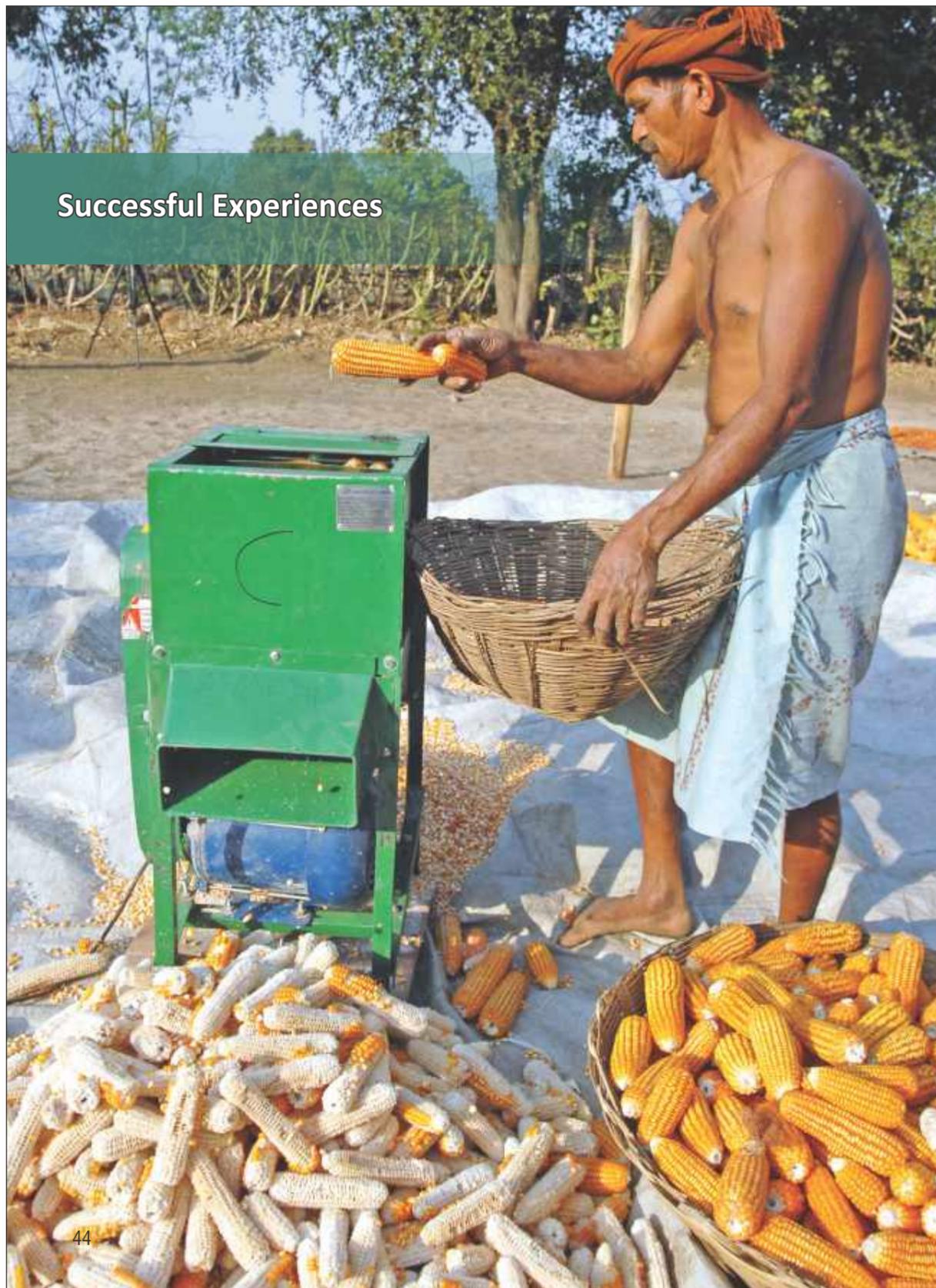
The Samaj Shilpis are groomed as trainers to train women farmers of their own villages. Initially they were supported by SFT staff for conducting trainings at farm schools, but gradually they have learnt to conduct training programs independently. The Samaj Shilpis themselves have adopted demonstrations of new farming techniques; which has helped in their establishment as role model of progressive farmers and agriculture entrepreneurs.

To address the sustainable agriculture practices, the crop wise gaps in traditional practices were identified to developing key messages & training modules for skill building of more than 8500 farmers through seasonal trainings. The training programs covered cropping practices of major grain crops, Maize, Paddy, Gram, Black gram and Wheat along with horticulture, animal husbandry and water management. The training methodology included different games, case studies, sharing of experiences, competitions and practical demonstrations.

The Samaj Shilpis have established themselves as change agents to play pivotal role in the transformation process. This is a social capital in real sense to sustain the development proces



Successful Experiences



SFT conducted several pilot experiments to introduce mechanization in farm operation and Agriculture practices.

A. Mechanization in Agriculture to reduce drudgery and enhance productivity

Drudgery in Farm Operations:

The agriculture operations by the tribal's are labour intensive, time consuming and hence drudgery prone. The agriculture operations are still carried out with agriculture implements which are traditional in design without use of modern mechanism. It results in hardship and drudgery from the beginning to the end of the cropping season. This has affected the health and the quality of farm produces.

In 2010, SFT had conducted a survey with 285 households of Rath area of Chhotaudepur to find out the drudgery involved in various agriculture works. It reveals that farm activities which are time and labour intensive, monotonous, and repetitive and drudgery prone are generally being performed by women. It results in physical strain, mental weakness and other allied health disorders.



Following are the major findings:

1. Ownership - affordability of tools and increased production cost:

Due to the small land holding, investment and up gradation of tools is not economically viable for the tribal farmers. The survey reveals that 96% of farmers are dependent on rented services for tools like, tractors, threshers and pumping machineries for irrigation. This situation not only increase the production cost but also affect timely operations ultimately affecting production.

Activities	Nos of Entrepreneurs
Mini Tractors	14
Mini Maize Shellers	9
Tractor mounted Maize shellers	5
Mini Rice Mills	14
Paddy Transplanter	5
Manufacturing of Bio inputs	4

2. Health Issues

The tribal farmers are found victims of severe health issues because of drudgery and hardship in various farm operations, which results in affecting overall health standards and work outputs.

Sr.	Health Problems	% Women	% Women
1	Backache	99.3	99.3
2	Hand & leg ache	98.6	99.3
3	uterus related	37.2	85.3
4	Injury	85.3	21.4
5	Skin Problem	76.5	75.4
6	Fever	33	33
7	Headache	32.3	33
8	Respiratory Problems	23.4	17.7
9	Giddiness	13	1.1
10	Other	14	13

Experience in farm Mechanization – Bringing world class technology in tribal area

In spite of increased productions the post harvesting works were being done manually due to lack of affordability and maintenance issues for post-harvesting machineries. As an experiment some small machines like, Mini maize Sheller, Mini Rice Mills and Corn Threshers were imported and redesigned as per local conditions needs. These implements were made available for use by the tribal farmer's families.

Entrepreneurs' development

From 2010, the entrepreneurs' development approach was initiated with 10 youths, have increased gradually reached to 37. They are facilitated by SFT to establish services to cater the needs of small and marginal farmers through bankable project. Local youths are trained in technical and business aspects. The equipments addressing drudgery reduction in farm operations are identified for services. The loan repayment schedule and documentation system and calculation of profit-loss are ensured. The utilization of each implement has helped in calculation of mandays reduction.

The entrepreneurs are regular in payments of bank loans. They also have expanded the activities from their earnings establishing themselves as successful entrepreneurs.

Drudgery reduction with Income generation

- ⇒ **A Mini Maize Sheller** can process 1680 quintals of Maize in a year and saves drudgeries of equal numbers of man days with earnings of ₹ 42,000/-year.
- ⇒ **A Tractor mounted Maize Sheller** can process 8400 quintals of Maize in a year; saved drudgeries equal numbers of man days in a year with earnings of ₹ 2.10 Lakhs year.
- ⇒ **Mini tractor with seed driller** can complete five acres in a day with a driver only. A mini tractor can complete 375 acres of land saving drudgery of 450 men/women days
- ⇒ **Mini tractor with small paddler** can complete three acres in a day with a driver only. A mini tractor and peddler can complete 60 acres of land saving drudgery of 120 men/women days
- ⇒ **Mini Rice Mills:** 14 more women entrepreneurs were provided Mini Rice Mills without subsidy. The women entrepreneurs are earning average ₹ 42,000/- in a year. Apart from the financial income the drudgery for milling works is reduced



Threshers were imported and redesigned as per local conditions needs. These implements were made available for use by the tribal farmer's families.

Institution building for Agriculture Mechanization

The second model experimented was a community model with formation of Tribal farmers' Organizations at village level. The government provided tractors and implements. The services were provided on subsidized rates. The tractors and implements were powerful and useful in hard tilling in pre Monsoon and Land Development works. Because of strengthened farmers' organizations the project has successfully completed five year tenure.

Agriculture Mechanization Project - At a glance			
Details	Chhota-udepur	Jetpur Pavi	Total
Nos of Registred Farmers	860	780	1640
Farmers Benefitted	7888	9793	17681
BPL Farmers	6020	8532	14552
Land covered-Acres	8276	9564	17840
Subsidy Rs.	24,53,729	31,36,457	55,90,186
Actual income Rs.	36,12,809	46,94,376	83,07,185
Fuel Expenses Rs.	29,84,773	36,73,534	66,58,307
Net Surplus Rs.	6,28,036	10,20,842	16,48,878

Cold Storage Management – A community managed business model



The Tribal Development Department of Gujarat has established a small (75 MT) cold storage in Pavi Jetpur. The objective is to provide cold chain facility to the small and marginal tribal farmers to increase the holding capacity with maintaining quality of vegetable crops. A farmers' Co-operative Society was in place to manage the unit. The cold storage remained unused for two years as the small and marginal farmers who were members of the co-operative were not

having surplus vegetables to store in cold storage.

SFT was given the responsibility to make this venture successful. The size of cold storage and the value chain of existing crops were studied. It was found difficult to make it a viable venture. It was decided to add ripening facilities and introduce new crops which demand cold storage facilities.

Banana farming with tissue culture plants

Banana ripening was found feasible activity. Government supported the small and marginal farmers to provide tissue culture plants of Banana. The crop was successful; farmers were facilitated in marketing for better rates. In first year, 200 Tonnes of Banana were ripened as an experiment and sold in local and urban based markets. Though it was not profit making business due to difference in scale and process charges of existing practices and cold storage facility, but Banana farming with tissue culture is successfully established among the small land holders in the area.

Potato, Introduced as new crop in the area

The Potato was experimented, though it was not recommended crop in Pavi Jetpur block. The trainings and field monitoring made it successful. The yield of potato met the standard. In 2014-15 it was up scaled with 39 farmers. The potato stored in the cold storage for three months and got better returns. The potato has been established as regular crop in the area.

Committee managed the business

Initially, Banana and Potato were procured by Committee for storage. The farmers were paid prevailing market rates; the Committee could get good profit in first year, which was later distributed among the farmers after deducting the operational costs. In second year the farmers stored Potato and Banana on rent basis on their own risks, which was a step forward to manage the unit independently. The committee members learnt various important technical and business features of the Cold Storage Unit. Now the committee is managing the cold storage without any support from government.



B. Reinstallation of natural farming practices

Soil Health Management

The preparation and use of natural fertilizer is known the farmers, but these practices are eroded due to easy availability of chemical fertilizer giving instant benefits. SFT standardized the models for Vermi-Compost and Farm Yard Manure (FYM) to reinstall practice. The natural compost has helped in improvement in soil health and reducing the use of chemical fertilizer. During last three years 4760 farmers have successfully produced 6400 MTs compost fertilizer. It has reduced the use of chemical fertilizer in tune of about 4500 bags.

The successful model is adopted by the commissioner rural development and has been made compulsory in MGNREGS in the state. SFT also have planned to upscale it with 4000 farmers.



The composting process have helped in clean village concept as it uses farm waste, animal waste and other solid waste of households.



Crop Growth and Protection Management

The consciousness of consumers for chemical free agriculture products is increasing to consume natural product to avoid health hazards. The tribal farmers are sensitized and trained on importance of bio pesticide and growth promoters. SFT standardized three

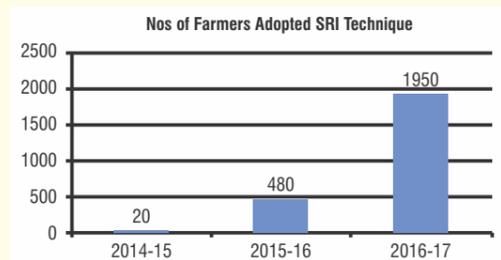
products known as Amrut Pani (growth promoter), Brahmashtra (pesticide) and Vermi Wash (liquid fertilizer) prepared from bio ingredients. The women members are trained on technical protocols and quality measures. The manufacturing processes were strictly monitored to maintain the quality and get optimum benefits. The products are validated by Agriculture University. So far 5500 litres of bio material are used on about 850 acres of land.

C. System of Rice Intensification (SRI) introduced in the area

SRI is a proven and internationally accepted technology. It is basically a set of systematic practices to manage rice plants, soil, water and nutrients that support their growth to improve the rice productivity and output. The SRI technique helps in marked increase in root volume, profuse tillering with bigger panicles and well-filled spikelet with higher grain-weight, which enhances yields and save water and inputs appreciably.

SFT successfully promoted basic principles of SRI, i.e. Seed rate,

Inducators	Control Plot-Acre	SRI Method-Acre
Seed rate:	20 kgs	4 kgs
Distance between two plants and row	10 cms	25 x 25 cms
Nos of Plants per sq meter	66 plants	16 plants
Nos of plants per hill	3 plants	1 plants
Nos of plants per acres	7.92 lakhs	64000
Nos of water	6 times	4 time
Production:	1200 kgs	2800 kgs
Nos of seed per one kgs	60500	57600



Spacing between plants and row, weeding and watering, in other major crops.

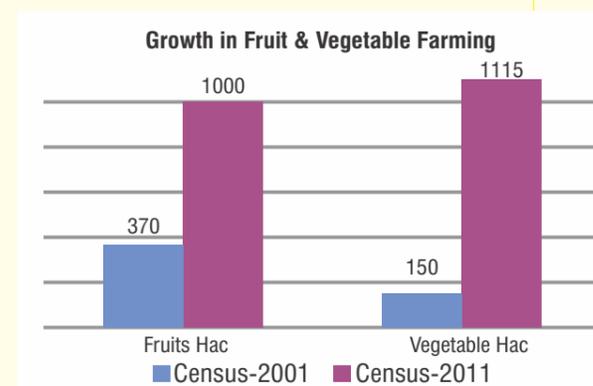
The multi dimensional interventions have impacted in reducing input cost up to 30% and increased production up to 40%. This has ensured food and nutrition securities with improving the house hold economy.

Processing and Value addition

Food processing generates large numbers of employments in various operations like, cleaning, grading, drying, storage, milling, packaging, transport and marketing. At the end of each operation, value is added to the product.

The rate fluctuations in the Agri-commodities are the biggest challenge faced by the farmers to make agriculture economically viable. The food processing industry and organized and collective marketing play bigger role in stabilizing the prices. In the state of Gujarat, cotton, sugarcane and Milk are the successful examples of processing, value additions and collective marketing.

In case of vegetable and fruit sector, the processing industries are not in position to influence the markets due to perishable nature and post-harvest losses and quality degradation. The situation at national level also is very disappointing. Currently only 2 % of India's vegetable and fruits production is processed. In comparison, USA and China processes their 90% and 40% produce. Other developing countries, such as Thailand, Philippines, and Brazil are processing as high as 30%, 78% and 70% of their produce. In this situation stability in prices become very difficult.



Situation in Chhotaudepur

Vegetable farming is one of the emerging practices in this tribal region. Local variety of Mango and Custard apple are the forest produces. In addition to that, there are good numbers of quality Mango orchids promoted under various government programs. Due to absence of organized and collective markets, perishable nature, lack of cold chain facilities and lack of value addition; the farmers are forced to sell their produce at buyer's rate.

To understand the market dynamics and demand for processed food, SFT conducted small research projects on selected commodities.

Custard Apple and Mango:

The forest area in and around Chhotaudepur district is rich in custard apple trees. The harvest period of custard apple fruits is about 20 to 30 days with low shelf life. These constraints are major weakness leading to exploitation of the forest produce collectors (Tribal families) who become victims of distressed sell. Pulp extraction was experimented by integrating it with cold chain to expand the shelf life. It was experienced that manual process is not feasible in scaling up of the activity. However, the assured market is encouraging factor and hence pulp extraction machine was used that has converted 8500 Kg custard apple in to 1700 Kg of pulp during last year. SFT team is equipped to up scale the activity by processing 60000 Kgs custard apple and extract 10000 Kgs pulp.

The mango trees in forest area are not preferred as table variety. Local tribal have practice to collect the mango fruits as forest produce and sell it in bulk packing in very cheap cost. Also there are good numbers of Rajapuri mango orchards. The absence of local market and processing facilities results in distress sale of mangoes by the farmers. SFT experimented by pickle making on a small scale, 2000 Kgs mango processed as pickle and sold in local and bulk markets. The experiment was successful, this year, it will be up scaled with 5000 Kgs mango adding slicing and pulping along with pickle.



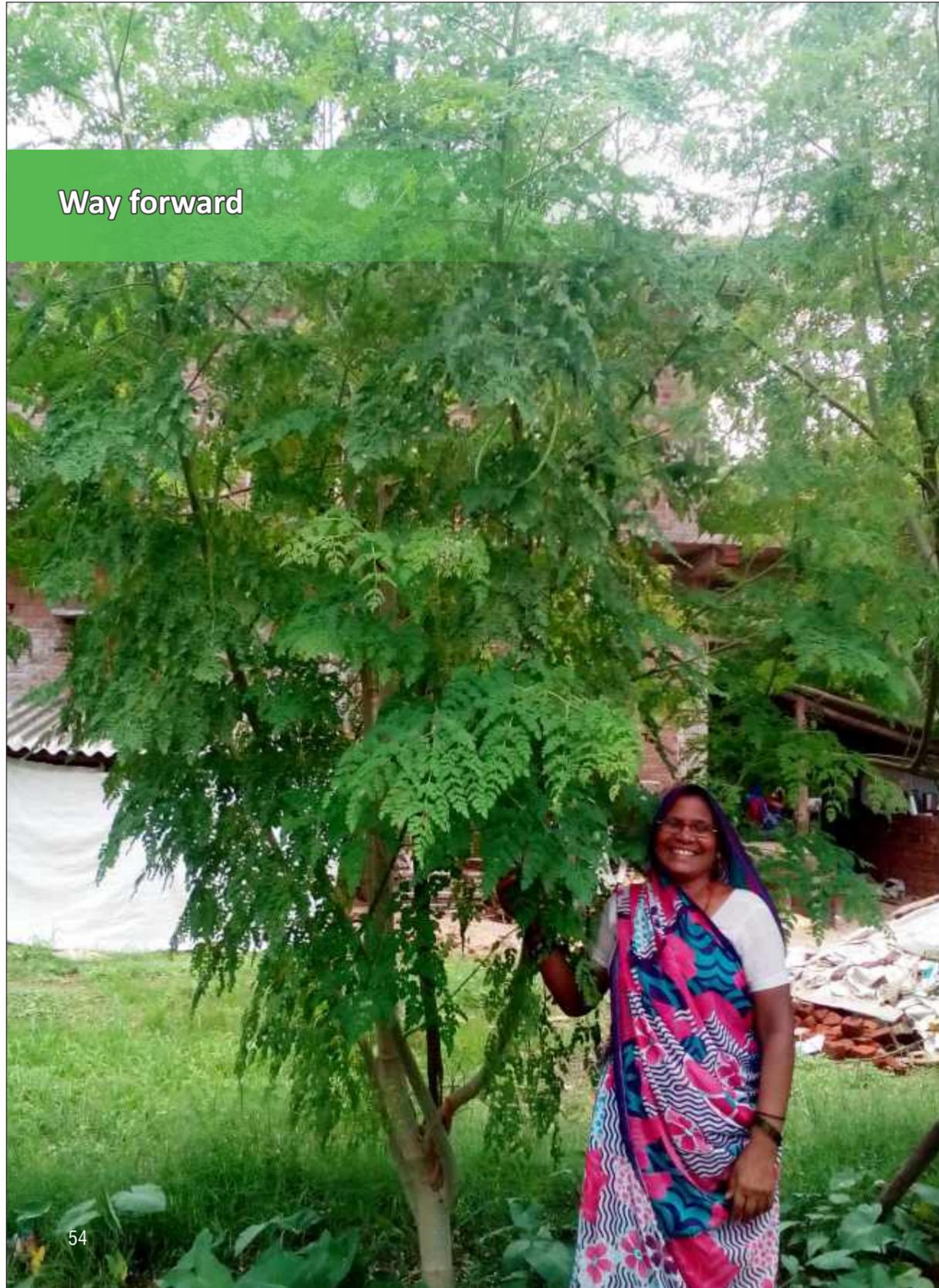
Vegetable-Tomato and Chilli

The increase in irrigation facilities during last decade has seen increase in the area under vegetable and horticulture crops. During 2017 Kharif season there was bumper production of vegetable and fruit crops resulting in glut in the market affecting farmer's returns on the investments. As an experiment 2000 Kgs tomato were processed and prepared tomato ketch up, Puree and dried slices by SFT for creating value addition market intervention. The Chilli was also experimented and prepared paste. The experiment was successful and market is available. SFT's team is hopeful to upscale it on larger scale.

The ultimate objective is to stabilize the price and generate employment opportunities in processing activities.



Way forward



National Outlook

In 2014, the Hon'ble Prime Minister, renamed Department of Agriculture and Cooperation as the Department of Agriculture, Cooperation and Farmers' Welfare. Consequently, the agriculture development approach has shifted significantly with emphasis on the welfare and prosperity of farmers along with agriculture growth. The new approach, thus gives utmost priorities for ecologically and socio-economical sustainability while addressing development of the agriculture and allied sector.

The farmer welfare-centred approach to agricultural development can empower the rural masses to earn higher income and employment along with make balanced development. Hence, in policies of poverty alleviation, the fair trade policies with easy access to the market for the farmer's are the central to the development agenda.

SFT's Outlook and Way Forward

Since beginning of its work with tribal community; SFT kept updating its strategies through reflecting and reviewing its developmental activities. The organisation always believes that the activities done should be relevant and benefiting the community and hence its agriculture development programs has also went through shift in strategies as required.

In mid nineties, the strategy was to establish agriculture as sustainable source of livelihood by introducing scientific agriculture practices. This has strengthened the tribal farmer's faith in agriculture development.

In the decade of 2000, SFT initiated agriculture diversification and new age agriculture practices for the tribal areas and introduced new cash crops and cropping techniques. Horticulture and animal husbandry were focused to improve the household economy. Optimum yields achieved in major food grain crops; has achieved the food and nutrition securities. Implementation of various government programs played significant role to achieve this. The challenges were make tribal farmers at par with other farmers so that they can equally become competitive in the market. During this period, they reached nearer to other farmers in the irrigated areas with an advantage of better soil health and use of bio fertilizer The shift towards ecological farming has become advantageous and easy.

After journey of more than two decades a major shift came. The market started demanding chemical free agriculture produces and favoured to reinstall the traditional agriculture practices. The intensity of climate change factors have also increased on cropping practices. SFT again took it as challenges started with some

crucial interventions in standardization of bio fertilizer, bio pesticide and cropping techniques. The journey continues with efforts to up scale the successful experiments. Following areas are identified as way forward in agriculture development program.

Missing links of Value Chain

The participation and increasing stake of farmer's in value chain of agriculture base products provide large scope for farmer welfare. In present situation, the value of

farm produce increase many fold after farmer sell it and hence majority of the profit share is earned by the non-farmers who are taking minimum risk as compare to risk taken by the farmer in production of agriculture produce. Thus climbing of the farmers higher in the value chain provides



scope for strengthening the economic returns for the farming community by reducing production cost and increases their earnings.

The farmer is the only producer whose product price is decided by the market. "Fair returns to the farmers and affordable rates to the consumers" is the primary objective of establishing value chain cycle in agriculture produces which also helps in reduce price volatility at the both the ends i.e. farmers and consumers. Value chain include aspects of farming, marketing and processing such as, scientific agriculture practices to ensure optimum production, organized marketing to save the farmers from exploitation, processing and value addition to fetch better returns and prevent wastages.

In recent years the farmers are getting benefited by increase in production due to increasing adoption of scientific agriculture practices, but the benefits of the increased production gets nullified by poor market rates and lack of stake in processing industries. The organized marketing and involvement in processing are still missing links in entire value chain.

End-to-end solution at Farm Gate

The market conscious for quality products is increasing due to globalisation. The globalisation has opened door for the agriculture produce beyond the national boundaries and hence the quality standards of the local markets have also moved up. This has made quality an important aspect of value chain. The End to End solution for quality produce and ensured market is demand achievable by quality. Firstly achieving quality norms of safe food by reinstalling the traditional agriculture practices, using natural fertilizers, pesticides and processes for soil health improvement. Unfortunately, because of casual approach and lack of understanding the farmers do not follow this and suffers heavily in revenue loss. Secondly, the post-harvest primary processing of cleaning, grading and packing that impacts the quality of the produce needs farmer orientation for increasing shelf life for fetching better price for their produce. It also satisfies the need of consumers for safe and quality products.

Crop rotation for sustainable Land Use

Land use planning addressing balance production for achieving household needs for food, nutrition and cash along with maintaining soil health is important. The repetitive farming of single crop particularly cereal crops results in degradation of soil health and reduce yield. Practicing mix or alternate farming of cereal and pulses crops maintains the soil health and yields. The changes in crops irrespective of economical benefits are required to prevent soil degradation and maintain yield.

Soil and Crop Health Management - Up-scaling of sustainable farming practices,

During last three years SFT has successfully promoted various measures to reinstall natural agriculture practices. Vermi-Compost, Farm Yard Manure (FYM), Vermi Wash (Liquid fertilizer), Amrut Pani (Bio fertilizer) and Brahmashtra (Bio Pesticide) are standardized and up-scaled with around 5000 farmer families. It has helped in reducing the consumption of chemical fertilizer and pesticide to great extent. The platform is ready to expand it on mass level.

Increasing Water Use Efficiency

Though there is significant increase in irrigation facilities in the tribal areas, the irrigated area remains on around 33%, which is not sufficient to engage the farmers in all three season's crops. The flood irrigation method ends in large water wastages and leaving enormous fields un-irrigated. The Government has introduced supportive policies to popularize the water efficient irrigation techniques. Lacks of proper extension activities, majority of tribal farmers do not have knowledge and information

about benefits of using efficient irrigation techniques and the Govt. schemes available for it. It has become extremely important to up-scale the micro irrigation techniques to ensure sustainable Agriculture and increasing production.

Managing Climate Change- Climate Resilient Farming,

The changing climatic conditions are resulting in fluctuation in rainfall and temperature, which poses biggest risk to the agriculture production. Both mitigation and adaptation strategies are required to be adopted. Agriculture needs to be restructured according to impacts of climate change. The agricultural research system needs to get oriented towards monitoring and evaluation of climate change and recommend changes in agricultural practices accordingly. The weather forecasting local system requires being agile and accurate and should make available to the farming community. Preparation of database will be required on the impact of climate change in agriculture and evaluation of its impact in selected locations. Awareness and capacity building of the tribal farmers about climate change, use of weather forecasting and insurance will be the focused area of interventions.

Realizing Horticultural Potential

Comparison of last three Censuses reveals that the area under horticulture is gradually increasing. The horticulture crops is found to be most effective defence mechanism for sustaining assured income and minimising climatic effects. Promotion of high valued crops including vegetable and species crops like ginger, turmeric and chillies have high potential in areas having assured irrigation. High density planting and tree canopy management of orchards right from establishment stage will be encouraged to derive better yield. Rejuvenation of old and unproductive orchards will be another potential area for enhancing productivity, profitability and sustainability.

Organization building

The state of Gujarat has proven models for marketing of agriculture products. Sugarcane Cooperative Societies, Cotton federations, and Milk Cooperative unions are successful business models having control over pricing and markets. Other commodities markets are in the hands of inter-mediators which are monopolistic. It has become demand of the time to organize the farmers in federations to get control over market to stabilize their income. It can also ensure the entire value chain of the crops. The farmers' institutes become a platform to raise their voice to influence the policies for agriculture development.

Agriculture Marketing

The development of competitive marketing channels is necessary to induce competition in the existing marketing systems and to facilitate sale of farm produce at remunerative prices. This would require states to make changes in their legislative policy framework like APMC rule, effective government support services as well as harnessing of the potential of the private sector. Efforts would also be needed to improve marketing linkages for farm inputs.

Establishment of Food processing at local level

The way forward consists in waste reduction, value addition and employment generation by greater infrastructure development. The involvement of government and private sector for setting up food parks and cold chains at cluster and block levels would be the better solution. It would not only add values to the products but stabilize the markets. Employment generation at local level would be an additional benefit.

Best quality and Healthy Livestock- an ecosystem of Agriculture

Animal Husbandry and Dairy sectors play multiple roles in the development of tribal household. Apart from contributing to family income, nutrition and gainful employment, the animal rearing provide access to manure and ingredient for bio-pesticides contributing to maintain soil productivity. Thus animals have significant role in promotion of natural farming systems. The animal available in Chhotaudepur are dominated by animal belong to non-descriptive categories. It is one of the priority areas of action to improve the animal breed to make animal husbandry remunerative livelihood option.





Conclusion

The Agriculture remains the major source of livelihood in the rural areas. The allied service sectors such as processing, value addition and Agri input and mechanization Industries also provides remarkable employment opportunities, hence a supportive policy framework is required to sustain the farmers in farming. The technologies in Agriculture are increasing in galloping speed with deadly competition, it has become difficult for the farmers to understand and adopt suitable technologies and save themselves from input costly practices. The dependency on monsoon and climate change has created new challengers to sustain the yields in limited water resources and changing rainfall pattern. The crop intensity and increased productions have created new sets of challenges i.e. mechanization in post harvesting operations and to get fair rates of the produces. The piecemeal efforts for infrastructure development have very little impact; “*End To End Solution*” approach is required for better yield and fair returns. Intensive trainings of the farmers are required to overcome these challenges.

In the journey of last three decades SFT has successfully experimented all aspects of agriculture with introducing appropriate technologies and suitable interventions. The collaboration with Agriculture universities, Corporate and Agriculture experts have helped in forming area specific strategies.

This document will be useful to the people who really want to make the farming a successful and sustainable model of livelihood.