

## **ANALYSIS ON ROLE OF FARMER PRODUCER ORGANIZATION IN AGRICULTURE SUPPLY CHAIN**

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### **ABSTRACT**

Agriculture in India has always been less lucrative. Many factors contribute to agriculture's low profitability, but a lack of value addition, a weak value chain system, and a lack of market linkage are among the most significant. Small farmers are being helped to break into the market by producer companies. Collective action is best demonstrated by farmer producer organisations (FPOs) affiliated with producer firms. Agriculture is critical to the economies of developing nations. Agriculture and allied activities employ 54.6 percent of the population and contribute 17.4 percent of the country's Gross Value Added in 2016-17. (at current prices). An increase in revenue and a decrease in costs have resulted from collective actions taken by the agriculture value chain. Collective action theory's underpinning theory of FPO and producer company is a good fit. Cooperatives have been used to strengthen AVC in a variety of ways, and this study aims to identify the factors that led to their success. Using digital technologies, outreach costs could be reduced, and information could be better tailored to farmers' specific needs and circumstances. An investigation of the link between digital extension services and smallholder agricultural performance is conducted using primary data from India. Some farmers use digital extension services that provide personalised information on the types of crops to grow, the types and quantities of inputs to use, and other cultivation methods. Propensity score matching (PSM) and estimates of farmers' willingness to pay for digital extension are used to reduce selection bias in the impact evaluation.

### **1. INTRODUCTION**

#### **1.1 Introduction to agriculture and farming**

As the world's largest agricultural exporter, India is preparing to meet a growing demand in the coming years. Increased population demands are driving up food prices everywhere, with India well-positioned to take advantage of this global trend. Farming in India had a gross value of 276.37 Billion USD in FY20, and exports in FY21 totaled 41.25 Billion USD.

Due to a diverse soil and favourable weather conditions, India is now the world's second-largest producer of rice, wheat, sugarcane, cotton, groundnuts, and fruits and vegetables (see chart). India's agricultural sector is expected to grow to a value of \$24

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billion by 2025, according to Inc42. Foreign incomes, sports policies, better infrastructure, technological assistance, and tax benefits are all provided by the government to keep up with the advancements and growing demand. This industry will continue to grow in volume, quality, safety, and exports over the next few years.

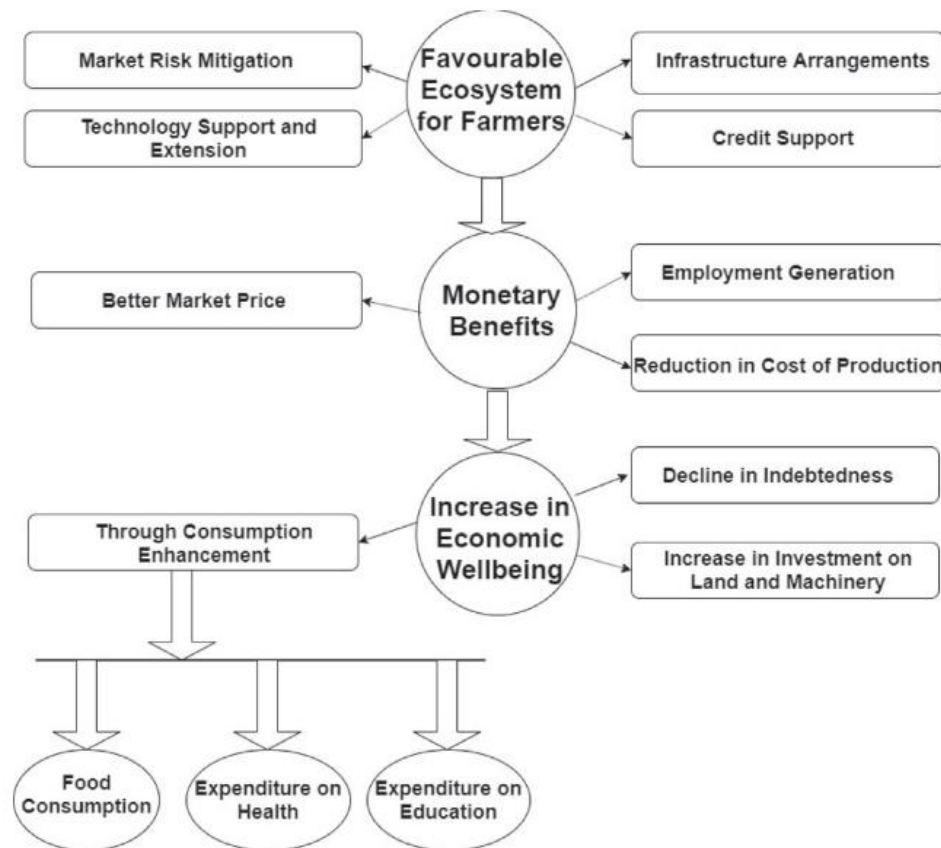


Figure 1.1. Impact of favourable ecosystem for farmers under FPOs and possible outcomes on economic.

At the household level, factors such as the level of education, the size of the land, the cropping pattern, the amount of consumption, and the knowledge of modern agricultural practises influence the participation decisions of farmers' interpersonal conditioning factors (Sharma 2016; Singh et al. 2018). Households benefit from well-executed marketing campaigns. Participation in FPOs is thought to lower transaction costs and yield remunerative prices by taking advantage of economies of scale.

- It's possible to do better in negotiations and avoid a forced sale.
- Creation of jobs, both on and off the farm.
- Improved extension services that can lower input costs and increase productivity..
- Transport, handling, and supervision-related transaction costs are all being reduced.

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Increasing spending on education, health, and nutrition, decreasing debt, and increasing investment in productive assets are some of the benefits that households may see as a result of all of these factors (figure 1.1).

Since the green revolution, the farming system has evolved significantly, and various technological and agriculturally aided infrastructure developments have taken hold across the country. Better farming methods have been adopted by the Indian government, but it has also worked to improve the seed quality and irrigation methods as well as the quality of the produce, as well as many other aspects of the supply chain.

## **1.2 What are Farmer Producer Organizations?**

Producers and non-producers join forces to form a farmer producer organisation (FPO), which provides inputs, technical assistance, processing and marketing services to farmers.

Farmers in India found themselves in need of an FPO because they couldn't get their products into the country's major markets. Providing high-quality seeds and training farmers in soil management and the efficient use of fertiliser, manure, irrigation, and livestock are just some of the ways FPO assists small farmers in raising better food. Additionally, it updates and aids farmers in the implementation of cutting-edge farming equipment and technological advancements.

Farmer-owned cooperatives (FPOs) are typically formed by the members of the cooperative and then registered as a non-profit organisation, trust, or company. In the FPO, the farmers collectively own the company, and a board of directors, or general body, oversees the day-to-day operations.

## **1.3 Need for FPO**

The primary goal of the FPO is to help the producers earn more money by forming their own organisation. Economies of scale are not available to small producers because they lack the volume (in terms of both inputs and outputs) to do so. There is also a long chain of intermediaries in agricultural marketing, which can lead to a situation where the producer only receives part of the price paid by the final consumer. Primary producers can take advantage of economies of scale by combining their efforts. Their negotiating position with large producers and suppliers of inputs will be strengthened as a result.

## **2. LITERATURE REVIEW**

FPOs have become increasingly popular in recent years due to their ability to connect producers and markets and to promote economies of scale (Trebbin, 2014; 2016). In addition, it is well-liked because it has assisted farmers in increasing their earnings. FPOs play an

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important role and process in establishing various links between farmers/producers and the market, according to numerous studies in the literature.

One of the primary sources of income for the rural population is agriculture. 168 million hectares of India's land can be used for agricultural purposes, of which about 60 million hectares are irrigated (Tripathy and Kumari, 2021). In terms of climate zones and crops, India's diversification has made it a major producer of crops such as paddy, jute, tea, milk, cereals, pulses, fruits, and vegetables.

When FPOs operate with high efficiency and responsiveness, they can address another major challenge in agriculture's value chain system: intermediaries (Vignesh, 2019). In this context, responsiveness refers to the types of products available, the shorter lead times, and the innovations. Because Indian farmers are small and marginal, they can't afford to invest in a supply chain that is more responsive because of the current farming system.

Collective action theory must be applied to agriculture in order to create a sustainable value chain system. To a large extent, FPO challenges related to leadership and governance have an impact on the organization's ability to function (Trebbin, 2016). However, the sustainability of the value chain system of agriculture in an FPO is influenced by a variety of factors, including innovation, infrastructure, and leadership.

Ereneus K. Marbaniang, forthcoming in 2019 Under formal contracts, small farmers with limited bargaining power are more vulnerable to monopolistic exploitation. India's government is working to create new institutional options that will give farmers a level playing field in today's modern agro-food networks in an effort to reduce the distance between them and consumers. In 2001, the Y K Alagh Committee's recommendations were implemented in the Companies Act, 1956, paving the way for the concept of 'Producer Companies' (PC). Small-scale farmers can benefit from the use of PCs in the production and marketing of their goods.

When looking at the impact of FPO formation on the development of sustainable crop production in Karnataka, a study by Rani Nidhi et al. (2017) found that farmers in that state had no regular and reliable source of market price information available. Farmers relied primarily on their own knowledge and that of other farmers for their decisions. A 10 percent increase in production per hectare was observed after FPOs were formed, according to results from the study. FPO farmers have seen a minimum 20% increase in net income over the past year.

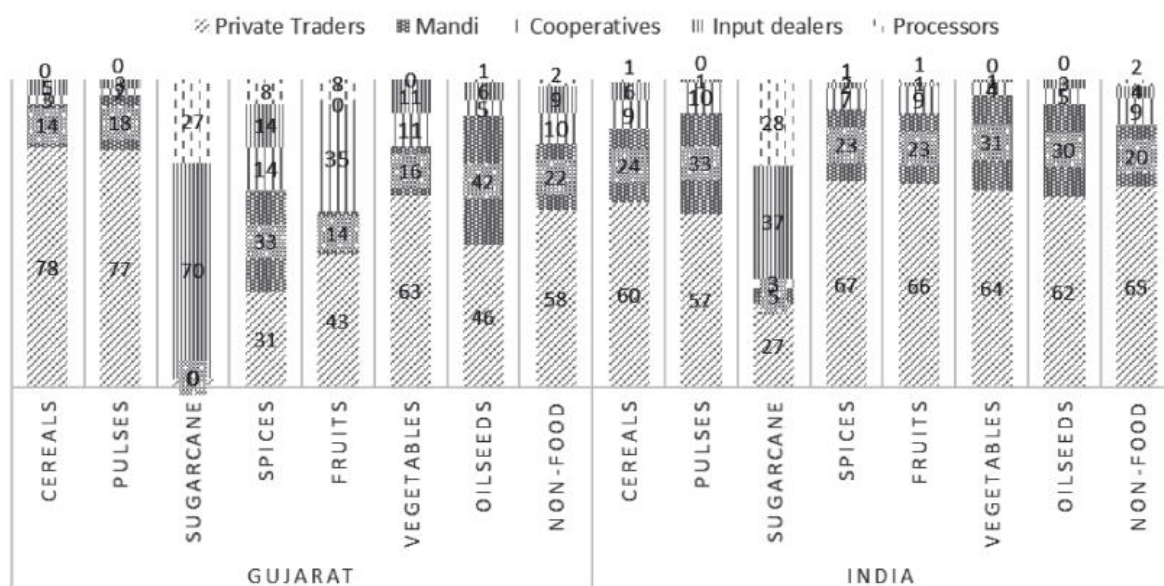
There are a number of FPCs that lack the value-added model of AMUL, according to Shah, T. (2016). Most people began to do the same things they were already doing, but with greater efficiency and transparency. It's worth noting that the majority of FPCs were established as part of a government initiative that offered to cover the promotional expenses of the promoting NGO. He criticised the lack of design-thinking in the promotion of the FPCs and

stated that the discourse in FPCs should be geared toward securing resources and concessions from external agencies, rather than "mobilising energy for growth from within.

In Sharma's article, he argued that the first consideration in obtaining a patent for mobile applications is the business's long-term viability, given that most apps fail within six months, whereas a patent application requires at least a year of operation. In order to secure a patent for a piece of software, extra care must be taken when describing the invention in the patent application and ensuring that it meets all the technical and legal requirements. Software developers in India have the option of obtaining copyright protection for their software codes, since a software programme itself is not patentable under Indian patent law.

### 3. AGRICULTURAL VALUE CHAIN NETWORKS AND PARTICIPATION OF SMALL FARMERS

Farmers are involved in a variety of ways in the agricultural supply or value chains. There are a lot of small-scale producers and retailers dominating traditional markets, which means that demand and supply tend to be tightly synchronised across all of these players. Small farmers have more freedom and control over their production activities in traditional market networks (Lee et al. 2012). The largest volume of produce is sold through these market networks, which have little or no brand recognition and are governed primarily by price and quantity (Singh 2005). Because of the high transaction costs and cartelization in the market, the mandi system only gives farmers a small share of the final consumer price, despite its stated goal of ensuring stable and remunerative agricultural prices for producers and consumers (Reardon et al. 2003; Birthal et al. 2007; Pingali et al. 2019). Even though the mandi system sells a small percentage of its produce, it's counterproductive for farmers who can only sell through commission agents. More than 75% of the output of cereals and pulses is sold by local private traders in Gujarat, a state in India, according to a recent report (figure 3.1).



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Figure 3.1. Percentage of agricultural produce sold through various agencies in Gujarat and India

It was in the 1990s that contract farming was introduced in India as a way to grow and sell commodities. Firms enter into contracts with farmers to buy their products under this system. Predetermined quantities and prices, as well as the availability of services such as inputs and technical assistance, are common (Singh 2002; Barret et al. 2012). As transaction costs dictate a firm's decision to contract with farmers, small farmers are often excluded from contract farming because of the higher transaction costs (Reardon et al. 2003; Singh 2000; Sharma 2016). alternatives in which farmers have a greater say in the management of production and marketing, such as cooperatives or producer companies, lower the transaction costs for farmers (Trebbin 2014; Singh et al. 2018). As part of the Small Farmers' Agribusiness Consortium's efforts to better connect small farmers with agricultural markets, the Indian government implemented an FPO pilot programme in 2011-12.

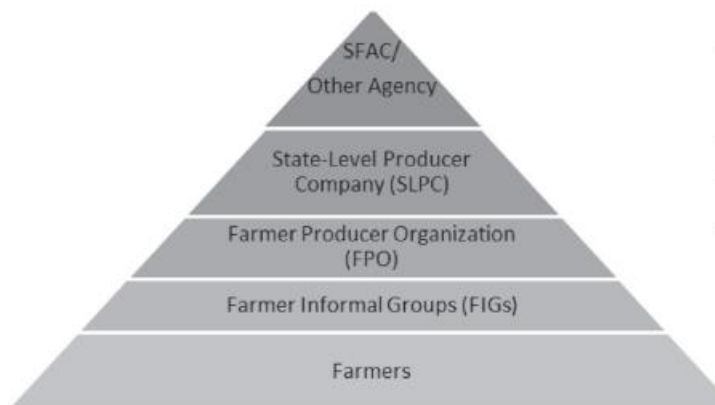


Figure 3.2. Vertical integration of agricultural marketing through FPOs

The goal of forming FPOs is to unite farmers, especially small farmers, across states in order to foster technology penetration, improve productivity, enable better access to inputs and services, and increase farmer incomes, thus enhancing their agriculture-based livelihoods. " (GoI 2013a). Farmers' cooperatives (FPOs) are designed to help small farmers by providing them with access to technology, inputs and markets. Input demand and production are aggregated by farmers' interest groups (FIGs) to reduce transaction costs and bring economies of scale to farmers (figure 3.2). An appropriate federating point (FPO) is needed to manage and plan the activities of the FIGs which are made up of 15-20 farmers. Allowing for capacity building, ensuring access to quality inputs and services, as well as encouraging cluster competitiveness with access to remunerative markets are all benefits of FPOs' decentralised structure.

### 3.1 Building sustainability in agri-food supply chains



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The food industry is under increasing scrutiny for its social and environmental impact. Our global food production system is on an unsuitable trajectory because of our increasingly resource-intensive consumption patterns. "Humanity will require the equivalent of two Earths to support it by 2030 if current trends continue," says a UNEP Discussion Paper.

As the population grows, so does the need for food production around the world. If current trends in diets and food systems continue, the amount of food needed will increase significantly. There has been an increase in the consumption of protein, sugar, and fats as a result of urbanisation in India, which has led to an increase in the consumption of inferior goods like rice. Food security is being jeopardised by these consumption trends, which have a negative impact on health and the environment. The current consumption patterns must be redirected to diets based on less resource-intensive foods through concrete action.

Indian policy in the past focused on food grain self-sufficiency and not necessarily on agricultural sustainability, which has changed. The National Action Plan (NAP) of India, on the other hand, emphasised the significance of resource management and conservation. Priority was given to enhancing soil and land quality, conserving water, and educating the farming community about environmental concerns. The central and state governments have taken a number of measures to encourage long-term agricultural growth. The management of small farms to improve productivity, profitability, and sustainability is critical to Indian agriculture's long-term viability.

Is there a way to produce, distribute and eat food more sustainably without sacrificing the cost of doing so? The food industry's stakeholders must work together to develop a sustainable food supply chain that includes environmental, technological, market, regulatory, and socioeconomic considerations. A good place to begin a collaborative effort is to address food loss and waste.

It is possible to create a more sustainable food system by stepping up global efforts to build climate-resilient agricultural production systems that conserve water and energy, reduce greenhouse gas emissions, create waste-free supply chains, provide adequate nutrition, and prioritise the needs of the world's poorest and most vulnerable populations.

Agri-food chains cannot function without the involvement of corporations, particularly retailers. These supply chains can be used to test new approaches to corporate social responsibility (CSR), such as social accountability and good agricultural practises (GAP), total quality management, and hazard analysis at critical control points (HACCP). However, despite the positive effects of a number of voluntary initiatives, such as fair trade, ethical trade (codes of conduct), and collective agreements, more obstacles remain.

"The multiple emerging challenges—food insecurity and undernutrition, climate change, increasing competition for energy and water, degradation of land and biodiversity—are connected in complex ways and require an integrated management approach," says the

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Commission on Sustainable Agriculture and Climate Change's report. Better global systems for integrating spatially explicit information about agriculture and ecosystem services with markets and human populations in real time are required for adaptive management and governance to improve nutritional security and economic prosperity while also protecting the environment.

For the global community to meet future food and agriculture production needs, combat hunger and rural poverty, as well as balance competing demands on land, water, and natural systems, the FAO report makes several observations. Improved governance of land and water resources and a closer integration of policies, as well as increased and more strategic investment in food security and poverty alleviation, are outlined in the Report.

#### **4. RESEARCH METHODOLOGY**

##### **4.1 Framework and economic model development**

The proposed framework is conceptualised in three phases, as shown in Fig. 1. Phase A depicts the SCC of FPO, farmers, and customers, as shown in Fig. 1. With the goal of creating a sustainable agriculture sector in India, the Indian government has promoted the formation of FPOs as an innovative business model that enables farmers to utilise resources sustainably and realise higher profit margins. To improve FSC management and yield numerous innovative practises, the FPO organisations work with farmers and customers even more closely than they already do. As shown in Phase B of Fig. 4.1, there are three types of innovative practises to consider: product, process, and technological.



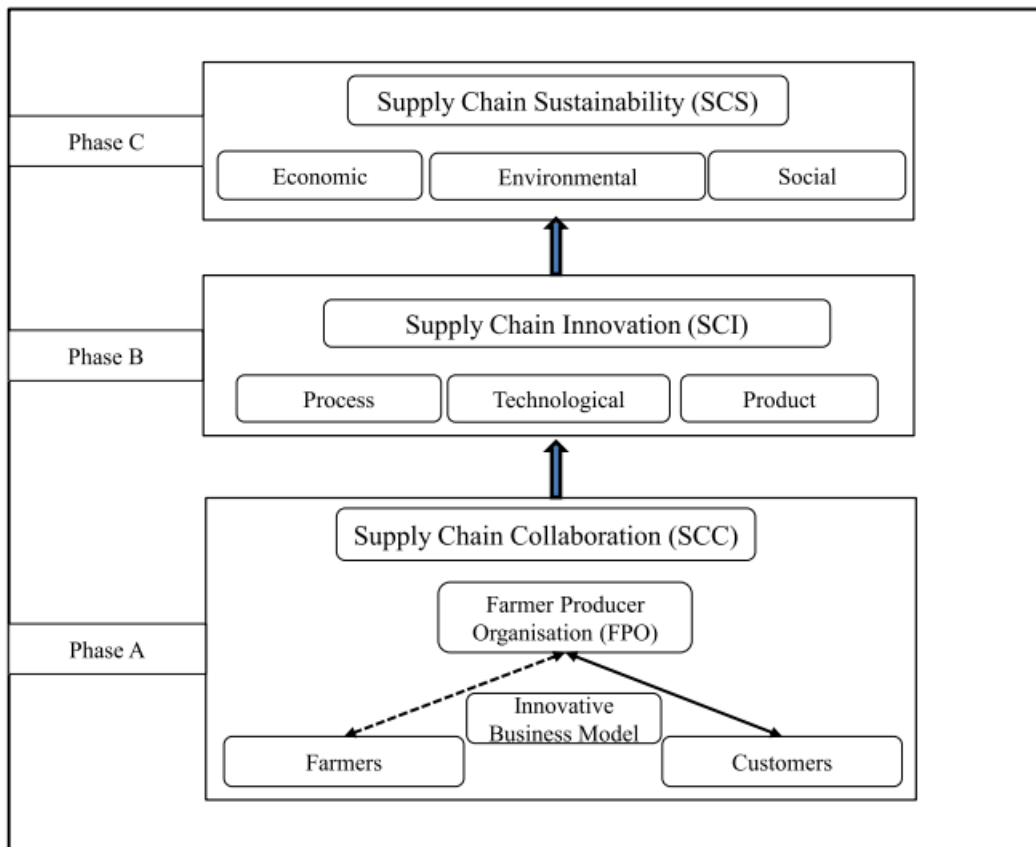


Fig. 4.1. Conceptual framework.

It is the primary goal of this research to determine how a collaborative network structure would lead to innovative practises that would provide long-term value. A case study approach is used in this study because little is known about how SCI achieves sustainability. Case studies can help answer research questions like "why" and "how," especially if the context in which a phenomenon occurs has an impact on the results. An additional reason for conducting case studies is to better understand "complex phenomena," such as how SCC's innovative practises are evolving and contributing to long-term success.

When the focus of research is on an emerging area, such as sustainable SCI, case study research is recommended (Gao et al., 2017). Case study research has another advantage: it provides a thorough understanding of the research problem and an opportunity to observe it in the context of everyday life.

### 3.2 Sample selection

This study focuses on FPOs in the southern Indian state of Karnataka, where rice and millets are the primary agricultural products, and where millets have been reintroduced by government initiatives. The use of multiple case studies allowed us to examine the differences between and among cases in order to identify commonalities that may exist across

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cases with different characteristics. Purposive sampling has been used to select locations and participants in order to ensure that innovative practises are implemented to some extent within their FSCs. Purposive sampling There are between 170 and 1000 farmers in each of the FPOs that were chosen for this research. Because the chosen FPOs are representative of other FPOs in terms of structure and functionality, the findings can be applied to other FPOs. In this section, the selected case organisations and their FPOs, products procured from member farmers, and products delivered to customers are described.

**3.3 Data collection**

We conducted a semi-structured interview with the head of each FPO and its farmer members for data collection purposes. Four FPOs agreed to participate in the interview process. Twenty-four farmers and their leaders were surveyed from each Farmer-Producer Organization. As part of the investigation, several follow-up phone calls were made to ensure everything was clear. The interviewees were sent a brief guide to help them better understand the interview process in order to make the process more efficient. A 30- to 50-minute interview was conducted between the months of June and July of 2021.

**4. RESULTS AND DISCUSSION**

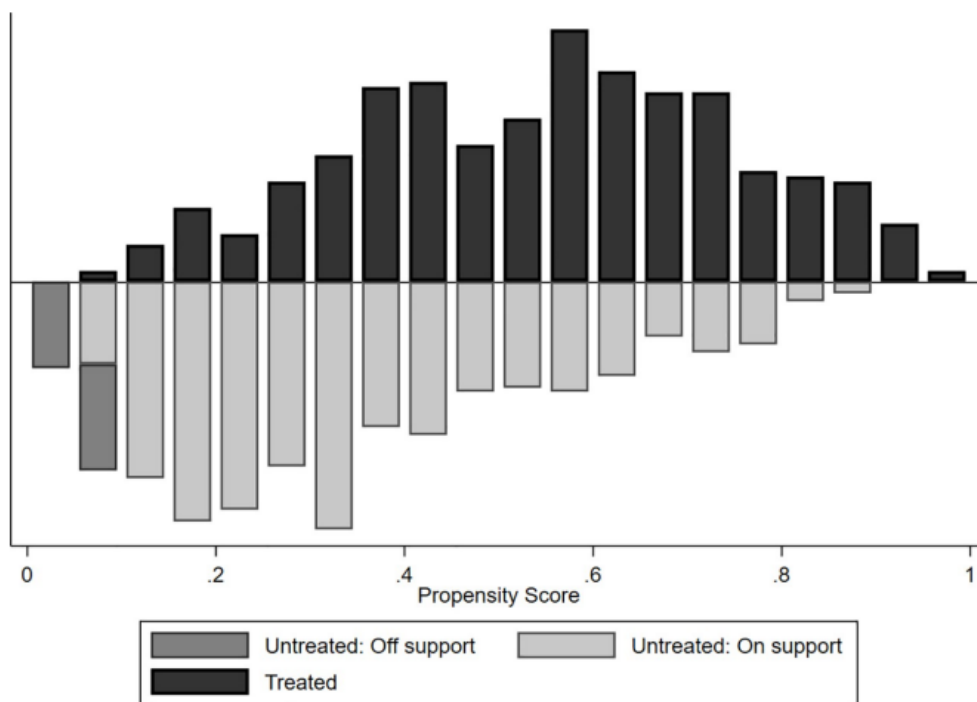


Fig 4.2. Distribution of estimated propensity scores and region of common support.

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Fig. 4.2 shows the distribution of propensity scores and the area where they overlap and where there is common support. Both groups' propensity scores have a large amount of overlap, which indicates that the assumption of shared support is correct.

Table 1. Types of information used by digital extension service adopters

Type of information used	Percentage of adopters
Types of crops to grow	88%
Methods of cultivating selected crops	88%
Types of inputs to use	85%
Quantity of inputs to use	62%
Where to sell output	17%
Price to sell outputs	5%

Average farm sizes are 1.3 acres, but the operational holdings are much larger, at about 4.7 acres, for the average household. It is also common for landowners to lease out their property to tenants. More than six out of ten of the sample farmers are considered marginal based on their land holdings in the field (10 acres). Irrigation is used to water about half of the farmland. Households typically cultivate seven different types of crops. About 43 percent of households' crop output is sold, and they travel an average of 5 kilometres to the nearest input and output markets. S3 Table also shows that at the time of the survey, 43% of the sample households had adopted digital extension services while 57% had not. According to Table 1, digital extension users accessed a variety of data types.

Table 2. Relationship between adoption of digital extension services and agricultural performance (PSM results).

Outcome variable	Nearest neighbour matching		Radius matching		Kernel matching	
	ATT	SE	ATT	SE	ATT	SE
Number of crops grown	1.211 <sup>ωωω</sup>	(0.443)	1.017 <sup>ωωω</sup>	(0.371)	1.095 <sup>ωωω</sup>	(0.355)
	[0.024]		[0.019]		[0.006]	
Seed expenditure per acre (log)	0.170	(0.115)	0.200 <sup>ωω</sup>	(0.099)	0.198 <sup>ωω</sup>	(0.097)

	[0.153]		[0.046]		[0.035]	
Fertilizer expenditure per acre (log)	0.161 <sup>ωω</sup>	(0.077)	0.149 <sup>ωω</sup>	(0.062)	0.153 <sup>ωω</sup>	(0.064)
	[0.039]		[0.032]		[0.028]	
Pesticide expenditure per acre (log)	0.199 <sup>ωω</sup>	(0.102)	0.195 <sup>ωω</sup>	(0.086)	0.198 <sup>ωω</sup>	(0.083)
	[0.047]		[0.032]		[0.028]	
Total expenditure per acre (log)	0.188 <sup>ωω</sup>	(0.079)	0.194 <sup>ωωω</sup>	(0.066)	0.197 <sup>ωωω</sup>	(0.066)
	[0.028]		[0.012]		[0.006]	
Crop productivity (log)	0.175 <sup>ωω</sup>	(0.065)	0.175 <sup>ωωω</sup>	(0.059)	0.177 <sup>ωωω</sup>	(0.058)
	[0.024]		[0.032]		[0.006]	
Crop commercialization	0.074 <sup>ωωω</sup>	(0.028)	0.049 <sup>ωω</sup>	(0.024)	0.049 <sup>ωω</sup>	(0.023)
	[0.024]		[0.046]		[0.035]	
Crop income (log)	0.285 <sup>ωω</sup>	(0.132)	0.254 <sup>ωω</sup>	(0.107)	0.265 <sup>ωω</sup>	(0.107)
	[0.039]		[0.046]		[0.024]	

ATT: average treatment effect on the treated. PSM: propensity score matching. Bootstrapped standard errors with 1,000 replications are shown in parentheses.

Significant at 10% level

Significant at 5% level

Significant at 1% level.

There are square bracketed corrected q-values following Anderson. Multiple hypotheses. The 2 Table in the supplementary information displays the p-values with and without Bonferroni and Holm corrections.

**Table 3. Critical level of hidden bias ( $\Gamma$ ).**

	<b>Nearest neighbour matching</b>	<b>Radi us mat chin g</b>	<b>Ker nel mat chin g</b>
Number of crops grown	1.30	1.15	1.20
Seed expenditure per acre (log)	1.15	1.45	1.40
Fertilizer expenditure per acre (log)	1.30	1.40	1.45
Pesticide expenditure per acre (log)	1.30	1.45	1.45
Total input expenditure per acre (log)	1.35	1.60	1.65
Crop productivity (log)	1.40	1.50	1.50
Crop commercialization	1.40	1.30	1.30
Crop income (log)	1.30	1.45	1.50

Unobserved variables that influence treatment allocation and are also associated with outcome variables may still bias PSM estimates of the ATTs. Rosenbaum bounds are calculated using the PSM estimates to see how sensitive our results are to any potential hidden bias. It is estimated that a positive treatment effect would have to be challenged at certain levels of hidden bias ( $\Gamma$ ) for Rosenbaum bounds. Table 3 displays the findings.

#### **FINANCIAL STATUS:**

As of the 2019-21 financial year, the company's authorised share capital is Rs. 25.00 lakh, and its paid-up capital is Rs. 17.55 lakh. It provides agricultural and animal husbandry services, but excludes veterinary services. Aside from banks and financial institutions, the federation also raises loans from individuals who can extend loans not only for financial returns, but also for social and ecological returns at a low interest rate..

#### **CONCLUSION**

Public extension services have traditionally been used to disseminate agricultural knowledge in developing countries, with extension agents visiting individual farmers or farmer groups to do so. For the most part, this is a bad way to get your message out there. Firstly, because of the high transaction costs associated with personal visits, only a small number of farmers can be contacted. To begin with, the information available to farmers via this channel is frequently generic and not always tailored to their unique circumstances. Agricultural

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extension services could benefit from digital approaches and technologies if they reduce transaction costs and improve the quality of the information they provide. Using data-driven algorithms, farmers can get information tailored to their specific needs and preferences. It's too early to tell whether or not personalised digital extension approaches are actually effective in the small farm sector. According to our findings, personalised digital extension services are associated with better agricultural performance among smallholder vegetable farmers in eastern India. Farmer's socioeconomic and agronomic conditions are taken into account by a recently launched digital agri-tech platform in the study area that provides advice on which crops and inputs to grow. Variables such as crop diversity, input intensity, yield per unit of input, commercialization scales and income from commercialization were all considered in the study.

Small and marginal farmers face a great deal of oppression from the middle men/commission agents when it comes to getting a fair price for their produce. FPO could be an ideal solution to this problem. For education, business planning, and market connections with various national and international companies, more and more contribution from promoting institutions is essential. The farming community will greatly benefit from policymakers' support in running the FPO. To instil a loving spirit and a passion for agriculture in their children, farmers must get them more involved in the industry.

Many of the agricultural performance indicators are positively correlated with the adoption of personalised digital extension services. Adopters of digital extension had 15–20% higher input intensity, 18% higher crop productivity, and 18–29% higher crop incomes after controlling for confounding factors. Non-adopters had none of these increases. Research shows that digital approaches and technologies can be effective tools for improving personalised agricultural extension and promoting the productivity and income of smallholder farmers. The correlations found in this study are more significant than those found in other studies on digital agricultural extension. Because we can't completely rule out the possibility of bias, we may overestimate our associations. ' Most existing studies have evaluated digital extension services based on generic advice, rather than the personalised advice that has been studied here. It is reasonable to assume that advice given to individual farmers, based on their particular circumstances and needs, will have a greater impact.

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