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Demarcating an Inclusive Policy for Sustainable Farming – A Case Study Approach

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Research Article

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ABSTRACT

India ranks one in the total number of sustainable farmers, but 0.8% of agricultural land is used for organic farming. Government of India introduced many schemes under the National Mission for Sustainable Agriculture. Even then, few states in India reported less productivity of organic agricultural outputs. In this context, the present study is motivated with the aim of identifying inclusive policy measures to increase sustainable farming methods in India. The research has been undertaken in a village in Puducherry state that has obtained 100% sustainability in farming practices. A case study is conducted in that village to identify the motives and barriers encountered by the farmers in the village in transforming from a traditional method to sustainable farming method. In the Indian condition, it takes 25 years to achieve the target of 100 % sustainability.

There are three burning issues identified by the researcher. Farmers lack beyond in identifying the standards for their cultivatable products. The second issue is knowledge about market conditions. The farmers find it difficult in identifying the needs of the consumers. The demand-driven market is absent in the agriculture supply chain. The third issue is sharing knowledge and collaborative work. Farmers find it difficult to share knowledge and collaborative venturing with other farmers.

We suggest that, creating Agro-Value chain, creating a larger farmer Cluster/Landbank and creating Organic co-operatives are essential to a have a sustainable agricultural policy.

INTRODUCTION

To have a good healthy life, the people are moving towards organic foods. The awareness created by the Government and NGOs paved the way for good food habits among the people and a transformation in the slow phase is starting. Agriculturists know the trend and with the aim of providing a healthy life, changing the pattern of cultivation from traditional farming to sustainable farming. Sustainable farming practice includes organic agriculture. India is having a large number of organic farmers as compared to other countries. However, the in organic productivity is less as compared to other developing countries. The fear of the high cost of input and low productivity in the beginning stages of organic farming are the challenging problems of the Indian farmers. Government of India introduced number of schemes under the national mission for sustainable agriculture. Even then, few states in India reported less productivity of organic agricultural outputs [1]. In this context, the present study is motivated with the aim of identifying inclusive policy measures to increase sustainable farming methods in Indian context after studying the successful sustainable farming practices undertaken in an Indian village. A village in Puducherry state has obtained 100% sustainability in farming practices. We conducted a case study in that village to identify the motives and barriers encountered by the village in transforming from a traditional method to sustainable farming method

LITERATURE REVIEW

Sustainable food consumption is a highly prioritized food habit in the technological world. Organic food consumption is increasing. Organic food consumption increased from 15 billion US $ to 90 billion US$ within two decades. According to the World Organic Agriculture Report, there are 57.8 million hectares of land that are cultivating organic foods in global level. Organic farmland is also increasing every year [2]. Eighty-seven countries have organic standards and regulations. In India, there are 835,000 organic cultivators and it accounts for 30% in global share (Fibl, 2018) . Exhibit -1 shows the top-ten countries based on the number of organic farmers in world-wide. In India only 0.8% of the agricultural farmlands are converted into organic farmland in the last two decades. India accounts for only 1.5 million hectares of land for organic cultivation. The Indian state of Sikkim is declared as the country's first organic state in 2018. However, a survey conducted by the Centre of science and environment reveals that phasing out of chemicals was not complemented by the increase in the consumption of organic manure. India produced around 1.70 million MT (2017-18) of certified organic products which include all varieties of food products namely Oil Seeds, Sugar cane, Cereals and Millets, Cotton, Pulses, Medicinal Plants, Tea, Fruits, Spices, Dry Fruits, Vegetables, Coffee etc. The organic food export realization was around Rs. 3453.48 crore (515.44 million USD) in 2017-18.

Government of India formulated National Mission for Sustainable Agriculture (NMSA) under National Action Plan on Climate Change (NAPCC), to enhance agricultural productivity especially in rainfed areas focusing on integrated farming, water use efficiency, soil health management and synergizing resource conservation. Due to introduction of the schemes, the organic cultivation in the states are showing up-ward trend during the period 2013-18. Table-1 shows the area and production of organic products in different states in India.

Table 1. Area and Production of Organic Products in India.

S No.	State Name	Total Cultivable Production(MT)	Area Under Organic Cultivation (in Ha)				
			2013-14	2014-15	2015-16	2016-17	2017-18
1	Andhra Pradesh	8516.65	14325.03	100623.8	93350.73	172783	184748.7
2	Arunachal Pradesh	29.451	71.49	3688.61	72485.26	72311.27	6179.689
3	Assam	52846.61	2828.26	16258.02	28493.24	23930.4	28071.81
4	Bihar	3.15	180.6	247.1	91.7	679.2	695.8
5	Chhattisgarh	6265.409	30754.82	32405.1	180924.9	179752.1	191464.7
6	Goa	2875.655	12853.94	15621.24	16957.59	15762.43	15698.98
7	Gujarat	75304.61	49363.89	49862	80421.4	70495.05	85400.71

8	Haryana	4245.483	3865.33	6783.21	4889.208	5031.759	6912.399
9	Himachal Pradesh	2620.636	1668176	1370744	1358449	14376.72	170153.5
10	Jharkhand	2.395	37447.3	71383.8	77048.73	36813.95	51187.93
11	Karnataka	154922.9	35450.22	92157.09	133647.3	81948.81	105515
12	Kerala	16134.3	15162.33	23123	44788.5	43701.88	34160.14
13	Madhya Pradesh	575346.3	1758226	1926369	2275567	2292697	1156881
14	Maharashtra	377308.2	87941.66	217649.2	266299.2	292391.8	304074.8
15	Meghalaya	612.804	4673.13	4489.29	4609.422	9629.598	40335.66
16	Nagaland	1369.657	12023.16	8362.43	6186.934	4699.934	8839.864
17	Odisha	74642.11	52787.35	91056.4	109224	99736.17	117910.3
18	Punjab	112.9	1534.39	19293.58	17577.2	17648.53	18000.77
19	Rajasthan	94029.22	599173.1	483090.7	553447.7	539522.1	442133.7
20	Sikkim	435.127	64296.17	76392.38	75851.21	75218.28	76076.18
21	Tamil Nadu	15893.3	34212.96	12536.97	19529.79	10775.69	20070.51
22	Tripura	237.314	203.56	203.56	203.56	203.56	2251.19
23	Uttar Pradesh	117358.6	112134	107529.1	106292.4	101459.9	192734.4
24	Uttarakhand	35644.32	79779.46	92480.23	99900.39	93586.42	104134.7
25	West Bengal	10207.14	2095.51	16266.61	17890.41	5176.026	5811.483

Physical Sensors

Vikas Yojana is another scheme under NMSA, that promote organic agriculture through a cluster approach along with different participators. Paramparagat Krishi Vikas Yojana is a comprehensive scheme under National Mission of Sustainable Agriculture (NMSA) to promote organic farming through a cluster approach along with Participatory. Under PKVY, Organic farming is supported through the adoption of the organic village by cluster approach and PGS certification. Financial assistance is given for direct marketing to the groups and clusters including procuring common packing material, printing of packing material, brochures, leaflets, preparation of labels, holograms, transportation expenses to local markets, hiring spaces on rent for specific organic markets and branding of organic products @ Rs. 15 lakhs/ cluster of 1000 ha. The total amount allocated for the scheme 2015-2018 is Rs. 947 crore and fund released Rs. 582.47 crore till date for entire 11891 clusters. Under PKVY scheme 237820 hectares of land has been converted into organic farming land and 3,94,550 farmers have been benefited. Realizing the potential of organic farming in the North Eastern Region of the country, Ministry of Agriculture and Farmers Welfare has launched a Central Sector Scheme entitled “Mission Organic Value Chain Development for North Eastern Region” (MOVCDNER) for implementation in the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, during 2015-16 to 2017-18. Under this scheme, as on against target of 50000 ha area, 45918 ha area brought under the Organic Farming and 48948 farmers are mobilized. As on against goal of 50000 ha area, 45918 ha area brought under the Organic Farming and 48948 farmers are mobilized under the scheme.

The Union Ministry of Commerce and Industry introduced the National Programme for Organic Production – which is aimed at exporters of organic food. For the domestic market, the Union Ministry of Agriculture and Farmers’ Welfare, introduced the Participatory Guarantee System (PGS). The Food Safety and Standards Authority of India (FSSAI) introduced Food Safety and Standards (Organic Foods) Regulations, 2017. ‘Jaivik Bharat’ logo has been launched by FSSAI. The FSSAI has jointly developed the logo in collaboration with the Agricultural and Processed Food Products Export Development Authority (APEDA) and Participatory Guarantee System for India (PGS-India) of the Ministry of Agriculture and Farmers Welfare. As in March 2019, under PGS, 443852 farmers are registered; there are 15097 groups and 326 active regional councils. The regulations allow for the direct sale of “fresh organic produce” by producers or producer organizations to the end consumer without it having been certified. However, “processed food” is not exempt from the requirement of certification. This means that for any processed food to be

sold as “organic” in Indian markets, it will have to be certified either by an agency under the third Party Certification system or under PGS.

The Indian organic farming community is also facing challenges. Firstly, in India, 3/4th of the farmers do not get benefits from government schemes. Eighty percent of the farmers are small and marginal. So, they are left out of these schemes even though the country has Rs 8 lakh crore credit for farmers (First Post,2014). Secondly, the Government subsidy to chemical fertilizers is also continuing. In 2017-18, the outlay on organic farming was a mere Rs 350 crore under the government's flagship Paramparagat Krishi Vikas Yojana; but the annual subsidy for chemical fertilisers is over Rs 70,000 crore. Third, according to the Indian Council of Agricultural Research, productivity on an average dip by 6.7 percent in the first year, and the government needs to have a plan in place to support farmers during the transition. Finally, the association of the Chamber of Commerce report mentioned that organic food consumption costs more by Rs 1,200 to 1,500 per month, if a consumer switches to organic food.

Past researchers have identified a few barriers for organic farming in India. It includes weak producer-consumer linkages, (Business Today, 2018) weak supplier power (Tilman 2002), overdependence on agriculture technology starved farming, subsistence agriculture policy, low investment in research and development and lack of enabling infrastructure along the value chain (Kesavan, 2002),

Past researchers suggest policy measures needed for sustainable farming. It includes supporting the farmers for the alternative farming system (Garnett, 2013) stimulating the demand for sustainable products (Seufert,2012) , increasing the taxes on chemical fertilizers and banning hazardous substances used in farming (Rigby 2001). Even then the productivity of organic farms are not showing improvement.

Case study

Mannadipet is a village located in Villianur Taluk Communes of Puducherry district in the Puducherry State of India. The population of the village is 11,176 and around 2580 families are living. The literacy rate is 81.6%. There are about 235 cultivators (owner or co-owner) and 730 agricultural labourers (Census, 2011). The cultivable land in the village is 8 hectares and all are certified as organic farms by national agencies in the year 2019.

From the beginning of the Green revolution, since 1970, onwards the village farmers have been using the chemical fertilisers. During 1994, the National Bank for Agriculture and Rural Development (NABARD) taken the initiative of training the farmers in the village towards the creation of organic farming. Agricultural scientists from Tamilnadu Agricultural University did the training. Puducherry Government initiated an agricultural training scheme called Perunthalaivar Kamaraj Krishi Vigyan Kendra (PKKVK), in coordination with the agriculture department for adopting organic farming.

The duration of the training period initially was one day. Then it went on to five days. The training programme later changed according to the type of crop they are cultivating. The first phase of the training was conducted in Sorapattu village, which is in located in the vicinity of Mannadipattu village. Two groups of farmers came forward in the beginning stage to curtail down the usage of chemical fertilizers. Perunthalaivar Kamaraja Krishi Vigyan Kendra (PKKVK) assisted them by providing Integrated Pest Management (IPM) services.

Murthy is the first farmer to adopt the IPM. He decided to change because of the increase in the input cost of cultivation, without any change in the output cost. He started ploughing the field by using sanappai (Crotalaria juncea or Indian hemp), groundnut oil cakes and erukku (Calotropis gigantea or crown flower) plants into the soil. Kalivaradhan is the second farmer moved towards organic farming. He could not control pests in the cotton plants even after spraying endosulfan; hence, he decided to use organic pest control methods.

Government of Puducherry under the PKKVK scheme provided the Integrated Pest Management equipment at the subsidized price. The environmentally friendly equipment such as pheromone traps, yellow sticky cards and Tricho cards which are used to keep pests under control are supplied at the subsidised rate [3]. The farmers use light traps when they have an electric source in their field. The bulb is fixed on a stand that the same height as the plant. The farmer fills the vessel at the base of the trap with water and a layer of an oil such as coconut or castor oil. Insects attracted by the light fall into the vessel and the oil prevents them from flying off. The lights are turned on only from 6 pm to 9.30 pm.

A private farm equipment provider comes forward to assist the farmhouse, which is not having electricity. It introduced solar lamps and portable lamps with a chargeable battery. The private firm sells three models with adjustable height and different features such as an automatic timer that turns on the light at sunset and turns it off after three hours. These lamps are designed to emit light in the ultraviolet spectrum to attract insects.

By 1998, all the farmers in the village have invariably decided to curtail the use of chemicals in cultivation. The farmers witnessed a change in natural orders. One of the farmers exclaimed that he saw a black drongo catching an insect and settles down on bird perch nearby. His black gram field was dotted with bird perches. Bird perches are considered as one of the best organic manure in the integrated pest management system.

The scripting success on its adoption, the strenuous efforts and consistent follow-up confirm that farmers have realised the ill-effects of chemicals in various crops which include rice, groundnut, cotton, coconut, banana, vegetables, flowers and sugarcane over the years. The farmers started following the best practices like using neem oil, neem cake, tricho cards, light trap, pheromone trap, and 'T' shaped bird perches. It helped them to save more than Rs.5,000 per hectare towards crop protection. All the farmers in the locality have been using at least one light trap that controls 70% of the pests.

During 2003, Kudumbam (an NGO) introduced SRI (System of Rice Intensification) method in the village. According to the farmers, the SRI method has increased their yield from 22 bags/acre to 32 bags/acre.

Since 2011, NGOs like Quintal, Ekoventure, Ozey, Kudumbam and organic farmer - Nammalvar, have been training the farmers. Flower cultivators faced the problems from pests such as stem borer, leaf folder and sugarcane borer affect crops, especially when the flowers start bearing fruits. The NGOs suggested the use of Trichogramma, an egg parasitoid, which is used to control these pests. The government under the scheme PKKVK produces and supplies three strains of Trichogramma, as pests are specific to crops. The cards contain eggs of Trichogramma parasitoids, which on hatching enter the eggs that the pests have laid on the plants. The parasitoids lay eggs within the pest eggs. The larvae feed on the pest eggs, thus protecting the crops. Meera, a farmer, uses the card in about fourteen locations in one acre of cultivation.

In 2014, the Indian Bank's Self Employment Training Institute (INDSETI) helped the farmers to get organic certification under the Participatory Guarantee System (PGS) of the Union Ministry of Agriculture and Farmers Welfare. Farmers started to plough the fields with the foliage of plants such as Chinese chaste tree (Vitex negundo), thumbai (Leucas aspera), Portia tree (Thespesia populnea) and Indian mulberry (Morinda tinctoria) into the soil.

According to Tamilnadu Agriculture University report, from 1997 to 2014, 69 training programs were organized for farmers and more than 2000 farmers in and around the Mannadipattu village are trained (Village Square, 2017) . From 2014 onwards, the farmers in the entire village started sustainable cultivation methods. The pesticide consumption by the farmers reduced significantly. In 90-91, the pesticide consumption in the whole region of Villianur Taluk Communes was 163 metric tonnes; where it was 35 metric tonnes in 2018. The number of pesticides outlet has decreased from 196 in 1990-91 to 90 in 2018. The retailers changed their practice of selling chemical fertilizer into bio-fertilizer. The input cost per acre of land during a course of cultivation decreased to Rs 18000 from Rs 10000 in that region. Those who are cultivating cash crops mentioned that their input cost decreased up to 50%. In 2019, 22 hectares of the land in the Villianur taluk are certified as organic farms.

To identify the challenging factors that are overridden by the farmers. We undertook a survey with 167 organic farmers. We identify seventeen variables that create barriers to sustainable agriculture. The variables are – low yield, sourcing of organic fertilizers, knowledge of pest control, sourcing of seeds, (Hobbs, 2007) knowledge on soil conservation, time limit in break-even productivity, sharing the resources with neighboring cultivator, sharing the pest control measures (Matson,1997), collaborative crop farming, awareness about cropping period, knowledge of weather forecasting (Pretty,1995) , risk about productivity, awareness about usage (Pannell,2003), awareness about market conditions, problems in transporting the organic manure (Rodriguez,2009), problems in storage of organic manure and lack of clear standards (Schaller,1993). Table-2 shows the challenges faced and solved by the organic farmers within 25 years of time.

The farmers in the sample village can overcome the challenges in significant issues, because of the training provided by government and NGOs. There are three burning issues still in the village. Farmers are lacking beyond in identifying the standards for their cultivatable products. The second issue is knowledge about market conditions. The farmers find it difficult in identifying the needs of the consumers. The demand-driven market is absent in the agriculture supply chain. The third issue is sharing knowledge and collaborative work. Farmers find it difficult to sharing the knowledge and collaborative venturing with other farmers. It is the main barrier that the farmers are unable to reap the benefits of large-scale farming.

Table 2. Classification of Farmers based on transformation process.

Cl.No	Sum of Centroid	Cluster Name	Number of Respondents	Percentage
1	25.84	Innovators	60	36
2	22.34	Trend Setters	21	12
3	21.56	Early adopters	43	26
4	20.34	Early Majority	23	14
5	17.72	Late Majority	20	12

The result indicates that 3/4th farmers have the attitude to transform to organic farming; while 1/3rd of the farmers are considered as the innovators. Hence, the village farmers are able to achieve 100% organic farming within 25 years.

In the next stage, we wish to identify the discriminant variable that differentiates between innovators and others. We use discriminant analysis to identify the transformation variables. The variables used in adoption from traditional farming to organic farming are considered as the core variable. The differentiating variables are innovators and non-innovators. The innovators have been identified based on the cluster analysis used above. The remaining respondents are considered as non-innovators. We use the two-group discriminant analysis. The Wilk's lambda associated with the variable is small (0.009) and the means of all discriminant functions are statistically significant. The eigenvalue of the function is 112.55 and Canoncial Correlation is 0.996.

DISCUSSION

To transform an Indian village towards sustainable farming, it takes 25 years. The Government and NGOs succeed in creating awareness about sustainable farming about new organic farming methods. However, farmers are still struggling to locate the specific demand for their product, fix a standard for their products and hesitate to collaborate with others in obtaining a higher yield. The farmers who know the methods of conserving the farm resources and efficient use of organic manures are the leaders in sustainable farming activities. These leaders effectively follow the echelon farming methods to overcome the barriers in sustainable farming.

Creating Agro-value chain

To match the demand and supply of organic products, we suggest the Agro-value chain model. This model proved to be successful in Australia. Under this model, a farm to consumer network will be created. The farmers, intermediaries, retailers and customers are also farming part of it. At present, using blockchain technology, the farming community are linked. The farmers and stakeholders will be integrated. This enables the farmer to know the demand of the product in each stage [4]. It will also allow farmers to do real-time management of the stock. IBM Food Trust is a good example of this. We need to train the farmers in using the application of blockchain technology. The Government and NGOs have to create strategic agenda for it.

Creating a larger farmer Cluster/Landbank

The case study reveals that farmers find it difficult to collaborate with others. Hence to motivate them, there is a need for more massive farmer cluster in the form of land bank methods. World Bank is financing this model. In Philippines around 3,00,000 farmers are benefitted [5]. Individual farmers can form large land banks by depositing their land into a large pool and then professionally cultivate as one body on predetermined price and other terms. This could be a partnership model between producer-supplier institutions on one hand and aggregators, retail chains, food processors, another buyer, on the other hand, making them a stakeholder in the bank.

CONCLUSION

As sustainable living practices are increasing, it is essential to have an inclusive policy for sustainable agriculture practices. In an Indian village, it takes 25 years to achieve. The villagers who reached 100% sustainable agricultural farming uses integrated farming practices. Hence we have to link agriculture with newer technology. To overcome the challenges of sustainable agriculture, it is essential to move into blockchain technology, introducing land-banks and establishing organic cooperatives. We believe that, if these measures are taken rapidly, we can solve the issues of farmers such as demand prediction, collaborative venturing and awareness about the global standards.

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