

Innovations to Get Markets Right

Emerging Ecosystem of Agritech Startups and FPOs

Manasi Phadke | Bhushana Karandikar | Ashok Gulati



Innovations to Get Markets Right

Emerging Ecosystem of Agritech Startups and FPOs

Authors

1. **Manasi Phadke**, Former Senior Consultant, Indian Council for Research on International Economic Relations (ICRIER), New Delhi
2. **Bhushana Karandikar**, Former Senior Consultant, Indian Council for Research on International Economic Relations (ICRIER), New Delhi
3. **Ashok Gulati**, Distinguished Professor, Indian Council for Research on International Economic Relations (ICRIER), New Delhi

Published by: Indian Council for Research on International Economic Relations (ICRIER)

Core-6A, 4th Floor, India Habitat Center, Lodhi Road, New Delhi - 110003

ISBN: 978-81-954132-1-8

© 2023: Indian Council for Research on International Economic Relations (ICRIER), New Delhi

Printed by: B Square

ALL RIGHTS RESERVED No part of this book shall be reproduced, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright holder(s) and/or publishers. Photographs in this report: All photographs have been digitally procured by ICRIER, with permission from commercial websites selling photographs, official field trips and by courtesy of respective organizations and individuals for the purpose of publishing this report.

Disclaimer: Opinions and recommendations in the report are exclusively of the author(s) and not of any other individual or institution including ICRIER. This report has been prepared in good faith on the basis of information available as on the date of publication. All interactions and transactions with industry sponsors and their representatives have been transparent and conducted in an open, honest and independent manner as enshrined in ICRIER Memorandum of Association. ICRIER does not accept any corporate funding that comes with a mandated research area that is not in line with ICRIER's research agenda. The corporate funding of an ICRIER activity does not, in any way, imply ICRIER's endorsement of the views of the sponsoring organisation or its products or policies. ICRIER does not conduct research that is focused on any specific product or service provided by the corporate sponsor.

Contents

<i>Foreword</i>	i
<i>Preface</i>	ii
<i>Acknowledgement</i>	iv
<i>Abbreviations</i>	v
<i>Executive Summary</i>	vii

CHAPTER 1

Strengthening Agriculture Markets through Innovations	02
--	----

CHAPTER 2

Agritech and FPOs: A Scoping Study	06
---	----

CHAPTER 3

Tech Solutions for Traceability in Value Chains	13
Case Study 1: Stellapps Technologies Pvt. Ltd	13

CHAPTER 4

Tech-Enabled Cold Storage, Warehousing and Fintech Solutions	20
Case Study 2: Ecozen Solutions Pvt. Ltd.	20
Case Study 3: Ergos: Decentralized Warehousing and Collateral Management	25
Case Study 4: Arya Collateral: Warehousing and Fintech solutions	29

CHAPTER 5

End-to-End Supply Chain Solutions	34
Case Study 5: WayCool Foods Pvt. Ltd.....	34

CHAPTER 6

Contracts – The Institutional Innovation	39
Case Study 6: Contract between Sahyadri FPC Ltd. (SFPCL) and Alandi Valley FPC (AVFPC).....	39
Case Study 7: Deccan Agro and Shree Mahaganapati FPC.....	43

CHAPTER 7

Futures Markets – The Institutional Innovation	47
Case Study 8: Parivartan FPC	47
Case Study 9: Surya FPC	50

CHAPTER 8

Overarching Observations and Policy Recommendations	53
References	60
Annexures	61

List of Figures

CHAPTER 1

Strengthening Agriculture Markets through Innovations

Figure 1.1: Scope of the Study	03
--	----

CHAPTER 2

Agritech and FPOs: A Scoping Study

Figure 2.1: VC funding to Agritech Startups (FY2016-FY2022)	07
Figure 2.2: Agritech startups within Post Harvest Operations	08
Figure 2.3: Entry points of Startups, Segment and Value Chain Technologies Used within Supply Chains.	09
Figure 2.4: Role of DAC and Central Agencies in developing FPOs	10
Figure 2.5: Different Agencies which promote FPOs in India	11
Figure 2.6: States with presence of agritech ecosystem and market-facing FPOs.	12

CHAPTER 3

Tech Solutions for Traceability in Value Chains

Figure 3.1: Geographical Presence of Stellapps in India	14
Figure 3.2: Stellapps' Solution deployment across Milk Value Chain in the BMU	16
Figure 3.3: Impact of Stellapps Solutions on Farmers, Bachkheda Society and BMU	17

CHAPTER 4

Tech-Enabled Cold Storage, Warehousing and Fintech Solutions

Figure 4.1: Major Product Offerings by Ecozen	21
Figure 4.2: Ecofrost, the Cold Room at Farmgate from Ecozen	21
Figure 4.3: Farmers at Pragati loading flowers for sale at market, Flowers stored at Cold Store under low price scenario	23
Figure 4.4: Impact of Ecofrost	24
Figure 4.5: The Grainbank at Ergos	26
Figure 4.6: From Ergos Grainbank to poultry feed mills	27
Figure 4.7: Impact of Ergos	28
Figure 4.8: Verticals Serviced by Arya Collateral	30
Figure 4.9: Sontat Seeds stored at the Arya Warehouse	32
Figure 4.10: Impact of Arya Collateral	33

CHAPTER 5

End-to-End Supply Chain Solutions

Figure 5.1: The WayCool Collection Centre	35
Figure 5.2: Impact of WayCool	37
Figure 5.3: Storage System at Vambori FPC	38

CHAPTER 6

Contracts – The Institutional Innovation

Figure 6.1:	Tomato Processing Facility at SFPCL	40
Figure 6.2:	Blockchain based Agrotrust platform	41
Figure 6.3:	Structure of the SFPCL Business Model	41
Figure 6.4:	Impact of SFPCL Contract on AVFPC Members	43
Figure 6.5:	Packhouse facilities built by Deccan Agro at MIDC, Sangli.	44
Figure 6.6:	Impact of Deccan Agro Contract on Members of Shree Mahaganapati FPC	46

CHAPTER 7

Futures Markets – The Institutional Innovation

Figure 7.1:	Infrastructure at Parivartan FPC	48
Figure 7.2:	Impact of NCDEX Futures on Members of Parivartan FPC	50
Figure 7.3:	Trading (Adat) Shop at APMC mandi at Sategaon	51
Figure 7.4:	Impact of NCDEX on Surya FPC	52

List of Tables

Table 5.1:	Institutional Sales by Vambori FPC in FY19 and FY20	36
Table 5.2:	Engagement of Vambori FPC with WayCool from FY19	36
Table 6.1:	Commodity Calendar for Exports of Baby Corn, Chillies, Okra.	44
Table 8.1:	Summary of Early Impact of Innovations	54

List of Boxes

Box 3.1:	Factsheet on Stellapps	13
Box 3.2:	Factsheet on Bachkheda Balaji Village Dairy Society	16
Box 4.1:	Factsheet on Ecozen Technologies Pvt. Ltd.	20
Box 4.2:	Factsheet on Pragati FPO.	22
Box 4.3:	Factsheet on Ergos.	25
Box 4.4:	Factsheet on Arya Collateral	29
Box 4.5:	Factsheet on Sontat FPO	31
Box 5.1:	Factsheet on Waycool	34
Box 5.2:	Factsheet on Vambori FPC	36
Box 6.1:	Factsheet on Sahyadri FPC Limited	39
Box 6.2:	Factsheet on Sahyadri Alandi Valley FPC (AVFPC)	42
Box 6.3:	Factsheet on Deccan Agro	43
Box 6.4:	Factsheet on Shree Mahaganapati Agro Producer Company Ltd.	45
Box 7.1:	Factsheet on Parivartan FPC Limited	48
Box 7.2:	Factsheet on Surya FPC Limited	50

Foreword

Innovations are spearheading agricultural transformation in India. Both technology and institutional innovations have contributed towards inclusive growth of agriculture. In the technology innovation domain, agritech startups are playing a phenomenal role in making the markets more sustainable, competitive, and inclusive. The startups are deeply involved in the creation of digital and smart supply chains, value chain financing, business to business/consumer linkages, quality assurance systems, among others. Many issues that stem the efficiency of agriculture markets such as lack of market infrastructure, warehousing, assaying, long chain of intermediation, and lack of finance, are being addressed by technology solutions. There is also a robust funding network to fuel the growth of agritech startups in India. Leveraging the agritech space, farmers can benefit from improved marketing practices and linkages in terms of higher net returns and sustainable livelihood opportunities.

With India being a smallholder agri economy, where 86% of the farmers operate less than 2 hectares of land, technology uptake is a challenge. But, farmer collectives such as co-operatives, farmer producer organizations, and other farmer groups have been effective in overcoming this challenge by mobilizing farmers, and achieving economies of scale. The evolving interface of agritech startups and FPOs are pushing the innovation frontiers of Indian agriculture. Technology solutions specific to a geography or a commodity chain, are helping address issues that impact profitability of farming and market linkages. Also, institutional innovations such as contract farming and futures market have the potential to deliver the benefits of higher price discovery, and price risk management, directly to the farmers.

These are some of the findings of ICRIER's latest report, Innovations to Get Markets Right: Emerging Ecosystem of Agritech Startups and FPOs, which was supported by the National Stock Exchange (NSE). We would like to congratulate the researchers of Agriculture Policy, Sustainability, and Innovation (APSI) team in ICRIER, led by Dr. Ashok Gulati, for undertaking this interesting study. We hope that this research study will make a valuable contribution to the ongoing dialogue on how innovations can be leveraged to strengthen Indian agriculture.

The study focusses on how agritech startups together with FPOs are impacting farmers in terms of economic returns, and what important lessons can be drawn to strengthen the existing policy framework. While the case studies show that farmers gain from higher net economic returns, they also benefit from assured markets, and sustainable incomes, as a result of the technology enabled marketing practices. As the agritech startup and FPO partnership consolidates further, policies aimed at creating a network of technology innovators, FPOs, investors, and other stakeholders will be critical. Also, incentives to further scale up technology and institutional innovations will deliver sustainable higher returns.

Dr Deepak Mishra
Director & Chief Executive
ICRIER, New Delhi

Mr Ashishkumar Chauhan
Managing Director and CEO
NSE, Mumbai

Preface

Technology has played a significant role in accelerating agriculture on many fronts – pre and post-harvest practices, agri supply chain management, linking farmers to markets, information and intelligence, among others. Interestingly, agritech in India is not restricted to big box ideas but include very local, and customized solutions led by startups. While the agritech space is evolving at a rapid pace, there are challenges in sustaining the initial momentum and ensuring greater uptake and impact of these technology solutions. As a strategy to take the agritech solutions to a large number of farmers spread across geographies and commodity value chains, startups are increasingly working with farmer groups and most notably, FPOs. This is an important trend to watch out for, as this partnership has the potential to not only accord higher scale to innovations, which is critical to realize higher impact, but also encourage innovations which address real time issues very specific to a geography, or commodity value chain, or farmers.

In 2019, there were 1,739 registered agritech startups (as per DPIIT). About 450 startups were operational in the areas of farm and data analytics, infrastructure, information platforms, finance and supply chain (NASSCOM 2019). Of these, 63% of the agritech startups were present in the supply chain segment. Since 2013, investments worth USD 630.2 million have been made and USD 330 million plus was generated in 2020 (PWC-FICCI 2021). These startups are delivering technology solutions and enabling farmers and other stakeholders to benefit in terms of higher net economic returns as well as sustainable practices. By FY2022, the numbers have significantly changed in this dynamically evolving space. In FY2022, there are 1500 active agritech startups in the country. The pandemic led to increased appeal of the segment amongst investors. FY2022 was a watershed year for agritech and the segment attracted USD 1604 million worth of investments in that year (Kalaari 2022). These startups are delivering technology solutions and enabling farmers and other stakeholders to benefit in terms of higher net economic returns as well as sustainable practices. There are 7,374 registered FPCs with an estimated 4.3 million farmer members in India. Nearly 50% of these FPCs are registered in Maharashtra, Uttar Pradesh, Tamil Nadu, and Telangana. Also, 49% of the registered FPCs have paid-up capital of less than Rs.1,00,000 (Govil, Neti and Rao, 2020). With a vision to expand the FPO network to 10,000 and recognizing them as pivotal institution at the grassroot level for strengthening farmer-market linkage, this can provide a major platform for technology uptake amongst small and marginal farmers.

Against this backdrop, APSI team at ICRIER envisaged a research study on Innovations to Get Markets Right - Evolving Ecosystem of Agritech Startups and FPOs under a larger research project on Getting Markets Right supported by the National Stock Exchange (NSE). The research objective was to understand how the evolving interface of agritech startups and FPOs is impacting farmers in terms of economic returns, and what important lessons can be drawn to strengthen the existing policy framework. The study included mapping of the landscape of agritech startups and FPOs in the area of agriculture marketing; a deep dive into the experience of agritech startups and FPOs working together; a measure of the early impact and direction of progress through case study approach; and coming up with policy recommendations that can help strengthen this ecosystem for larger sustainable gains for the farmers.

The 9 case studies under 5 verticals of technology and institutional innovation include Stellapps Technologies Pvt. Ltd. & Bachkheda Village Society within the Bhilwara Milk Union (BMU), Bhilwara, Rajasthan; Ecozen Solutions & Pragati FPO, Nellore, Andhra Pradesh; Ergos Grainbank – warehousing solution at farmgate for maize farmers in Nayanagar, Bihar; Arya Collateral Warehousing Services Private Limited & Sontat FPC,

Rewa, Madhya Pradesh; WayCool Foods Pvt. Ltd. & Vambori FPC, Ahmednagar, Maharashtra; Sahyadri Farmer Producer Company Ltd. (SFPCL) & Alandi Valley FPC, Nashik, Maharashtra; Deccan Agro & Shree Mahaganapati FPC, Sangli, Maharashtra; NCDEX & Parivartan FPC, Washim, Maharashtra; and NCDEX & Surya FPC, Hingoli, Maharashtra.

Technology and institutional innovations have created significant impact at the grassroots. The net price realization for the farmers/FPOs who adopted the technology has been much higher than those who did not. Despite higher cost of innovation, the net returns to the farmers have been higher, as observed in certain case studies. The study indicates that technology solutions have the potential to break down a problem and address the core issue with very local customized solutions, which is very important for India. Technology solutions address very important issues related to sustainable agricultural practices – be it solar enabled cold chains, traceability, or supply chain management. The solutions offered by the agritech startups enhance farmer's income not just by allowing him to reap a higher price but also ensuring sustainability of income by giving him the right ecosystem of assured markets, and sustainable practices. Many of the solutions also reduce the vulnerability of farmers to downside risks and hence help control income volatility.

The momentum between agritech startups and FPOs working together needs to be harnessed in order to scale up and replicate the successful outcomes. Within the revamped space of legal and institutional reforms, and presence of FPOs which can potentially offer scale, innovations have tremendous scope in getting the agriculture markets right. Efforts towards creation of a nodal agency offering single window networking, and partnership opportunities amongst startups, FPOs, investors, incubators, etc. can lend the right structure to the network. Also, with the growing number of FPOs, a rating tool to identify the market oriented FPOs will be useful to fuel this partnership. With technology solutions dovetailing warehousing and fintech can improve farmers' access to warehousing. Digitalization of dairy value chains can be replicated across the co-operative network for delivering higher returns to the milk farmers from efficient and sustainable supply chain management. The economic gains from contract farming and futures market in terms of assured markets, fair price discovery, and price risk management can be strengthened with appropriate policy decisions. Government and organizations like NABARD, NDDDB, and others can provide the right incentives for faster and wider adoption of agriculture innovations.

The research findings clearly demonstrate the potential of technology and institutional innovations in improving agriculture market efficiency and delivering higher returns to the farmers. We hope this research will add value to the discourse on how innovations are critical for getting market right, and both practitioners and policymakers can benefit from the case study findings and policy recommendations presented in this report.

Authors

Acknowledgement

We take this opportunity to acknowledge and thank a number of individuals and institutions for their support, guidance, feedback and patience. We are grateful to National Stock Exchange (NSE) for acknowledging the importance of studying the role of innovations in shaping Indian agriculture and supporting this research study.

The study on Innovations to Get Markets Right: Evolving Ecosystem of Agritech and FPOs has benefitted from the contribution of many experts, whom we wish to acknowledge and thank.

We express profound gratitude to experts from incubators, VCs and impact funds within the startup ecosystem, who generously spent time and shared their valuable insights with us. These include experts from CIIE.CO (IIM Ahmedabad), Startup Oasis, NASSCOM, KIIT, SIIC (IIT Kanpur), ThinkAg, Caspian, a-IDEA, Indigram Labs Foundation, Villgro and Omnivore. We were ably guided by several Government officials within the World Bank funded State of Maharashtra's Agribusiness and Rural Transformation (SMART), MahaCot and PPP-IHD, Government of Karnataka. We also connected with several value chain experts from NABARD, Akash Agro, Kaybee Exports, Freshrop, Aroma Organics, MTR, Katraj Dairy and MahaFPC, and benefitted immensely from the discussions.

The nine case studies presented in this report required multiple online meetings and discussions with CEOs, founders, employees and field staff of Stellapps Technologies Pvt. Ltd., Ecozen Solutions Pvt. Ltd., Ergos, Arya Collateral Warehousing Services Pvt. Ltd., WayCool Foods and Products Pvt. Ltd., and Deccan Agro Pvt. Ltd.. We express our gratitude to each of the agritech startups for having taken us through their business models and shared their insights with us so generously. Our interactions with all the FPOs were extremely gratifying. We extend a heartfelt thanks and appreciation to the founders, Directors and employees of Bhilwara Milk Union, Bachkheda Balaji Village Dairy Society, Pragati Yuva Kendram FPO, Sontat FPO, Vambori FPC, Mahaganapati FPO, Sahyadri FPC Ltd., Alandi Valley FPC, Shree Mahaganapati Agro Producer Company Ltd., Parivartan FPC and Surya FPC for the insightful conversations. Last but not the least, we wish to put on record our sincere appreciation and gratitude to all the farmers who agreed to talk to us about the impact of technology on their lives and livelihoods.

Our sincere gratitude to Mr Jinesh Shah, Co-founder, Omnivore and Mr. Hemendra Mathur, Co-founder, ThinkAg, for reviewing the report. Their suggestions and insights have been invaluable in helping us to finalize the contents. We acknowledge with thanks the valuable inputs given by Ms Kavery Ganguly in content editing of the early draft of the report. We wish to thank Ms Tanvee Kanitkar, Ms. Hemangi Dhanke and Mr Mohit Kumar Shrivastav for their research assistance during the course of the study. Our special thanks to Mr Rahul Arora for providing the administrative support and contributing in preparing the final report.

Needless to mention, the responsibility of data and views in this report and any omissions or errors that remain in the text, are of the authors only.

Abbreviations

ADB	Asian Development Bank
AI	Artificial Intelligence
a-IDEA	Innovation Development Entrepreneurship in Agriculture
AMCU	Automatic Milk Collection Unit
AMIF	Agri-Market Infrastructure Fund
AMLA	Aggregation, Market Linkage and Advisory
APMC	Agricultural Produce Market Committee
ATMA	Agriculture Technology Management Agency
AVFPC	Alandi Valley Farmer Producer Company
B2B	Business to Business
B2C	Business to Consumer
B2G	Business to Government
BMC	Bulk Milk Coolers
BMGF	Bill and Melinda Gates Foundation
BMU	Bhilwara Milk Union
CIIE	Centre for Innovation, Incubation and Entrepreneurship
CIPHET	Central Institute of Post-Harvest Engineering and Technology
CoE	Centre of Excellence
CSR	Corporate Social Responsibility
CSS	Centrally Sponsored Schemes
CWC	Central Warehousing Corporation
CY	Calendar Year
DAC&FW	Department of Agriculture, Cooperation & Farmers' Welfare
DCS	Dairy Co-operative Societies
DFP	Direct Farmer Payments
DISQ	Digital Impact Square
DPIIT	Department for Promotion of Industry and Internal Trade
ECA	Essential Commodities Act
ELM	Extreme Loss Margin
EMS	Environmental Management Systems
eNAM	electronic National Agriculture Market
eNWR	electronic Negotiable Warehouse Receipt
ERP	Enterprise Resource Planning
EU	European Union
F&V	Fruits and Vegetables
FAO	Food and Agriculture Organization
FCI	Food Corporation of India
FI	Financial Institution
FICCI	Federation of Indian Chambers of Commerce and Industry
FMCG	Fast Moving Consumer Goods
FPC	Farmer Producer Company
FPO	Farmer Producer Organization
FSMS	Food Safety Management Systems
FY	Financial Year
GAP	Good Agriculture Practices
GMP	Good Manufacturing Practices
GTM	Go-To-Market
HoReCa	Hotels, Restaurants, Catering
HUL	Hindustan Unilever Limited
ICAR	Indian Council of Agricultural Research
ICRISAT	International Crops Research Institute for Semi-Arid Tropics
ICT	Information and Communication Technologies

IIM	Indian Institute of Management
IIT	Indian Institute of Technology
ILF	Indigram Labs Foundation
IOT	Internet of Things
IQF	Individual Quick-Frozen Process
ISO	International Organization for Standardization
KII	Key Informant Interview
KIIT	Kalinga Institute of Industrial Technology
LTF	Loan to Value
MACP	Maharashtra Agricultural Competitiveness Project
MBCFPCL	Madhya Bharat Consortium of Farmer Producer Company Limited
MCX	Multi Commodity Exchange
ML	Machine Learning
MRL	Maximum Residue Level
MSP	Minimum Support Price
MT	Metric Tonne
MTM	Mark-to-Market
NAARM	National Academy of Agriculture Research Management
NAAS	National Academy of Agriculture Science
NABARD	National Bank for Agriculture and Rural Development
NAF	National Agro Foundation
NASSCOM	National Association of Software and Service Companies
NBFC	Non-Banking Financial Company
NCDC	National Corporation for Development of Cooperation
NCDEX	National Commodity and Derivatives Exchange
NCR	National Capital Region
NDDB	National Dairy Development Board
NFSM	National Food Security Mission
NSC	National Seed Corporation
OEM	Original Equipment Manufacturer
PACS	Primary Agriculture Credit Societies
PDS	Public Distribution System
PMFBY	Pradhan Mantri FasalBima Yojana
PMJDY	Pradhan Mantri Jan Dhan Yojana
PODF	Producer Organization Development Fund
PRODUCE	Producer Organization Development and Upliftment Corpus
QCI	Quality Council of India
R&D	Research and Development
RCDF	Rajasthan Cooperative Dairy Federation Ltd.
RKVY	Rashtriya Krishi Vikas Yojana
SAARC	South Asian Association for Regional Cooperation
SEBI	Securities and Exchange Board of India
SFAC	Small Farmers and Agribusiness Consortium
SFPCL	Sahyadri Farmer Producer Company Limited
SME	Small and Marginal Enterprise
SNF	Solid Not Fat
SWC	State Warehousing Corporation
TCS	Tata Consultancy Services
UN	United Nations
USD	United States Dollar
USP	Unique Selling Proposition
VC	Venture Capitalists
WB	World Bank
WDRA	Warehousing Development and Regulatory Authority
WRF	Warehouse Receipt Financing
WTP	Willingness to Pay

Executive Summary

Agriculture markets in India are beset by a number of well documented problems. These include fragmented and non-compressed value chains with multiplicity of intermediaries, non-transparent price discovery mechanisms and lack of scientific storage and logistics systems. But this space has witnessed a number of reforms in recent times. The reforms framework has encompassed the broad themes of allowing direct trading between farmers and buyers, encouraging contract farming, incentivizing private participation in building market infrastructure, warehousing, cold chains and other logistics, and moving towards one nation one market. To allow farmers to benefit from such reforms, the need to mobilize them into groups was also deemed important, which brought into focus institutions like Farmer Producer Organizations (FPOs).

Within the revamped space of legal and institutional reforms and presence of FPOs which can potentially offer scale, innovations have tremendous scope in getting markets right. Innovations in the agricultural sector are not limited to big box ideas; increasingly, it is startups that have been first movers in providing important plug-ins to address issues related to farming, post-harvest supply chain management, participation of farmers and linking them to markets.

Agri-tech startups have been offering disruptive technology solutions in the agri-marketing space. There are startups that have created online mandis, so that players can directly quote requirements and source from other players with the requisite quantity and quality. Many of the online models boast features such as rating systems that allow participants to rate each other and others to see the rating. Some startups have done digitization of entire FPOs so that produce can be traced back to individual farmers. Some startups tie up FPOs to traders, while others tie them up to kirana stores or to the Hotels/ Restaurants/ Cafes (HoReCa segment). Some startups offer intelligent vision, using which it is possible to segregate F&V produce or staples as per specifications of the buyer. Technology is being used to offer modular, energy-efficient storage systems at farmgate. Fintech products that allow warehousing to be layered with credit and insurance are getting created. Startups use combinations of sensors, IOT, blockchain and ML driven data systems to create end-to-end traceability within the food chains.

However, innovations need not only be technology driven. Institutional innovations too have the power to change the structure of agribusiness radically. Introduction of contract farming or futures markets are examples of such institutional innovations that have the potential to change the game completely. These have offered farmers gains in terms of transparent price discovery, known prices for standardized produce and risk hedging; these are features that are missing in the traditional markets that farmers have been working in.

As a flurry of tech-led and institutional innovations changes the way in which agricultural markets have traditionally worked in India, the impact of these at the grassroots, on the net incomes of the farmers and their ability to hedge risks needs to be documented. Only if the net impact is positive and substantial will the innovations have scalability in the future. The present study was designed with a view to answer the following specific questions: (i) How has the agritech ecosystem evolved in India? (ii) Are agritech solutions helping farmers earn remunerative prices for their produce and hedge risks better? (iii) What has been the quantitative and qualitative impact of innovations on FPOs? (iv) What policies are needed to strengthen the ecosystem and mitigate concerns?

In order to study the impact of tech-led innovations, we chose the verticals of traceability, warehousing and cold storages, as well as end-to-end supply chains, all of which show high levels of engagement between

agritech startups and FPOs. We study impact of contract farming solutions and trading on futures markets under institutional innovations. We choose an FPO privy to the innovation and a suitable comparison FPO not privy to it. The difference in the net price realization (price less variable costs) in the members of the two groups could be read as the impact of the innovation. Access to innovative solutions comes at a price. Hence, we were expecting that the variable costs of the groups with tech solution to be higher than that without the solution. The research study was to check if the increment in returns was higher than the increment in costs. Hence, net price realization was a key variable in the framework for identifying impact. For some case studies however, it wasn't possible to attribute the change in net price realization purely to the innovation. In such cases, the impact was documented through a qualitative, rather than quantitative narrative.

The methodology for the study involved deep-diving into a case study format through Key Informant Interviews (KIIs) with startup founders and executives, FPO Directors, farmer members, Government officials, experts, incubators, venture capitalists and social impact firms. Since the study was undertaken between September 2020 and January 2021 when the Covid-19 pandemic was raging through the country, no field visits could be undertaken. A total of 90 KIIs were conducted through online meetings and over telephone using specially designed questionnaires.

Within the traceability vertical, we profiled the innovation offered by **Stellapps Technologies Pvt. Ltd.** The startup offers full-stack traceability solutions for the dairy value chain. The farmer milks the cattle, after which she pours the milk at the village society collection centre. From there, the milk moves through multiple nodes such as Bulk Milk Coolers (BMC) and tankers to the milk processing plant. In this chain, quantity and quality of milk can get compromised. The Stellapps solution monitors the quantity and quality of milk through the entire value chain, thereby converting it into a smart value chain with full traceability. The case study of the Bhilwara Milk Union (BMU) and the Bachkheda Village Society indicates that traceability enhanced the trust amongst farmers. After the solution was deployed, the society could identify those farmers pouring poor quality of milk and hence could launch targeted capacity-building programs. This also led to an increase in sales of feed and supplements for the society. Women farmers were empowered since they knew exactly how much payment was due to them. The solution has also facilitated direct payments to women farmers and reduced instances of rent-seeking.

Ecozen has developed solar-powered cold storages that can be installed at the farmgate. The major products for which the solution is being used are perishables such as high value F&V (litchies, cherries, okra etc.) as well as flowers (roses, tuberoses, jasmynes etc.). The 5 MT cold stores are leased in or bought by FPOs; the startup also engages in training the FPOs to operate the facility. We profile the story of the Pragati FPO, which sells tuberoses in the Nellore market and is a user of the Ecozen cold store. Farmer members of Pragati have been able to store their flowers and sell them only when the peak season commences, thereby driving huge price gains. During the non-festive period, high market arrivals can really push prices into a trough. Farmers without cold store are forced to sell at distressed prices; however, the members of Pragati can hold the produce to get a better price. Under the low price scenario, farmers without solution get net income of Rs.11000 per MT. Pragati farmers get net income of Rs.53230 per MT. This is despite higher costs of rent and FPO fees.

Ergos is a startup that offers a “Grainbank” to individual farmers at farmgate. It partners with banks and NBFCs to offer credit to the farmers against the collateralized value of stored produce. It even offers market linkage options for maize wherein it has tied up with millers and traders, who offer good prices for maize throughout the year. Our case study highlights the impact of the solution on the small and marginal rabi maize farmers of Nayanagar village in Bihar. To begin with, farmers were unwilling to entrust their produce with the Grainbank. Through consistent outreach programs and a policy of allowing farmers to literally “view” his

produce stored in the Grainbank, the Ergos operations started taking off after 2 years. The impact is substantial. Maize farmers store their produce with the Ergos facility between May, when the prices are at a nadir, and November, when the prices increase. The net income of farmers without solution stands at Rs.4930 per MT whereas Ergos farmers get Rs.9423 per MT, despite paying storage costs and interest costs on credit facilities. There is also a soft impact, wherein farmers exhibit financial discipline and take credit only to the exact extent that is immediately required.

Arya Collateral offers warehousing solutions but also offers innovative fintech solutions through Aryadhan, which is its own NBFC arm. We profile the Sontat FPC in Siddhi district of Madhya Pradesh, which produces wheat seeds. The FPC procures raw produce from November onwards, stores the aggregated produce with the Arya warehouses and avails a credit line from Aryadhan. After the procurement, it needs to move the stored produce to process it into seeds. Normally, such a facility is not allowed by any FIs dealing in collateral management. However, Arya Collateral and Aryadhan have created a fintech product to cater to this niche requirement. Aryadhan, in partnership with the Rabo Bank, has also launched an interesting product that acts as an insurance layer to the FPOs, should the price of the stored commodities fall below the benchmarked valuation. Net income of comparison FPC without access to solution stands at Rs.4055 per MT whereas Sontat FPC gets net income of Rs.7003 per MT.

WayCool Foods Pvt. Ltd. is an end-to-end supply chain that procures produce from FPOs through its Collection Centres and links it to Hotels, Restaurants and Cafes (HoReCa). The Vambori FPC in Ahmednagar district of Maharashtra has been engaging with WayCool for past three years. The farmer members segregate the “WayCool quality” onions at the farm. The transport of the sorted produce to the Collection Centre is arranged by the startup. The most interesting aspect of the story is that the farmers know the price that is tagged to a particular quality of onions, which is exactly the missing piece in the APMC puzzle. WayCool may not always offer prices that are higher than those at APMC, but the ease of transport and knowledge of certain prices for a particular quality of onions are big advantages for the farmers. Net income for farmers through APMC sales stand at Rs.5983 per MT, whereas that through sales to WayCool stands at Rs.7523 per MT. Importantly, presence of an institutional buyer such as WayCool has now led to risk diversion; farmers sell lower grade onions at the APMC and higher-grade onions to WayCool.

We present a case study of the **Sahyadri Farmer Producer Company Ltd. (SFPCL)** under the vertical of contract farming. SFPCL is biggest FPC in India with a big focus on technology-led processes. Grapes and tomatoes are two major verticals at SFPCL. The company is a private label manufacturer for Kissan Ketchups, wherein it procures tomatoes and manufactures ketchup as per the instructions from HUL. To facilitate the massive procurement needed for this, SFPCL has implemented an Amul framework in horticulture produce. SFPCL is the umbrella company that looks after sales, packaging, exports and marketing, whilst leaving the production activity to smaller FPCs under its fold. SFPCL has entered a soft, unwritten contract with the Alandi Valley FPC (AVFPC) for the procurement of tomatoes. The distinguishing feature of the contract is that the SFPCL always offers Re.1 per kg premium over the prevailing APMC rates for procurement. Further, it always gives a minimum price of Rs.3.5 per kg to the farmer members of AVFPC. The impact is huge. Under bad prices, farmers without contract selling at the APMC experience negative returns; this indicates that prices are lower than the costs of production and marketing. However, the contract enables the AVFPC members to earn a positive net income even under bad prices scenario. Thus, the contract has created positive net returns for the farmer-members of the AVFPC and provides a hedge against the risk of price reduction.

The contract between **Deccan Agro**, a small exporting firm and Shree Mahaganapati FPC of Sangli district, Maharashtra, for the production of chillies, okra and baby corn, which are then exported to London, have

increased the returns accruing to farmers substantially. Sales of okra to the local APMC fetch net returns of Rs.3530 per MT to the farmers. However, sales of okra to **Deccan Agro** and there through to the London markets gives net returns of Rs. 11380 per MT to the farmers. However, this story is not only about higher returns. The farmers have exposure to requirements of the MRL sensitive London market, but the risk of price volatility is borne by Deccan Agro, the contract sponsor. The FPC charges a service charge of Rs.0.25 per kg of produce that it transacts with Deccan Agro. This has created a source of revenue for the FPC, which is now planning to move up the value chain by constructing a packhouse.

Parivartan FPC in Washim district of Maharashtra has been selling soybean on NCDEX. The Directors of the FPC have been instrumental in engaging with their members. Member farmers of the FPC sell soybean to solvent extraction plants or to the APMC traders to meet their immediate cash requirement. However, the rest of the produce is 'aggregated' with the FPC, which then sells it on NCDEX when the prices increase. The farmer involvement on NCDEX has increased; increasingly it is the members who study the prices on NCDEX and call upon the Directors with a request to sell a lot on the market. Once the exchange pays the FPC, the FPC deducts marketing costs and service fees from it and makes the payments to farmers. Thus, the gains made by selling on the exchange literally trickle down to the farmer level. The net returns to farmer members of FPC by selling on NCDEX stand at Rs. 17257 per MT, as compared to net returns of Rs. 12847 per MT by selling produce to the solvent extraction plant. Most importantly, the futures contract on NCDEX allows the farmer to lock in the price which always covers his costs and hence hedges him against the instance of a price reduction at harvest.

The Surya FPC in Hingoli district of Maharashtra trades turmeric on futures. The FPC has its own trading (Adat) shop, in which it purchases turmeric from members and non-members. It segregates good quality turmeric to sell on NCDEX futures and takes a loan from NBFCs to make down payments to the seller-farmers. The other channel on which the FPC sells the turmeric is that of branded masala companies. The FPC gets higher net returns from the NCDEX sales as compared to sales to branded masala companies; this is due to reimbursement of expenses by NCDEX and higher lock-in prices on futures contracts.

Across products, geographies and verticals, we find that tech innovations as well as institutional innovations have created huge impacts at the grassroot. The case studies indicate that technology solutions have the potential to break down a problem and address the core issue with very local customized solutions, which is very important for a geography like India. We find that tech solutions address very important issues related to sustainable agri practices – be it solar enabled cold chains, traceability or supply chain management. The solutions offered by the agritech startups enhance farmer's income not just by allowing him to reap a higher price but also ensure sustainability of income by giving him the right ecosystem to work in, assured markets, sustainable practices, etc. Many of the solutions also reduce the vulnerability of farmers to downside risks and hence help to control volatility in incomes. On their part, farmers too are more driven to deliver quality because of the inbuilt incentives and penalties in the system.

Agritech startups often piggyback on the existing infrastructure created through Government schemes, converting the infrastructure facilities into smart facilities. This leads to optimal utilization of the infrastructure created through Government schemes. Agritech solutions work when the digital solutions by startups are optimally combined with physical presence of staff on the field. Thus, we find that 'phygital' interventions have a higher probability of success on ground.

Farmers and/or FPOs which agreed to be first movers in the innovative tech solution offered by the agritech startups had an extraordinary market orientation. They had already decoded the market cues and saw value in

the solutions being offered by the startups. The first participants in the innovative tech solution have been, more often than not, well-off farmers with an innate understanding of markets and agribusinesses. This perhaps is the reason why the early impact of innovations is seen to be so positive and encouraging.

The very presence of agritech solutions indicates the problems that plague the present marketing system. Failure of APMC mandis to offer even basic standards and formal grading methods, lack of cold stores, lack of information about prevailing prices are the issues that create a natural context for business-oriented startups to offer tech solutions that address these issues. This is not to say that everything is at its optimal best within the new structures. There are doubts that startups might become the new traders within the system, albeit with a touch of technology.

The insights lead to a few policy recommendations.

i. Setting up of a nodal agency to scale up agritech interventions

Currently, the FPOs and agritech startups are registered with State Departments of Agriculture and Department for Promotion of Industry and Internal Trade (DPIIT) respectively. The departments work as silos, rarely consulting with each other on the requirements of the FPOs and the solutions offered by agritech startups. A nodal agency at the Central Government is needed to integrate databases of state-level FPOs and incubators. It can offer single window solution for supporting adoption of agritech solutions by FPOs through convergence of schemes offered by the MoA&FW and NABARD. It may also identify commodity clusters and startups with capabilities to offer agritech solutions in those clusters. Corresponding state-level agencies can be set up to carry out rating of FPOs and to facilitate engagement of rated FPOs with startups within commodity clusters.

ii. Strengthening of the warehousing vertical

Mere presence of a warehousing solution with an eNWR layer is not enough to inspire confidence in the farming community. Access to warehousing entails storage costs. Farmers and FPOs storing their produce may be satisfied with the warehousing facility and with the credit access, but many of them have fears that the price of the produce would crash. Price risk can be mitigated through an insurance layered financial product such as the one hosted by Aryadhan in partnership with Rabo Bank. NABARD should launch a study of such layered fintech solutions primarily aimed at assessing feasibility and scalability of the same at the grassroots.

For bringing in a framework of decentralized warehousing solutions at farmgate, the State Governments need to allow asset monetization of the godowns available with PACS, marketing and other departments and facilitate integration of these facilities with agritech startups.

iii. Need for standards and certification to give scale to agritech startups

There is an urgent need for creation and implementation of standards and certifications within food value chains. This will bring in benefits for farmers, processors, value chain actors as well as consumers. Introduction of such certificates and standards will necessitate creation of testing laboratories, quality assaying infrastructure, safe packaging systems, safe storing systems, cold stores, cold transport solutions, traceability software, apps for in-farm and in-transit monitoring etc. This, in turn, will give the much-required scale to agritech startups which are operative within the F&V vertical.

iv. Strengthening of data culture around agritech startups and FPOs

There are multiple agencies such as NABARD, SFAC, NCDC and ATMA which maintain data on FPOs. Each

agency has its own template for maintaining details and the datasets are not mutually exclusive. This needs to be harmonized. DPIIT maintains registration level data on startups, without offering a view of 'live' startups. Dynamic datasets need to be maintained by relevant Government departments. This function could be integrated with the afore suggested nodal agency.

v. Strengthening of FPOs through promotion of an Amul framework

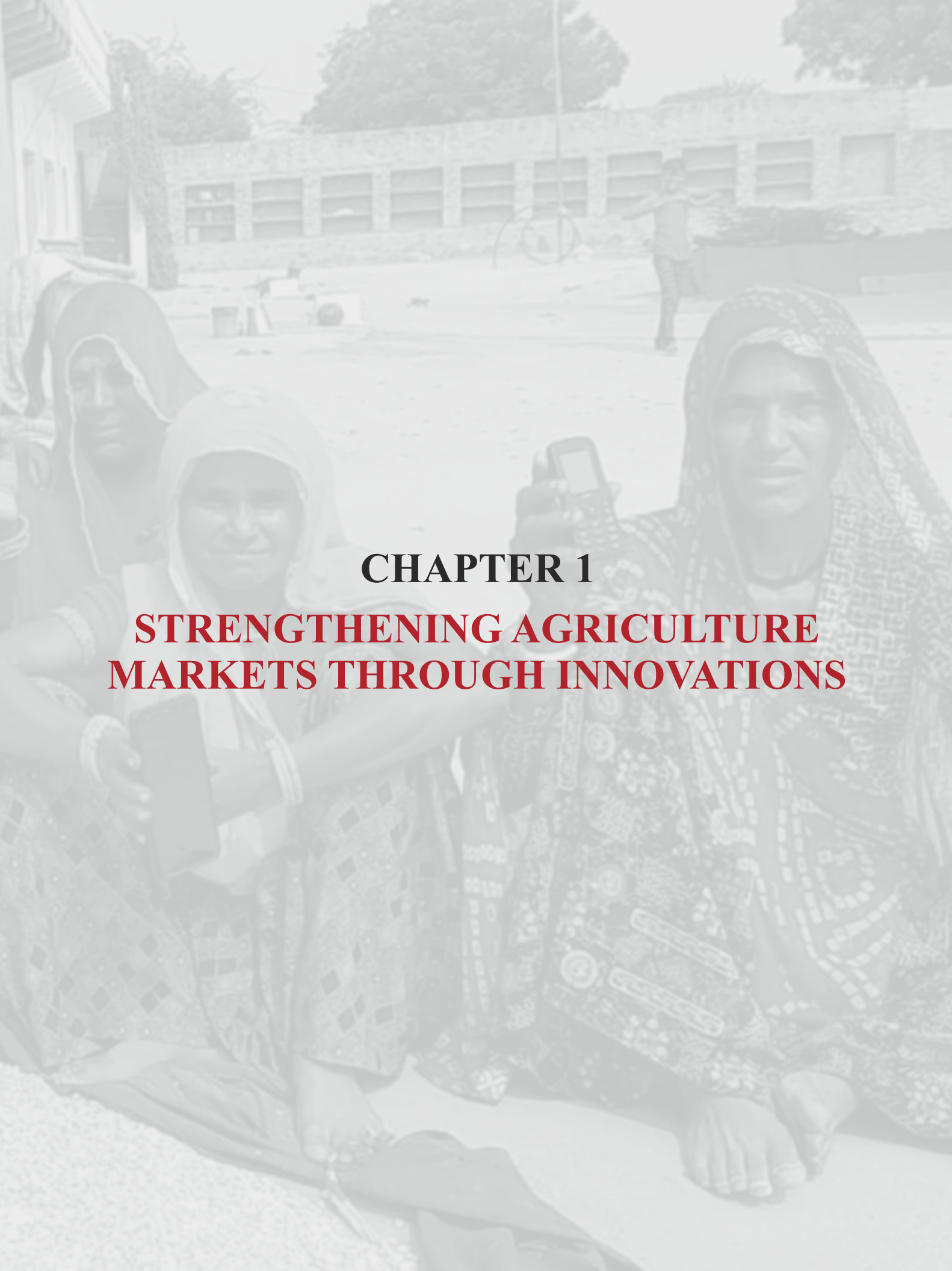
One of the insights derived from the case study of SFPCL is that a two-tiered FPC structure works viably as a business model. The umbrella FPC can handle the marketing, sales and branding of the produce. It communicates the market intel, standards and requirements to a number of purely production oriented FPCs that work within its fold. The smaller FPCs can then concentrate on production related matters.

vi. Banks to offer customized financial solutions to strengthen FPOs

Interactions with Directors of FPOs reveal that they find it cumbersome to work with banks and prefer to access credit through NBFCs. One reason for this is the aggressive presence of NBFCs at the grassroots. NBFCs may have more agility to customize financial products to suit the requirements of the FPOs. NABARD needs to review innovative fintech products and facilitate mainstreaming of the same through banking products.

vii. Policy interventions needed by NCDEX

The outreach program of the NCDEX should be enhanced to quell suspicions of farmers regarding futures. Those FPOs which have already opened an account with NCDEX but have not yet traded thereon, need to be given handholding to start their transactions on futures. While the FPOs are happy about the timely payments on NCDEX, the once-a-month payment cycle creates cash flow pressures for FPCs. The NCDEX could introduce a twice-a-month payment cycle for the FPOs. However, the delivery centres are often at a huge distance from production clusters. NCDEX may want to increase the network of accredited warehouses in the production centres.



CHAPTER 1

STRENGTHENING AGRICULTURE MARKETS THROUGH INNOVATIONS

CHAPTER 1

STRENGTHENING AGRICULTURE MARKETS THROUGH INNOVATIONS

1.1 Context of the Study

Agriculture markets in India are beset by a number of well-documented problems. These include fragmented and non-compressed value chains with multiplicity of intermediaries, non-transparent price discovery mechanisms and lack of scientific storage and logistics systems. But this space has witnessed a number of reforms in recent times. The reforms framework has encompassed the broad themes of allowing direct trading between farmers and buyers, encouraging contract farming, incentivizing private participation in building market infrastructure, warehousing, cold chains and other logistics, diluting the role of the government, and moving towards one nation one market. To allow farmers to benefit from such reforms, the need to mobilize them into groups was also deemed important, which brought into focus institutions like Farmer Producer Organizations (FPOs).

Within the revamped space of legal and institutional reforms and presence of FPOs which can potentially offer scale, innovations have tremendous scope in getting markets right. Innovations in the agricultural sector are not limited to big box ideas; increasingly, it is Startups that have been first movers in providing important plug-ins to address issues related to farming, post-harvest supply chain management, participation of farmers and linking them to markets.

Agri-tech startups have been offering disruptive technology solutions in the agri-marketing space. There are startups that have created online mandis, so that players can directly quote requirements and source from other players with the requisite quantity and quality. Many of such models offer features such as digital tech and rating systems that allow participants to rate each other and others to see the rating. Some startups have done digitization of entire FPOs so that produce can be traced back to individual farmers. Some startups link FPOs to traders, while others link them to kirana stores, Hotels/ Restaurants/ Cafes (HoReCa segment) or institutional buyers. Some startups offer intelligent vision, using which it is possible to segregate F&V produce or staples as per specifications of the buyer. Technology is being used to offer modular, energy-efficient storage systems at farmgate. Fintech products that allow warehousing to be layered with credit and insurance are getting created. Startups use combinations of sensors, IOT, blockchain and ML driven data systems to create end-to-end traceability within the food chains.

However, innovations need not only be technology driven. Institutional innovations too have the power to change the structure of agribusiness radically. Introduction of contract farming or futures markets are examples of such institutional innovations that have the potential to change the game completely. These have offered farmers gains in terms of transparent price discovery, known prices for standardized produce and risk hedging; these are features that are missing in the traditional markets that farmers have been working in.

It is interesting to note the complementarity between technology innovations and institutional innovations. Technology innovations that offer scientific storage, finance products, assaying solutions and traceability are natural plug-ins that support the institutional innovations such as contracts and futures markets to become efficient. Similarly, the presence of contracts and futures markets create requirements that spur technology innovations.

1.2 Objectives

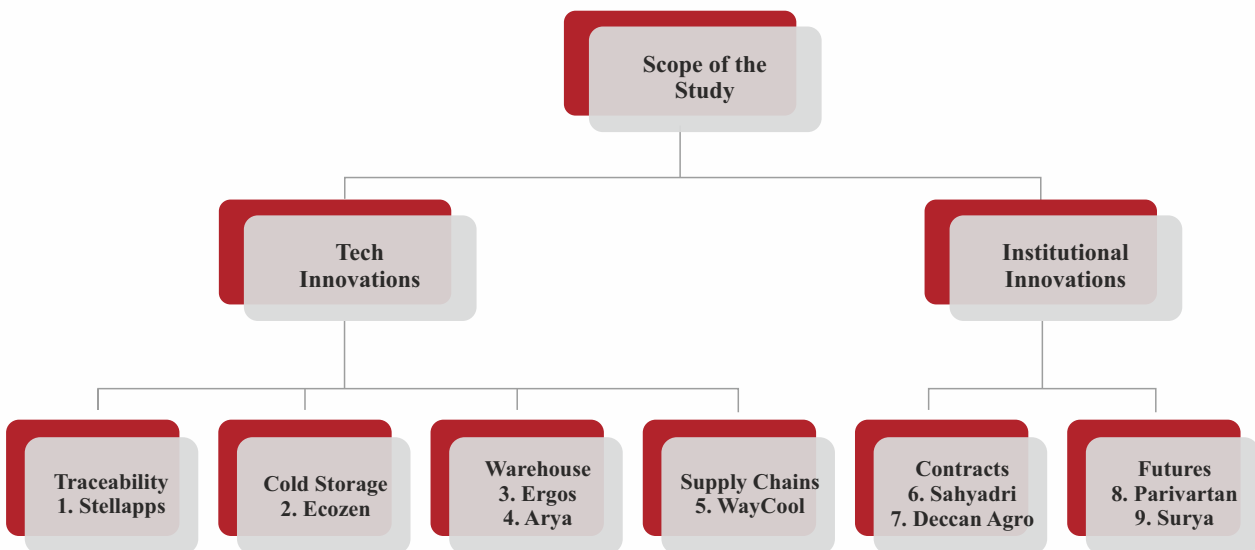
As a flurry of tech-led and institutional innovations changes the way in which agricultural markets have traditionally worked in India, the early impact of these at the grassroots, on the net incomes of the farmers and their ability to hedge risks needs to be documented. Only if the net impact is positive and substantial in the early days will the innovations have scalability in the future. The present study was designed with a view to answer the following specific questions:

- i) How has the agritech ecosystem evolved in India?
- ii) Are agritech solutions helping farmers earn remunerative prices for their produce and hedge risks better?
- iii) What has been the quantitative and qualitative impact of innovations on FPOs?
- iv) What policies are needed to strengthen the ecosystem and mitigate concerns?

1.3 Methodology

In order to study the impact of tech-led innovations, we chose the verticals of (1) traceability solutions; (2) cold storage solutions; (3) warehousing and fintech; and (4) end-to-end supply chains, all of which show high levels of engagement between agritech startups and FPOs. In each of these verticals, we chose one or more agritech startups and profiled their business model. See Figure 1.1.

Figure 1.1: Scope of the Study



Source: Authors' Compilation

We chose an FPO working with that startup; farmer members of the FPO were positioned as the group with tech solution. We also chose another comparison FPO in the same geography dealing in the same product and positioned its members as the group without tech solutions. The difference in the net price realization (price less variable costs) in the members of the two groups could be read as the impact of the innovation.

Access to innovative solutions comes at a price. Hence, we were expecting that the variable costs of the groups with tech solution to be higher than that without the solution. The research study was to check if the increment in returns was higher than the increment in costs. Hence, net price realization was a key variable in the framework for identifying impact. For some case studies however, it wasn't possible to attribute the change in net price realization purely to the innovation. In such cases, the impact was documented through a qualitative, rather than quantitative narrative.

For studying the impact of the institutional innovations, we chose FPOs that have been privy to contract farming solutions and to trading on futures markets. We chose appropriate comparison groups which would not be privy to the same institutional innovations. The difference in the net price realizations of the two groups was defined as the impact of the institutional innovation.

The methodology for the study involved deep-diving into a case study format through Key Informant Interviews (KIIs) with startup Founders and Executives, FPO Directors, farmer members, Government officials, experts, incubators, venture capitalists and social impact firms. Since the study was undertaken between September 2020 and January 2021, when the Covid-19 pandemic was raging through the country, no field visits could be undertaken¹. A total of 90 KIIs were conducted through online meetings and over telephone using specially designed questionnaires.

1.4 Limitations of the Study

- a. The study has been carried out through KIIs rather than through representative sample surveys. Hence, the estimates are to be treated as only indicative of early impact.
- b. Further, the farmers for the KIIs were not chosen randomly, but rather, through a system of referrals akin to snowball sampling process. To that extent, the findings of the study might be biased.
- c. Many of the innovative solutions studied have been newly introduced and hence are not time-tested. Hence, any impact observed in this study has not been tested for stability across time.

Even with the limitations, the findings of the present study bring out very important insights and learnings for the agritech-FPO ecosystem. Also, the research findings serve to highlight policies needed to deepen and broaden the impact and mitigate the challenges.

¹ The data, as was available in the study period, is quoted in the report. Agritech is a rapidly evolving segment. Updated data for FY22, if available, has been quoted in the footnotes.

1.5 Organization of the Study

The report is organized as follows. Chapter 1 gives the background, relevance, objectives, scope, methodology and limitations of the study. Chapter 2 presents a scoping study on the agritech startups and FPOs in India. Chapter 3 presents a case study on Stellapps Technologies Pvt. Ltd. in order to assess impact of traceability solutions on the dairy value chain. Chapter 4 focuses on tech-enabled cold storage and warehousing solutions. It analyses the impact of three separate agritech startups namely Ecozen, Ergos and Arya Collateral. Chapter 5 presents a case study on WayCool Foods, which is an example of an end-to-end supply chain. Chapter 6 looks into cases pertaining to contract farming. In this, we study the 'soft' contract between Sahyadri FPC Ltd. and Alandi Valley FPC. We also present the case study of a 'formal' contract between Deccan Agro (a small exports firm) and the Shree Mahaganapati FPC. Chapter 7 studies cases of two FPCs in Maharashtra (Parivartan FPC and Surya FPC) that have successfully traded soybean and turmeric respectively on NCDEX futures market. Chapter 8 synthesizes the learnings from the study. It also gives a set of policy recommendations to strengthen innovations within agriculture markets of India and suggests the way ahead.

CHAPTER 2

AGRITECH AND FPOs: A SCOPING STUDY

A scoping exercise of agritech startups and FPOs in India was undertaken while commencing the study. The objective of the scoping exercise is to examine the existing data and trends and identify stylized facts of operations of agritech startups and FPOs.

2.1 Agritech Startups: Data Trends and Stylized Facts

The Startup India initiative was launched by the Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industries on 16th January 2016 to “catalyse the startup culture and build a strong and inclusive ecosystem for innovation and entrepreneurship in India”. According to gazette notification released by DPIIT in 2019, an entity is a startup upto 10 years from its date of incorporation. The other requirement for an entity to be a startup is that its turnover should not exceed Rs.1000 million in any of the financial years since its incorporation. As of 21st September 2019, 37423 startups were recognized by the DPIIT, of which 1,739 startups were registered as agritech startups².

According to NASSCOM (2019), there were 450 operational agritech startups in India in 2019³. According to Kalaari (2022), there are 1500 active agritech startups in FY2022. Some of the major verticals in which agritech presence is seen are as follows:

- i. Farm and data analytics (integrated platforms, remote sensing, software platforms, farm mapping)
- ii. Infrastructure (Growing systems and components, aquaponics)
- iii. Information platforms (Information dissemination)
- iv. Finance (Payments, Revenue Sharing, Lending)
- v. Supply chain (e-distribution, marketplace, listing platforms)

Incubation-Acceleration

Nearly 63 per cent of the agritech startups work in the supply chain segment. A majority of startups have been registered in Karnataka and Maharashtra. These 2 states host incubators, accelerators, venture capitalists as well as a pool of skilled, tech-oriented manpower. India has the third largest incubator-accelerator program in the world (NASSCOM 2020). There are 441 incubators (for all sectors including agritech) in India, of which 85 also host acceleration services. Whereas incubators are mostly sector-agnostic, accelerators tend to be theme-specific or sector-specific. Incubators-accelerators are hosted by private sector, public sector, academic institutions as well as corporate bodies. The Government of India runs several programs through incubators to support startups through grants or through equity. The incubators partner with agencies or funds that can support sector specific innovations. A new trend that is visible in the incubator-accelerator domain is that the

² However, the major issue with this database is that it does not give a status update on whether the startup is live, dormant or has ceased operations. As of July 2023, 99380 startups are registered with DPIIT, of which 2603 are registered as agritech startups

³ According to Tracxn (2022), there are 1500 agritech startups in FY22. Of the top 10 funded agritech startups, 6 are operational in end-to-end supply chains.

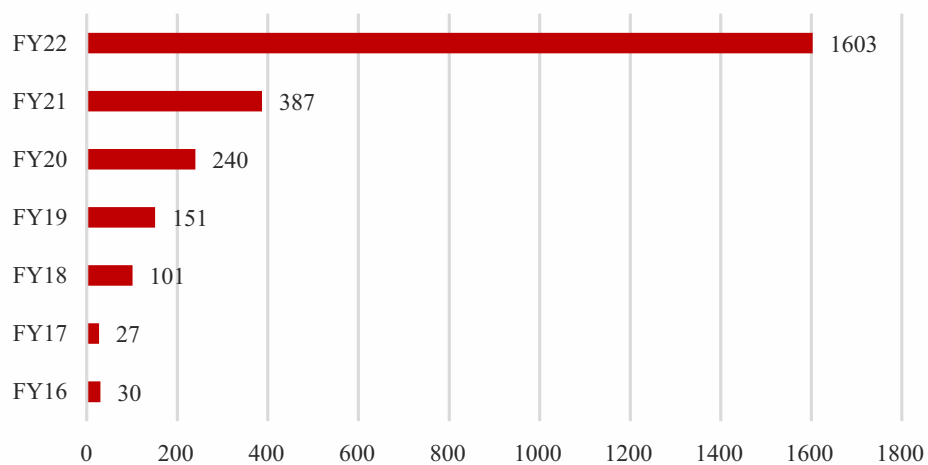
VCs themselves support incubation centres. This is a win-win situation. On one hand, the startups engaging with incubators get a professional, commercial guidance throughout the incubation period. The incubators have a Go-To-Market (GTM) orientation due to involvement of professionally run VCs. The VCs get a pipeline of new ventures with a potential for growth.

Social Impact Funds and Vcs

Increasingly, we also find that incubation-acceleration avenues are opening up for high-risk, low-return startup ideas which have a strong social sector focus. 'Social impact funds' offer equity capital to startups that engage with marginal or small holder farmers. These funds also partner with companies with a strong CSR focus and/or with philanthropic organizations.

There has been an exponential growth in VC funding to agritech startups after 2014. According to FICCI (2019), agritech startups received funding of USD 545 million since 2014. Of this, USD 330 million was received in 2019. The Covid-19 pandemic opened new possibilities within the agritech segment and investors responded actively. In FY2022, the segment received a total funding of USD 1604 million, which is 4 times higher than the investment received in FY2021 (Kalaari 2022). See **Figure 2.1**.

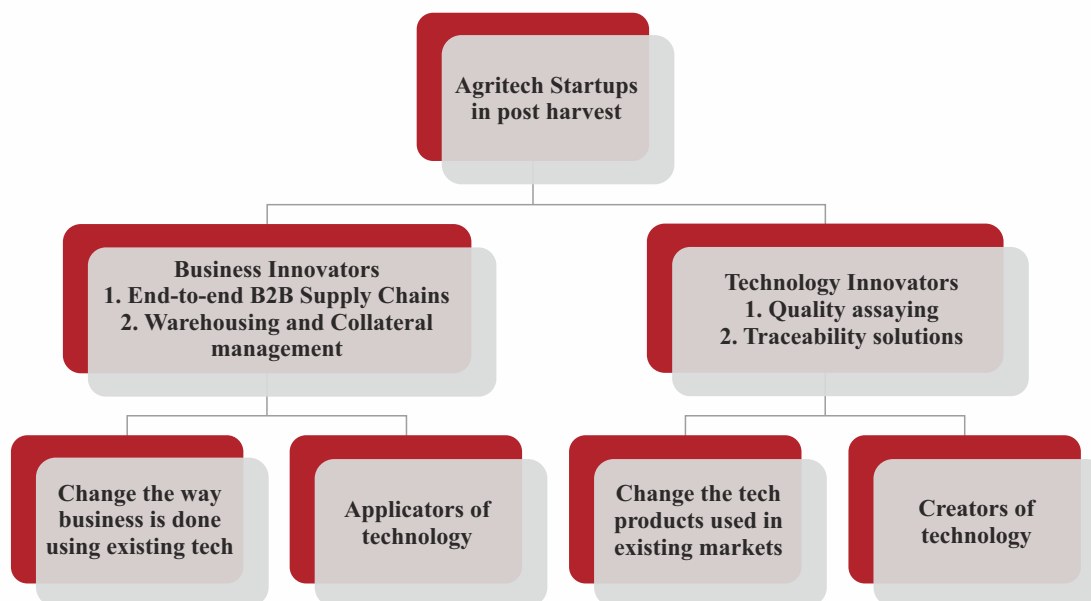
Figure 2.1: VC funding to Agritech Startups (FY2016-FY2022)



Source Kalaari, 2022

There are two types of business models within the post-harvest agritech startups – i) business innovators, who have changed the way the market operates using existing technology; and ii) tech innovators, who are coming up with new tech solutions in existing market conditions. The former apply technology, the latter change it (**Figure 2.2**).

Figure 2.2: Agritech startups within Post Harvest Operations



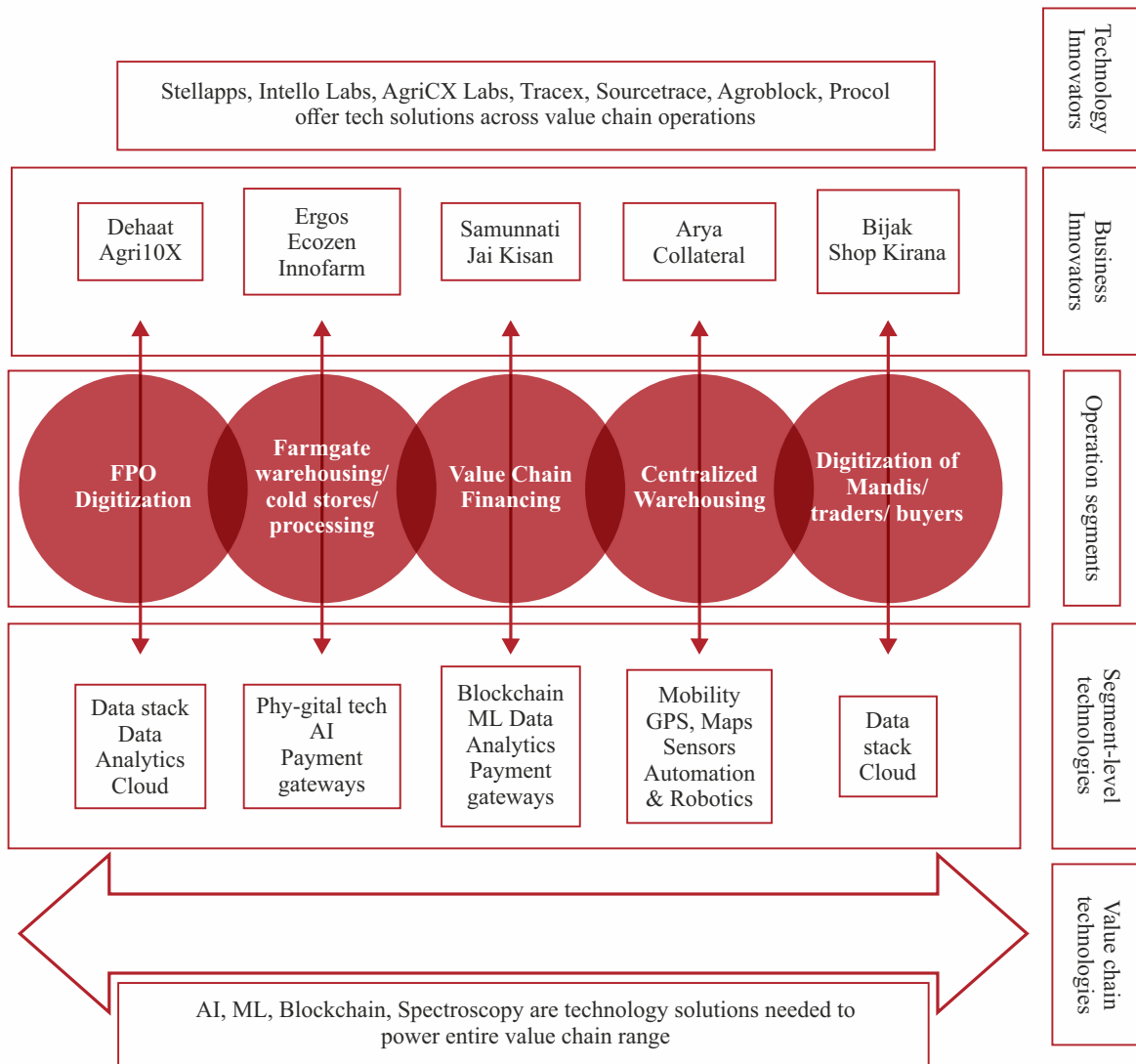
Source: Authors' Compilation

The startups in the end-to-end B2B supply chain space or in warehousing solutions are mostly business innovators. While they heavily use technology solutions such as AI, IOT and blockchain, their innovation lies in the way they apply these tech solutions to plug the gaps in the market. On the other hand, startups that offer services such as quality assaying, sorting and grading, cold storage, packaging or value chain solutions are technology innovators. These startups create tech products based on blockchain, IOT, AI, ML, sensors, robotics or automation.

The scope of operations handled by supply chain startups is huge. They handle operations such as FPO digitization, local storage, grading and sorting, transport, value chain financing, centralized storages, NWRs, quality assurance systems, advisories, mandi digitizations, and market linkages. However, the entry point of the startups into the value chain depends on their orientation and on their value proposition. For example, Dehaat entered the supply chain in order to get aggregated, high quality input supplies to farmers. They started with digitizing FPO records and then secured input supplies for the FPOs. By now, they have also created a marketplace for the goods produced by the farmers. Ninjacart was always oriented to solving the problem of reducing wastage in the fresh food chains by offering efficient intermediation solutions. Thus, it has always focussed on linking players on market platforms and on logistics. Samunnati entered with value chain finance products, and then quickly upscaled to AMLA (Aggregation, Market Linkage and Advisory). Arya Collateral entered the value chain at the point of creating warehousing, accessorized with quality assurance and logistics solutions. They finance WRs through tie-ups with FIs and through their own NBFC Aryadhan. They now offer market linkage services as well.

Thus, the entry point into the value chain for each startup is different. However, once they enter and consolidate their positions, they spread out horizontally to other operations within the supply chain. Though the Startups might host unique tech solutions at the level of entry, they start to host similar business models and similar ranges of technologies once they start offering end-to-end solutions. See infographic given below (Figure 2.3).

Figure 2.3: Entry points of Startups, Segment and Value Chain Technologies used within Supply Chains



Source: Authors' compilation

Agritech is like Wall Street in that there is a lot of churning within limited space; the players move about flexibly within the contours of the same ecosystem. There are instances wherein ex-employees of the FIs or retail chains become innovators and over a period of time offer incubation services. VCs also have their own incubators and co-fund investments together with other VCs. Finally, startups have also started engaging with each other, creating a dynamic inter-startup space.

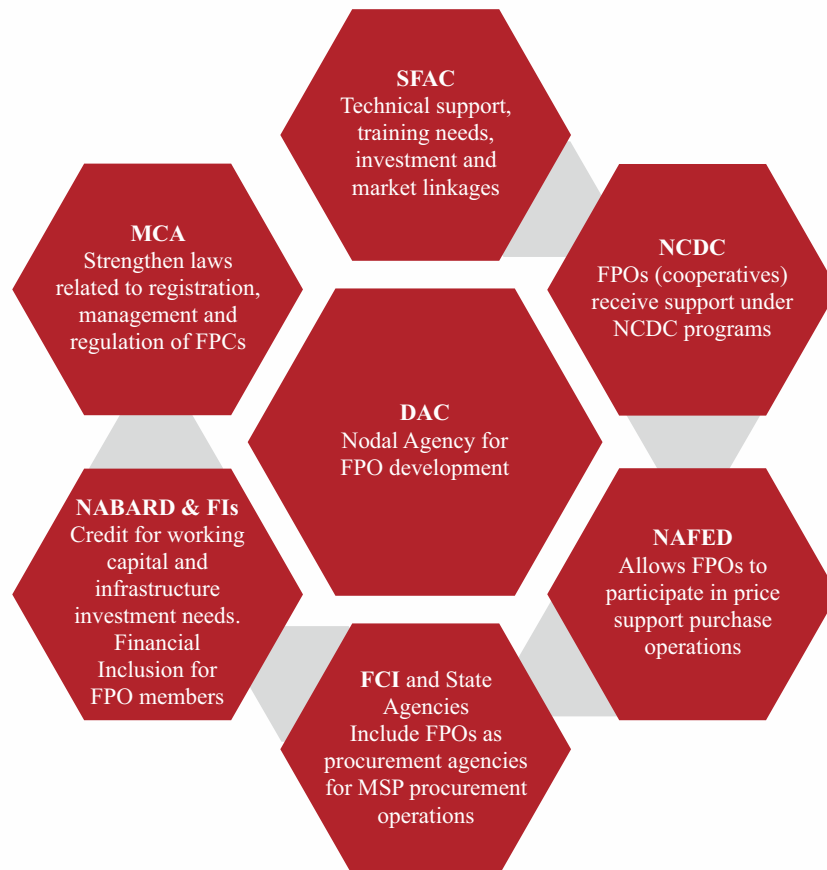
2.2 FPOs: Data Trends and Stylized Facts

In 2011-12, the Department of Agriculture and Cooperation (DAC), Ministry of Agriculture, Government of India (GOI) launched a pilot program for promoting Farmer Producer Organizations (FPOs) throughout the country with the assistance of State Governments under the Rashtriya Krishi Vikas Yojana (RKVY). This program was implemented by the Small Farmers Agribusiness Consortium (SFAC). Later, the National Policy for Promotion of Farmer Producer Organizations by DAC (2013) identified Farmer Producer Companies (FPCs) registered under special provisions of the Companies Act, 1956, as the most “appropriate institutional form around which to mobilize farmers and build their capacity to collectively leverage their production and marketing strength”.

There are 7374 registered Farmer Producer Companies (FPCs) in India with an estimated 4.3 million farmer members (Govil, Neti and Rao, 2020). FPCs have an average membership of 586 farmer members. Even with such a huge membership base, 49 per cent of the FPOs have paid-up capital of less than Rs. 1 lakh. Geographical distribution of the FPCs shows a skew. Half of the FPCs have been registered in 4 States only – these are Maharashtra, UP, TN, Telangana. Further, 25 per cent of the FPCs are registered in just 20 districts; Pune district in Maharashtra with 185 FPCs leads in terms of number of FPOs registered at district level.

The DAC is the nodal agency for development and growth of FPOs. It works with other Central and State level agencies such as SFAC, NCDC, NAFED, FCI, NABARD and MCA to advance its objective. See **Figure 2.4**.

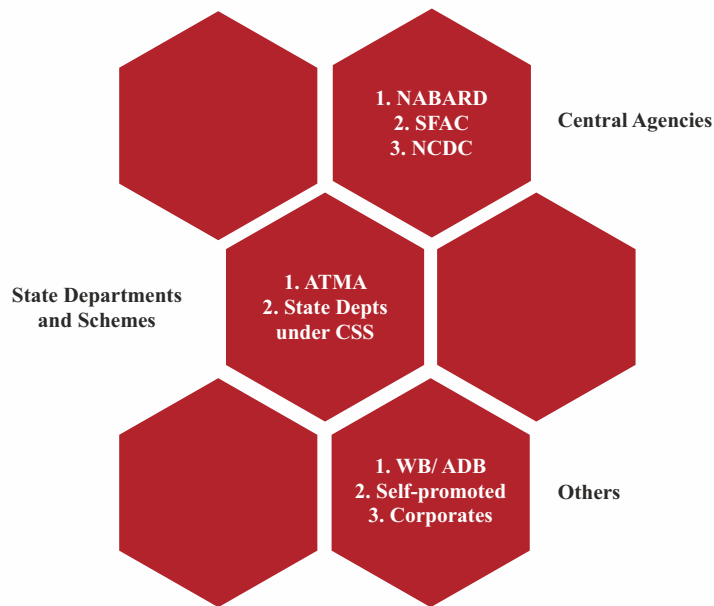
Figure 2.4: Role of DAC and Central Agencies in developing FPOs



Source: Author's Compilation

Apart from the DAC, the State Governments also support setting up and promotion of FPOs through Centrally Sponsored Schemes (CSS) and State financed programs. From its own resources, NABARD had set up a fund called the Producer Organization Development Fund (PODF) in 2011. Under the PODF, loan-linked grant was available to any Producers' Organization (PO) for promotional activities such as capacity building and market interventions. FPOs were eligible to receive the grants under PODF. In 2014, the GOI set up another fund called the Producer Organization Development and Upliftment Corpus (PRODUCE) fund in NABARD. This fund, with a corpus of Rs.2000 million, was meant for setting up 2000 new FPOs and helping them with initial financing needs. In the Union Budget of 2019-20, the GOI announced a Central Sector scheme under which 10000 FPOs would be set up. To ensure credit support for the scheme, two separate credit guarantee funds with corpus of Rs.10 billion and Rs.5 billion have been created in NABARD and NCDC respectively. Additionally, the corpus fund with SFAC has been augmented as well. Thus, FPOs have been set up and promoted in India by several agencies (**Figure 2.5**). 5029 FPOs are registered under NABARD-PRODUCE. Of these, 2917 FPOs are market-linked. (NABARD)

Figure 2.5: Different Agencies which promote FPOs in India



Source: Author's Compilation

What activities are undertaken by the FPOs? In India, it has been observed that most FPOs offer sales of inputs as a service to their members. Market-facing FPOs that undertake some processing of the produce or marketing of the produce are typically lower in number and are mostly seen in Andhra Pradesh, Odisha, Madhya Pradesh, Karnataka and Maharashtra (NABARD-PRODUCE database)

Finally, we identify those States/ regions which have a good presence of the agritech startup ecosystem together with market-facing FPOs (**Figure 2.6**).

Figure 2.6: States with presence of agritech ecosystem and market-facing FPOs



Source: Authors' compilation, NABARD

Label markings - Green Point: Presence of Market-facing FPOs, Blue Point: Presence of Agritech Startups with funding > USD 1 million, Red Point: Presence of Major VCs, Purple Point: Presence of Major Incubators

Andhra Pradesh, Telangana, Maharashtra and NCR emerge as the 'hot-spots' within the agritech sector in India.

CHAPTER 3

TECH SOLUTIONS FOR TRACEABILITY IN VALUE CHAINS

Over a period of time, traceability in value chains has become a central focal point of change. This has been driven by demand from increasingly health-conscious consumers. Traceability empowers all stakeholders in the value chain and creates a win-win situation from an economic, logistics, health and nutrition perspective.

Dairy is an interesting sector from the traceability perspective. Given the highly perishable nature of milk, the dairy industry had to embrace quality-assurance technology fairly early in its development. Together with the development of the co-operative structure as a leading business model in Indian dairy, the quality technology had to embrace all nodes (automated milk analyzers, bulk milk coolers, refrigerated trucks and other products) through which the milk moved.

Over a period of time, slowly but surely, the focus within the milk value chain has been shifting from quality to traceability. To put it simply, traceability solutions connect the quality tech nodes and make them smart. And it is here that startups, armed with new technologies such as blockchains, AI and ML, have found their forte. In this chapter, we study the journey of Stellapps, an agritech startup that has created traceability and quality solutions for the dairy industry in India and beyond.

Case Study 1: Stellapps Technologies Pvt. Ltd

Box 3.1: Factsheet on Stellapps

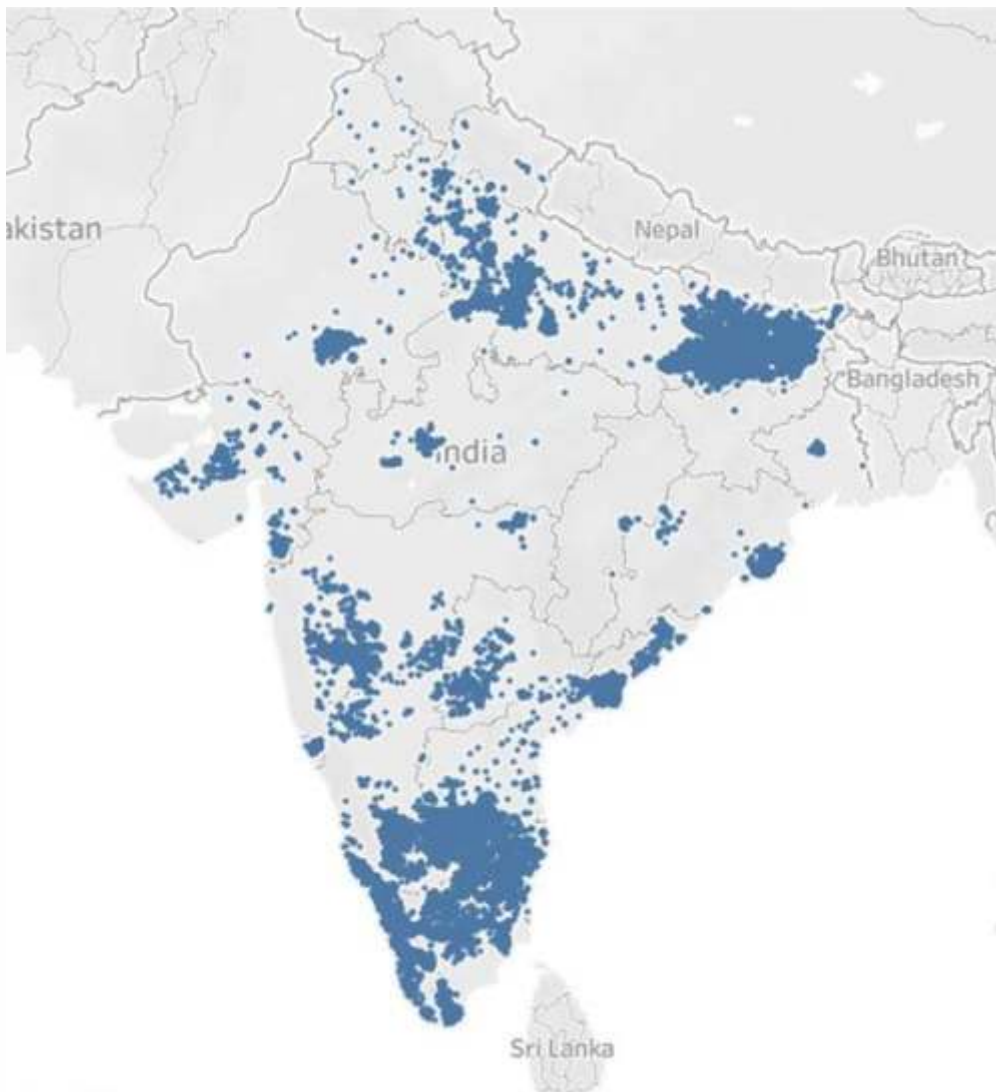
- **Name of Company:** Stellapps Technologies Pvt. Ltd.
- **Website:** www.stellapps.com
- **Year of Establishment:** 2011
- **Headquarters:** Bangalore, India
- **Working Geography:** Pan India
- **Products/ Services:** mooOn, smartAMCU, smartCC, ConTrak, mooOpt, mooFlowErp and mooPay
- **Turnover (FY20):** Rs. 370 million
- **Employee Strength:** 665 (as of March 2021)
- **Funding details:** Stellapps has raised a total of USD 18.8 million
- **Number of farmers connected:** 2 million Farmers. 1 million cattle registered on the platform.
- **USP:** End-to-end digitalization of the dairy supply chain thereby enhancing traceability, quality and higher yield per animal across the entire value chain.

Source: Stellapps, all figures as of April 2021

Stellapps Technologies Pvt. Ltd. commenced its operations in 2011 in Bangalore. It was founded by an experienced group of industry experts, including alumni from IIT-Madras and IIT-Kharagpur, each with over 18 years of corporate experience. The founders were passionate about applying Internet of Things (IoT) solutions in an innovative way for solving issues in rural India.

Over a period of time, the company created a full stack solution for the dairy industry, ensuring digitalization of the entire dairy value chain. Today, the company boasts of a presence in 28 Indian States (See **Figure 3.1**). It has covered 20 lakh farmers through 260 dairies in India.

Figure 3.1: Geographical presence of Stellapps in India



Source: Stellapps

Stellapps has an extensive portfolio of dairy clients including Amul, Haldiram, Prabhat, Osam etc. In the coming years, Stellapps plans to expand its business to other emerging markets such as Africa, Southeast Asia, Latin-America and other SAARC Nations. It has entered partnerships with large original equipment

manufacturers (OEMs) that will enable it to enter the European and US markets as well. Furthermore, it is also considering setting up channel partners and dealer networks to sell retail-oriented products like animal wearables. It is in the process of developing products on the distribution side as well.

3.1 Product Offerings by Stellapps

Solutions offered by Stellapps “digitize” and “digitalize” the dairy value chain. Information is digitized and processes are digitalized.

Following are the major product offerings of Stellapps:

1. MooOn

The MooOn device is a pedometer for cattle, which detects temperature and other disorders based on activities and resting behaviour of cattle. The MooOn app is a herd management application which gives recommendations to optimize herd performance.

2. SmartAMCU

Stellapps SmartAMCU is an Automatic Milk Collection Unit controlled by an android IoT device. It enables IoT-based, real-time acquisition and dissemination of milk procurement data at the collection centres. This product really gave scale to the operations of Stellapps. Supported by the National Dairy Development Board (NDDB), automated milk analysers were installed in many cooperative societies between 2011 and 2018 (NDDB 2015). The Stellapps intervention converts the analysers into smart analysers. It enables dissemination of quality and quantity details to all stake holders; farmers get the information through SMS. SmartAMCU is the flagship product of the startup and contributes to 80 per cent of the turnover of Stellapps.

3. SmartCC

Stellapps SmartCC is a cloud-based chilling centre management solution for milk procurement, controlled by an IoT device. It is integrated with the SmartAMCU as well as with the mooFlow ERP system.

4. ConTrak

ConTrak tracks the data on quantity and quality parameters of milk collected at the collection centers and later at the Bulk Milk Coolers (BMCs) in real time. When the milk tanker lifts milk from BMCs, this data is integrated with the tanker id. This helps to maintain quality and quantity checks at an aggregated level.

5. MooPay

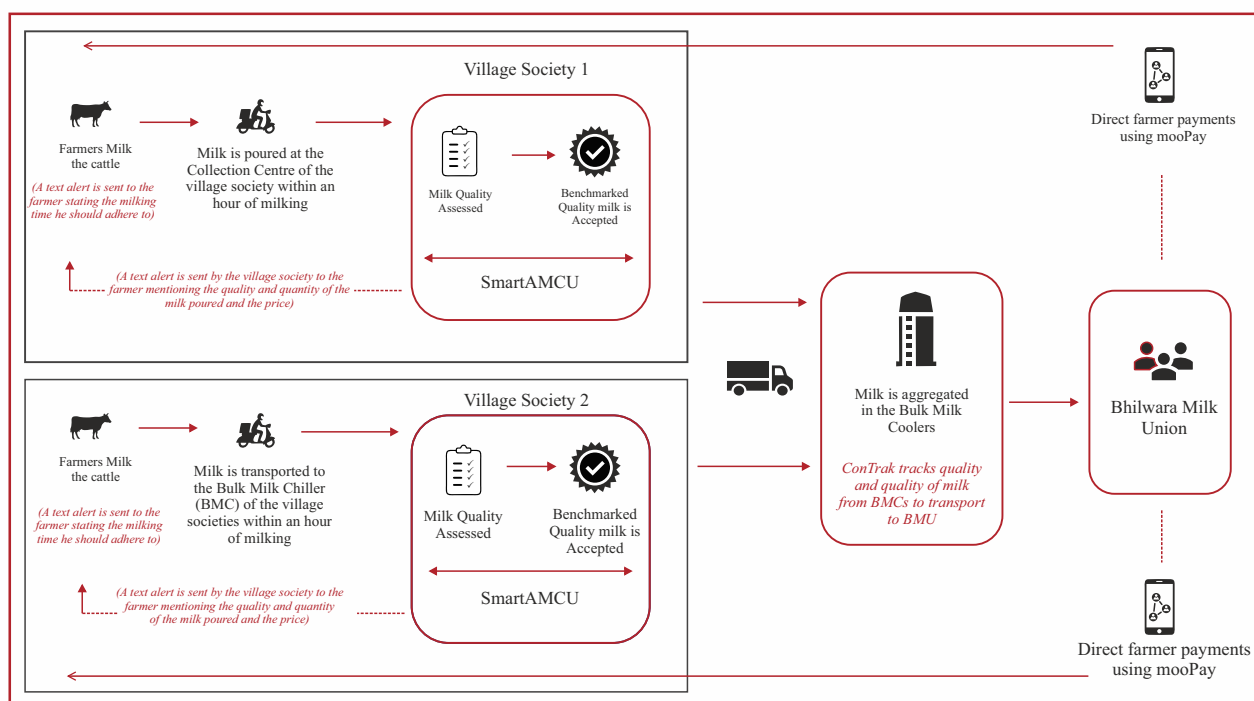
MooPay ensures direct payment from milk unions to farmers. Though it is newly deployed solution, it has large potential in terms of creating credit history for farmers, and especially for landless dairy owners.

3.2 Meet the Beneficiary: Bachkheda Balaji Village Dairy Society of the Bhilwara Milk Union (BMU)⁴

The Stellapps solution (except herd management) was adopted by the Bhilwara Milk Union (BMU), which is a district-level milk union of 1110 village societies in Rajasthan. BMU has deployed the Stellapps solution for 830 out of 930 active village societies. See **Figure 3.2**.

⁴ BMU, established in 1972, engaged with 47550 farmers in FY20 and had a recorded average daily milk procurement of 0.28 million litres.

Figure 3.2: Stellapps' Solution deployment across Milk Value Chain in the BMU



Source: Authors' Compilation

Bachkheda Village Society (**Box 3.2**) is one of the 900 village societies attached with the BMU. It is one of the bigger societies within the BMU and has its own BMC. The BMU makes payments for the milk received to the society. The society keeps records and makes cash payments to farmers after every 15 days.

Box 3.2: Factsheet on Bachkheda Balaji Village Dairy Society

- **Name:** Bachkheda Balaji Village Dairy Society
- **Year of Incorporation:** 2011
- **Located in:** Bhilwara, Rajasthan
- **Turnover (FY20):** Rs.18 million
- **Number of staff:** 2
- **No. of Member Farmers:** 260
- **Women members:** 100 per cent
- **Facilities:** Own BMC with capacity 2000 liters per day
- **Average Land Holding:** 5 Acre
- **Crops:** Corn, Jowar, Urad, Wheat, Mustard and Chana
- **Milk capacity:** 2000 litre per day
- **Current Daily Milk Sold:** Approximately 1650 litres per day

Source: KII, all figures as of April 2021

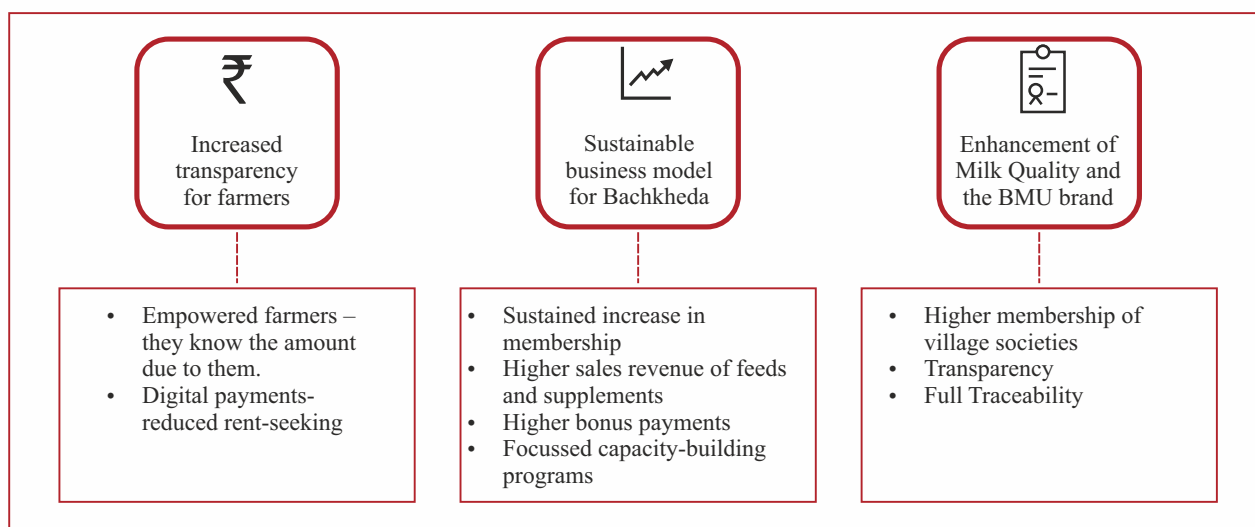
The society receives a commission of 35 paise per litre of milk that it sells to the BMU. The commission from collecting and selling milk to the BMU is one of the sources of own income for the society. Apart from that, the village society is an outlet for BMU for selling cattle feed, mineral mixture etc. to the member farmers. It also sells BMU products such as pouched milk, ghee, etc. Sales of cattle feed, pouched milk and ghee contribute 50 per cent, 30 per cent and 20 per cent to the sales of the society.

3.3 Impact of Stellapps on the Bachkheda Village Society

In this case study, we document the impact of the Stellapps solution at the level of the village society. Since a comparison village society without the solution was not easily available within the BMU, we attempt to delineate the impact of the traceability solution through the lens of before-after analysis.

Stellapps solutions were deployed at Bachkheda Society from November 2019⁵. The transparency and dynamic prices linked to quality introduced through the solution have helped to create trust in the minds of farmers. The Secretary of the Village Society maintains that this has helped the Society to increase membership from 160 farmers (before solution) to 260 farmers (after implementing solution). Quality of milk has bettered and the society has started receives bonuses more regularly than before for consistently pouring high-quality milk. Farmers have become quality conscious and have been buying necessary feed supplements, driving higher sales revenue for the society after implementing the solution. The solution has also helped the society to identify such farmers wherein the milk quality does not meet prescribed norms, thereby making the capacity building exercise more focussed. MooPay has led to a huge time-saving for the staff. Thus, Stellapps solutions have created a sustainable model with higher memberships, sales revenues and bonuses for the Bachkheda Society.⁶ See **Figure 3.3**.

Figure 3.3: Impact of Stellapps Solutions on Farmers, Bachkheda Society and BMU



Source: Authors' compilation

⁵ SmartAMCU commenced in November 2019, ConTrak was deployed from February 2020. MooPay was introduced in October 2020.

⁶ Between FY18 and FY19, factors other than implementation of the Stellapps solution may have contributed to higher memberships, bonuses and sales revenues at the Village Society. We hence do not present the quantitative impact of the solution in this case study.

The case study also serves to highlight that agritech startups often offer products/ services which form an additional layer over the existing value chain created through Government support. With a view to bring in automation and some level of transparency within the milk value chain, a major drive for installation of automated milk analysers and BMCs was undertaken under the National Dairy Plan in 18 states of India between 2011-18(NDDDB 2015). Such a large-scale automation of the dairy industry and installation of automated milk analysers and bulk milk coolers led to 'digitization' of the industry. Stellapps simply made the system smart by allowing the automated nodes to communicate with each other. It has thus 'digitalized' the value chain.

Yet another example is that of the Pradhan Mantri Jan Dhan Yojana (PMJDY). Many women farmers covered under the PMJDY now hold bank accounts. This made it possible for Stellapps to launch MooPay, which is a platform to pay farmers digitally, thereby increasing the frequency of cash flow at even remote locations.

Whilst the case study documents the impact at the level of the village society, it is heartening to note impacts at the level of the women farmers as well. The system has enabled women to know, at a click, the total payment that is due to them. Digital modes of payment have made sure that rent-seeking at the society level is curtailed and that the women farmers get their dues. See **Figure 3.4**.

Figure 3.4: Women farmers at Bachkheda receive payments on their mobile phones



Source: Stellapps

3.4 Challenges in deploying the Solution

Digitalization of systems is never an easy decision. Deployment of solutions that ensure transparency is an anathema for players who benefit by the presence of non-transparent transactions. There was a cultural resistance to deployment of the solutions within a few of the village societies, truck operators, society staff etc.

Rejection of milk by the automated system of the SmartAMCU created problems for the farmers who were not accustomed to the quality parameters. They showed resistance to the milk rejected by the automated systems. However, this was handled through training camps at the villages, wherein farmers were sensitized to the quality parameters that could lead to acceptance and rejection of milk by the system. Over a period of time, the farmers started understanding the parameters. The solution led to a definite increment in the quality of milk procured at the village societies.

Direct Farmer Payment (DFP) was a contentious issue right from the beginning. It was feared that the solution would erode the importance of the all-powerful village dairy societies. There was higher resistance within those players where loopholes in payments had hitherto gone unnoticed. Lastly, adoption of the new system entailed centralized payments made by the Union. Accountants at the BMU had to be trained multiple times to understand and carry out direct payments through the system.

CHAPTER 4

TECH-ENABLED COLD STORAGE, WAREHOUSING AND FINTECH SOLUTIONS

As production sufficiency is achieved in India, debates in Indian agriculture policy are increasingly moving into spheres of post-harvest mechanisms. One of the major gaps in the current post-harvest space is the lack of cold stores, godowns and warehousing at decentralized levels.

Agritech startups have emerged to be key players in the agri-warehousing domain, their USP being addressing the gaps in the system. Understanding the capital-intensive nature of the above-mentioned investments, the startups have come up with business models which make use of the existing warehouses in a much more efficacious manner. Solar-powered portable cold storages, containerized storage systems are being experimented with. Warehousing solution providers have been tying up interesting finance models and market linkages to enhance the value of their offerings. All of these services together will lead to a radical shift in the development trajectory of the entire agriculture sector if implemented in a sustained and effective manner.

Tech-enabled Cold Storage

Case Study 2: Ecozen Solutions Pvt. Ltd.

Lack of cold infrastructure is one of the biggest impediments for the development of the F&V value chain across states. Agritech startups have developed innovative cold storage solutions at farmgate to address the issue. Ecozen, a Pune-based startup, has developed small solar-powered cold rooms that can be purchased/leased by FPOs.

Box 4.1: Factsheet on Ecozen Technologies Pvt. Ltd.

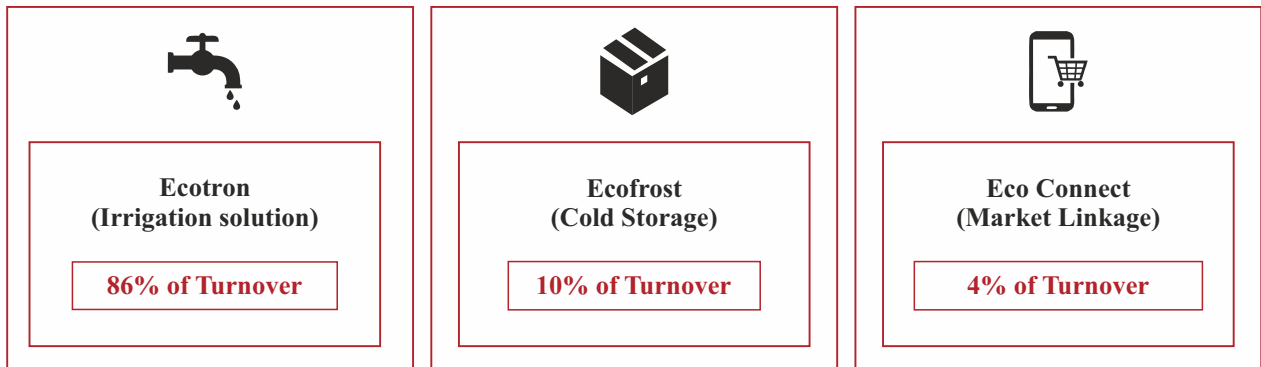
- **Name of Company:** Ecozen Solutions Pvt. Ltd.
- **Website:** www.ecozensolutions.com
- **Year of Establishment:** 2010
- **Headquarters:** Pune, Maharashtra
- **Working Geography:** Pan India with Exports in Africa, S E Asia
- **Products/ Services:** Ecotron, Ecofrost, Eco connect, Ecofrost Link
- **Turnover (FY20):** Rs.740 million
- **Employee Strength:** 150
- **Funding details:** The company has raised a total of USD 7 Million
- **Number of farmers connected:** 45000
- **USP:** Enhancing shelf-life and marketability of F&V through modular, solar-driven cold storage at farmgate

Source: Ecozen, all figures as of April 2021

4.1 Products Offered by Ecozen

Ecozen started its journey with a solar-based irrigation solution called Ecotron. Ecozen later developed Ecofrost, sustainable, solar-powered, portable decentralized cold room that could offer storage at farm-gate itself. Over a period of time, Ecozen has also started venturing into linking farmers with markets through their platform EcoConnect. See **Figure 4.1**.

Figure 4.1: Major Product Offerings by Ecozen



Source: Authors' compilation

In this case study, we study the impact of Ecofrost, the solar-powered cold room that offers cold-storage facilities at farmgate. See **Figure 4.2**. The portable cold room not only uses solar energy to power the system but also provides a power backup of about 30 hours for the non-sunny hours. The temperature, humidity and other variables required for optimal storage of different fruits and vegetables can be set by the farmers from a mobile app which connects to the system.

Figure 4.2: Ecofrost, the Cold Room at Farmgate from Ecozen



Source: Ecozen

In 2021, Ecofrost is being used by 35,000 farmers across 6 countries. The founders soon realized that it was unwieldy and expensive to export the entire cold room to other countries. Hence, the startup went for exporting the Ecofrost Link, which is the refrigeration system of Ecofrost. The Link is a plug-and-play model which is retrofitted on existing insulated rooms at the destination farms of the importing countries such as Kenya and Myanmar.

The major products for which the solution is being used are perishables such as high value F&V (litchees, cherries, okra etc.) as well as flowers (roses, tuberose, jasmynes etc.). The 5 MT cold stores are leased in or bought by FPOs; the startup also engages in training the FPOs to operate the facility. Availability of portable cold rooms at farmgate has led to a change in the sales strategies of farmers who produce perishables. The cold room has given them the option of not selling perishables when the prices are low. Thus, this innovation has not only increased the prices accruing to the farmers, but has had a significant impact in terms of reducing downside risks to income.

4.2 Meet the Beneficiary: Pragati FPO

Box 4.2: Factsheet on Pragati FPO

- **Year of Incorporation:** 2016
- **Located in:** Veguru Village, Nellore district, Andhra Pradesh
- **No. of Member Farmers:** 1028 (200 are flower farmers)
- **Major Crops:** Flowers (tuberose, jasmine, marigold), Fruits and Vegetables (bottle gourd – pandal cultivated), banana (local variety – Amrutpani)
- **Average Landholding per farmer:** 1 acre for flowers, 2 acres for veg, 4 acres for fruits
- **Total turnover of FPO (FY20):** Rs. 55 lakhs
- **Contribution of flowers to turnover of FPO (FY20):** Rs. 32 lakhs

Source: KII; all figures as of April 2021

We profile the story of the Pragati FPO, which sells tuberose in the Nellore market and is a user of the Ecozen cold store. The FPO has availed of subsidies from the State Horticulture Department for purchase of cold store as well as a vehicle. Every morning, farmers bring the freshly picked flowers and other produce to the collection point, where it is loaded into the vehicle and taken to the Nellore market. See **Figure 4.3**. If the rates are good, the flowers are sold off in the market immediately. However, if the rates are too low in the market, the FPO vehicle simply brings the flowers back to be stored in the cold store. The proximity to the market (10 kms from FPO) has proven to be a huge advantage for the FPO. Of the sales proceeds collected every day, the FPO retains a 5 per cent share before disbursing the rest to the members. This share is a major source of revenue for the FPO and serves to service costs such as those of maintenance of the cold storage, petrol expenses for the vehicle, etc.

Figure 4.3: Farmers at Pragati loading flowers for sale at market, Flowers stored at Cold Store under low price scenario



Source: Pragati FPO

4.3 Impact of Ecozen on Farmer-Members of Pragati FPO

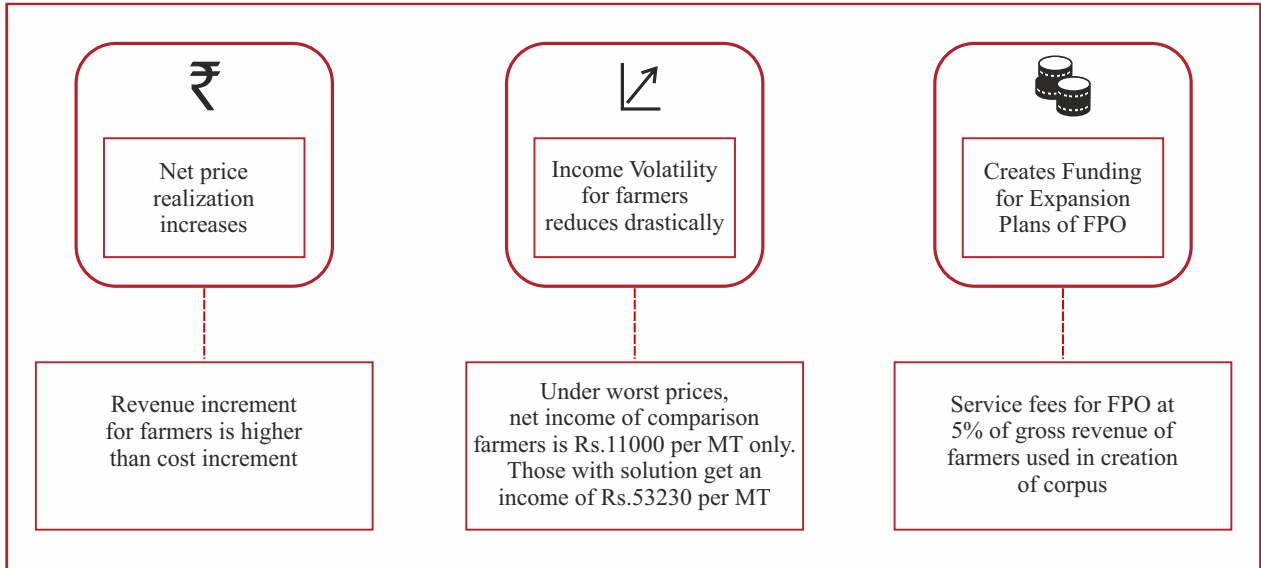
Farmer members of Pragati have been able to store their flowers and sell them only when the peak season commences, thereby driving huge price gains. While they have to pay storage costs as well as service fees to their FPO, farmers report higher net realization and also find significant reduction in income volatility. It is under the worst price scenario that the impact of the cold store becomes dramatically visible. See **Annexure A**. When the prices drop to Rs.20000 per MT, the farmers without a cold store have no option but to sell off their produce in the market. However, farmer members of Pragati store their produce and have been able to fetch an average price of at least Rs. 50000 per MT in the market⁷. The net income of the farmers without cold store ranges from Rs.62000 per MT under best prices to Rs.11000 per MT under worst prices. However, the Pragati farmers get a net income of Rs. 73180 per MT under best prices and Rs.53230 per MT under worst prices⁸. Thus, not only are the average incomes of the Pragati farmers higher, but they experience lower income volatility. Also, the solar powered cold storage solution is environmentally sustainable, and farmers do not have to bother about availability of electricity to power these units. See **Figure 4.4**.

The Ecozen solution has also helped the FPO to earn regular service fees and create a corpus that can fund further expansion of infrastructure. The FPO, together with some other FPOs, plans to create sales stores for selling fresh F&V produce. Thus, the cold storage, which is powering its B2B sales, has also created surpluses that can help the FPO move into a B2C marketing strategy.

⁷ Numbers are based on KIIs. Primary survey is needed to verify the numbers statistically.

⁸ Net income estimates have been carefully constructed through KIIs with farmers.

Figure 4.4: Impact of Ecofrost



Source: Authors' compilation

The role of Ecozen does not end with sales of the cold solutions; it trains farmers to run the facilities properly using apps. At the same time, it analyses the tick-by-tick data generated by the cold room (temperature and moisture settings, number of times the room was opened, time for which the door was kept open, etc.) using Machine Learning models. The model will eventually be dovetailed into Artificial Intelligence which can predict breakdown of cold rooms in remote areas, enabling the startup to offer pre-emptive solutions. Increasingly, agritech providers are using remote data to create overall solutions and better their products/services, while at the same time creating physical presence on ground to engage with beneficiaries and understand ground level issues. It is perhaps this combination of the remote and the local connect that spells success for startups.

Case Study 3

Ergos: Decentralized Warehousing and Collateral Management

Access to decentralized warehousing solutions complete with a credit facility is one of the most important plug-ins required in the post-harvesting space in India today. Warehousing infrastructure is highly capital intensive and demands higher maintenance costs as well. Since farmers rely on home storage practices and are wary of these facilities, undertaking heavy investments with negligible return on investments may not suit the economics of business.

Ergos is a startup that offers a “Grainbank” to individual farmers at farmgate.

Box 4.3 : Factsheet on Ergos

- **Name of Company:** Ergos
- **Website:** www.ergos.in
- **Year of Establishment:** 2012
- **Headquarters:** Bangalore, India
- **Working geography:** Bihar and Uttar Pradesh, Maharashtra (upcoming) and Karnataka (upcoming)
- **Products/ Services:** GrainBank (Storage, Credit and Market Linkages) and the e-batua (Decentralized warehousing solutions at the farmgate with eNWR facility)
- **Employee Strength:** 221 employees
- **Funding details:** Raised a total of USD 12.9 million (Equity) over 7 funding rounds and US\$ 8 million (Debt)
- **Number of farmers connected:** 62,100 farmers
- **USP:** Decentralized warehousing solutions at the farmgate with eNWR facility

Source: Ergos; all figures as of April 2021

4.4 The Business Model @ Ergos

Ergos partners with banks and NBFCs to offer credit to the farmers⁹ against the collateralized value of stored produce. Ergos does not build fresh warehouses; rather, it retrofits existing warehouses and godowns of Primary Agriculture Credit Societies (PACS) in villages. This has enabled Ergos to remain asset-light and scale up quickly across geographies. Warehousing capacities of Ergos facilities vary between 200 MT and 2400 MT. Nearly 50 per cent of the warehouse capacities are used for maize. Rice and wheat account for 20 per cent and 30 per cent of the storage space, respectively. Ergos practices state-of-art, scientific warehousing management practices¹⁰. The warehouses are located at a distance of approximately 3 to 4 kilometres from client farms and hence are easily accessible. This has given a sense of trust to the farmers. See **Figure 4.5**.

⁹ Ergos directly works with farmers and not with FPOs.

¹⁰ This includes humidity and temperature control, pest management, fumigation, insurance etc.

Figure 4.5: The Grainbank at Ergos



Source: Ergos

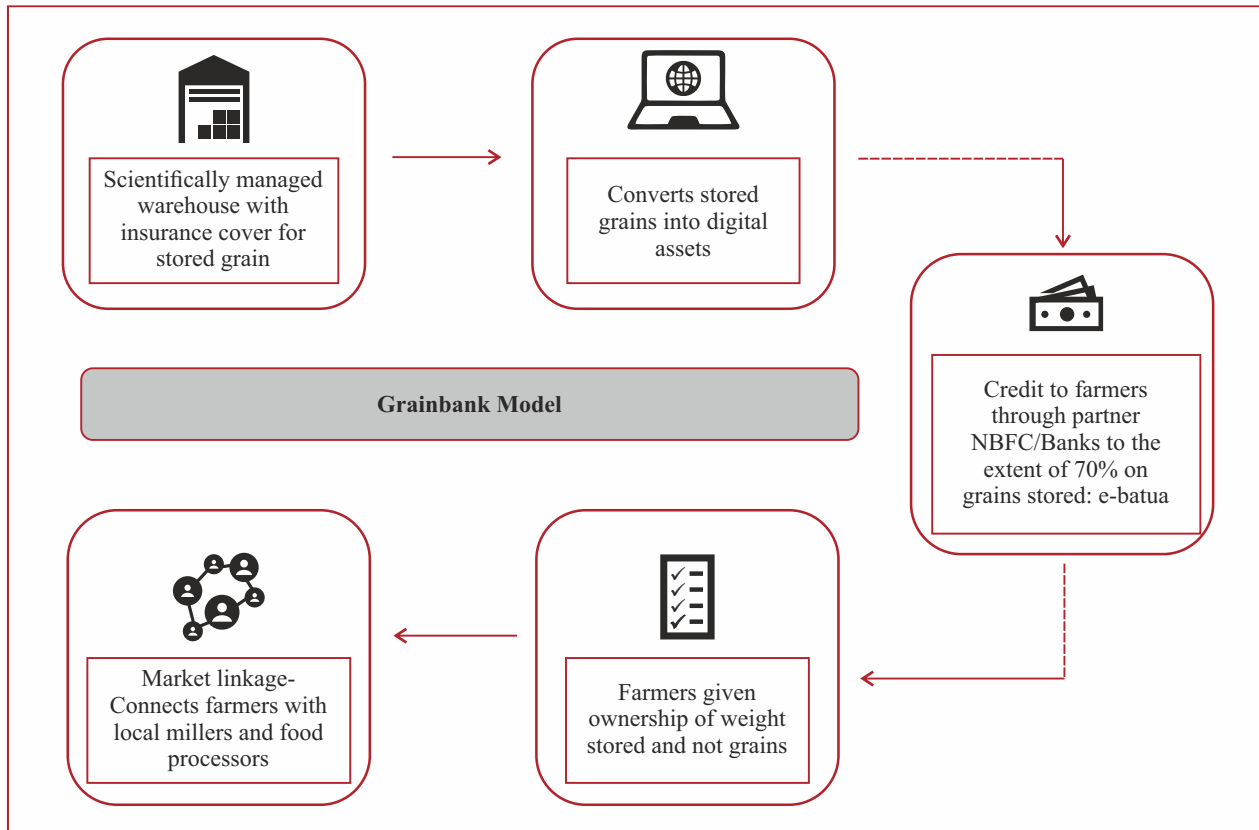
Just like Ecozen, Ergos boasts of a huge ground connect. In every village in which it has a presence, the company employs a “village champ”. This employee is also a farmer and understands the local product and community very well. The founders of Ergos are vocal about the length of time that it takes to create a trust factor within the farming community. Farmers take a long time to trust a warehouse with their produce. Also, complete absence of warehousing solutions at farmgate in the past many years implies that many farmers have built informal storages within their own houses. These are not scientific and lead to damage in the stored produce. However, it is tricky to convince the thrifty farming community to pay for a service which is “apparently free” currently. It is here that the village champ is very important to get connected to the farmers.

Ergos engages with 56 flour mills, 25 feed companies and several major traders in Bihar to buy the stored produce. The highest price offered by a buyer is sent to the farmer daily on the app. However, it is not binding for the farmer to sell his produce to the buyers registered with Ergos. The farmer has the full freedom to decide what quantity to sell, to whom to sell and at what price to sell. He may sell even a single bag of grain to a buyer outside the Ergos platform.

Farmers intending to store their produce at the Ergos warehousing facility are required to book their storage space through the Ergos mobile application. Normally, farmers start booking their warehouse spaces for maize in mid-March. Pick-up facility is also available at a cost of Rs. 60 per MT. Ergos insists that the grains be packed and stored in breathable jute bags distributed by Ergos to the farmers during the harvest itself. The cost for the jute bags and for the labour to unload the produce at the Grainbank is Rs.60 per MT. Grain is sampled from each bag at the warehouse for checking the quality and moisture of the produce. Approved bags are weighed and enter the storage. There is a minimum lock-in period of 4 months for the stored produce. Millers and traders submit a buy quote to Ergos, daily. The highest price offered on the Ergos platform on the day of

entry into warehouse is treated as the valuation price for the stored produce. The farmer receives the valuation receipt on his mobile. The farmer now owns, not the bag of grain, but rather, the weight of the grain stored in the warehouse. The grain is fully digitized and commoditized and now has the potential to be used as collateral. See **Figure 4.6**.

Figure 4.6: From Ergos Grainbank to poultry feed mills



Source: Authors' compilation, KII with Ergos

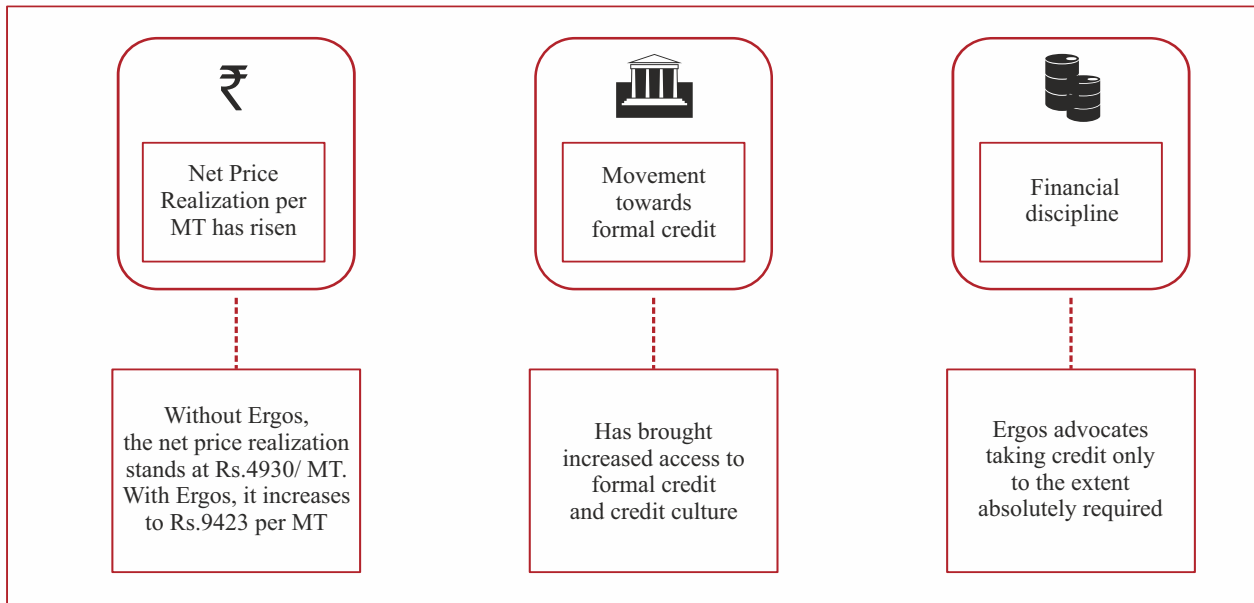
4.5 Impact of Ergos on farmers at Nayanagar village, Samastipur district, Bihar

We examine the impact of the solution on the small and marginal rabi maize farmers of Nayanagar village in Samastipur district in Bihar. The impact is substantial. Maize farmers store their produce with the Ergos facility between May, when the prices are at a nadir, and November, when the prices increase. Their liquidity requirements are also met through the eNWRs. Even after paying storage and interest costs on credit facilities, the net price realization of the farmers engaging with Ergos, at Rs.9423 per MT, is substantially higher than that accruing to those without the solution at Rs.4930 per MT¹¹. See **Annexure B**. There is also a soft impact, wherein farmers exhibit financial discipline and take credit only to the exact extent that is immediately required.

¹¹ Net price realization estimates have been carefully constructed through KIIs with farmers.

Under the Ergos model, farmers get access to formal sources of credit. Ergos provides handholding in terms of the documentation required by its NBFC partners. The credit facility is managed by Ergos because of which the farmer is not required to visit the bank multiple times for the documentation process. Once the produce is sold, Ergos pays off the loan to the NBFC and then returns the rest of the amount to the farmer. Since taking a loan and paying it off is a facility extended by Ergos, farmers have a hassle-free experience in terms of switching to formal credit sources. See **Figure 4.7**.

Figure 4.7: Impact of Ergos



Source: Authors' compilation

Farmers are allowed by NBFCs to take credit to the extent of 70 per cent of the value of the stored produce. However, the village champs advocate taking credit only to the extent that is absolutely essential. Due to this advisory and discussions, most farmers availing the credit facility have taken a loan to the extent of 50 per cent of the stored produce only. Thus, Ergos has created a sensitivity to financial discipline amongst its farmer clients.

Case Study 4

Arya Collateral: Warehousing and Fintech solutions

The logical next step for an agritech startup in the warehousing space would be to launch its own Non-Banking Financial Company (NBFC) that could then offer fintech products to its clients as per their requirements. Arya Collateral offers warehousing solutions but also offers innovative fintech solutions through Aryadhan, which is its own NBFC arm.

Box 4.4 : Factsheet on Arya Collateral

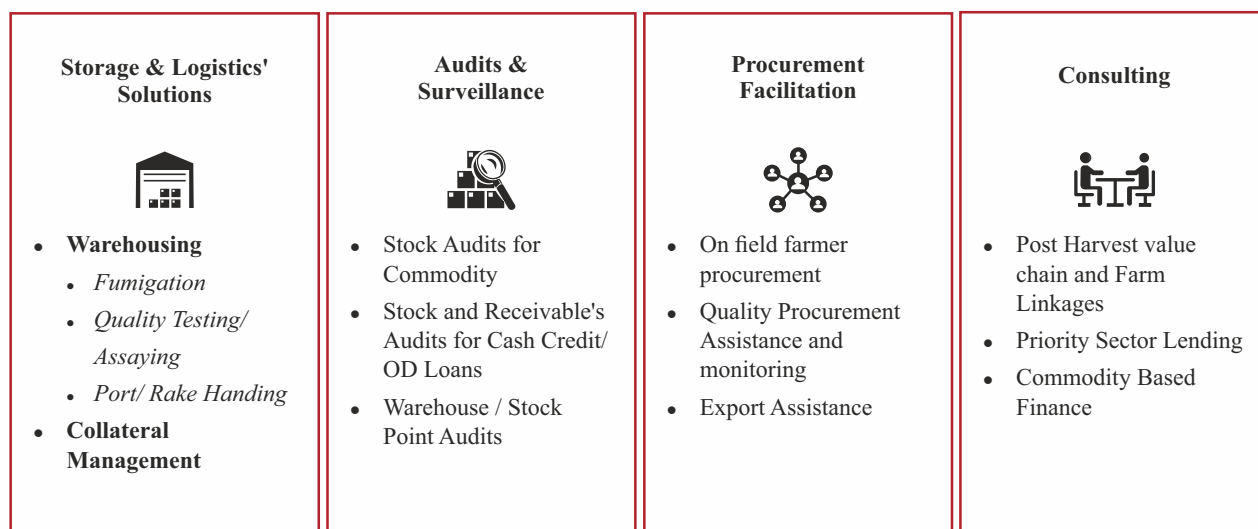
- **Name of Company:** Arya Collateral Warehousing Services Pvt Ltd
- **Website:** www.aryacma.co.in
- **Year of Establishment:** 2003
- **Headquarters:** Noida, Uttar Pradesh, India
- **Working geography:** Pan India
- **Services:** Storage & Logistics Solutions, Audits & Surveillance, Procurement Facilitation and Consulting
- **Turnover (Fy20):** Rs.1260 million
- **Employee Strength:**1601
- **Funding details:** The company has raised a total of USD 7.9 Million
- **Number of warehouses:** 1605
- **Amount of commodity managed:** 29.28 lakh MT
- **Installed capacity:** 32.15 lakh MT
- **Number of farmers connected:** 116489
- **USP:** Provides bundled warehousing and warehouse receipts solutions. Has recently launched a rural storage discovery platform www.A2ZGodaam.com

Source: Arya Collateral; all figures as of April 2021

4.6 Service Verticals @Arya

Arya Collateral provides services across four broad verticals - Storage & Logistics Solutions, Audits & Surveillance, Procurement Facilitation and Consulting (**Figure 4.8**). These post-harvest services are offered to a broad clientele base. The company's client portfolio includes farmers, farmer producer companies, agribusinesses, commodity traders, financial institutions etc. Every client is provided services as per his needs. The services across verticals are bundled together and tailored as per requirement after the initial discussion with the client.

Figure 4.8: Verticals Serviced by Arya Collateral



Source: Arya Collateral

4.7 Working with FPOs

Arya Collateral has been emphatic about creating customized products that can help to relieve financial pain points of FPOs. Most FPOs that stock their produce with Arya are in the business of seed manufacturing. Very often, raw produce is brought in by FPOs to be stocked at the warehouses. This is then covered with warehousing finance. FPOs use the credit to pay the member farmers since they buy the produce rather than aggregate it.

Now, the raw produce has to be processed in order to convert it into bags of sell-able seeds. Aryadhan allows the pledged stock to be moved so that it can be processed and converted into finished goods. Very few FIs give this facility. Most FIs do not even allow pledged stocks to be moved to another location. This agri-finance product by Aryadhan gave a very good scale to the FPO engagement of Arya Collateral¹².

4.8 Meet the Beneficiary: Sontat FPC

We profile the Sontat FPC in Siddhi district of Madhya Pradesh, which produces wheat seeds.

The FPC deals in input supply and has been into the seed-making business for the past 3 years.

¹² Apart from this, Aryadhan has piloted an extremely interesting finance product for FPOs in partnership with the Rabo Bank Foundation. This is called as the Arya Rabobank Price Risk Mitigation Tool (Arya 2018). In case of a price of stored commodities fall, FPOs face the prospects of bearing costs of storage and bearing a loss due to price fall.

Aryadhan can avail of the Rabo Bank Guarantee Fund in such a scenario. If the price of the commodity drops below the initially benchmarked price at which warehousing finance was availed, then the FI initiates a claim with the guarantee fund. This saves the bank the transaction costs of operationalizing the margin calls. At the same time, it ensures that FPOs do not lose value due to a price fall. Thus, the guarantee works as an insurance against price fall for the FPOs.

Box 4.5 : Factsheet on Sontat FPO

- **Year of Incorporation:** 2016
- **Located in:** Village Odara, Sidhi district, Madhya Pradesh
- **No. of Member Farmers:** 1300
- **Major Crops:** Wheat and Paddy (Seed Production)
- **Average Landholding per farmer:** 2 hectare per farmer
- **Total turnover of FPO (FY20):** Rs. 10 million
- **Contribution of wheat seed production to turnover of FPO (FY20):** 60 per cent

Source: KII; all figures as of April 2021

It sells wheat seeds of a pre-determined quality to its members. It also issues advisory on the package of practices needed to get the desired yield. Once the produce is ready, the FPC arranges to collect the same from the fields. Weighing machines are also sent along with the transport to the fields and the produce is weighed in front of the farmers. Payment is made within a week of sourcing the produce at a rate that is higher than the MSP rate. The produce is aggregated, sorted and graded. The grading standards set by the Madhya Pradesh Seed Certification Agency are used by the FPC for the process. Sontat rents out a grading centre for its operations.

The major hurdle in the business was lack of professionally managed storage space due to which there was a risk that the quality of seeds would deteriorate. Arya Collateral has created a bundle of facilities relevant to the FPC. These were as follows:

- i. The FPC was offered state-of-the-art storage facilities at lease rentals that were comparable to the Government warehouses in Rewa district. Arya Collateral however, conducts its own quality assaying prior to storage. See **Figure 4.9**.
- ii. The FPC needed immediate working capital to pay the farmers within a week of sourcing the produce. The FPC was introduced to Aryadhan, which offered the FPC credit equivalent to 70 per cent of the value of the produce at the time of storage.
- iii. Sontat FPC was also allowed, after payment of the full rent, to move the stored raw produce for processing it into final sale-able seeds.

Sontat FPC started storing raw produce and finished seeds in bags at the Arya warehouses. The seeds are ultimately sold under the brand 'Sontat' in the markets.

Figure 4.9: Sontat Seeds stored at the Arya Warehouse



Source: Sontat FPC

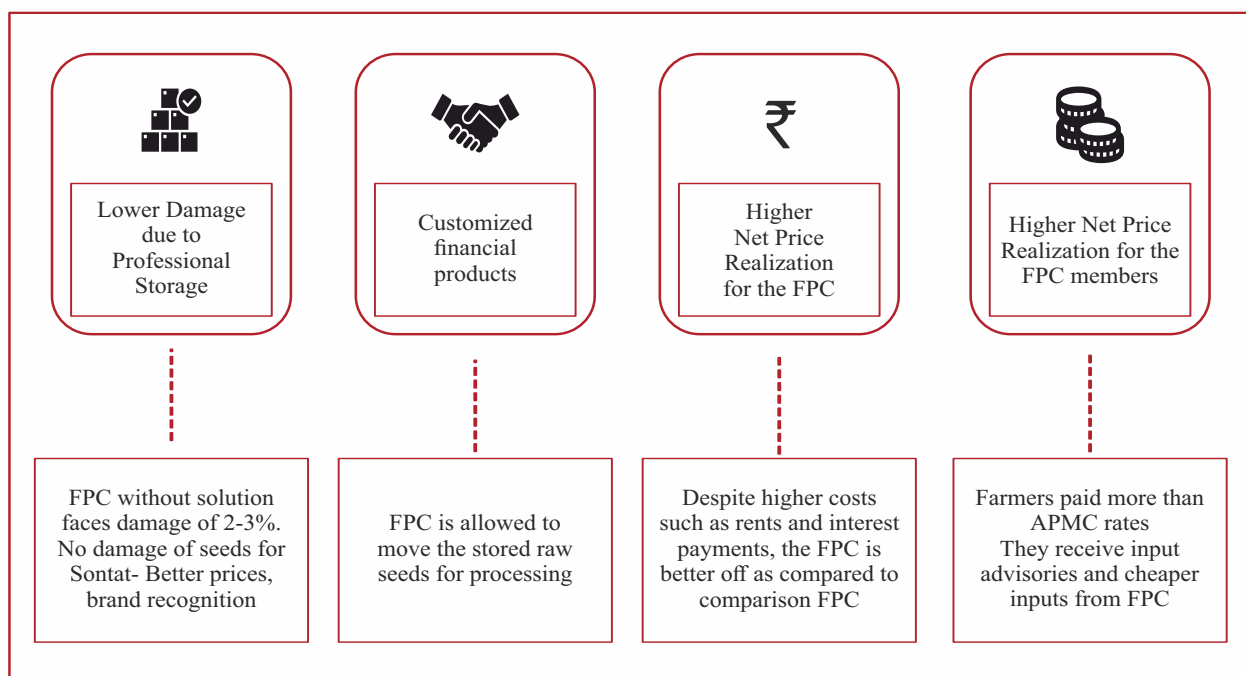
4.9 Impact of Warehousing and Fintech Solution on Sontat FPC

The impact of the warehousing and customized finance on Sontat is encouraging. Other FPCs, which store produce in their own warehouses, suffer a damage of 2-3 per cent in the stored produce. However, Sontat FPC faces zero damage to the stored produce due to the presence of professionally managed storage solutions given by Arya Collateral. Access to agritech solutions is expensive. Sontat FPC spends more per MT of seeds in order to avail warehousing, collateral management and financial services. However, due to higher quality, it also gets higher price per MT, which creates higher net price realizations as compared to the FPC not engaged with Arya Collateral.

The net price realization for Sontat FPC stands at Rs. 7003 per MT of wheat seeds sold as compared to that for the comparison FPC, which stands at Rs. 4055 per MT of seeds¹³. See **Annexure C**.

¹³ Estimates of Net Price Realization have been carefully constructed through KIIs with the Directors of FPCs.

Figure 4.10: Impact of Arya Collateral



Source: Authors' compilation

Farmer members of the FPC get the input seed at a discount. They also get advisories on the package of practices. This helps them to save on costs. Sontat FPC offers a price higher than the MSP prevailing in the APMC. Further, it also saves the farmers the transport costs of hauling the produce to the APMC, loading and unloading it etc.

CHAPTER 5

END-TO-END SUPPLY CHAIN SOLUTIONS

Agritech startups offering end-to-end supply chain solutions form the biggest block within the pool of agritech startups. Six of the top 10 funded agritech startups in FY22 major in supply chains. Most agritech startups in this space work with a bouquet of tech products including Artificial Intelligence, Machine Learning, Blockchain platforms, mobility software, automation and robotics, spectroscopy, etc. Many of the startups prefer working with FPOs in order to get scale for their operations. In this chapter, we narrate the story of WayCool, a supply chain startup, and assess its impact on the net incomes of the farmer members of the Vambori FPC in Ahmednagar district of Maharashtra.

Case Study 5: WayCool Foods Pvt. Ltd.

WayCool Foods Pvt. Ltd. is an end-to-end supply chain that procures produce from FPOs through its Collection Centres and links it to Hotels, Restaurants and Cafes (HoReCa). The company enjoys a high FPO engagement in Maharashtra and Tamil Nadu.

Box 5.1: Factsheet on Waycool

- **Name of Company:** WayCool Foods & Products Pvt. Ltd.
- **Website:** www.waycool.in
- **Year of Establishment:** 2015
- **Headquarters:** Chennai, India
- **Working Geography:** Chennai, Andhra Pradesh, Karnataka and Maharashtra
- **Products/ Services:** Supply of fresh produce to HoReCa, Retailers
- **Turnover (FY20):** Rs. 2890 million
- **Employee Strength:** 890 (as of January 2021)
- **Funding details:** WayCool has raised a total equity of USD 46 million
- **Number of farmers connected:** 70,000
- **Number of FPOs connected:** 35
- **USP:** End-to-end traceability and control across the entire food value chain with an objective to positively impact farmers at a grassroots level and reduce food wastage.

Source: WayCool; all figures as of April 2021

5.1 FPO Engagement of WayCool

WayCool works for reducing the food wastage across the entire value chain. For this purpose, it has been unceasingly working with the direct source, i.e. farmers, since the very beginning.

It has diversified its FPO engagement across three broad models. These are as follows:

i. The Collection Centre (CC) Model

Waycool procures produce from FPOs and farmers at its Collection Centres (**Figure 5.1**). The Collection Centres are operational throughout the year. Bulk procurements are carried out on spot at the CCs.

Figure 5.1: The WayCool Collection Centre



Source: Way Cool

ii. Deep Engagement Model or the Outgrow Program

WayCool enters quasi contract farming vis-à-vis FPOs, delineating the quantity required, the timeline, the acreage and the number of farmers. The Deep Engagement model is specifically beneficial for crops such as onion, potatoes, pulses and other bulk procurement produce.

iii. Storage Model

WayCool engages with certain FPOs for storage of Rabi onions in Maharashtra. For a commission paid by WayCool, the FPOs identify storages available with their own farmer members. The FPOs also conduct a quality check on the available storage space. The onions are sold by the farmer members to Waycool and stored with the storage spaces of the farmer members of the FPO. The typical storage season for Rabi onions extends for 5-6 months. Nearly 70 per cent of the stored produce is procured from those FPOs with which the company has entered a deep engagement. The produce thus purchased has moisture levels and other quality parameters which make it amenable for storage.

5.2 Meet the Beneficiary: Vambori FPC

Box 5.2: Factsheet on Vambori FPC

- **Year of Incorporation:** 2018
- **Located in:** Vambori Village, Tal. Rahuri, Dist. Ahmednagar, Maharashtra
- **No. of Member Farmers:** 300
- **Major Crops:** Onions, Moringa, Quinoa
- **Average Landholding per farmer:** 2 – 7 acres
- **Total turnover of FPO (FY20):** Rs. 65 million
- **Contribution of onions to turnover of FPO (FY20):** 72%

Source: KII

The Vambori FPC sells aggregated produce to institutional buyers such as WayCool, Reliance and Ninjacart. It also participates in the procurement program by NAFED. However, it does not sell any produce through the APMC markets; farmer-members however use the APMC market channel regularly. (Table 5.1).

Table 5.1: Institutional Sales by Vambori FPC in FY19 and FY20

Sales of Onions by Vambori FPC	FY2019	FY2020
Sales (MT) to WayCool	450	845
Sales (MT) to NAFED	800	1899
Sales (MT) to other institutional buyers - Reliance, Ninjacart etc.	1060	2700
Total Sales (MT) by Vambori FPC	2310	5444

Source: KII

The Vambori FPC in Ahmednagar district has 3 levels of engagements with WayCool. See Table 5.2.

Table 5.2: Engagement of Vambori FPC with WayCool from FY19

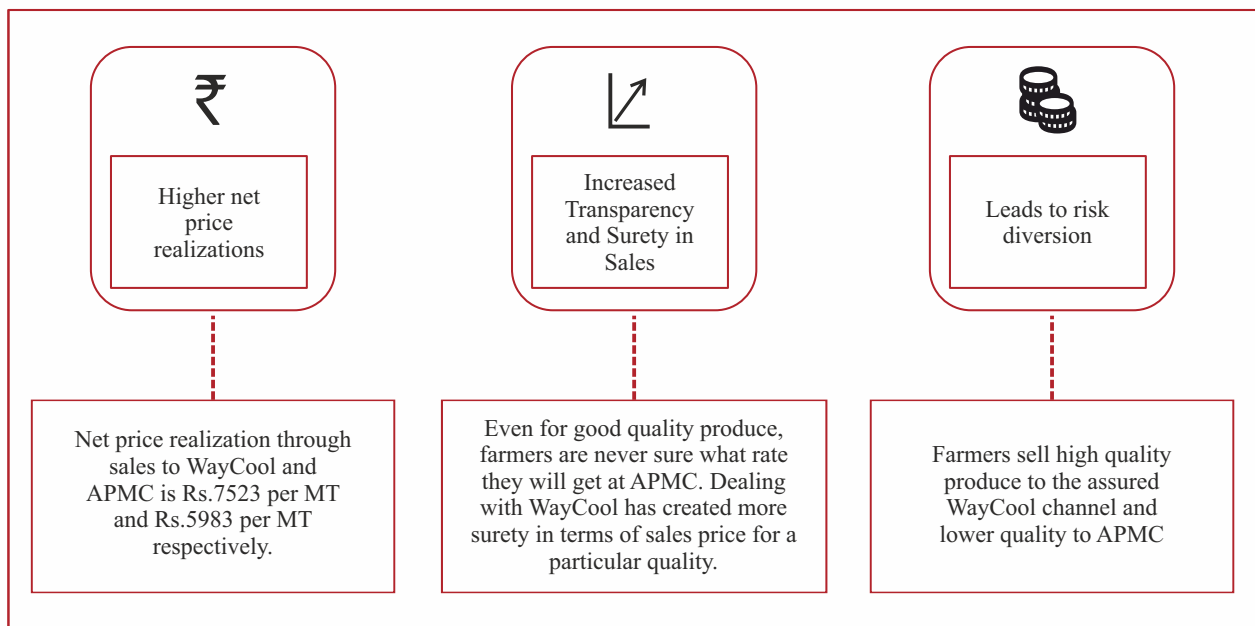
Engagement with WayCool	FY2019	FY2020	FY2021
CC Model - Bulk Sales			
Storage facility for Onions			
Deep Engagement - Outgrow Program			

Source: Authors' compilation, KII with Vambori FPC

5.3 Impact of WayCool on Farmer-Members of Vambori FPC

We examine the impact of the CC model of WayCool on the farmer members of Vambori FPC. Farmer-members of the Vambori FPC sell their produce to WayCool through the FPC; optionally they may take their produce to the APMC mandi. We compare the net price realizations accruing through the two channels. Prices offered by WayCool may or may not be higher everyday as compared to the prevailing mandi prices. However, the costs of dealing with WayCool are definitely lower for farmers. Farmers save on transport costs and service fees that they have to bear at the APMC mandis. There is an additional grading cost for supplying to WayCool, but this is more than neutralized by the reduction in transport costs. See **Figure 5.2**.

Figure 5.2: Impact of WayCool



Source: Authors' compilation

The WayCool CC marketing channel creates a net price realization of Rs. 7523 per MT to the farmers. In contrast, the APMC marketing channel creates a net price realization of Rs. 5983 per MT only to the farmer members of the Vambori FPC¹⁴. See **Annexure D**. Interestingly, availability of an alternate marketing channel has created risk diversification options for farmers. They sell high quality produce to WayCool whereas lower quality produce makes its way to the APMC mandis.

Presently, we have documented only the impact of the WayCool CC model on the farmer members of Vambori FPC. WayCool has recently also engaged with this FPC through the storage model (**Figure 5.3**).

¹⁴ Estimates of Net Price Realization have been carefully constructed through KIIs with farmer-members and Directors of Vambori FPC.

Figure 5.3: Storage System at Vambori FPC



Source: Waycool

The impact of the storage model may be more nuanced, since it not only creates additional income sources for farmers, but also offers immediate storage solutions at the farmgate. It also creates an additional revenue source for the FPC, since the FPC is paid commission fees for identifying and monitoring the storages. The storage models have also paved the way for deep engagement models vis-à-vis the FPCs, wherein the startup gets into an on-farm advisory mode. Since these interventions are very recent, the impact of these have not been documented in this case study. Further research is needed to study the WayCool impact on an FPC that engages purely through the CC model as compared to one that is privy to storage and deep engagement as well.

CHAPTER 6

CONTRACTS – THE INSTITUTIONAL INNOVATION

Contracts are innovative tools that can change market dynamics. In this chapter, we present two case studies pertaining to contract farming. The first case study is unique in that we find a marketing oriented FPC (Sahyadri Farmer Producer Company Ltd.), which is the contract sponsor entering a contract with a producer FPC (Alandi Valley Farmer Producer Company), which is the contract producer, for sourcing processing-grade tomatoes. The contract has interesting features such as benchmarking of contract prices to the APMC mandi prices and offering a minimum guaranteed price for tomatoes throughout the year. However, the level of formalization for the contract is very low. The other case study is that of a small exporter firm (Deccan Agro, which is the contract sponsor) that sources baby corn, chillies and okra from an FPC (contract producer) and exports the same in London markets. Interestingly, despite high volatility in prices of these products, the firm has entered a formal, fixed price contract with the FPC. We assess the impact of the contract on net price realization of the farmer members of the producer FPCs.

Case Study 6: Contract between Sahyadri FPC Ltd. (SFPCL) and Alandi Valley FPC (AVFPC)

The Sahyadri Farmer Producer Company Ltd. (SFPCL) was established in 2011 with core ideas of competence and professionalism. “Agriculture is not a last-resort occupation, it is a profitable and a sustainable business”, says founder Vilas Shinde, “we have to treat agriculture as an industry, the farm as an enterprise and every farmer as an entrepreneur”. He is emphatic that the exploitation of the small farmer can only end if one manages to disrupt the traditional agri supply-chain which is predominated by commission agents, lack of infrastructure, lack of price transparency and limited market access.

Box 6.1: Factsheet on Sahyadri FPC Limited

- **Name of Company:** Sahyadri Farmers Producers Company Limited
- **Website:** www.sahyadrifarms.com
- **Year of Establishment:** 2010
- **Headquarters:** Mohadi, Nashik, Maharashtra
- **Working geography:** Pan – India presence. Exports to 42 countries
- **Products/ Services:** Fresh F&V (40+ commodities), frozen diced F&V, pulps, pastes, purees, tomato ketchups, jams, squashes
- **Turnover (FY20):** Rs.4650 million
- **Employee Strength:** 650
- **Funding details:** The company has raised a total of Rs.1.2 billion
- **Number of farmers connected:** More than 8000
- **USP:** The biggest FPC in India. The first FPC in India to use blockchain to ensure traceability. Is an angel investor in agritech startups. Biggest institutional procurement of tomatoes in India in FY20. Is a private label manufacturer for Kissan ketchup. Presence in 42 countries through exports.

Source: SFPCL; all figures as of April 2021

6.1 Powering Business Model through Technology

SFPCL is biggest FPC in India with a big focus on technology-led processes. Grapes and tomatoes are two major verticals at SFPCL. The company is a private label manufacturer for Kissan Ketchups, wherein it procures tomatoes and manufactures ketchup as per the instructions from HUL. This led to a massive procurement of 55000 MT of tomatoes in FY20. **Figure 6.1.**

Figure 6.1: Tomato Processing Facility at SFPCL



Source: SFPCL

Procurement on such a large scale would have been impossible except for the tech intervention offered by Vesatogo, a rural mobility startup. The Vesatogo app allows the farmer to book a slot to sell tomatoes at SFPCL, saving the waiting period at the SFPCL gates from 18 hours to just 3 hours.

SFPCL is the first FPC in India to use Blockchain technology to ensure traceability. Together with an agritech startup called Emertech, it has launched Agrotrust. Agrotrust is a blockchain based IOT and AI platform that connects all players within the SFPCL operations. Traceability has enhanced the trust quotient for consumers. By scanning the QR code, consumers are able to trace the produce back to the farm where it was produced. Interestingly, the same logic works for farmers too. In case of fresh produce, farmers can track the movement of produce from farm to SFPCL to the retail chains and finally to the consumer. He can also see the prices at which his produce moved through the value chain.

In case of processed produce, he can track the movement of produce from farm to SFPCL processing facility, storage facility and then into distribution networks of client companies. See **Figure 6.2.** The major advantage of using blockchain is that the data, once entered, is tamper proof.

Figure 6.2: Blockchain based Agrotrust platform



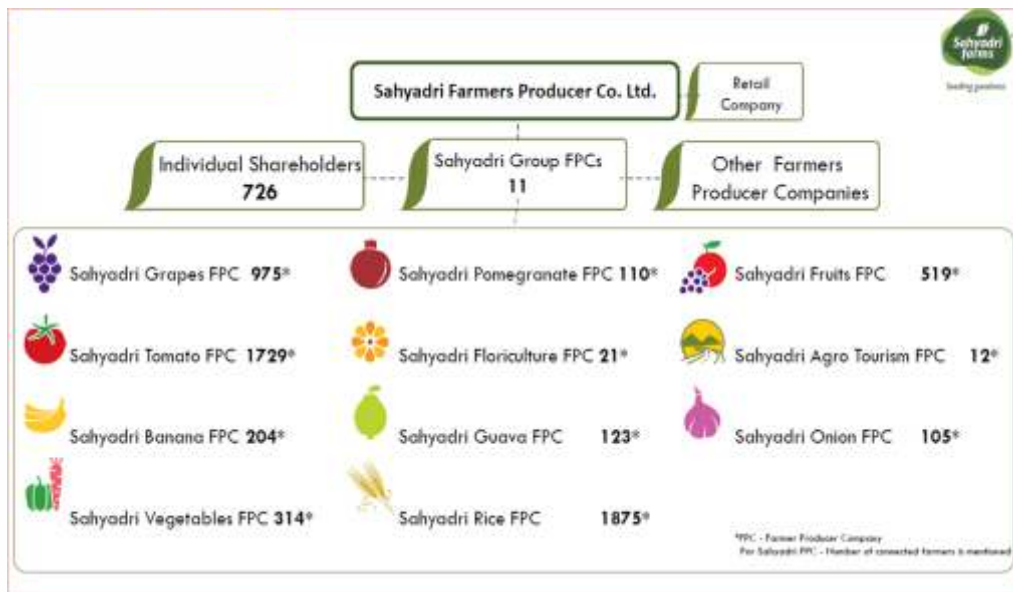
Source: SFPCL

It is interesting to note that SFPCL is an angel investor in the agritech startups Vesatogo and Emertech, that currently offer logistics and blockchain services to it.

6.2 The Amul framework

SFPCL has created an 'Amul' framework (multi-tiered framework with the top tier engaged in market activities and the subsequent tiers engaged in production) in F&V. SFPCL is the umbrella company that looks after sales, marketing, packaging, exports and marketing, whilst leaving the production activity to smaller FPCs under its fold. See Figure 6.3.

Figure 6.3: Structure of the SFPCL Business Model



Source: SFPCL, November 2020

6.3 Meet the Beneficiary: Alandi Valley FPC (AVFPC)

Box 6.2: Factsheet on Sahyadri Alandi Valley FPC (AVFPC)

- **Year of Incorporation:** November 2019
- **Located in:** Girnare Village, Nashik, Maharashtra
- **No. of Member Farmers:** 188
- **Major Crops:** Tomato, Bottle-gourd, Cabbage, Bitter gourd, Grapes
- **Average Landholding of member farmer:** 5-7 acres
- **Total turnover (2019-20):** Rs. 55 lakhs
- **Contribution of tomatoes to turnover (2019-20):** 100 per cent

Source: KII

SFPCL has entered a soft, unwritten contract with the Alandi Valley FPC (AVFPC) for the procurement of tomatoes. SFPCL sources quality inputs at aggregated level for all the commodities. AVFPC has its own input shop at Girnare village. The discount that SFPCL gets is passed on to the AVFPC input shop. In this way, the members of AVFPC can access high quality inputs (seeds, fertilizers, pesticides etc.) at lower rates. SFPCL hosts group meetings for AVFPC members throughout the season. Training and advisory on which variety to sow, staking, pruning methods, irrigation cycles, usage of fertilizers, pesticides etc. is given to the farmers. Weather advisories are also shared. Farmers from AVFPC are taken for exposure visits. In such visits, farmers have been taken to meet progressive farmers in India and abroad. SFPCL also arranges for visits by experts for the farmers.

The distinguishing feature of the contract is that the SFPCL always offers Rs.1000 per MT premium over the prevailing APMC rates for procurement. Further, it always gives a minimum price of Rs.3500 per MT to the farmer members of AVFPC. The impact is huge.

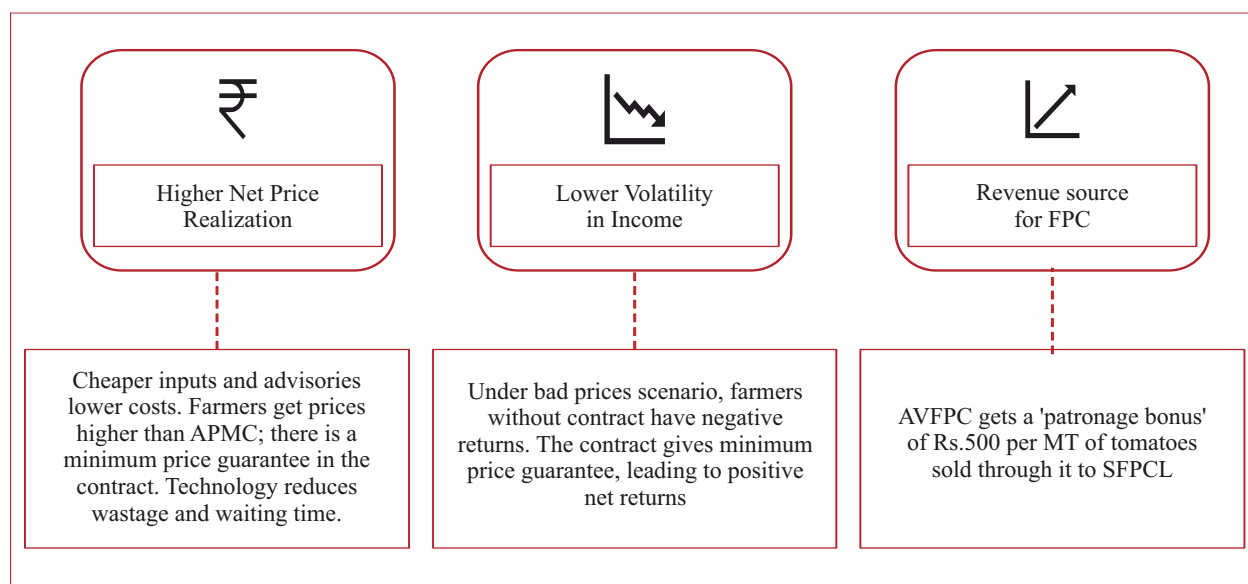
6.4 Impact of the Contract on the Farmer-Members of AVFPC

Tomato prices are extremely volatile. The average modal prices for tomatoes drop sharply as the season progresses from November to March. There are at least 2 months in every harvest season in which the prices drop to less than Rs. 3500 per MT for at least half of the trading days. The contract of SFPCL with AVFPC serves to offer a risk hedge on precisely such occasions. See **Figure 6.4**.

Under best prices scenario, the farmer-members of AVFPC get net income of Rs.7529 per MT of tomatoes sold. Those selling only at APMC get a net income of Rs. 5380 per MT. However, the impact of the contract gets amplified under worst prices scenario. When the prices drop to less than Rs.3500 per MT, the farmer-members of AVFPC earn a net income of Rs.887 per MT. This may seem to be very low. But, to put matters in perspective, we need to see how farmers without contract fare under worst prices – the farmers get a negative net income i.e. they face a loss of Rs.892 per MT under worst prices¹⁵. See **Annexure E**.

¹⁵ Estimates of net income accruing to farmers under best price and worst price scenarios were carefully constructed through KIIs with farmer-members of AVFPC.

Figure 6.4: Impact of SFPCL Contract on AVFPC Members



Source: Authors' compilation

Clearly, the institutional innovation of the contract has not only increased average incomes for the farmer-members of the AVFPC, but has also reduced income volatility experienced by the farmers. The contract has also created an additional source of revenue for the AVFPC.

Case Study 7: Deccan Agro and Shree Mahaganapati FPC

Deccan Agro Pvt. Ltd., incorporated in 2002, started its journey with the cultivation of grapes.

Box 6.3: Factsheet on Deccan Agro

- **Name of Company:** Deccan Agro Private Limited
- **Year of Establishment:** 2002
- **Headquarters:** Sangli District, Maharashtra
- **Commodities Transacted:** Grapes, Baby Corn, Okra & Chili
- **Main export market:** UK
- **Turnover (FY20):** Rs. 40 million
- **Employee Strength:** 17 full time employees, 50 contractual women labour for packing
- **Facilities:** Precooling (5 tonnes), Cold storage (100 tonnes) and Packing Shed (1000 sq. ft.)
- **USP:** Deccan Agro Private Limited is involved in contract farming with FPC and exporting agricultural. It also provides 'Packing sheds', 'Precooling and cold storage'. The Company also plays an advisory role to farmers for producing high-quality agricultural produce which is suitable for export.

Source: Deccan Agro; all figures as of April 2021

In 2006, Deccan Agro built its own pack house at Sangli in MIDC in compliance with international pack house requirements. This enabled it to move up the value chain. See **Figure 6.5**.

Figure 6.5: Packhouse facilities built by Deccan Agro at MIDC, Sangli



Source: Deccan Agro

The company started a vertical of precooling and packing grapes for grape exporters in its own packhouse. However, its packhouses were underutilised as the season of grapes was only from December to April. Deccan Agro built a network of progressive farmers through FPOs and later diversified¹⁶ into baby corn, okra and chillies, which it directly exports to the European market.

Table 6.1: Commodity Calendar for Exports of Baby Corn, Chillies, Okra

Commodity	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Baby Corn	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Chillies	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Okra	Green	Green	Green	Green					Green	Green	Green	Green

Source: KII

¹⁶ The commodity choice enables the company to utilize the packhouse infrastructure fully.

6.5 Meet the Beneficiary: Shree Mahaganapati FPC

Box 6.4: Factsheet on Shree Mahaganapati Agro Producer Company Ltd.

- **Name of Company:** Shree Mahaganapati Agro Producer Company Limited
- **Year of Establishment:** 2015
- **Located in:** Sangli District, Maharashtra
- **No. of farmer members:** 948
- **Facilities:** Dal Mill, Cleaning & Grading unit, Seed Processing Unit and Rice mill
- **Average Land Holding (in Acres):** 1 acre
- **Commodity Transacted:** Baby Corn, Chilli and Okra
- **Turnover (FY20):** Rs. 12.7 million
- **Total Paid-up Capital:** Rs.1.9 million
- **Total Turnover from Contract Farming (FY20):** Rs.4.6 million
- **USP:** The company has entered into contract farming with Deccan Agro Private Limited Company for 3 commodities: baby corn, chilli and okra since 2019-20.

Source: KII

Horticulture produce shows significant price variation in European/ London markets. The firm can get benefits only if it has a sustained presence in the market throughout the year. For this, Deccan Agro needed guaranteed volumes of produce. It entered a contract with Shree Mahaganapati FPC for the production of chillies, okra and baby corn.

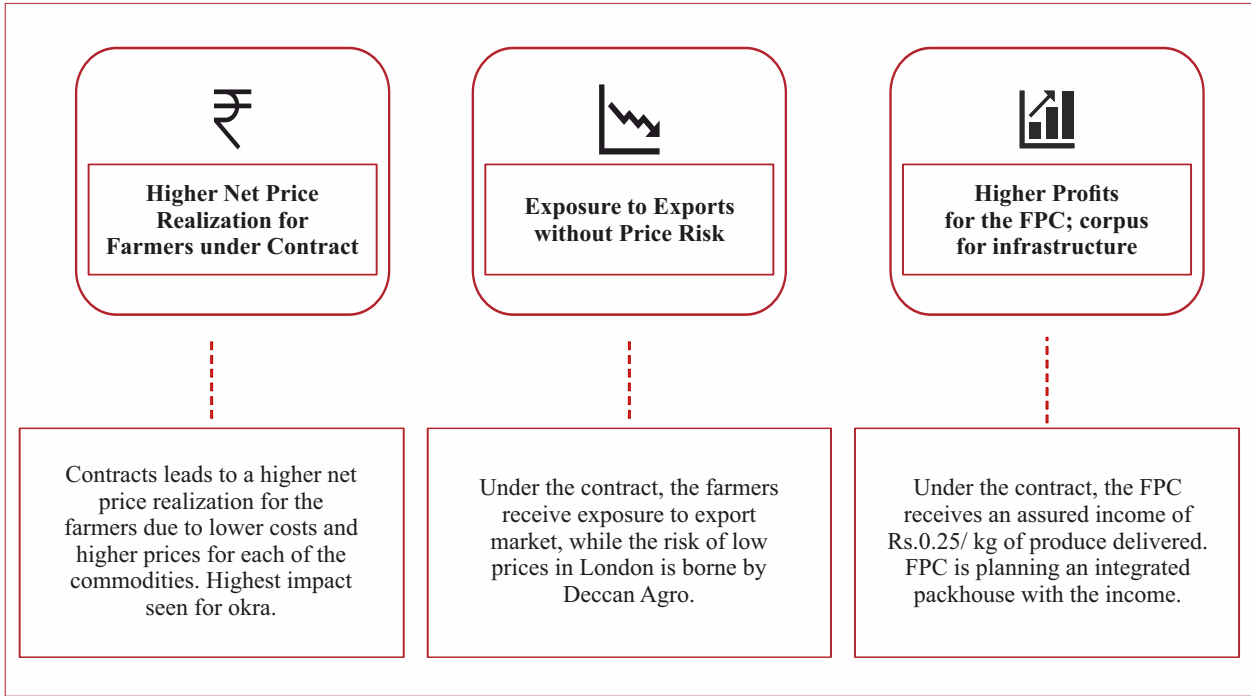
London markets are very sensitive to Maximum Residue Limit (MRL) norms. Hence, Deccan Agro itself arranges for pesticides to be sprayed on the farms of members of the FPO; thus, the pesticide cost for farmers under contract is zero. Deccan Agro also arranges transport from the farm to the packhouse; hence transportation cost for farmers under contract is zero. The FPO is paid outright by Deccan Agro; thus, it is not exposed to the risk of prices falling at London.

6.6 Impact of the Contract on Farmer-Members of Shree Mahaganapati FPC

The contract has increased the net returns accruing to farmers (as compared to those not covered by contract) substantially; the net price realization on chillies and okra under contract stands at Rs.14820 per MT and Rs.11380 per MT respectively. See **Figure 6.6**. For the same commodities, farmers without contract selling to local APMCs get net returns of Rs. 12110 per MT and Rs.3530 per MT respectively¹⁷. See **Annexure F**.

¹⁷ Estimates of Net price realization were carefully constructed through detailed KIIs with farmer-members and Directors of Shree Mahaganapati FPC.

Figure 6.6: Impact of Deccan Agro Contract on Members of Shree Mahaganapati FPC



Source: Author Compilation

However, this story is not only about higher returns. The farmers have exposure to requirements of the MRL sensitive London market, but the risks of price volatility and other transactions risks such as exchange rate risk, risk of rejection etc. are borne by Deccan Agro, the contract sponsor. Thus, the contract has provided farmers with a steep learning curve minus the risks that such learnings may entail. The FPC charges a service charge of Rs.250 per MT of produce that it transacts with Deccan Agro. This has created a source of revenue for the FPC, which is now planning to move up the value chain by constructing a packhouse.

CHAPTER 7

FUTURES MARKETS – THE INSTITUTIONAL INNOVATION

Indian agriculture is challenged on many fronts – presence of small land-holdings which make the activity commercially unviable, opaque information on how prices of different commodities will behave at harvest, a mandi system dominated by big traders, lack of assaying infrastructure and practice, lack of quality norms and standards that are accepted by both buyers and sellers, lack of a system that ties up prices transparently to different quality specifications, lack of holding capacity due to which the small farmer is pushed into distress sales at harvest, lack of scientific warehousing solutions, and finally, a cultural reluctance to shift to new market opportunities.

All of this changes when an agriculture commodities derivative exchange comes into the picture. An exchange allows market intel about stock, supply and demand positions of different commodities across time to be revealed; futures prices are a mirror of this market intel. Farmers can get a sense of how prices of a commodity may move after harvest. This empowers them to take a more informed decision about which crop to sow.

Importantly, presence of an agriculture commodity exchange allows the farmer to hedge himself against the risk of prices falling at harvest. The farmer can enter a futures contract at a price that covers not only his cost of production but also gives him a margin over the costs. Thus, futures contracts help in risk hedging and thereby act like a price insurance instrument for farmers.

There are two main exchanges dealing in commodity derivatives in India. These are the Multi Commodity Exchange (MCX) and the National Commodity and Derivatives Exchange (NCDEX). NCDEX is the market leader in agriculture commodity derivatives. In FY19, NCDEX boasted a share of 81.5 per cent in the agriculture commodity segment. The Exchange has been active in engaging with Farmer Producer Organizations so as to encourage them to trade on the NCDEX platform.

Case Study 8: Parivartan FPC

Based in the Kamargaon Village of Washim, Maharashtra, Parivartan Organic Farmer Producer Company Limited (Parivartan FPC) was formally incorporated in the year 2016 with just 10 members. The company later grew to a strength of 350 members and intended to work in soybean and chana. With own equity of Rs.4.5 lakhs and grant assistance of Rs.13.5 lakhs from the World Bank aided Maharashtra Agricultural Competitiveness Project (MACP), Parivartan FPC put up infrastructure facilities for its member farmers (**Figure 7.1**). This included a godown, cleaning and grading machine required for soybean, packaging equipment, 1 truck for transport of soybean to the market and a mini-truck for collection of produce from the members.

Figure 7.1: Infrastructure at Parivartan FPC



Source: Parivartan FPC

Box 7.1: Factsheet on Parivartan FPC Limited

- **Name of Company:** Parivartan Organic Farmers' Producer Company Limited
- **Year of Establishment:** 2016
- **Located in:** Village Kamargaon, Tal Karanja, District Washim, Maharashtra
- **No. of farmer members:** 350
- **Average Land Holding (in Acres):** 5 acres
- **Average Yield Per Acre:** 0.5MT/ Acre
- **Commodity Transacted:** Soybean
- **Turnover (FY 2020):** Rs. 10 million
- **Total Paid-up Capital:** Rs. 10,00,000
- **Volume of Soyabean Sold in FY20:** 350 MT
- **Volume of Soyabean Planned for Sale in the FY21:** 1000 MT
- **USP:** FPC sells its entire produce through NCDEX futures exchange only. First FPC to buy a put option for chana in November 2020

Source: KII; all figures as of April 2021

7.1 The Experience of Selling on NCDEX

Parivartan FPC in Washim district of Maharashtra has been selling soybean on NCDEX. The story of how the FPC started selling on NCDEX has huge learnings to offer.

In April 2018, the ten Directors of Parivartan FPC had some of the stocks of soybean that they still were holding after the harvest of 2017. They decided to sell 0.1 MT each on NCDEX futures. The produce, now totalling 1 MT was readied for the futures market. They got a price of Rs. 43000 per MT. The MSP for soybean for 2018-19 was Rs. 33990 per MT.

Impressed with the ease of transaction and transparency of pricing, the Directors went back to their members. The plan was to aggregate the unsold stocks of members and sell the same on NCDEX. However, farmer members were not forthcoming since they were dealing with two unknowns – one was the newly formed FPC, and the other was an exotic market that could only be seen on a ‘dabba’ i.e. a computer. The FPC realized that the plan of aggregation and sales was not feasible. It then took a working capital loan of Rs. 1.5 million from Samunnati Finance. The loan was used to buy the produce from members and non-members. In order to complete a lot size for NCDEX, the FPC once even bought soybean from a local trader. This reverse transaction of an FPC buying from a trader so as to sell on futures is a classic example of how presence of a new market can change systems within existing markets. These lots were sold at an average price of Rs.40000 per MT. The FPC was successfully able to record sales of 10 MT on NCDEX futures in FY19.

The confidence of the Directors was boosted manifold with the success of sales on NCDEX in FY19. The FPC Directors were active in gathering historical trend of prices as well as the near future projections of prices in futures market. The prices offered by the futures market were then discussed internally with the farmers. Farmers realized that the futures prices were much higher than the prices at the local Washim Mandi. Some members decided to sell part of their produce at the local mandi or at the local solvent extraction plants in Washim to meet the immediate financial requirements. But they were ready to 'aggregate' rest of their produce at the FPC level so as to be traded on NCDEX. Some farmers even deposited their entire produce with Parivartan FPC to avail the benefit of higher prices in futures market. After the Kharif harvest in 2019, Parivartan FPC sold 350 MT of soybean on NCDEX in FY20.

NCDEX reimburses costs borne by the FPCs to ready the produce for the market¹⁸; this has reduced the costs undertaken by the FPCs tremendously. Once the exchange pays the FPC, the FPC deducts (reduced) marketing costs from the price. It also deducts some service fees and then makes the payments to farmers. Thus, higher prices on futures markets eventually reach the purses of the farmers.

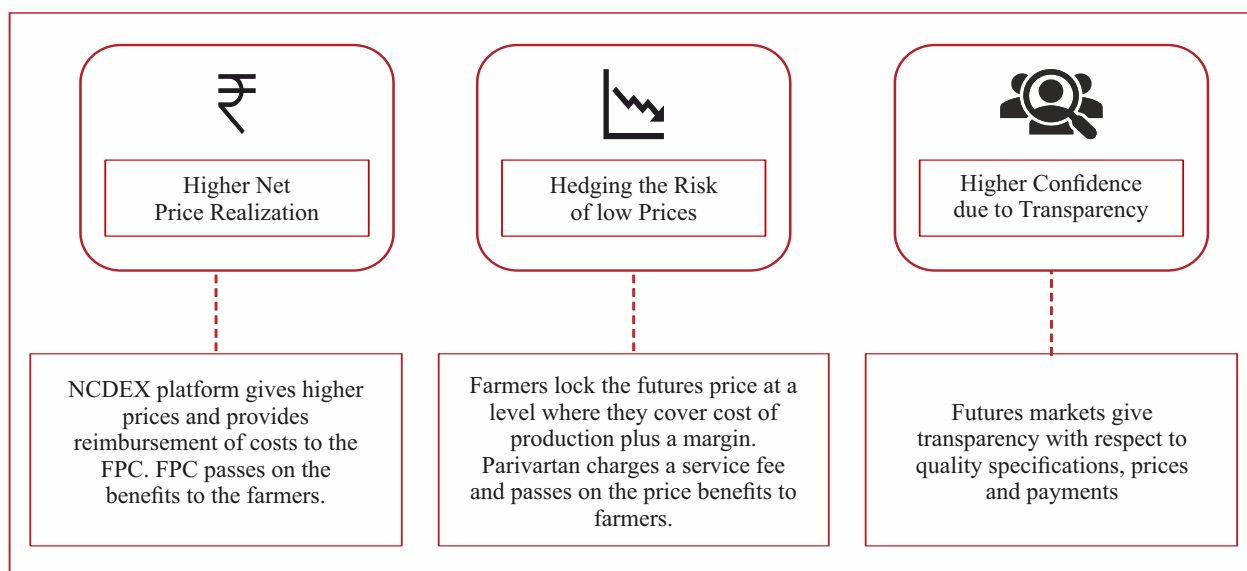
7.2 Impact of Futures on the Farmer-Members of Parivartan FPC

We examine the impact by comparing net returns accruing to farmers by selling on NCDEX (through FPC) and by selling to solvent extraction plants (through FPC). Access to futures has given good returns to farmers. Farmers selling to solvent extraction units through the FPC get a net price realization of Rs. 12847 per MT. Those selling on NCDEX through the FPC get a net price realization of Rs. 17257 per MT¹⁹. See **Annexure G**. Further, the futures contract on NCDEX allows the farmer to lock in the price at a much higher level and hence hedges him against the instance of a price reduction.

¹⁸ There is 100% reimbursement of costs borne for assaying, cleaning, sorting and drying the produce as well as for bags. There is 50% reimbursement of transportation costs, warehouse rents and other fees

¹⁹ Estimates of net price realization accruing to farmers selling to NCDEX and solvent plants were carefully constructed through KIIs with farmer-members and Directors of Parivartan FPC. .

Figure 7.2: Impact of NCDEX Futures on Members of Parivartan FPC



Source: Authors' compilation

Case Study 9: Surya FPC Limited

Box 7.2: Factsheet on Surya FPC Limited

- **Name of Company:** Surya Farmer Producer Company
- **Year of Establishment:** 2015
- **Located in:** Village Satephal, District Hingoli, Maharashtra
- **NCDEX trade:** From August 2019
- **Commodity Transacted:** Turmeric
- **No. of farmer members:** 535
- **No. of Members Producing Turmeric:** 335
- **Variety of Turmeric Cultivated:** Salem
- **Average Land Holding (in Acres):** 2 acres / farmer
- **Average Yield Per Acre:** 2 – 4 MT/ Acre
- **USP:** Surya FPC is sharply focussed on marketing. It owns an Adat shop in the local Basmat mandi wherein it auctions turmeric fingers to traders and branded Masala companies. It sells powdered turmeric on India MART and hedges against falling prices on NCDEX.

Source: KII

Surya Farmer Producer Company (Surya FPC) was incorporated in the year 2015. Located in the village of Satephall of Hingoli District, the FPC comprises of 535 farmer members, a majority of whom produce turmeric. From its very inception, the company has been sharply oriented towards marketing. The company set up its own trading (Adat) shop in the Basmat mandi of Hingoli in 2016. Nearly 3000 farmers got connected with the company for selling their produce. The buyers included traders from other markets as well as branded spice companies such as Rajasthan Masalewale, Akola Masalewale etc.

The Surya FPC in Hingoli district of Maharashtra trades turmeric on futures, but its business model is different from that of Parivartan FPC. The FPC has its own trading (Adat) shop, in which it purchases turmeric from members and non-members. See **Figure 7.3**.

Figure 7.3: Trading (Adat) Shop at APMC mandi at Sategaon



Source: Surya FPC

It segregates good quality turmeric to sell on NCDEX futures as well as to branded masala companies. For this, it takes a loan from NBFCs to make down payments to the seller-farmers. Thus, the farmers in this business model do not get the benefit of prices offered by buyers; they get a price decided by the FPC and the FPC gets the benefits of the market channels.

7.3 Experience of Selling Turmeric on NCDEX

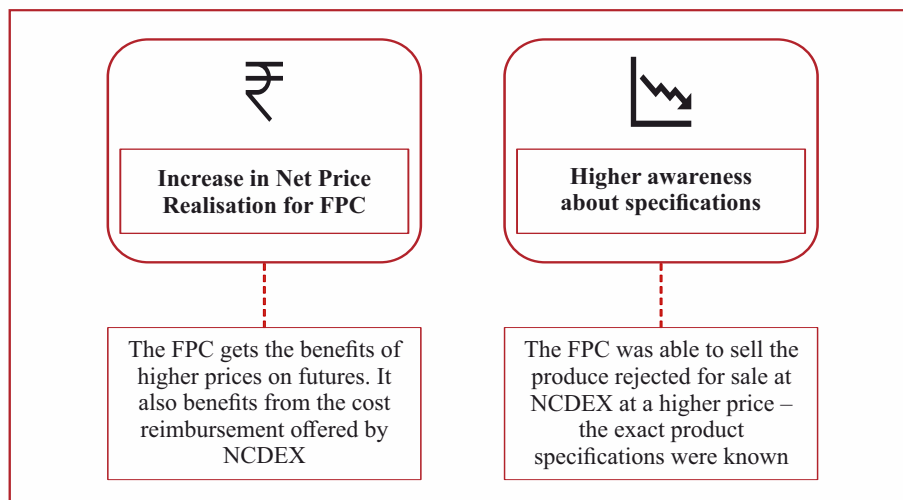
In August 2019, Surya FPC sold 10 MT on NCDEX and earned good profits. Encouraged by its first success, Surya FPC went on to prepare 200 MT of produce for trade on NCDEX over the next two months. However, this time, almost half of the turmeric produce was rejected after quality assessment at the NCDEX warehouse. Quality assessment revealed the presence of 2 per cent unboiled or less boiled turmeric fingers, whereas the accepted standard was maximum 0.3 per cent of unboiled or less boiled turmeric fingers. The FPC could sell only 110 MT worth of produce on the exchange at around Rs.61000 per MT.

While the rejection of half of the produce came as a blow, there was an interesting aspect to marketing the rejected produce. The produce was of very good quality since it was prepared for the exchange. There was no infestation or fungus. The length of turmeric fingers was also very good. The only issue was that the percentage of unboiled turmeric was higher than the level accepted by NCDEX. Since the FPC knew why exactly the produce was rejected, it knew that it was still worthy of being sold to food processing and masala companies who insist on high-quality. Thus, the FPC managed to get a higher-than-APMC price for this produce. The company also has realized that they will need to train their female workforce, which handles the sorting and grading activities, for NCDEX trade separately. In the FY21, the FPC plans to trade 100 MT on futures.

7.4 Impact of futures market on Surya FPC

We compare the net returns to the FPC by selling to futures market and to branded masala companies. The FPC gets net price realization of Rs. 1045 per MT by selling to masala companies. It gets a net price realization of Rs. 7580 per MT by selling on NCDEX. See **Annexure H**. The sharp difference is due to much higher prices on NCDEX as well as the reimbursement of costs provided by NCDEX. See **Figure 7.4**.

Figure 7.4: Impact of NCDEX on Surya FPC



Source: Authors' compilation

CHAPTER 8

OVERARCHING OBSERVATIONS AND POLICY RECOMMENDATIONS

The study of “Innovations to Get Markets Right” brings out interesting insights into the dynamics of innovations in agricultural marketing. Technological as well as institutional innovations have changed the way markets function. Agritech startups have typically been forerunners in terms of technological innovations. Many of these engage with FPOs and/or individual farmers at a pilot level and then scale up their innovation to other FPOs/ farmers in same geographies or with same product profiles. Contract farming and futures markets are interesting examples of institutional innovations that have allowed farmers to try their hand at alternate markets. Like in any other experimental space, there have been successes and failures, hits and misses and of course, learnings, which are summarized below.

8.1 Over-arching findings

- i. The case studies indicate that technology solutions have the potential to break down a problem and address the core issue with very local customized solutions, which is very important for a geography like India.
- ii. We find that tech solutions are addressing some of the very important issues related to sustainable agri practices – be it solar enabled cold chains, traceability or supply chain management. The solutions help conservative use of resources as well as enable stakeholders to take preemptive measures to handle sudden changes in demand, supply shocks, plant disease, etc
- iii. The solutions offered by the agritech startups enhance farmer's income not just by allowing him to reap a higher price but also ensure sustainability of income by giving him the right ecosystem to work in, assured markets, sustainable practices, etc. Many of the solutions also reduce the vulnerability of farmers to downside risks and hence help to control volatility in incomes. On their part, farmers too are more driven to deliver quality because of the inbuilt incentives and penalties in the system.
- iv. Access to innovations is expensive. Innovative solutions entail higher costs in the form of rents, interest payments, service charges and fees. However, the increase in revenues outweigh the increase in costs, giving positive net returns to the farmers. Thus, early impact is positive and encouraging.
- v. Farmers and/or FPOs which agreed to be first movers in the innovative tech solution offered by the agritech startups had an extraordinary market orientation. They had already decoded the market cues and saw value in the solutions being offered by the startups. The first participants in the innovative tech solution have been, more often than not, well-off farmers with an innate understanding of markets and agribusinesses. This also might be the reason why early impact seems so impressive.
- vi. For an agritech product or service to take off successfully, the presence of a local farmer client is very important. Presence of an intelligent, visionary farmer with the financial wherewithal to take a risk is one of the most important factors leading to success for agritech startups. Agritech solutions are often piloted on successful, financially well-off farmers before they can be scaled up to give benefit to the small and marginal farmers. The trickle-down effect is thus observed within the sphere of agritech innovations too.
- vii. It is not that startups build up tech solutions from scratch. What the tech solutions do is that they add a layer of digitalization on digitized systems, thereby making the systems more efficient. This helps to connect different market models like digital marketing, warehousing, futures, and with the help of FPOs create the scale for feasible operations.

viii. The very presence of agritech solutions indicates the problems that plague the present marketing system. Failure of APMC mandis to offer even basic standards and formal grading methods, lack of cold stores, lack of information about prevailing prices are the issues that create a natural context for business-oriented startups to offer tech solutions that address these issues. This is not to say that everything is at its optimal best within the new structures. There are doubts that startups might become the new traders within the system, albeit with a touch of technology. What happens when the existing APMC markets become more competitive, how will the end game really play out is a question that will require deeper research.

Across products, geographies and verticals, we find that tech innovations as well as institutional innovations have created huge impacts at the grassroots. While there seems to be discernible impact in terms of increase in net price realization, it is exciting to also see the impact in qualitative terms. **Table 8.1** offers a summary of the observed impacts.

Table 8.1: Summary of Early Impact of Innovations

S. No	Agritech Startup/ Contract Sponsor/ NCDEX	Innovation	FPO	Product	Impact
1	Stellapps	Full-stack traceability within milk value chain and digital payments	Bachkheda Village Society (of Bhilwara Milk Union), Rajasthan	Milk	(1) Transparency in milk movement (2) Higher bonus for society (3) Society identifies weak farmers - focussed capacity building programs (4) Higher sales of feed and supplements (5) Women farmers empowered - they know how much is due (6) Farmers paid directly from Milk Union- reduces rent-seeking of intermediaries
2	Ecozen	Solar-powered cold store at farmgate	Pragati FPO, Andhra Pradesh	Flowers	(1) Higher net incomes for farmers despite higher storage costs and service fees (2) Reduced income volatility - Under worst prices, farmers without solution get net income of Rs.11000 per MT. Pragati farmers get Rs.53230 per MT(3) Revenue model for FPO for business expansion (4) Environmentally sustainable
3	Ergos	Grainbank + eNWR for farmers + market linkage	Farmers from Nayanagar, Samastipur, Bihar	Rabi Maize	(1) Higher net incomes despite higher costs of engaging with Ergos facility - distress sales are avoided. (2) Net income of farmers without solution at Rs.4930 per MT. Ergos farmers get Rs.9423 per MT (3) Liquidity needs are met (4)Financial discipline amongst farmer clients. (5) Inclusion into formal banking

S. No	Agritech Startup/ Contract Sponsor/ NCDEX	Innovation	FPO	Product	Impact
4	Arya Collateral	Warehousing and customized fintech solutions for FPOs	Sontat FPC, Madhya Pradesh	Wheat Seed	(1) Higher net FPC income despite higher costs (2) Net income of comparison FPC at Rs.4055 per MT. Sontat gets Rs.7003 per MT(3) Liquidity needs of FPC are met (4) Enhanced brand valuation of seeds due to low damage (5) Customization - FPC allowed to move collateralized produce for processing
5	WayCool	End-to-End Supply Chain	Vambori FPC, Maharashtra	Onion	(1) Higher net incomes for farmers (2)Net income through APMC sales at Rs.5983 per MT, through sales to WayCool at Rs.7523 per MT(3) Advisories on extension (3) Risk diversion is possible - farmers sell lower grade onions at the APMC and higher-grade onions to WayCool.
6	Sahyadri FPC Ltd (SFPCL)	Contract farming within Amul model framework (soft contract)	Alandi Valley FPC, Maharashtra	Tomato	(1) Contract enables higher net returns - lower input costs, advisories (2) Farmers protected from fall in price below limit set in contract. In case of price crash, farmers without contract get negative net returns. AVFPC members continue to get positive returns. Thus, risks are reduced (3) Sustained revenue model for FPC
7	Deccan Agro	Contract farming (regular contract)	Shree Mahaganapati FPC, Maharashtra	Okra, chillies, baby corn	(1) Higher net returns to farmers. (2) Net income through APMC sales of okra at Rs.3530 per MT, through sales to Deccan Agro at Rs.11380 per MT (2) Farmers have exposure to requirements of MRL-sensitive London market, without exposure to price risk (3) Sustained revenue source for FPC (4) With the corpus, FPC plans to move up in the value chain
8	NCDEX	Futures trading	Parivartan FPC, Maharashtra	Soybean	(1) Higher net returns to FPC due to reimbursement of expenses by NCDEX and higher prices (2) Hassle-free payments (3) Higher trust since standards and corresponding prices are specified (4) Sustained source of revenue for FPC (5) Risk is completely hedged (6) Business model of FPC

S. No	Agritech Startup/ Contract Sponsor/ NCDEX	Innovation	FPO	Product	Impact
					allows farmers to get higher returns. Net income through sales to solvex plants at Rs.12847 per MT, through sales to NCDEX (through FPC) at Rs.17257 per MT
9	NCDEX	Futures trading	Surya FPC, Maharashtra	Turmeric	(1) Higher net returns to FPC due to reimbursement of expenses by NCDEX and higher prices as compared to sales to branded masala companies (2) Risk is completely hedged (3) Presence of standards helps FPC to assess price of even rejected produce

Source: Authors' compilation

8.2 Policy Recommendations

Bettering the Ecosystem

i. Setting up of a Nodal Agency for scaling up of Agritech Startups

The agritech ecosystem functions within a multi-player framework comprising agritech startups, FPOs, bankers, Venture Capitalists, Social Impact Funds, NBFCs, Government officials etc. However, the major players within the system are seen to work in a silo environment, wherein dialogues between the stakeholders have remained limited, sporadic and weak.

An FPO desirous of seeking a tech solution normally approaches the state-level Department of Agriculture, which tries to facilitate contact of the FPO with a few startups that it feels are best-suited for the challenge. However, identifying suitable startups which may have the potential to provide a tech solution to the FPO is a not a core competency area for the Department.

Similarly, a startup wishing to pilot its tech solutions normally approaches an incubator, which may connect it to the FPO base within its reach. However, FPO outreach of incubators is normally restricted geographically. Incubators may not assess their suitability to serve as a pilot in the innovation correctly.

Thus, institutional arrangements are required to facilitate systematic, long-lasting and scalable contact in this space. These arrangements can be visualized at the Central as well as State level. A nodal agency at the Centre can prepare an integrated databases across State-level Federations of FPOs, incubators and agritech startups registered under DPIIT. It will also offer a single window solution for supporting adoption of tech solutions through convergence of schemes of the Ministry of Agriculture and Farmers' Welfare (MOA&FW), Ministry of Food Processing Industries (MOFPI), NABARD and other relevant departments. The nodal agency also may form commodity clusters for different states (in consultation with State-level agency) and identify startups with suitable tech profiles. It may also develop a rating tool for FPOs as well as startups. State level Departments should facilitate engagement of startups with rated FPOs within the State. The State Department

should integrate the tech solutions applicable for relevant commodity clusters with its existing FPO extension programs to enhance the tech-absorption capacity at farmer level.

ii. *Strengthening of the Warehousing Vertical*

- a. Price Risk to be mitigated through a layered insurance-credit product

Mere presence of a warehousing solution with an eNWR layer is not enough to inspire confidence in the farming community. Access to warehousing entails storage costs. Farmers and FPOs storing their produce may be satisfied with the warehousing facility and with the credit access, but many of them have fears that the price of the produce would crash. In such an instance, the farmer/ FPO would be left with higher storage costs, higher interest costs and lower prices. Lack of credible market intel on movement of prices and the subsequent price risk is one of the chief hindrances for farmers/ FPOs to access warehouses.

Price risk can be mitigated through an insurance layered financial product such as the one hosted by Aryadhan in partnership with Rabo Bank (See case study of Arya Collateral). NABARD should launch a study of such layered fintech solutions primarily aimed at assessing feasibility and scalability of the same at the grassroots. Availability of such products across FIs supporting warehouses will lead to strengthening of the warehousing vertical.

- b. Asset monetization of PACs/ other existing godowns

State Governments need to allow asset monetization of the godowns available with PACs, marketing and other departments and facilitate integration of these facilities with agritech startups. This is a win-win situation for all stakeholders. It enables the startups to remain asset light. They need not set up new warehouses but need to only retrofit the existing ones available with PACs. It also creates a revenue source for PACs. Finally, and most importantly, this will enable bringing in a framework of decentralized warehousing solutions at farmgate, thereby benefitting the farmers.

iii. *Need for Standards and Certification to give scale to Agritech Startups*

The FAO defines Good Agriculture Practices (GAP) as “collection of principles to apply for on-farm production and post-production processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economic, social and environmental sustainability.” No such standards (for products) and certification (for production and post-harvest processes) currently exist in the Indian scenario. Creation and implementation of such standards and certifications will be a win-win for all the stakeholders in the commodity value chains. Farmers benefit since agriculture becomes more profitable. Processing industries get access to safe raw material. Consumers are the biggest beneficiaries since they get access to safe food. Introduction of such certificates and standards will necessitate creation of testing laboratories, quality assaying infrastructure, safe packaging systems, safe storing systems, cold stores, cold transport solutions, traceability software, apps for in-farm and in-transit monitoring etc. This, in turn, will give the much-required scale to agritech startups which are operative within the F&V vertical.

iv. *Strengthening data culture around Agritech Startups and FPOs*

- a. Standardize data templates for FPO promoting agencies

There are multiple agencies such as NABARD, SFAC, NCDC and ATMA which maintain data on FPOs. Each agency has its own template for maintaining details and the data sets are not mutually exclusive. Even if there are multiple agencies in charge of setting up the FPOs, their data template needs to be standardized and harmonized.

- b. Startup India to host dynamic data system

Similarly, the Startup India website hosts data on startups. However, this is registration level data and offers no insight on whether the startups are live, dormant or have ceased operations altogether. Dynamic data systems need to be created to maintain data on startups.

Strengthening of FPOs

v. Create an Amul framework for FPCs

- a. Promote two-tiered FPC structures

One of the insights derived from the case study of SFPCL is that a two-tiered FPC structure works viably as a business model. The umbrella FPC can handle the marketing, sales and branding of the produce. It communicates the market intel, standards and requirements to a number of purely production oriented FPCs that work within its fold. The smaller FPCs can then concentrate on production related matters.

- b. Allow Market Savvy FPOs to function as POPIs

NABARD provides technical as well as financial support to 'Producer Organization Promoting Institutions (POPIs)', which further are given responsibility of promoting new Producer Organizations or strengthening the existing ones. Using the aforementioned rating tool created by the nodal agency, market-savvy FPCs could be allowed and encouraged to function as POPIs by NABARD. Such a step will help the umbrella FPCs to form and/or strengthen the other producer-level FPCs that they wish to work with. A similar pattern can be adopted by NCDC, SFAC and other organizations as well.

vi. Banks to offer customized financial products to FPOs

Interactions with Directors of FPOs reveal that they find it cumbersome to work with banks and prefer to access credit through NBFCs. One reason for this is the aggressive presence of NBFCs at the grassroots. NBFCs may have more agility to customize financial products to suit the requirements of the FPOs. One example of this is covered in the case study of Arya Collateral.

NABARD needs to review such fintech products wherein a tech solution (warehousing, in this case) is layered with an innovative and niche financial product offered by an NBFC. It could advise and allow banks to create their own versions of such financial products in partnerships with select warehouses, cold storages, etc. and promote the same aggressively, thereby offering more choices in financial products to FPOs.

Strengthening of futures markets

vii. Policy Interventions for NCDEX

- a. Enhance FPO outreach

The case study on Parivartan FPC shows that the major challenge to trading on futures was the resistance to change in the status-quo. The farmers were initially reluctant to trade in futures market. The FPC had to undertake the risk of borrowing funds to make down-payments to farmers so as to prepare the lots for futures. This was compounded by perception issues wherein futures markets are eyed suspiciously by the farming community. The outreach program needs to be enhanced to address such issues.

- b. Increase Payments frequency

While the FPOs are happy about the timely payments, the once-a-month payment cycle creates cash flow pressures for FPCs. The NCDEX could introduce a twice-a-month payment cycle for the FPOs.

c. Delivery Centres to be created within Production Clusters

Delivery centres are often at a huge distance from production clusters. NCDEX may want to increase the network of accredited warehouses in the production centres.

8.3 Way Ahead

Early impact of innovations in agriculture marketing seems to be positive and encouraging. The trends identified in this study need to be verified through primary surveys with scientific sample designs and sample sizes. More needs to be done in terms of strengthening the ecosystem and including more FPOs in the fold of innovations. Any chain is only as strong as its weakest link. Attention will need to be given to strengthen FPOs so that they can benefit from the space of innovative tech and fintech products. Data gaps in the ecosystem need to be addressed with priority.

Slowly but surely, agriculture is getting digitalized in the country. Deeper study is required to understand and drive scalability and inclusivity of the successful innovations.

References

1. Arya (2018), Price Risk Mitigation Tool for irreversible prosperity of Smallholders and their organizations, Research Paper, Arya Collateral Warehousing Services Pvt. Ltd., December 2018
2. FICCI (2020), Compendium on Best Practices adopted by Agri Startups to Address Covid-19 Challenges in Agri & Allied Sectors, 2020
3. Govil Richa, Neti Annapurna and Rao Madhushree (2020), Farmer Producer Companies: Past, Present and Future, Azim Premji University
4. NABARD; <https://www.nabard.org/about-departments.aspx?id=5&cid=470>
5. NASSCOM (2019), Agritech in India: Emerging Trends in 2019
6. NASSCOM (2020), Startup Catalysts: Incubators and Accelerators in 2020
7. NDDDB (2015), National Dairy Plan I, National Dairy Development Board, <https://www.nddb.coop/ndpi/about/brief>, last accessed on 3/12/2020
8. ThinkAg (2020), Ag-tech in India: Investment Landscape Report, 2020
9. Tracxn (2022), AgritechStartups in India; <https://tracxn.com/explore/AgriTech-Startups-in-India>
10. Kalaari 2022, Agritech: India's Sunrise Sector, A Kalaari Capital Report <https://www.kalaari.com/wp-content/uploads/2022/09/AgriTech-Indias-Sunrise-Sector.pdf>

Annexure A: Indicative Impact of Ecozen

Table A.1: Net Price Realization for Farmer-Members of Pragati FPO and of Comparison FPO from sales of flowers (Best Price)

S. No.	Items - Costs and Revenue	Farmer Members of Pragati - With Tech Solution	Farmer Members - Without Tech Solution
1.	Av landholding per farmer (acres)	1	1
2.	Yield per acre (MT)	5	5
3.	Produce sold in regular season (%)	70	85
4.	Produce sold in peak season (%)	30	15
5.	Produce sold in regular season (MT)	3.5	4.25
6.	Produce sold in peak season (MT)	1.5	0.75
7.	Price (per MT) during regular season	80000	80000
8.	Price (per MT) during peak season (Navratri, Dasara, Diwali, weddings)	180000	180000
9.	Gross Revenue from regular season	280000	340000
10.	Gross Revenue from peak season	270000	135000
11.	Gross Total Revenue to Farmer	550000	475000
12.	Total Production Cost - Rs.30000 per MT	150000	150000
13.	Cost of storing: 40 kgs stored for 40 days at Re.1 per kg per day (About 60 -80 kg harvested per day)	1600	0
14.	Cost of transport to mandi(Re.1 per kg)	5000	5000
15.	Service fees paid to FPO: Rs.2 per kg for comparison FPO, 5% of sales for Pragati	27500	10000
16.	Total Cost to farmer (12+13+14+15)	184100	165000
17.	Net income (11 less 16)	365900	310000
18.	Net Income per MT	73180	62000

Source: KII

Table A.2: Net Price Realization for Farmer-Members of Pragati FPO and of Comparison FPO from sales of flowers (Worst Price)

S. No.	Items - Costs and Revenue	Farmer Members of Pragati - With Tech Solution	Farmer Members - Without Tech Solution
1.	Av landholding per farmer (acres)	1	1
2.	Yield per acre (MT)	5	5
3.	Produce sold in regular season (%)	70	85
4.	Produce sold in peak season (%)	30	15
5.	Produce sold in regular season (MT)	3.5	4.25
6.	Produce sold in peak season (MT)	1.5	0.75
7.	Price (per MT) during regular season	50000	20000
8.	Price (per MT) during peak season (Navratri, Dasara, Diwali, weddings)	180000	180000
9.	Gross Revenue from regular season	175000	85000
10.	Gross Revenue from peak season	270000	135000
11.	Gross Total Revenue to Farmer	445000	220000
12.	Total Production Cost - Rs.30000 per MT	150000	150000
13.	Cost of storing: 40 kgs stored for 40 days at Re.1 per kg per day	1600	0
14.	Cost of transport to mandi (Re.1 per kg)	5000	5000
15.	Service fees paid to FPO: Rs.2 per kg for comparison FPO, 5% of sales for Pragati	22250	10000
16.	Total Cost to farmer (12+13+14+15)	178850	165000
17.	Net income (11 less 16)	266150	55000
18.	Net Income per MT	53230	11000

Source: KII

Annexure B: Indicative Impact of Ergos

Table B.1: Net Price Realization for Maize Farmers with Ergos facility and without Ergos facility

S. No.	Items – Costs and Revenue	Farmers with Tech Solution by Ergos	Farmers without Tech Solution
1.	Yield per acre (MT)	2.6	2.6
2.	Average landholding (acres) under Maize	1.5	1.5
3.	Price (per MT) at harvest in May - Without Ergos, produce is sold to local trader at farmgate. On Ergos platform, produce sold to buyer with highest price quote. Average prices as revealed from KIIs for May 2020 are used here for calculations	11600	10000
4.	Price (per MT) 6 months after harvest in November as quoted by buyers on Ergos platform (Highest Price)	15500	0
5.	Production Cost (per MT)	5000	5000
6.	Cost of transport + jute bags (per MT) for availing Ergos facility	60	0
7.	Cost of loading at farmgate and unloading at Grainbank (per MT)	60	0
8.	Cost of transport + labour charged by local trader (per MT) for buying the maize at farm-gate	0	70
9.	Cost of storing for 6 months (per MT)	600	0
10.	Average ticket size of stored produce (MT)	4	0
11.	Total Interest Cost- Assuming that the Ergos farmer takes a loan at 12% p.a to the extent of valuation of 50% of his produce (2 MT valued at Rs.11600/MT) for 6 months	1427	0
12.	Interest Cost (Per MT)	356.7	0
13.	Gross Income (per MT)	15500	10000
14.	Total Costs (per MT) (5+6+7+8+9+12)	6076.7	5070
15.	Net Price Realization per MT (Price less Variable Cost)	9423	4930

Source: KII

Annexure C: Indicative Impact of Arya Collateral

Table C.1: Net Price Realization for FPO for Wheat Seeds with scientific storage (Sontat FPC) and without scientific storage (comparison FPC)

S. No	Items – Costs and Revenue	Sontat FPC (with Tech Solution)	Comparison FPC (without Tech Solution)
1	Price paid by FPO to member farmer per MT	21250	21250
2	Jute bags per MT	360	360
3	Transport cost (per MT) to the sorting/ grading centre in Rewa - 80 KM	500	200
4	Cost of grading (labour + machining) per MT	1200	1200
5	Transport cost per MT to the Arya Warehouse for Sontat/ own warehouse for Comparison FPC	100	100
6	Storage cost per MT for 8 months	600	0
7	Sampling costs per MT	50	50
8	Repacking in Government specified seed bag - labour cost per MT	300	300
9	Cost of seed bag per MT	520	520
10	Simple Interest at 14% on 70% of stock value at Aryadhan for Sontat; Interest at 11.3% on 70% of stock value at NABKISAN for Comparison FPC – for 8 months	117.6	94.92
11	Total Costs (1 to 10) per MT	24997	24075
12	Price of packaged seeds (per MT)	32000	29000
13	Damage (%)	0	3
14	Revenue per MT from Sales	32000	28130
13	Net price realization per MT (Price less Variable Cost)	7003	4055

Source: KII

Annexure D: Indicative Impact of WayCool Foods

Table D.1: Net Price Realization for Farmer Members of Vambori FPC in FY19 from sales of onions to WayCool and at local APMC mandi

S. No.	Items – Costs and Revenue	WayCool	APMC mandi
1	Landholding (acre)	1	1
2	Yield (MT/acre)	15	15
3	Cost of cultivation and harvesting (Rs/ MT)	2666	2666
4	Cost of labour for sorting/ grading (Rs. per MT)	600	450
5	Cost of packaging, if any (Rs. per MT): Rs. 560 for gunny bag	560	560
6	Cost of loading/ unloading (Rs.150 per MT)	150	150
7	Cost of transport to client (Rs. per MT)	0	40
8	Any other cost (Rs. per MT): APMC charges levied by Arthiyas	0	150
9	Price per MT	11500	10000
10	Total Revenue per MT	11500	10000
11	Total Costs per MT	3976	4016
12	Net Price Realization (Rs/ MT)	7523	5983

Source: KII

Annexure E: Indicative Impact of SFPCL Contract

Table E.1: Net Price Realization for Farmer-Members of AVFPC (under contract) and Comparison group (no contract) from sale of tomatoes under Best Prices

S. No.	Items – Costs and Revenue	AVFPC: Contract with SFPCL	Comparison Group: No contract with SFPCL
1	Average land holding (acre)	5	1
2	Yield per acre (MT)	40	25
3	A grade (MT) - 10%	4	2.5
4	B grade (MT) - 20%	8	5
5	C grade (MT) - 70%	28	17.5
6	Produce sold to APMC (%)	30	100
7	Price - A grade (per MT)	45000	45000
8	Price - B grade (per MT)	15000	15000
9	Price - C grade (per MT)	6000	5000
10	Production cost (per MT)	3000	4500
11	Transport cost: Nashik APMC (per MT) at 40 km distance	400	400
12	Loading/ unloading costs at APMC (per MT)	500	500
13	Transport cost to SFPC (per MT) at 48 km distance @ Rs.400 per MT: Paid by SFPCL to Vesatogo	0	0
14	Loading/ unloading costs at SFPC (per MT)	100	0
15	Total Revenue per acre	461160	269500
16	Total Revenue (per MT)	11529	10780
17	Total Variable Costs (per MT)	4000	5400
18	Net income per MT (16 less 17)	7529	5380

Source: KII

Table E.2: Net Price Realization for Farmer-Members of AVFPC (under contract) and Counterfactual group (no contract) from sale of tomatoes under Worst Prices

S. No.	Items – Costs and Revenue	AVFPC: Contract with SFPCL	Counterfactual Group: No contract with SFPCL
1	Average land holding (acre)	5	1
2	Yield per acre (MT)	40	25
3	A grade (MT) - 10%	4	2.5
4	B grade (MT) - 20%	8	5
5	C grade (MT) - 70%	28	17.5
6	Produce sold to APMC (%)	30	100
7	Price - A grade (per MT)	15000	15000
8	Price - B grade (per MT)	5000	5000
9	Price - C grade (per MT)	3500	3000
10	Production cost (per MT)	3000	4500
11	Transport cost: APMC (per MT) at 40 km distance	400	400
12	Loading/ unloading costs at APMC (per MT)	500	500
13	Transport cost to SFPC (per MT) at 48 km distance	0	0
14	Loading/ unloading costs at SFPC (per MT)	100	0
15	Total Revenue per acre	195510	112700
16	Total Revenue (per MT)	4887.75	4508
17	Total Variable Costs (per MT)	4000	5400
18	Net income per MT (Total Revenue less Total Variable Costs)	887.75	-892.00

Source: KII

Annexure F: Indicative Impact of Deccan Agro Contract

Table F.1: Net Price Realization for Baby Corn, Chillies and Okra for Farmers – under Contract with Deccan Agro

S. No.	Items – Costs and Revenue	Baby corn	Chili	Okra
1.	Area (acres)	1	1	1
2.	Average yield (in MT)	5.5	22.5	7.5
3.	Pesticide costs per acre	0	0	0
4.	Seed + other inputs cost per acre	15000	109675	34725
5.	Labour costs per acre -Harvesting	6000	80000	40000
6.	Total cultivation cost per acre (3+4+5)	21000	189675	74725
7.	Cultivation cost per MT	3820	8430	9960
8.	Price per MT as per contract	6750	23250	21750
9.	Transport from farm to cold store - per kg	0	0	0
10.	% of rejected produce	6	0	6
11.	Price for rejected produce per MT	2500	0	15000
12.	Weighted average price per MT after adjusting for rejection	6500	23250	21350
13.	Net Price Realization per MT (Weighted average price less variable costs)	2680	14820	11380

Source: KII

Table F.2: Net Price Realization for Baby Corn, Chillies and Okra for Comparison group – without Contract

S. No.	Items – Costs and Revenue	Baby corn	Chilli	Okra
1.	Area acres	1	1	1
2.	Average yield in MT	5.5	22.5	7.5
3.	Pesticide costs per acre	5000	10325	11275
4.	Seed + other inputs cost per acre	15000	109675	34725
5.	Labour costs per acre - Harvesting	6000	80000	40000
6.	Total cultivation cost per acre	26000	200000	86000
7.	Cultivation cost per MT	4730	8890	11470
8.	Transport and labour from farm to mandi - per MT	3000	3000	3000
9.	Total Costs per MT	7730	11890	14470
10.	Average Price per MT in APMC mandi	NA	24000	18000
11.	Net Price Realization per MT (Average Price less Total Variable Costs)	NA	12110	3530

Source: KII

Annexure G: Indicative Impact of Futures on Parivartan FPC

Table G.1: Net Price Realization to Farmer Members of Parivartan FPC from Sales of Soybean to NCDEX Futures Platform and local Solvent Extraction Plant

Sr. No.	Items – Costs and Revenue	NCDEX (Price and Costs Per MT)	Soya Solvent Extraction Plant (Price and Costs per MT)
1	Price on Futures Contract/ declared by Solvent Plant	43000	41000
2	Reduction in Price, if any at time of delivery	0	512.5
3	Actual Price	43000	40487.5
4	Production Cost	25000	25000
5	Marketing Costs after re-imburement by NCDEX deducted from payment by FPC	643.85	2540
6	Service fees paid to FPC @ Rs. 100 per MT	100	100
7	Total Costs	25743	27640
8	Net Price Realization per MT (Price less Variable Costs)	17257	12847

Source: KII

Annexure H: Indicative Impact of Futures on Surya FPC

Table H.1: Net Price Realization to Surya FPC from Sales of Turmeric to NCDEX Futures Platform and branded masala companies

Sr. No.	Revenue and Costs for Surya FPC	NCDEX (Per MT)	Branded masala Companies (Per MT)
1	Price on Futures Contract/ declared by Buyer	65600	61000
2	Cost of Purchasing Turmeric from Farmer	57000	57000
3	Marketing Costs undertaken by FPC	2661	2100
4	Reimbursement from NCDEX	2495.5	0
5	Marketing Costs after re-imburement by NCDEX	165.5	2100
6	Interest Costs: Loan of Rs. 57000 taken at 18% pa for 1 month	855	855
7	Total Costs	58020.5	59955
8	Net Price Realization (Price less Total Costs)	7579.5	1045

Source: KII



National Stock Exchange of India Limited

Exchange Plaza, Plot no. C/1, G Block,
Bandra-Kurla Complex, Bandra (E), Mumbai - 400 051
www.nseindia.com



Indian Council for Research on International Economic Relations

Core 6A, 4th Floor, India Habitat Centre, Lodhi Road, New Delhi - 110 003, India
www.icrier.org

 www.facebook.com/icrier

 www.twitter.com/@icrier

 www.youtube.com/icrier

 www.linkedin.com/icrier