

Agricultural Marketing in India

Reforms for a Liberal and Competitive System

Edited by

Dr. V. David Chella Baskar
Dr. Shalendra

2022



**Rani Lakshmi Bai Central
Agricultural University
Jhansi (Uttar Pradesh)**



**National Institute of Agricultural
Extension Management (MANAGE)
Hyderabad (Telangana)**

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This e-book is a compilation of resource text obtained from various subject experts for Collaborative Online Training Programme of RLB-CAU, Jhansi (Uttar Pradesh) & MANAGE, Hyderabad (Telangana) on 'Reforms in Agricultural Marketing'. This e-book is designed to educate extension personnel, students, research scholars, policy makers and academicians on various aspects of agricultural marketing reforms introduced by the Government in recent past. Neither the publisher nor the contributors, authors and editors assume any liability for any damage or injury to persons or property from any use of methods, instructions, or ideas contained in the e-book. No part of this publication may be reproduced or transmitted without prior permission of the publisher/editor/authors. The content of the e-book is based on the contribution made by different authors. Publisher and editors do not give warranty for any error or omissions regarding the materials in this e-book.

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Director General



Foreword

Indian agriculture has made impressive growth since Independence. The foodgrain production has gone past 300 million metric tonnes (mmt). Same is the case with production of horticultural crops which stands at 325 mmt during 2020-21. However, the challenge is to integrate this production with market mainly when so many changes are being observed in the trade environment on account of preference of consumers and need for a transparent and competitive agriculture marketing system. The Government has also introduced so many initiatives in the recent past to make agriculture marketing system in the country effective and efficient like reforms in agricultural marketing facilitated by the Model Acts circulated during 2003 and 2017, electronic National Agriculture Market (eNAM), regulations in agri-warehousing sector and aggregation of farmers. Farm Acts introduced by the Government during 2020, through repealed subsequently, also expresses the need of the sector and intent of the Government.

In order to facilitate the learning of officers placed at various academic and training institutes on different aspects of agriculture marketing, MANAGE has attempted this e-book with focus on various dimensions of agriculture marketing mainly the reforms introduced in recent past. The e-book is prepared by MANAGE, Hyderabad in association with Rani Lakshmi Bai Central Agricultural University, Jhansi (Uttar Pradesh).

I acknowledge the efforts made by Dr V David Chella Baskar and Dr Shalendra in editing the chapters contributed by various authors on different aspects of agriculture marketing. I am quite confident about the publication being of immense use for all relevant stakeholders including trainers and extension functionaries placed at various institutes in exposing them to the importance of agricultural marketing and the changes facilitated through various reforms measures adopted by the Government. I hope the document will also facilitate the process of bringing the desired changes in the lives of farmers by helping them in getting integrated with market.


(Dr P Chandra Shekara)
Director General

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Need of agricultural marketing reforms in India

Dr Arvind Kumar, Vice Chancellor, Rani Lakshmi Bai Central Agricultural University, Jhansi (Uttar Pradesh)

Introduction

Agriculture is important for a country like India having more than 58 percent of its population relying on agriculture as their main source of livelihood. According to estimates, agriculture, forestry, and fishing contributed Rs 19.48 lakh crore (US\$ 276.37 billion) to gross value added during the financial year 2020-21 (Agricultural and Processed Food Products Export Development Authority - APEDA, Department of Commerce and Industry, Union Budget, 2021-22). The outbreak of COVID-19 and the subsequent slowdown in the economy will add further pressure on agriculture and allied activities as migrant workers are moving back to their native places. Though, contribution of agriculture in Gross Domestic Product of the Country has come down over years, it is still the primary source of livelihood for majority of the Indian working population. Considering the importance of agriculture, Indian Government is working on a multi-facet strategy to help its farmers achieve the ambitious goal of doubling farm income by 2022.

Shift in focus

As per the information compiled by the Ministry of Agriculture and Farmers Welfare (2021), India has achieved impressive growth since independence in terms of production of foodgrains (305 MMT during 2020-21), fruits and vegetables (330 MMT during 2020-21) and production of milk (198.4 million tonnes in 2019-20). However, these indicators do not lead to similar growth in the income of the farmers. Taking away the effect of inflation, real farm income just doubled during past 22 years i.e. 1993-94 and 2015-16 (Chand, 2017). This probably happened as the focus of the government mainly was on raising agricultural output and improving food security and not on farmer's income and welfare. Now, the government is having its focus on farmer's welfare and income enhancement. The Government of India has focused its attention on doubling the farmers' income during the seven-year period from 2015–16 to 2022–23, marking a significant departure from past policies when the emphasis had been only on production rather than the marketability of the produce. Accordingly, a Committee on Doubling Farmers' Income was constituted in April 2016 under the chairmanship of Dr Ashok Dalwai, The committee has suggested various measures to help farmers improve their income including strengthening of an integrated agricultural marketing system.

Importance of agricultural marketing

The changes experienced in the economy and agricultural sectors have made marketing important for overall development of the agriculture and welfare of the farmers. Due to the technological breakthrough, the marketable surplus of crops has become more visible in recent years leading to the requirement to follow a market-oriented approach to agriculture. Some of the changes making agricultural marketing important are as discussed below –

- *Increase in marketable surplus* – Today India is a surplus state in many of the agricultural commodities. The availability of good quality seeds and other technological developments have helped increase production and productivity leading to increased marketable surplus of most of the agri-commodities. More efficient and responsive markets are required to handle the increased surplus.
- *Market requirement for horticultural crops* – Another change in Indian agriculture has been the diversification towards high value horticultural crops. Horticultural crops are bulky and perishable in nature and therefore, need proper handling to maintain their quality all through the food supply chain till it reaches the final consumer.
- *Price discovery and price signals* – Agricultural marketing deals with the discovery of prices at different stages of marketing and also the transmission of price signals in the marketing chain specifically from consumers to farmers.
- *Shift in focus to market-led production* – Economic development, urbanisation, liberal trade policies and consumer awareness for safe and quality food has also led to increased opportunities in agricultural sector. Farmers are expected to respond to these increased opportunities by shifting their focus from production oriented to market oriented agriculture to increase their income.
- *Feeding urban population* – Urbanisation has increased substantially due to economic growth leading to more and more people required to be fed in urban areas by rural people. This will need not only production but also sound marketing system to facilitate efficient movement of agri-commodities from the point of production to the point of consumption.
- *Making smallholdings viable* – Small and marginal farmers play a key role in meeting the food requirements of the growing and increasingly rich and urbanized population. The earning potential of such smallholders can be greatly improved by adopting a market oriented approach.
- *Liberal and integrated marketing system* – The Doubling Farmers' Income (DFI) report of the GoI emphasises on the development of an integrated

marketing system by developing Rural Periodic Markets (RPMs) into Gramin Agricultural Markets (GrAMs) to operate as collection and distribution centres in rural areas and by integrating markets with knowledge centres and other services like warehouse/cold storage and banks.

Changing Indian agriculture

Indian agriculture is undergoing various changes. Planners and all other stakeholders should be concerned about how agriculture will evolve in the future. Indian governments and organizations are addressing several challenges in the agriculture sector, such as small holdings of farmers, primary and secondary processing, supply chain management, infrastructure supporting the efficient use of resources and marketing and reduction of middlemen (Madhu, 2021). The trend will continue in future as well. It is important to understand these expected changes and prepare production and marketing related strategy around these changes.

- 1) With an increase in income, globalization and awareness for safe food, the demand for agricultural produce is changing and will continue to be so in the future as well. These changes and preferences of the consumer may result in growing demand for fruits, vegetables, dairy products, fish and meat. The demand is anticipated to increase for quality products that are affordable and processed. This may only be achieved through research and improvement in technology leading to better production and reduced costs.
- 2) The environment conducive for participation of private players will help in creating competition and supply of various inputs like seeds, fertilizers, plant protection products, farm equipment and feed for animals in cost-effective ways ensuring greater return on investment.
- 3) Breeding along with biotechnology will become extremely important in the development of eco-friendly and disease-resistant varieties of crops that are more nutrient rich, tastier and climate-resilient.
- 4) There will be application of technologies like hydroponics, bioplastics and plastics to make agriculture more efficient. Vertical and urban farming will be emphasized to find a new production area in the competitive market.
- 5) It is expected that precision farming based on soil testing and automation using artificial intelligence will be used for precise and optimal application of inputs. The cost-effective method will be used to fit sensors and drones for quality, precision and reduced used of inputs leading to environment protection and better economics. Small and marginal farmers will also be able to take advantage of these technologies with the participation of private players, government agencies and/or farmer producer

organizations (FPOs). There will also be scope for use of GPS technology along with drones, robots, cameras and other tools to make lives of farmers easy and exciting with agricultural production and improved income. As a result of these advanced devices, agriculture will be more profitable, easier and environmentally friendly.

- 6) Agricultural will see improved efficiency due to use of nanotechnology. The nano-materials will reduce the use of chemicals, minimize nutrient losses in fertilizing and can be used to manage pests and nutrients for achieving higher yield.
- 7) Digital connectivity in India has increased significantly in recent past which has improved access to domestic and global market. According to projections, the number of internet users in the country will reach more than 666.4 million by 2025. Farmer's behaviour will be smarter with availability of mobile phones and they will be better connected with wide range of stakeholders. Government has extensive plans for implementation of various farmer centric schemes by using digital technologies for creating awareness, disseminating information and managing direct payments of benefits.
- 8) Central and State Governments, village communities, agriculture start-ups, and private players will have to play a major role in conserving sharply depleting natural resources like water and land. A revolution can be brought about in this direction with the application of digital technology.
- 9) The application of technology like IoT and drones with ability to collect and analyse information more precisely, quickly and effectively will help in providing better estimates on soil health, acreage under different crops, crop yield and various other related factors. The better estimates obtained with the application with technology will make availability of various services cheaper like insurance. The cost of production will also come down with optimum utilization of inputs.
- 10) Niche markets will be more prevalent. Equipment specific to operations, area/ region and crop will be available with capacity to streamline operations even at small farms.
- 11) There are policies of the government not only to encourage construction of storage capacity by private players but also to integrate them with market. The warehouse sector is expanding and is expected to have creation of more storage space by the private sector with better linkage with government warehouses and market. This will help in creating a balance between supply and demand and, stabilize the price of agricultural products.
- 12) Retail market is going to be another important component in marketing of agri-produce. Retail market is estimated to reach USD 1.6 trillion by 2026,

registering a CAGR of approximately 10 percent. Share of organised retail will likely increase to 22 – 25 percent in 2021 from 12 percent in 2017 (FICCI, 2020). A large part of agriculture's retail market will be digitized in the coming years. It is estimated that over 90 percent of Kirana stores across the country will be digitalized by the year 2025 with advanced logistics and an efficient supply chain that is fully traceable. Kirana stores have already been provided to consumers by many players such as *Amazon and Jio Mart*.

Farm Acts, 2020 – Myths and Realities

Indian agricultural is experiencing various changes on the front of production and trade. Farmers are also expected to cultivate as per the requirement of the market because of changes like better income due to economic development, growing population, urbanisation, globalisation and liberalisation and awareness for safe and healthy food among consumers. A conducive market environment is vital to operate under such a situation. Accordingly, Government of India has introduced various reforms in agricultural marketing to bring desired changes. The Ministry of Agriculture and Farmers Welfare prepared a Model State Agricultural Produce Marketing (Development & Regulation) Act, 2003 and circulated to all the states with a request to amend their respective APMC Act as per the provisions suggested in the model Act mainly for private markets and direct marketing.

As the response from States was lukewarm and also not uniform across different State/UTs, the Ministry set up a Committee of State Ministers In-charge Agricultural Marketing during 2010 to expedite the pace of reforms. Subsequently in year 2017, the Government introduced an even more comprehensive and forward looking document called Model Agricultural Produce and Livestock Marketing (Promotion & Facilitation) Act which suggesting measures like warehouses to operate as sub-market yards.

In order to have a liberal, transparent, efficient and competitive, barrier free marketing system providing alternatives to farmers, the Government of India passes three Farm Laws in September, 2020 namely (i) the Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020, (ii) the Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020, and (iii) the Essential Commodities (Amendment) Act, 2020.

Though, the Farm Laws have been repealed with the introduction of Farm Laws Repeal Bill, 2021 in the parliament in the month of November, 2021, it would be important to know different aspects of these bills to have an understanding of the intent of the government and requirement of the sector. Pros and cons association with the Farm Laws, 2020 are as summarized below –

Farm Acts	Pros	Cons
The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020	<ul style="list-style-type: none"> ▪ Permits the sale of produce outside the Agricultural Produce Market Committee (APMC) Mandis ▪ Trade taking place outside the Mandis will be exempted from any cess or levy ▪ Permits interstate trade of agricultural produce 	<ul style="list-style-type: none"> ▪ The state may lose the income derived from the respective Mandis for trade taking place outside the market ▪ Though the Acts aim at making the marketing channels more slim and efficient, many farmers across states fear that the scheme would end the Minimum Support Price (MSP) scheme, which otherwise has no bearing on the policy and process of procurement on MSP which continues to be the priority of the Government
The Farmers (Empowerment & Protection) Agreement of Price Assurance and Farm Services Act, 2020	<ul style="list-style-type: none"> ▪ Under this Act, farmers with purchase orders will directly contract with buyers without the involvement of the state APMC, thereby encouraging 'contract farming' 	<ul style="list-style-type: none"> ▪ In view of the fact that companies may prefer negotiating with groups of farmers rather than individual farmers, conflicts may arise ▪ A business perspective, dealing with the agents would be much better than dealing with a direct seller
The Essential Commodities (Amendment) Act, 2020	<ul style="list-style-type: none"> ▪ Commodities like cereals, pulses, oilseeds, edible oils, onion and potatoes have been removed from the list of essential commodities ▪ New investments can be made through FDI and by big companies in infrastructure development like cold storage 	<ul style="list-style-type: none"> ▪ The Act can be invoked if prices of perishables or non-perishables increase by 100 percent or 50%, respectively ▪ The primary purpose was to protect the interests of consumers by preventing illegal trade practices, such as hoarding and distress sale

The new laws were aimed at creating market environment providing choices to farmers and traders to buy or sell agricultural commodities. The concept of trade area introduced under the Act suggested that rules of APMC Act will be applicable only on the transactions taking place within the physical premises created under APMC Act whereas trade transactions taking place outside the market yard will have to be completed as per the provisions suggested in Act on trade and commerce by the the Central Government. Which suggests the co-existence of both the Acts with common interest of supporting farmers in true spirits of cooperative federalism. Farm Acts were also expected to have a major impact on stimulating farm sector growth by encouraging investment, facilitating creation of required post-harvest infrastructure and expansion of markets to help farmers realise competitive and remunerative prices of their produce. These reforms may have proved to be a significant step towards making Indian agriculture more demand-driven, accessible and competitive both at domestic and global level. The repeal of the Farm Laws will definitely slow down the reform process in agricultural marketing.

Conclusion

The production focused policies of the government have resulted in impressive growth of Indian agriculture over years. A shift is now being observed from production to welfare and income enhancement. The Government has, accordingly, introduced various reforms in agricultural marketing to improve the system and help farmers having better access to market. The better market access is expected to facilitate farmers realising better income. This will improve their ability to investment in new technologies. The cumulative effects of technology is expected to change the face of Indian agriculture in the days to come and will see investment by private players and participation of rural youth in different agribusiness activities. Although, the agricultural sector is facing several constraints making it difficult to calculate the returns, still the sector exhibits a huge untapped potential. Many individuals, big companies, start-ups, and entrepreneurship ventures are investing heavily in innovations, inventions, research and development as well as other business aspects due to ideal weather and soil conditions. Food is in high demand, there are many untapped opportunities and the government is offering various incentives to help farmers and other stakeholders avail these opportunities. This process is the key to the future of Indian agriculture.

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Agricultural marketing - the concept and its implementation In India

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Introduction

Agricultural marketing in India has undergone a sea change over the last 70 years owing to increase in the production and marketable surplus of major agricultural commodities, better income levels and urbanization and thereby changes in the pattern of demand of farm products, slow and steady increase in linkages with the overseas markets and changes in the form and degree of government intervention in agricultural markets. An efficient marketing system minimizes costs and maximizes benefits of different players participating in the food supply chain. It will facilitate farmers in realization of remunerative prices and make good quality food available at reasonable prices to the consumers. It will also ensure optimum margins for different players participating in the supply chain to allow them to continue in the business.

Marketing functions

Agricultural marketing system is comprehensive in its operations involving wide range of functions in the movement of agricultural commodities from producer to consumer (Fig – 2.1).

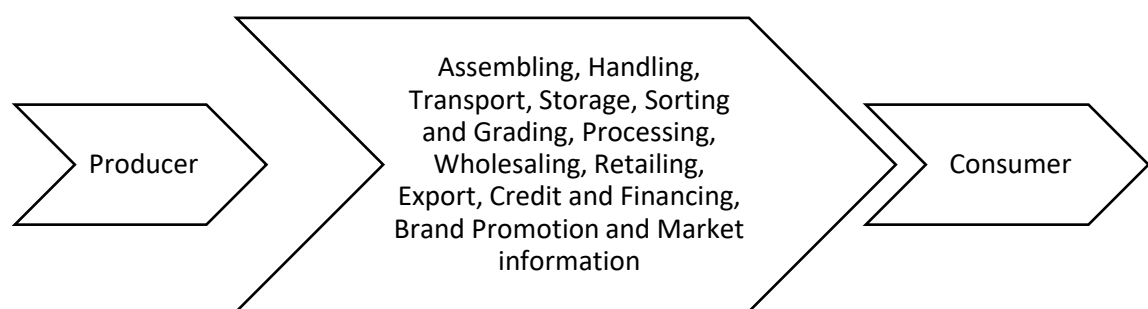


Figure 2.1. Functions involved in agricultural marketing

Kohls and Uhl (1990) have classified various marketing functions into three categories namely; exchange functions, physical functions and facilitating functions. Under exchange functions we have buying and selling. As already mentioned, while discussing agricultural marketing we confine ourselves to only buying and selling but it is much beyond that covering physical (storage, transportation and processing) and facilitating functions (standardization,

financing, risk bearing and market intelligence) as depicted in Figure – 2.2. This categorization of functions is important as it will help in better understanding of other concepts like National Agricultural Market (which is explained separately) dealing with integration of functions like storage, transportation, grading and assaying and market information.

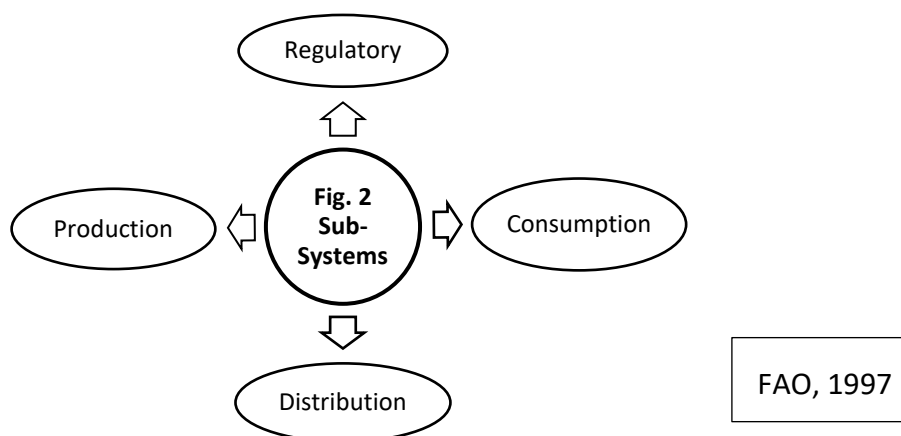
Figure 2.2. Categorization of Marketing Functions

Exchange Functions	Physical Functions	Facilitating Functions
<ul style="list-style-type: none"> • Buying • Selling 	<ul style="list-style-type: none"> • Storage • Transportation • Processing 	<ul style="list-style-type: none"> • Standardization • Financing • Risk Bearing • Market Intelligence

Sub-systems of agricultural marketing

It is also important to understand that the production, consumption, distribution and regulatory framework are the four sub-systems of agricultural marketing (Figure – 2.3). In the process of taking the produce from point of production to the place of consumption, there is a network of distribution/ channels that will be influenced by the existing regulations and policies of the government.

Figure 2.3 Sub-systems of Agricultural Marketing



Implementation of the concept

So far we have tried to understand the concept of agricultural marketing. Now, we will try to understand the way this concept is being implemented in India. Marketing of agricultural produce is serviced through a network of regulated wholesale markets (APMCs). Regulation and development of agricultural produce markets was taken-up as an institutional innovation and construction of well laid-out market yards was considered essential for regulating the practices

followed in wholesale markets. The regulated marketing system revolves primarily around wholesale physical markets to facilitate mainly buying and selling of agri-commodities. In some of the markets we may observe other functions also being performed like storage but it is confined to only a limited number of markets. Despite significant progress in production of various agri-commodities, the farmers' income remain subdued owing to market imperfections and deficiency of infrastructure in agricultural supply chains. In order to overcome these limitations, government has introduced a number of policy initiatives to help evolve an integrated marketing system not only in-terms of physical markets but also in terms of various marketing functions like storage, banking and assaying. But, before coming to these policy initiatives especially market reforms, we will try to understand the regulations in agricultural marketing first as the regulations will help in understanding rest of the initiatives.

History of regulation

Prior to independence, the major concern of the government policies related to agricultural marketing was to keep the price of food for the consumers and agro-raw-material for the industry in check. Accordingly, regulation introduced during nineteenth century mainly aimed at ensuring supply of pure cotton at reasonable price to textile mills in Manchester. The Karanjia Cotton Market was the first regulated market established in 1886 under Hyderabad Residency order. The first legislation was the Berar Cotton and Grain Market Act of 1897 which became model act for legislation in other parts of the country.

Subsequently, in order to strengthen agricultural marketing system further and also to safeguard the interest of farmers by overcoming the defects of the system, Royal Commission on Agriculture in 1928 and Central Banking Enquiry Committee in 1931 suggested the introduction of regulations in agricultural marketing. For the purpose, Directorate of Marketing and Inspection (DMI) was established in 1935 and it was DMI only which prepared a Model Bill on regulations in agricultural marketing in 1938. DMI advised state governments to regulate markets to safeguard the interest of the producers by overcoming the prevailing malpractices in agricultural markets. The role of DMI operating under central government was only advisory in nature for agriculture being state subject *(though subsequently in year 2020, central government introduced Ordinances having their pan India application for trade in food-stuff)*.

The primary objective of introducing regulation was to prevent exploitation of farmers and help develop an efficient and effective agricultural marketing system ensuring remunerative price to farmers for their produce and delivery of goods to consumer at affordable price.

Understanding regulations

Regulations from implementation view point mainly have three components i.e. physical markets, functions that a market performs and different players responsible for performing these functions. Physical markets are regulated in terms of implementation of the provisions of the APMC Acts as stipulated therein for orderly marketing of agricultural produce. Only state government is empowered to set-up physical markets through the institutional arrangement as defined under respective APMC Act. The market functionaries are required to obtain permission/ licence from the concerned state authorities before performing any market function. The regulations also defined the ways in which different marketing functions will be performed like price discovery has to be through methods like open auction or tender to ensure transparent and competitive price being discovered. (Figure – 2.4).

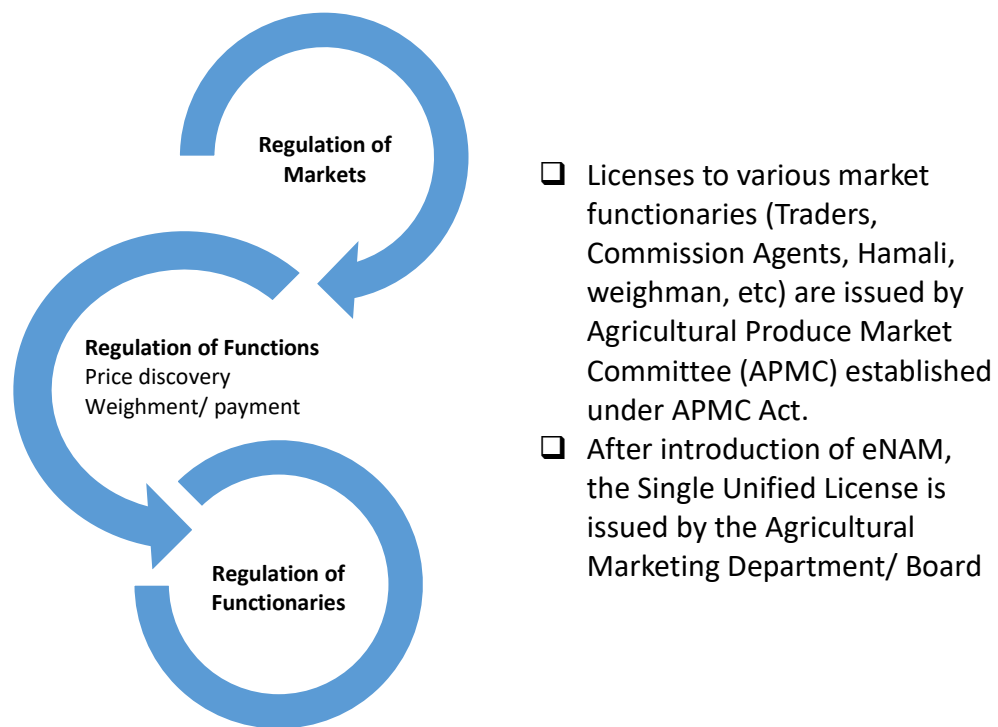


Figure 2.4 Framework for regulation of wholesale markets

The regulations have served some of the important purposes and helped in removing several malpractices and imperfections prevailing in present agricultural markets and ensured a fair deal to the farmers in selling their produce (Acharya, 2004). However, the regulations were considered to be relevant only when private trade was underdeveloped, exploitative and controlled by mercantile power (Chand, 2012). Regulation is considered to have lost its relevance with liberalization of trade and growing integration of the global economy (Kaplinsky, 2000).

Accordingly, reforms were introduced in agricultural marketing to allow participation of private players and direct contact between producers and consumers. Under reform process, agricultural marketing has seen many policy initiatives taken by the Government like circulation of Model Act, 2003 & 2017, introduction of eNAM and ordinances like the Farmers' Produce Trade and Commerce (Promotion & Facilitation) Ordinance, 2020 and the Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Ordinance, 2020. In addition to reform initiatives taken in agricultural marketing sector, there are various other initiatives like enactment of Warehousing (Development and Regulation) Act, 2007 and Food Safety and Standards Act (FSSA), 2006. Act on warehousing regulation will facilitate development of warehousing and protecting farmers from distress sales through pledge financing. In order to maintain the food safety and quality standards of agricultural produce, Food Safety and Standards Authority of India (FSSAI) established under FSSA Act, 2006, is implementing food certification program and guiding farmers and industries to adopt the provisions of the Act. These measures will facilitate develop a conducive trade environment for agricultural commodities.

Reforms in agricultural marketing

In order to push the agricultural marketing system in the country to the next level of development through transparency, competition, market efficiency, participation of private players and to take advantage of changing trade environment world over, market reforms were introduced in agricultural marketing during 2003. Expert Committee (2001) made several recommendations which were examined by the Inter – Ministerial Task Force (2002) set-up by the Ministry of Agriculture and Farmers Welfare (GoI) to bring in reforms in agricultural marketing. The Task Force identified nine areas to work out a road map for strengthening agricultural marketing system in the country. In addition to legal reforms in the existing APMC Act, these areas included direct marketing, market infrastructure, pledge financing, warehousing receipts system, forward and futures markets, price support policy, information technology in agricultural marketing and marketing extension training and research.

Model State Agricultural Produce Marketing (Development and Regulation) Act, 2003.

In order to facilitate the process of modification/ amendment of APMC Act, the Ministry of Agriculture and Farmers Welfare, Government of India prepared and circulated a Model Act to all states called Agricultural Produce Marketing (Development & Regulation) Act, 2003. Some of major provisions included in the Model Act are establishment of private/ cooperative markets, direct marketing, contract farming, establishing farmer/ consumers market, single point levy of

market fee, constitution of State Agricultural Produce Marketing Standards Bureau and single unified trading license in mandis across the state. The response for implementation of suggested provisions was lukewarm and not uniform across different State/UTs. Accordingly, the Ministry of Agriculture and Farmers Welfare set up a Committee of State Ministers In-charge Agricultural marketing during 2010 to expedite the pace of reforms.

Model State/UTs Agricultural Produce and Livestock Marketing (Promotion and Facilitation) Act, 2017

In order to further strengthen the agricultural marketing system through reforms, Model Agricultural Produce and Livestock Marketing (Promotion & Facilitation) Act was prepared by the Government in 2017 and shared with the states for adoption of the provisions as suggested in the Act. The new Model Act circulated in 2017 is comprehensive and have various forward looking provisions like (a) declaration of whole state/ UT as one unified market; (b) APMCs to regulate practices only in respective principal market yards and sub-yards; (c) warehouses to operate as sub-market yards (d) provision of single state-wide trading license; (e) allowing and promoting private wholesale market yards; (f) promotion of farmer-consumer markets; (g) promoting e-trading; and (h) moving to a common national market for farm products.

The Government of India recently in the month of June, 2020 has introduced new Ordinances with a focus on trade and commerce and price assurance to transform agriculture by helping farmers to get assured markets for their produce and have alternative options for transactions where prices are favourable to them. The Essential Commodities Act, 1955 has also been modified by removing the commodities from the list of essential commodities to create a better agribusiness environment for participation of private players, aggregators and processors. The commodities like cereals, pulses, oilseeds, edible oils, onion and potatoes have been removed from list of essential commodities.

The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Ordinance, 2020

The Farmers' Produce Trade and Commerce (Promotion & Facilitation) Ordinance, 2020 mainly aims at facilitating barrier free inter and intra state trade across the country. The provisions of the Ordinance provide freedom of trade in farming produce outside APMC Market Yards. So far, the trade was restricted to the APMC market yards only and transactions of agricultural produce were required to be routed through the concerned APMC with payment of applicable market fee/levies.

The traders/commission agents were required to obtain applicable licence from the concerned APMCs to operate in the notified markets area for sale and purchase of notified agricultural commodities under whose jurisdiction trading is

taking place. With the introduction of this Ordinance, any trade taking place outside the physical market yard has been exempted from any levies and licences. The ordinance also has provision for setting up of

Benefits

- Farmer gets right market
- Farmer gets advanced technology
- Transportation becomes easy for farmer
- Farmer gets right price
- Farmer becomes free from the worry of insurance
- Farmer becomes free from the worry of marketing
- Overall practice of farming becomes easy

an electronic trading platform. Any person having PAN or any other documents as notified by the Government can operate at such platform after completing the required formalities.

The FPOs /farm cooperatives can also establish such platform to facilitate inter-state and intra-state trading in scheduled farmers' produce in a trade area. This will enhance the bargaining power of the farmers and help in improving economies of scale. Trade area, as defined under the Ordinance, means any area or location, place of production, collection and aggregation including farm gates, factory premises, warehouses, silos, cold-storages or any other structures or places from where trade of farmers' produce may be undertaken.

However, trade area does not include the physical markets established and operated under APMC Act. This Ordinance will provide pan India trading opportunity to both traders and farmers, barrier free inter-state and intra-state trade and commerce outside the physical markets, reduce marketing cost and enhance remuneration to farmers.

The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Ordinance 2020

The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Ordinance 2020 provides a national framework for farming agreements, that will enable the farmers to engage with agricultural business firms, processors, wholesalers, exporters or large retailers for farm services, and sale of future farming produce at a remunerative price in a fair and transparent manner. The farmer may enter into a contract with sponsor through farming agreement after getting it registered with the prescribed authority. The agreement should cover aspects like supply of inputs, ownership rights of farming produce with the farmer during production, time of supply, quality, grade, standards, price and delivery mechanism. Farming agreement aims at offering various advantages to farmers like easier access to inputs, services and credit, improved production and management skills and secure market. The sponsor will also get assured supply of quality produce. The provisions of the Ordinance safeguard the interest of both the parties. In case of any dispute there is provision for conciliation board to settle the dispute mutually. In case of recovery of any amount, it cannot

be more than the support extended by the sponsor and completely safeguard the farming land of the farmers as in no case the action for recovery of any amount will be initiated against the farm land.

Summary

Agricultural marketing is comprehensive performing wide range of functions in taking produce from point of production to point of consumption. Government has taken various initiatives to strengthen the system. Regulations in agricultural marketing were introduced to overcome the limitations of the system and safeguard the interest of farmers. Regulation served some important purposes and subsequently lost the relevance with liberalization of trade and growing integration of the global economy. Accordingly, reforms were introduced in agricultural marketing to make it more liberal and open for participation of private players. The Government of India has taken a number of policy initiatives in the field of agricultural marketing with implications at state and national level with focus mainly on improving marketing efficiencies, better participation by farmers, price assurance, availability of better alternatives, scale of operation, participation of private players, transparency and higher degree of competition. Extension system has to create awareness among farmers on these initiatives and encourage them to take advantage of the available benefits.

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Recent development in agricultural marketing in India

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Background

Recent years have been good for Indian agriculture with an annual growth rate in the range of 3 – 5 percent. The broad-based growth has been observed both in terms of production and geographic reach. The advance estimates for the 2020-21 crop year suggest record production of foodgrains at 308.65 million tonnes on projected record output of paddy, wheat, maize and pulses. The second advance estimates for the crop year 2020-21 expect horticultural production to reach 329.86 million tonnes. While the difficulties created by COVID induced lockdowns adversely affected the performance of the non-agricultural sectors, the agriculture sector came up with a robust growth rate of 3.4 per cent at constant prices during 2020-21 (Economic Survey, 2020-21). Further, as per the Food Corporation of India (FCI) information, it is estimated that the central pool of wheat and rice consists of 70.02 million tonnes as on September 2020, which is three times as much as the operational buffer/strategic stock of 21.04 million tonnes. Taking these factors into account, food supplies in the country appear to be more than adequate.

Indian agriculture has achieved impressive growth on production front but a lot is required to be done to improve marketing and distribution. The restrictions imposed to curb the spread of COVID-19 have further influenced the agri-supply chain mainly in case of horticultural commodities. Production and marketing of fresh fruits and vegetables in India have been severely hampered by COVID-19. It is important to build more resilient and robust value chains for their linkage with regional and global market. The development of resilient value chain will need a thorough understanding of the present challenges faced by agricultural marketing in India. It is imperative to strengthen agriculture in order to combat rural poverty, food insecurity, unemployment, and the degradation of natural resources. Marketing concerns and issues relate primarily to the effectiveness (efficiency) of the marketing system, which depends on the market structure and conduct (Acharya et al, 2006).

Issues with agricultural marketing in India

The trade environment is changing world over which offers opportunities for international trade. Through, Government of India has taken various initiatives to make marketing system more responsive, conducive for participation of players from different sectors and infrastructure rich, still there are so many issues farmers and other stakeholders encounter with in taking the farm produce to market. Some of them are listed below –

- *Inadequate transportation facilities* – Transportation plays an important role in the distribution of agricultural products, helps in creating market for agricultural produce and reduces spoilage and wastage of farm products. There is an increase in farm produce wastage because of inadequate transportation facilities. Government has introduced application like Kissan Rath to improve the availability of transportation facilities in rural areas.
- *Lack of market Information* – The agriculture has become information intensive. Farmers need information to make decision at each states of production and marketing. The farmers have limited access to market related information like price and arrival of agricultural commodities of their interest. Access to market price information is essential to develop a strategy facilitating in realization of better price for their produce. Though, there are so many initiatives under public and private sector like agmarknet, IFFCO Kisan Sanchar, etc, still it is a challenge to provide information to all farmers in a user friendly manner.
- *Lack of credit* – Farmers for their need for money are compelled for distress sale. Many time adoption of technologies is also influenced by the availability of funds. There is need for farmers to be linked with institutional credit. The government has introduce in recent past various measures like NWR and eNWR to promote pledge finance so that farmers are not compelled to sell their produce immediately after harvest at low price. There is need to create awareness among farmers and other stakeholders on the same.
- *Long chain of intermediates* – Farmers share in consumer rupee is low due to presence of too many intermediaries in the supply chain. The presence of long chain of intermediaries lead to inefficiency in the system and unfavourable prices at both the ends, i.e. producer and consumer.
- *Lack of proper storage facilities* – The lack of scientific storage will lead to post-harvest losses and compel the producer to sell the produce at low price as the produce cannot be retained safely until the availability of favourable price in the market. Approximately 20 - 30 per cent of the gains are lost due to rodents and insects. Lack of proper storage facilities leads

to increase in distress sale of the farm produce. The Government in recent past has taken various initiatives to promote negotiable warehouse receipt, eNWR, pledge finance and warehouses to operate as market yard. The concept of storage is integrated with markets like national agricultural market (eNAM). However, there is need to create awareness among farmers to avail the benefits and among other stakeholder awareness is required to facilitate adoption of these changes.

- *Lack of awareness on standardization and grading* – The absence of trade taking place on the basis of grade and standardization can broadly be observed in the Indian agricultural marketing system. This makes it difficult to fix the price for farm produce. Due to the lack of proper standardization and grading, the customers face problem in purchasing the quality produce and farmers also get affected because of price variability.
- *Availability of machinery and manpower* – The migration of agricultural labour is very common among states for taking up different agriculture related activities ranging from sowing to harvest during normal year. The availability of labour, and machinery and their movement was influenced during COVID-2019 due to lock down and various other restrictions.
- *Maintaining social distancing and hygiene in markets* – Agricultural markets are generally crowded where stakeholders like farmers, labourers, transporters, weighmen, traders and commission agents visit on regular basis. Functioning of these markets during the pandemic period was very challenging by following the necessary norms like maintaining social distancing and proper hygiene during marketing operations. There is need for creating awareness among all relevant stakeholder on maintain safety norms during COVID time in particular and regular times in general.
- *Average size of land holdings* – More than 85 percent of the farmers are operating of small and marginal land holding size. The small size of operational holdings lead to low marketable surplus available with the farmers and also achieving economics of scale is not possible.

Recent developments and strategies

Government has realized the importance of an efficient agricultural marketing system in helping farmers not only in realizing the best possible price but also to diversify towards other crops and enterprises and avail the benefits of international market. Accordingly, some of the leading developments in marketing of farm produce are listed below –

- ✚ *Improving the performance of wholesale markets* – There are 7000+ regulated wholesale markets operating in the country. In order to strengthen the marketing system at wholesale level, the Government of

India has suggested various measures through Model Acts circulated during 2003 & 2017. More than 16 states have introduced provision of direct marketing and markets under private/ cooperative sectors. As an outcome of these initiatives, more than 50 private markets have been established/ licenses issued (dmi.gov.in). Unified license is also an important initiative to improve trade activities in regulated wholesale markets. A total of 72260 unified licenses have been issued by more than 20 states/UTs.

- ✚ *Deregulation/ Delisting and Exemption of Market Fee on Fruits and Vegetables* – In order to promote marketing of perishables and encouraging emergence of alternative marketing channels for fruits and vegetables, various states have deregulated/ delisted and exempted Market Fee on Fruits & Vegetables. States like Assam, Odisha, Meghalaya, Gujarat, West Bengal, Madhya Pradesh, Delhi, Nagaland, Karnataka, Himachal Pradesh, Haryana, Chhattisgarh and Maharashtra have supported this initiative in different form to encourage the marketing of perishables in their state.
- ✚ *Strengthening of farmers' markets* – The concept of farmers' market has been experimented in various states with different names like Apni Mandis in Punjab and Haryana. The concept, with certain modifications, has been popularized in Telangana and Andhra Pradesh through Rythu Bazars, Raitha Santhe in Karnataka and in Tamil Nadu as Uzhavar Santhai (Gol, 2001). About 488 such farmers' markets are operating in different States of the country (Gol, 2017). However, these markets mainly provide a platform for direct transaction between producer and consumer for supply of locally grown fresh produce unlike western concept where the platform is utilized for education and extension in addition to marketing.
- ✚ *Creation of infrastructure* – Availability of infrastructure in markets play an important role in proper handling and reducing the post-harvest losses. However, as per Doubling Farmers' Income Reports, the status of infrastructure in market is not very encouraging. The covered and open auction platforms exist only in two-thirds of the regulated markets, while only one-fourth of the markets have common drying yards. Cold storage units exist in less than one tenth of the markets and grading facilities in less than one-third of the markets. Electronic weigh-bridges are available only in a few markets. To cite an example, there are only 447 godowns and 334 drying yard available in the different regulated markets in Tamil Nadu. Government has introduced various schemes like Integrated Scheme for Agricultural Marketing (ISAM) and Agricultural Infrastructure Fund to support creation of market related infrastructure. The provision has been made to strengthen Rural Haats / RPMs into Grameen

Agricultural Market (GrAMs) as suggested in DFI Report under Agricultural Marketing Infrastructure Sub-Scheme of Integrated Scheme For Agricultural Marketing.

- ✚ *Envisaging online trading* – The concept of e-NAM was launched by the Government on pilot basis in 21 APMC market from 08 States. At present, a total of 1000 markets have been integrated with the electronic portal from 21 States/UTs. The platform has been made comprehensive and more user friendly by introducing warehouses based trade module and module for the participation of FPOs. About 37 warehouses from Telangana and Andhra Pradesh have already been declared as deemed market. However, the present rate of participation by traders and farmers is moderately low.
- ✚ *Creating local outlets at each village* – The creation of local outlets where the farmers can sell their crops directly to the consumers or authorized buyers would be very beneficial. For farmers to reap the benefits of this network, government intervention is essential. The rural haats or rural periodic markets have been suggested to develop into GrAM under DFI Report to operate as collection and distribution centres.
- ✚ *Strategies taken during pandemic by Government and wholesale markets* – Central and State Governments have taken various steps to manage the pandemic situation. Various micro need based innovations are taking place at ground level. Agricultural Marketing Departments and marketing Boards have advised Standard operating procedures (SOPs) to be followed for performing various operations in wholesale markets. Emphasis was given to maintain proper social distancing and hygiene in wholesale markets. Recommended chemical was sprayed in premises of market on daily basis. Separate places were identified for farmer's vehicles and loader's vehicles. Separate timings were fixed for operation of different kind of activities. There were thermal scans conducted on wholesale market visitors to detect any symptoms. A harvest permit was issued during harvest season. In some markets having huge arrivals during marketing season, token system was adopted to avoid rush. Farmers were told to dry the crop as per specifications and if moisture level is high, their produce will be rejected. This lead to extend the marketing season of crop and long queues were avoided.

Conclusion

Indian markets are faced with various challenges like inadequate transport facilities for agri-produce, poor market infrastructure, lack of market information, unavailability of sufficient processing units and storage facility and price fluctuation which limit these markets to operate at their full potential. Regulating

presence of too many middlemen, creation of sufficient storage facilities and other infrastructure, linking farmers with formal credit, sufficient transportation facilities at proper rates and building capacity of all relevant stakeholders is required for proper integration of farmers with market and help them realize the best possible price for their produce.

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Linking farmers with markets through ICT Tools

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Introduction

The agricultural development programs in developing countries depend mainly on the nature and the level of use of Information and Communication Technology (ICT) in mobilizing the people. In India, agricultural marketing system is encountering rapid transformation on account of changes in world trade environment and corresponding policies of the Government. Agricultural processors, retailers, farmers and others stakeholder are working together to replace traditional marketing channels with modern more efficient marketing channels. Indian agriculture production ensuring national food security and stability to the economy is dominated by small holder farmers. Though, these smallholders play a crucial role in the overall development of the nation, they face various problems like poverty, low yields, inconsistent quality, post-harvest losses, lack of knowledge about national and international markets, climatic changes, poor understanding and access to technology, presence of long chain of intermediaries and many others. Application of ICT can be vital in supporting small farmers and also in helping them to link with market.

Linkage of farmers to markets

Linkage of farmers to markets needs either the “top-down” strategy, which involves identifying demand in the market and then seeking farmers or farmers group to satisfy it or the “bottom-up” strategy involving identification of farmers/ farmers group to work with and then finding suitable market that they can be linked to for supplying the produce. Whatever strategy is adopted, awareness of the markets and marketing condition among farmers is essential for successful market linkage development. Availability of markets may not be the sufficient condition to ensure success, they need to be in a state to facilitate the farmers and other stakeholders in realising the profit who are linked with entrepreneurs or farmers, respectively. Participants also need to be ensured of greater net incomes from entering into a new linkage than they obtain through their existing

activities. In the beginning of the linkages itself farm profitability must be accounted for by making realistic assumption of production and distribution. Furthermore, identification of market is important and this should be followed by bringing farmers in a position to bring the quality produce at right time, which will inevitably accrue more investments to them. The establishment of these linkages and their information need can be supported by the application of information technology. The entire process of “Linking” farmers with market can be facilitated with the application of ICT.

Types of farmers to market linkages

In recent past Government of India has come-up with various policy measures to strengthen agricultural marketing system and make it not only efficient but more suitable for smallholders. These changes in policies have witnessed emergence of various alternatives facilitating linkage of farmer with market, like –

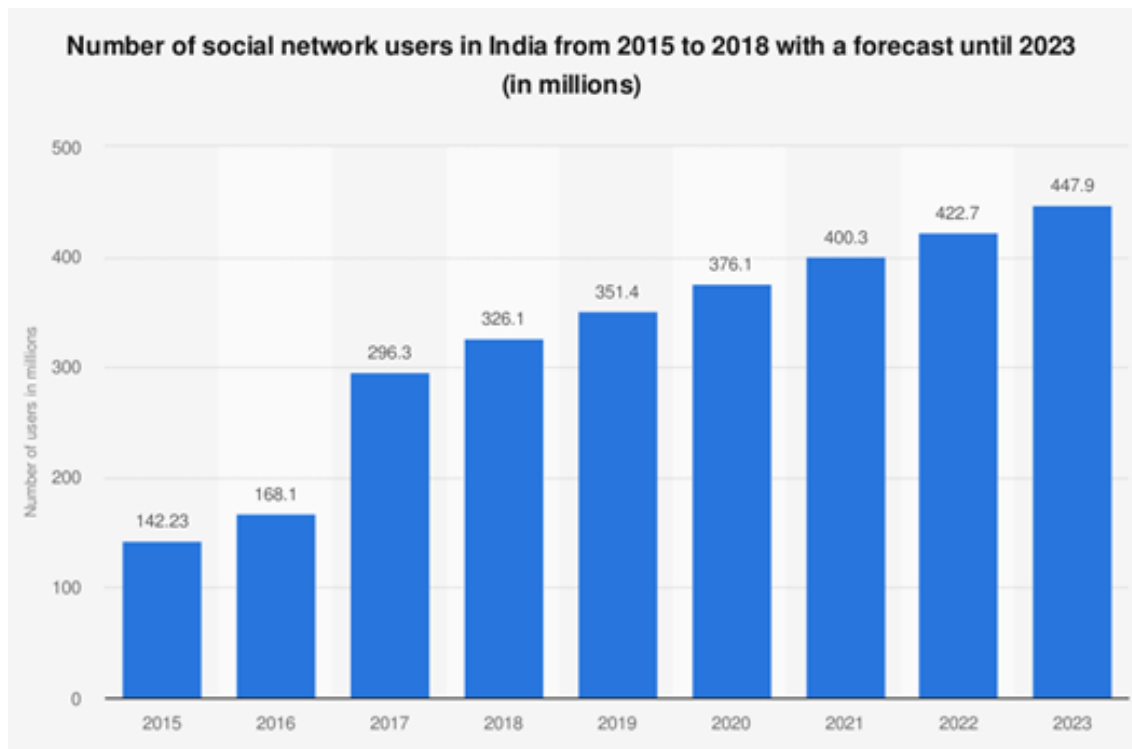
- Farmer Producer Organisations
- Linkages through a leading farmer
- Cooperative linkages
- Farmers to domestic trader
- Farmers to retailer
- Farmers to agro processor
- Farmer to exporter
- Farmers to Government

Information and Communication Technology (ICT)

It is important to understand Information and Communication Technology (ICT) as application of technology may help farmers in better participation in the emerging marketing channels. ICT is the technology used to communicate information. There are a variety of digital ICT tools, including radio, television, cellular phones, computers, networks, hardware, software and satellite-linked systems and their associated services and applications, such as video conferencing, community radio and distance learning systems. India’s first online learning happened when the country launched a program called Educational Research Network (ERNET) in 1986. In the past decade, ICT has drastically transformed the way the world functions, operates, communicates and shops. The application of Information and Communication Technology (ICT) can play a pivotal role in efficient dissemination of information. The ICT can deliver fast, reliable and accurate information in a user-friendly manner for practical utilisation by the end user. The information disseminated facilitates the farmers to decide what and when to plan, how to cultivate, when and how to harvest, what post-

harvest management practices to follow, when and where to market the produce (Barber et al., 2016).

The Government of India have been implementing various programs and schemes to connect rural areas with social media by giving them adequate training and awareness. In India, the number of social media users in 2020 are nearly three times higher than 2015 (Sandhya Keelery, 2020). The major reason for this growth is the evolution of the smartphones over the period. Smart phone usage in India has continuously increased over year and is estimated to reach 448 million by 2023 (Shangliao Sun, 2021).



Source: Statista Digital Market Outlook @ Statista 2021

Need of ICT tools in agriculture

ICT is now seen as an important tool for development in agriculture (Lola Leveau et al., 2019). The following points show the need for ICT application in agriculture.

- Inadequate information on agricultural inputs such as seeds, fertilizers and pesticides
- Poor linkage with cities and information sources
- Lack of market information such as commodity prices, Mandi information and information on alternative market channels, and consumer behaviours
- Lack of extension facilities
- Unavailability of online marketing platforms

- Low level of awareness on soil and water testing
- Deficiency of knowledge on modern technologies and market prevailing prices
- Inability to compete with modern farmers
- Low level of education among farmers
- Lack of knowledge about credit creation
- Lag between traditional and modern technology
- Some of the areas of application for ICT in agriculture are as listed below –

Areas of ICT intervention in Agriculture				
Soil, Water and Weather	Crop Production	Livestock and Fisheries	Agricultural Education & Extension	Marketing, Agribusiness and Trade
<ul style="list-style-type: none"> • Improved soil management • Soil mapping • Weather forecasting • Abiotic stresses • Environment and natural resources • Disasters • Remote sensing 	<ul style="list-style-type: none"> • Seed production systems, planting material • Crop production systems • Farm mechanisation • Farm management • Precision farming • Pest/ disease management • Biotic stress management • Post-harvest management • Food processing systems 	<ul style="list-style-type: none"> • Herd and flock management • Management of semen stations and semen availability • Milk collection, storage, processing • Production , availability of fish seed • Marine fishing and logistics • Fish processing and production • Marketing of products 	<ul style="list-style-type: none"> • Education and training processes • Produce professionals with practical and research skills • Extend crop technologies • Reducing lab to land gap • Better capacity building / training of stakeholders • Real-time advisory 	<ul style="list-style-type: none"> • Efficient procurement • Provision of consumers with processed goods and produce • Sale of produce by farmers • Better market intelligence • Knowledge of international prices.

Types of ICT tools used by farmers

Different ICT tools are available and selection of tools is important in an environment where level of literacy is low and availability of infrastructure is also limited and selective. Some of the widely used tools are discussed below –

Radio and TV

All India Radio (AIR) stations located in various parts of the country broadcasts agricultural programs in all the regional languages of India (Pulugurta Chandrasekhar, 2018). India was one of the first countries from the developing world to test the use of television for education with the support of the United Nations Educational Scientific and Cultural Organisation (UNESCO) in 1959 (Rommani Sen Shitak, 2011). In a nation where literacy level is down, the choice of communication technology is of vital importance and these devices play major role.

Mobile Phone

Farmers are using mobile phones to improve their business through better exposure to the agriculture industry (Subhrayoti Panda et al. 2019). The better penetration of mobile phone is expected to improve access of farmers to market information and improve communication within the members of farming community (Surabhi Mittal and Gaurav Tripathi, 2009). The usage of smartphones not only keep farmers in touch with various other supply chain participants but also update them with information on weather forecast, appropriate use of inputs and access to various warning and advisories issues by meteorological department and scientific institutions to avoid any crop related disaster (Abdul Razaque Chhachhar and Md Salleh HJ. Hassan, 2013). Smart phones have provided ample scope to the farmers to communicate directly with intermediary and to sell their produce to consumers at reasonable prices.

Community Radio

Community radio is a social activity in which community members link together to design, produce and broadcast programs (Seidu Al-hassan, Alhassan Andani and Abdulai Abdul-Malik, 2011). This social media provides voice to the voiceless, which serves as the mouthpiece of the deprived farmers (Madeleine C. Fombad and Glenrose Veli Jiyane, 2016). It serves as the heart of communication and democratic processes within societies. With community radio, progressive farmers have the means to convey their own views and decisions regarding concerned crops. The feedback network is always accessible and connection between producers and receivers is always smooth. Participation progressive farmers in radio is allowed at all levels from planning to implementation and evaluation of the project.

Social Media

Social media is a significant tool in farming to connect the farmers and agribusiness people across wide geographical boundaries. It also plays a pivotal role in magnifying interactions and information flows among stakeholders present in agricultural supply chain and also enhances the reach of agricultural extension system and consultancy service providers. Sharing of such information improves the marketing network and thereby increases the sales of the farmers produce by creating commodity based or need based social networks. Availability of digital network at affordable price has attracted considerable number of people to patronize internet in India. About 400 million were active social media users in the year 2021 (Table-4.1). YouTube and Facebook influenced largest number of people, approximately 86 percent and 76 percent respectively as of January 2021 (Sandhya Keelery, 2021)

Table 4.1. Social media influence on Indian Citizens in 2021

Social Media	Share of Population in %
YouTube	85.8
Facebook	75.7
WhatsApp	74.6
Instagram	70.6
Facebook Messenger	55.0
Twitter	50.6
LinkedIn	37.7
Pinterest	34.3
Snapchat	33.7
Tiktok*	31.5
Skype	29.3
Telegram	28.5
Helo	22.9

* Banned now in India / Source – Statista-2021

Application of ICT for dissemination of information to farmers

Some of the models emerging under different sectors to facilitate dissemination of information on agricultural and related aspects in the country are presented below –

- 1) **Digital Mandi** – A digital application created by IIT Kanpur and BSNL, which aims to provide present market rate of agricultural commodities to farmers. This help farmers in making market related decision like selection

of market and appropriate time to sell their commodities to maximum return.

- 2) **m-Krishi** – TCS mobile agro-consultancy technology uses mobile and sensor technology to let farmers send their queries and receive information on climate and local Mandi prices. Farmers are also delivered with expert's advice and other relevant information to them in their local language. This app also supports text, voice and pictures.
- 3) **m-Kisan** – m-Kisan is a mobile based agro advisory for farmers with actionable information. The information is delivered through mobile channels like voice, text messages, on-demand videos and farmer's helpline. This app gives appropriate advice to farmers on the relevant crop, livestock issues and provide platform for exchange of knowledge.
- 4) **YouTube** – YouTube provides a roadmap towards successful agricultural business dimension through attractive videos. Since many people feel easy when accessing visually, this tool easily convey benefits and features of goods and services. Video can be particularly useful in showing viewers a process (e.g., such as planting seeds, methods of harvesting, use of fertilizers and pesticides), documenting events and activities that occur at the farm or garden. Farmers can also create a YouTube account and "subscribe" to "channels" that are specific to them. By subscribing, farmers receive alert message, when a new video is posted to the channel. Farmers will also find a list of recommended videos based on their subscription preferences when they log into YouTube. Another major feature in YouTube is that farmers can earn income from their videos if they fulfil YouTube policies of monetization.
- 5) **WhatsApp** – WhatsApp sends real time messages and it is among the leading communication applications of 21st century. WhatsApp can be used to establish linkage between agricultural value chain agents viz., agro input dealers, agro business centres, Small and Medium Enterprises (SMEs) and extension workers. This paves way for creating greater value for the small and marginal farmers. The key feature of WhatsApp has been the group messaging ability of the platform to send messages, photos and videos to individuals and groups in a cost effective manner. There are so many examples in agricultural where WhatsApp has been used for quick sharing of information on various production related aspects and also marketing of locally grown produce.
- 6) **Facebook** – Farmers can use Facebook in multiple ways for production and market related aspects. It offers an avenue to keep customers in contact and the public in general. Facebook provides facilities like digital

walls, posts, status, videos and links which allows farmers to advertise about their farm produce and value added products.

- 7) **Telegram** – Telegram offers huge potential while maintaining the privacy of the mobile number from unknown people. Telegram can accommodate about 2 Lakh members in a group. Due to this wide extended facility more and more farmers can join in a group and share their commodity, knowledge and other useful information. Information can be transferred through PDF, PPT, Docs and Links.
- 8) **AgriMarket** – AgriMarket mobile app provides information about market news (arrivals and prices) of agricultural commodities in the vicinity of 50 kilometres around the farmer's location with the help of mobile GPS. There is an alternative choice to get price of any market and any crop just in case person does not want to use GPS location.
- 9) **e-NAM** – National Agriculture Market (eNAM) is a pan-India electronic trading portal which networks the existing APMC Mandis to create a unified national market for agricultural commodities. Small Farmers Agribusiness Consortium (SFAC) is the nodal agency for implementing eNAM under the supervision of the Ministry of Agriculture and Farmers Welfare, Government of India. It is a comprehensive model envisaged to take care of various physical and facilitating functions of the market like storage, grading, packing, finance, insurance, promotion, etc. in addition to the scientific, transparent and competitive price discovery of prices.
- 10) **Farmers Portal** – Farmers Portal website is venture to make one stop shop for meeting all information needs on production, sales and storage of farmers relating to agriculture, animal husbandry and fisheries sectors. Using the Portal, a farmer will be in a position to access related sources of information on their area of interest. The sources of information shared to the farmers in multimedia formats covering text, audio and video in the local languages. Farmer's enquiries are addressed properly through separate feedback mechanism designed with interactive features to address their problems.
- 11) **Kisan Call Centres** – Kisan Call Centres are exclusively designed as a phone helpline for the farmers in the regional languages. Kisan call centres are located in every state to manage enquiries without congestion from every location of each state. Solutions to queries related to agricultural and allied activities are offered through these call centres by the experts. By using toll free number 1551 or 1800-180-1551 farmers can share their issues associated with their crops with the Kisan Call Centre. The staff of the Kisan Call Centre will try to reply to the queries of the farmers as early

as possible, based on their knowledge or refer to a subject matter specialist.

- 12) **IFFCO Kisan Sanchar Limited** – IFFCO Kisan Sanchar Limited aims in uplifting the farmer's livelihood by providing a range of practical solutions. It aims to transform the agriculture with the application of technology and facilitating farmers by providing mobile advisory services through IFFCO Kisan Agriculture App, and IFFCO Kisan call centre. They have their own distribution network to supply variety of commodities like feed for cattle, honey and spices. Working closely with their institutional partners, they also help farmers associations and Farmers Producers Organizations (FPO) to upgrade the quality of products and provide viable options to sell their produce directly to the manufacturing and processing units.
- 13) **AGMARKNET** – Ministry of Agriculture launched the Information and Technology (ICT) based central sector scheme named as Agricultural Marketing Information Network (AGMARKNET) by connecting vital regulated markets located throughout the country and state agriculture marketing boards and directorates. AGMARKNET provides interface among farmers and other beneficiaries and share market related information.
- 14) **e-Choupal** – An initiative by ITC provides alternative marketing channel and provide information to help farmers overcome various challenges faced by them in practicing agriculture. Under the initiative, a kiosk equipped with computer with internet access and managed by trained sanchalak is established at village level. The sanchalaks using the village internet kiosks provide access to information on parameters like weather forecast, Mandi prices, share good agricultural practices and risk aversion strategies. It also facilitates the sale of farm inputs and purchase farm produce from the farmers' doorsteps. e-Choupal provide information on market related aspects on real time basis and farmer specific customised knowledge. This enables farmers to decide at right time matching the requirements of farm produce in the local market. The aggregation of the demand for farm inputs from individual farmers gives them access to high quality inputs from experienced and reputed manufacturers at fair prices.

Conclusion

Farmers may avail the best possible price for their produce by getting linked with the market appropriately. This process of market linkage can be enhanced by the application of ICT. Accordingly, agriculture has seen application of various communication tools like television, radio, mobile phone, community radio and social media. The role that can be played by the application of ICT in the development of agriculture and improving linkage of farmer with market has been

recognised by different organisations operating under government, non-government, private and co-operative sector as suggested by the various initiatives like digital mandi, m-Krishi, m-Kisan, National Agricultural Market (eNAM), Kisan Call Centre, AgriMarket and Agmarknet. However, the optimum utilisation of the system and the information disseminated will depend on a number of factors like literacy level, understanding of ICT, extent of telecommunication infrastructure, level of awareness of the farmers, information need of the farmers, etc. Let the farmers be exposed to variety of ICT tools and let them select the tool as per their convenience and utility. Extension system will also have to play an important role in taking the benefits to the farmers and other stakeholders and facilitate the process of doubling farmer's income by providing real time and appropriate information.

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Farmer Producer Organization (FPO): A holistic approach

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Introduction

The Indian economy is driven by agriculture which consists primarily of large numbers of fragmented small holdings and is largely production oriented. It employs nearly 56 per cent of the Indian workforce, contributes to the overall growth of the economy, and reduces poverty by providing employment and food security to the majority of the population. The smallholding-based agriculture has gradually become unviable due to fragmented, scattered and heterogeneous landholdings, rising cultivation costs, and limited access to public resources and markets. Low quality production and limited availability of public funding, quality inputs, credit facilities, modern technology, and frequent crop failures, combined with a poorly developed supply chain and insufficient market and income security, have resulted in farmers becoming dependent on exploitative intermediaries and local money lenders. Almost 86 percent of all land holdings are held by small and marginal farmers. Some of the key concerns relating to small farm holders include availability of inadequate agricultural service delivery, low technology adoption due to lack of capital, limited business skills, low income due to poor infrastructure and poor market efficiency. Small-scale producers are at the receiving end of the market for lack of capital to invest, limited availability of alternative marketing channels and reliance on family labour (Reardon & Barret 2000; Daviron & Gibbon 2002; De Janvry & Sadoulet 2005). The above situation calls for major structural reforms and transformational initiatives towards the revitalisation of Indian agriculture both, by way of stepping up investments for productivity enhancement and also bringing in adequate reforms in agricultural marketing and post-harvest agricultural logistics to ensure desired growth in agriculture. In this context, a sustainable solution may emerge through the collectivization of agricultural produce by encouraging aggregation of primary producers through various models promoted by the Government so as to

achieve economies of scale in agriculture for value addition and efficient marketing of agricultural produce, and development of commodity-specific agricultural value chains by active involvement of farmers.

Producer organisation

A Producer Organisation is a legal entity formed by primary producers, viz. farmers, milk producers, fishermen, weavers, rural artisans, craftsmen. A Producer Organisation can be a producer company, a cooperative society or any other legal form which provides for sharing of profits/benefits among the members. In some forms like producer companies, institutions of primary producers can also become member of producer organisation (NABARD, 2015).

The challenges faced by farmers mainly smallholders in terms of low yields, credit shortages and market inequities coupled with lack of effective organisational structure curtail their ability to maintain the competitive edge in the market and therefore farmers get confined to only local markets. Collectivization of farmers is essential to help them overcome these challenges. Collectivisation will help farmers achieve economies of scale, reduce input costs, improve their bargaining power and have a stronger voice as a group. Farmers in India have adopted several forms of collectivisation over time. Cooperative societies, federations of self-help groups, joint liability groups, farmer clubs, common interest groups and Farmer Producer Company are some of the popular examples.

Farmer Producer Organization (FPO)

A Farmers' Producer Organization is established for the purpose of leveraging collective economies of scale in the production and marketing of agriculture and related products. These organizations are formed or registered under Part IXA of the Companies Act or the Cooperative Societies Act of the relevant state. A FPO registered under the Co-operative Societies Act of the State (including Mutually Aided or Self-Reliant Societies Act by whatever name) is to be protected from any interference from any source including election process and management and to be encouraged to flourish. The bylaws of these FPOs will have to conform to the laws of respective states regarding cooperative societies.

Functions of FPOs

Aggregation under a suitable model for originating farmers in group can help them take up a number of functions for its farmer-members. Some of the functions are as listed below –

- Provide quality production inputs such as seeds, fertilizer, pesticides, and similar products at reasonable wholesale prices.

- Members can reserve need-based production and post-production equipment such as cultivator, tiller, sprinkler set, combine harvester, and other machinery and equipment for custom hiring on a reservation basis to reduce the per unit production cost.
- Make available value addition like cleaning, assaying, sorting, grading, packaging, as well as farm level processing on a reasonable cost.
- Participate in higher income-producing activities such as seed production, beekeeping, mushroom cultivation, etc.
- Ability to aggregate smaller lots of farmer-members' produce, adding value to these aggregated lot and integrating with market for better price realization.
- Provide logistics services, including storage, transportation, loading and unloading on cost-sharing basis.
- Integration of aggregated and value added product at the appropriate level in the supply chain can help in improving ability of the farmer-members to negotiate for better price.

Importance of Farmers Producer Organization (FPO)

Creating an organisation of their own will help farmers in aiming for enhancement of income mainly in an environment where majority of the farmers are smallholders. Economies of scale don't apply to small producers (both inputs and outputs). Most of the times, primary producers receive only a small percentage of the final price paid by consumers due to presence of large number of middlemen in agri marketing channels. However, by aggregating, primary producers will be able to avail benefits of economies of scale and integrate efficiently in the marketing channels more towards consumers leading to better producer's share in consumer's rupee. They will be in a better position to bargain with bulk buyers of agri-commodities and bulk supplier of inputs. There are various examples suggesting the importance of such organisations in better integration with markets, organised retailers and international market.

Essential features of a Farmer Producer Organisation (PO)

- It is a group of producers that are engaged in farming or non-farming activities.
- It is a registered body and a legal entity.
- Producers are shareholders in the organization.
- It deals with business activities related to the primary produce/product.
- It works for the benefit of the member producers.
- A part of the profit is shared amongst the producers.
- Rest of the surplus is added to its owned funds for business expansion.

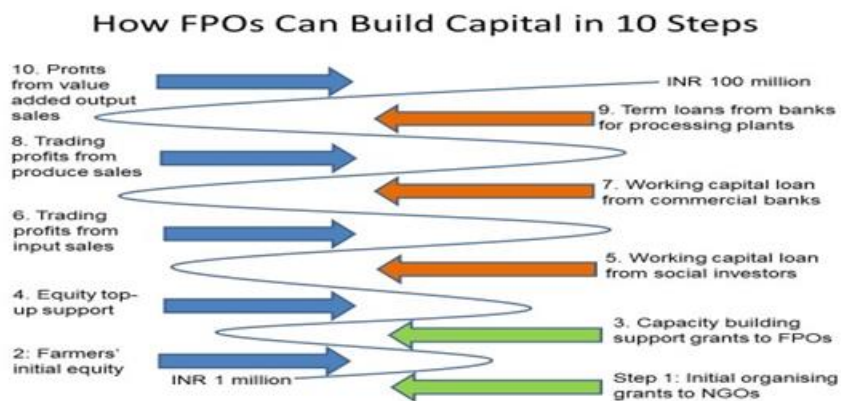
Different types of legal forms of Producer Organisation (PO)

Producer Organisation can be registered under any of the following legal provisions –

- Cooperative Societies Act/ Autonomous or Mutually Aided Cooperative Societies Act of the respective State
- Multi-State Cooperative Society Act, 2002
- Producer Company under Section 581(C) of Indian Companies Act, 1956, as amended in 2013
- Section 25 Company of Indian Companies Act, 1956, as amended as Section 8 in 2013
- Societies registered under Society Registration Act, 1860
- Public Trusts registered under Indian Trusts Act, 1882.

FPO capital formation

The formation of capital will be an important issue for any organisation. Member-farmers contribution is vital for initial investment. Producer members' share, matched by a matching equity grant from the Government is necessary for a strong financial base of farmers organisation and to help them have access to financial



resources for their projects and development of their business. In the first instance, FPO members are eligible for equity grants of up to Rs. 2,000 each, capped at Rs. 15.00 lakh. According to the government, the equity grants for farmer cooperatives are simply matched by the grants given by the government as the farmers' equity share.

Strategy for promoting Farmer Producer Organizations

Aggregation of farmers is important mainly in an environment where majority of them are operating on small and marginal land holdings. However, it is required to follow a comprehensive strategy for formulation and sustainability of such organisations. A sound strategy will include –

- Formation of farmer groups by identifying natural clusters

- The intimacy of stakeholders such as NGOs, Banks and Government in FPOs
- Development of best practices, pilot projects and success stories for wider publicity and field level replication
- Implementation in mission mode with quarterly quantitative and qualitative milestones
- Media publicity through print and electronic media and other mass media for the FPO Scheme
- Conventional/ non-conventional publicity and awareness creation methods
- Explore diverse FPO models and their successful replication strategies.

Challenges faced in the promotion of FPOs

There is difficulty in mobilizing farmers in a diverse environment as present in India. There is also delay observed in the formation of many FPOs because of the limited capacity of the officers placed at the organizations involved in the promotion of FPOs. Furthermore, the members of the Board of Directors and leaders of FPOs lack a thorough understanding of business planning and the benefits of collective action. There is need to build the capacity of the Board Members and CEOs of FPOs so that they are able to understand the opportunities available in the changing agricultural and trade environment and provide leadership role to the members. FPOs face difficulties in negotiating with multiple stakeholders and networking for the implementation of their business plans, resulting in inability to realize the envisaged economies of scale. There is need for FPOs to be incubated and supported at different stages of development.

There is need for increasing the membership base of the organizations. Several Indian organizations promote FPOs and their members broadly range from 50 to 1000 members. It is important to have the right size as too big an organization in size can make it tedious and difficult to manage and evolve. Another important aspects is to raise necessary equity. The SFAC offers an Equity Grant Scheme to FPOs that matches their equity stakes (1:1) for a maximum of Rs. 15 lakh. Farmers may not own more than Rs. 1000 worth of shares.

FPOs are also facing policy related challenges. There is lack of understanding about the policy related aspects and asymmetry of information that hinder FPOs from reaping the benefits of the current environment. The FPOs need to know about the policy reforms taking place in the field of trade like various provisions introduced in the APMC Acts to facilitate farmers and farmers-organizations, warehouses to operate as Mandis, FPOs to participate directly at National Agricultural Market (eNAM) platform and warehouse related provisions.

Current status of FPO

There are around 8500 FPOs (including FPCs) established across the country, working on a number of initiatives of State governments, NABARD and other organizations over the last 8-10 years. A little more than 3200 of them are producer companies, the rest are cooperatives and other associations. In addition to technical assistance, these FPOs require adequate capital, infrastructure, and market links for sustaining their business operations. According to information compiled by NABARD, there are 4251 FPOs promoted by March 2021, whereas 177 Organisations promoted by NRLM and another 910 Organisations promoted by SFAC.

Conclusion

Aggregation of farmers has an important role to play in Indian Agriculture. A Farmers Organisation must have a strong governance system, management system and capital structure for its success. In addition, it is important for government to address issues related to efficient commodity pricing mechanism, improved infrastructure, access to market and finance and availability of affordable credit. Developing strong institutional approaches are essential for the improvement of non-profit organizations, both emerging and established. There are various issues and therefore provide scope for participation of research organisations and policy institutes. Meanwhile, farmers should be trained regularly on various aspects of production and marketing like business management, management information systems, production practices, and production based technical skills. The farmer-organisations have the potential to make agriculture profitable and help farmers improve their income in long run if implemented properly and supported by appropriate policies.

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Postharvest and value addition of horticultural crops

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Introduction

Substantial amount of value can be added to the food sector in India for its growth and profit-orientation mainly through processing. Food processing industry is the fifth largest in the country in terms of production, consumption, exports and expected growth and contributes 32 percent of total food market. It contributes 8 percent and 8.39 percent of Gross Value Added (GVA) in manufacturing and agriculture, respectively. It is also contributing 13 percent in total exports from India and 6 percent of total industrial investment (ibef.org). Currently, the Indian gourmet food market is valued at US\$ 1.3 billion and has been growing with a Compound Annual Growth Rate (CAGR) of 20 percent since 2011. The online food ordering business though at nascent stage but has witnessed exponential growth in recent past (Sharma, 2016). Participation of several players in the food delivery space like Food Panda, Zomato, TinyOwl and Swiggy have expressed a promising future for the organized food business. As of 2016, online food delivery had grown at 150 percent year-on-year with a net merchandise value (GMV) estimated at 300 million dollars. Around US\$ 7.54 billion worth of foreign direct investments have been made in India's food processing sector during the period April 2000 – March 2017 (Department of Industrial Policies and Promotion – DIPP). The Confederation of Indian Industry (CII) estimates that in the next 10 years, the food processing sector is expected to attract as much as US\$ 33 billion of investment and also to generate employment of nine million person-days (Shanmuganathan *et al.*, 2020).

Government initiatives to improve food processing sectors in India

Government has taken various policy decisions along with various infrastructure based schemes to transform the food processing sector in the country.

- Foreign Direct Investment (FDI) rules in India have been relaxed for the sector, allowing up to 100 percent FDI in the e-commerce of food products. This is coupled with incentives to strengthen infrastructure all along the supply chain. As per the announcement made in the Union Budget 2017-18, India has set up an infrastructure fund to the tune of Rs 8000 crores (U \$1.2 billion) to support dairy processing.

- India's Food Safety and Standards Authority (FSSAI) plans to invest approximately Rs 482 crores (US\$ 72.3 million) in food testing infrastructure by upgrading 59 existing food testing laboratories and setting up 62 new mobile testing laboratories across the country.
- Research conducted by the Indian Council for Fertilizer and Nutrient Research (ICFNR) in the fertilizer sector will encourage adoption of international best practices, which will enable farmers to procure good quality fertilizers at affordable prices and thereby ensuring food security for the common man.
- Human Resource Development (HRD) has been added to the food processing sector by the Ministry of Food Processing Industries. In the National Mission on Food Processing, the State Governments are implementing the Human Resource Development program. The program is having following four components –
 - Creation of infrastructure facilities for degree/ diploma courses in food processing sector
 - Entrepreneurship Development Program (EDP)
 - Food Processing Training Centres (FPTC)
 - Training at recognized institutions at State/ National level

Processing of fruits and vegetables in India

The final estimates released for the year 2019 – 20 suggest horticultural production of 320.77 million tons (mt) in comparison to the production of 310.73 mt recorded previous year (pib.gov.in). According to the USDA, the annual vegetable production increased to 191.77 million tons (MT) based on productivity gains. Estimated potato production during 2019 – 20 is 51.03 million tons. With an estimated 99.09 million tons of production in 2019-20 in comparison to 97.96 million tons in 2018-19, India is the world's second largest producer of fruits.

Export Statement of Processed Fruits and Vegetables for the period 2017 – 20 is compiled in Table – 6.1. The table reveals that India's export of processed fruits and vegetables during the period has increased in value terms but decreased marginally in quantity terms. This decline in export in quantity terms is mainly on account of decrease in the export over years of items like cucumber and gherkin and mango pulp. However, an increased in the quantity exported has been observed in case of processed vegetables and fruits, juices and nuts.

Table 6.1. Three year export statement of processed fruits and vegetables

(Qty in MT, Value in Rs. Lacs)

PRODUCT	2017-18		2018-19		2019-20	
	Qty	Rs. Lacs	Qty	Rs. Lacs	Qty	Rs. Lacs
Processed Fruits & Vegetables						
Cucumber & Gherkins (Prepd. & Presvd.)	220939	128522	212820	143713	189343	124121
Proc. Vegetables	226484	221159	248122	247400	253277	276053
Mango Pulp	110924	67392.1	105873	65767	85725.6	58432
Proc. Fruits, Juices and Nuts	317353	264784	339607	280497	360488	308644
Total	875700	681857.4	906422	737376.9	888833.6	767249.3

Source: APEDA, 2019-20

*Postharvest technology – importance and role***Maturity**

Postharvest maturity is classified into two groups *i.e.* horticultural maturity and physiological maturity (Dhatt and Mahajan, 2007). The quality of horticultural commodities and their shelf life are dependent on the maturity index. It is imperative that maturity indices be determined so that farmers can harvest at the right time for local markets, distant markets, export and processing (Kader, 1995).

Table 6.2. Maturity indices for temperate fruits

Cultivar	DFFB (Days)	Firmness (kg)	TSS (%)
Apple			
Starkrimson Delicious	103 ± 3	8.2 ± 0.20	12.5 - 13.5
Royal Delicious	120 ± 5	8.2 ± 0.40	13.0 - 15.0
Red Gold	122 ± 3	8.3 ± 0.20	12.0 - 13.5
Richared	128 ± 3	8.6 ± 0.25	12.0 - 13.0
Red Delicious	134 ± 5	8.4 ± 0.40	11.0 - 14.0
Golden Delicious	148 ± 6	8.4 ± 0.40	12.0 - 14.5
Grannv Smith	180 ± 5	8.7 ± 0.30	11.5 - 13.0
Peach			
July Elberta	103±3	5.9	13.5-14.5

Apricot			
New Castle	84±4	5.2	12-14.5
Royal	100±4	5.45	12.5-14.5
Plum			
Santa Rosa	94±3	5.9	15-17

Harvesting

Harvesting should be done when the days are cooler preferably during the early morning. If possible, move the crops to a shaded area after harvesting. If harvested during hot periods, the exposure to temperature may cause the produce to wilt and shrivel (Hodges, 2003). Harvesting should be avoided in inclement weather or immediately after heavy rain as it may allow microorganisms to multiply rapidly. It is important to harvest the crop at proper time and stage of maturity mainly taking into consideration the purpose. The stage of harvesting of leading flowers based on purpose is given in Table-6.3.

Table 6.3. Stages of harvest for flowers based on the purpose

Sr. No.	Flowers	Purpose	Stage of Harvest
1	Rose	Cut flower	1-2 petals beginning to unfold. At tight bud stage.
2	Jasmine	Loose flower	Matured, unopened bud stage
		Oil extraction	Fully opened flowers
3	Anthurium	Cut flower	Spadix almost fully developed 1/3 rd of flowers on spadix mature. Change of colour from base to top.
4	Antirrhinum	Cut flower	1/3 rd florets open
5	Cattleya spp.	Cut flower	4-5 days after opening.
6	Chrysanthemum	Standard	When outer florets frilly expanded
		Spray	Flowers open but before the shedding of pollens
		Pompons and decorative	Centre of the oldest flower fully open
		Anemones	Open but before central disc florets begin to elongate.

Equally important is to take appropriate care of produce before and after the harvest. Appropriate care may play an important role in defining the quality and market value of produce. In case of mango, it is recommended to prevent latex from coming out of the stem immediately after harvesting as it may cause black spots on the fruit leading to reduced market value. Ascorbic acid concentration is higher in small cabbage heads than large ones and therefore small and compact heads should be preferred. In tomato fruit, carotenoids increase during the ripening process. A fruit that matures earlier and has a shorter growing season generally has a shorter storage life than fruit that matures later.

Pre-cooling

Pre-cooling is the most important technique to remove field heat. There are different types of precooling techniques which can be applied to the horticultural crops like cryogenic cooling methods which covers cryogenic water cooling, forced air cooling, vacuum cooling and packing. The use of a particular cooling method depends on the type of crop.

- Room cooling – It is the most widely used method of precooling. The cooling is done by placing the perishables in boxes and in a room where they are exposed to cold air. Fans circulate the air over evaporator coils fitted with fans to distribute the cooled air. The cooling process involves forced draft coolers, or induced draft coolers. Because of this, proper packaging (with well vented containers) and stacking patterns are essential for achieving fast and efficient cooling (Ryall and Pentzer, 1982; Gibbon, 2009; Boyette *et al.*, 1990).
- Forced air cooling – Forced air-cooling is the fastest method of pre-cooling and used for a wide range of horticultural produce. Forced air-cooling either pulls or pushes air through the vents/holes in storage containers. Cooling time depends on (i) the airflow, (ii) type of commodity, (iii) the temperature difference between the produce and the cold air and (iv) produce diameter (Lill, 2006).
- Hydrocooling – The use of cold water is the oldest and quick method used to precool the fruits and vegetables. It is not suitable for packed commodities. The hydrocooler normally used are of two types i.e. shower and immersion type.
- Vacuum cooling – Vacuum cooling takes place by water evaporation from the product at very low air pressure and generally suitable for leafy vegetables. Removal of air results in the reduction of pressure of the atmosphere around the product, which further lowers, the boiling temperature of its water. As the pressure reduces, the water boils quickly by releasing the heat from the produce. Vacuum cooling cause about 1 % produces weight loss (mostly water) for each 6°C of cooling (FAO, 2004).

- Package icing – In this method, crushed or flaked ice is packed along with produce for fast cooling. The method keeps a high relative humidity around the product. It is usually done with flowers and flowery types of vegetables and with water-tolerant, non-chill-sensitive products. It is also used with water-tolerant packages such as waxed fiberboard, plastic or wood that are suitable for packaging ice (Dhatt and Mahajan, 2007).

Storage and handling

During respiration, horticultural crops commonly use hexose sugars as main substrates and organic or fatty acids as other substrates. In the process the substrate is oxidized by O₂ and degrade to CO₂ and heat is liberated, referred to as “vital heat” or “heat of respiration”. “Vital heat” is very important from the perspective of cooling and scheming of refrigeration equipment. The faster the product respire, the more heat it generates and the warmer it will be unless it is cooled adequately. The rate of respiration is a direct indicator of postharvest or storage life. Products that respire quickly are regarded as perishable and have a shorter postharvest life than those that respire slowly (Hodges *et al.*, 2005). Temperature control is the most important postharvest technique for the preservation of fresh horticultural crops. All the other treatments and techniques used in postharvest, including use of chemicals, irradiation and modified and controlled atmospheres, can only serve as supplements to refrigeration (Kitinoja and Kader, 2002). Generally, the lower the temperature around fresh horticultural crops, lower is the rate of deterioration, whereas higher the temperature faster is the rate of deterioration leading to higher losses. As per Van't Hoff's law (Temperature Quotient (Q₁₀)), for every increase of 10°C in temperature, the biological activity or chemical/ biochemical reactions (such as respiration rate) increases 2 to 4 folds.

Postharvest losses

Postharvest loss reduction technology comprehends the usage of proper maturity indices, reduction of losses in handling, packaging, transportation, storage and distribution with modern infrastructure and machinery, processing and preservation with low-cost technology (Simson and Straus, 2010). Use of low temperature (cold storage, freezing *etc.*), high temperature (drying, cooking, canning *etc.*), chemicals (preservatives class-I & II) and biological reactions coupled with other preservation techniques are applied to enhance the storability (Long and Prange, 2003). Proper packaging in suitable containers or packaging materials not only extends the shelf-life but also improves the distribution. Adoption of these techniques could make a large quantity of food accessible by avoiding wastage. This will provide better quality nutrition by making more food available and more raw materials for processing, thus ensuring

better returns to the farmers. In the absence of adoption of proper postharvest loss reduction measures, the agri-produce may incur losses in terms of –

- **Quantitative loss** – It means the reduction in weight due to water loss from the commodity and loss of dry matter by respiration metabolism.
- **Qualitative loss** – It means freshness deterioration due to loss of consumer appeal (change in shape, colour, flavour, etc.) and nutritional loss (vitamins, minerals, sugars, etc.).

Cost of preventing losses after harvest, in general, is less than the cost of producing a similar additional amount of produce and reduction in the losses is a complementary mean for increasing production. Pre-harvest treatments, harvesting at the right maturity stage, adopting proper harvesting techniques, stem cutting, curing greens, trimming vegetables, waxing fruits, cool chain transportation, packing and storing are some of the measures that can help in minimization of both qualitative and quantitative post-harvest losses. The factors that are responsible for the deterioration of quality or quantity of agricultural commodities are –

- **Biological factors** – Respiration rate, ethylene production, compositional changes, growth and development, transpiration, physiological breakdown, physical damage, pathological breakdown, surface area to volume and membrane permeability.
- **Environmental factors** – Temperature, relative humidity, atmospheric gas compositions, ethylene, light and other factors.

Processing and value addition

Important sectors in food-processing industries are fruit and vegetable processing, cereals processing, milk processing, meat, fish and poultry processing, instant food, non-alcoholic and alcoholic beverages and plantation crops (tea, coffee, cocoa, etc). Most of the produce like fruits, vegetables, milk, meat and fish are perishable in nature and needs proper processing and storage for extension of their shelf-life. In order to extend their shelf-life, it is necessary to check moisture loss, denaturation of enzymes, micro-organisms activity and proper packaging (Watkins, 2003). It is important to understand the primary processes contributing to food deterioration and spoilage and to take appropriate measures and adopt methods of preservation to ensure availability, acceptability and safety of foods (Rolle, 2006) as the absence of processing may lead to huge post-harvest losses.

Value addition to agri-produce has significant importance for a country like India for its diversity in socio-economic conditions, level of industrial growth, urbanization and globalization. It is not just about business opportunities it

provides but also about the taste, nutrition and safe food delivered to the consumers. The processing can help perishable agricultural produce undergo change in form, colour, taste and flavour to increase their shelf life. The availability of perishables mainly the horticultural produce not only through improved production but also through better post-harvest management can help the country in moving from food security to nutritional security for most of these crops are good source of vitamins (Table 6.4).

Table 6.4. Fruits and vegetables as a source of vitamins

Vitamin	Source
Retinol	From carotene in dark green leaves, tomato, carrot and papaya
Thiamine	Unpolished Pulses, green vegetables, fruits (cereal grains have B1 in germ and outer-seed coat)
Riboflavin	Green leafy vegetables and pulses
Pyridoxin	Banana, apple, orange, peanuts and almonds
Niacin	Pulses, almonds, peanuts and leafy vegetables
Folic acid	Dark green leaves, broccoli, spinach, beetroot, lettuce and avocados
Ascorbic acid	Dark green leaves, spinach, cauliflower, sweet pepper, citrus, guava, mango, papaya and aonla

Source: Jaganath and Crozier (2008)

Status of food processing industry

Food processing refers to improvement in the quality by bringing desirable changes in the form or characteristics of the agricultural produce to a valuable form. Processing food is primarily intended to reduce the qualitative and quantitative changes that occur after harvest. Processing can be classified into following –

- **Primary processing** – The term "primary processing" simply means the removal of foreign matter, immature and diseased parts from raw materials, followed by grading the materials into different lots and converting them into a form suitable for secondary processing.
- **Secondary processing** – Processing of primary processed raw material into a product which is suitable for food uses or consumption after slight modification like cooking, roasting, frying, etc.
- **Tertiary processing** – It is the conversion of secondary processed product into ready to eat form like biscuits. The farmers, in general, do not

go for processing and prefer to sell their produce immediately after harvest. It has been estimated that the farmers retain 44 per cent of the total wheat and 48 per cent of the paddy for own consumption and seed purposes (Anonymous, 2019). The food processing sector in India has gained importance due to demand for instant food, besides increased demand for snack foods and beverages.

Fruits and vegetable processing

India is the second largest producer of fruits and vegetables in the world. It has the potential to grow all types of temperate, subtropical and tropical fruits and vegetables because of agro-climatic diversity. However, the losses are estimated to the extent of 20 – 30 per cent due to lack of proper harvesting, processing and storage facilities (Abrol *et al.*, 2021). People, in India, generally prefer fresh produce due to availability of seasonal fruits throughout the year at low prices. The fruits and vegetables have the potential for easily getting processed into wide range of products like beverages, jams, jellies, candies, preserves, canned fruits and vegetables, dehydrated fruits and vegetables, pickles, soup mixes, sauces and ketchup, etc. In the recent past, an increase has been observed in the uses of fruits in the form of concentrated juice, dry powder, jam and jelly. Juice and pulp produced from fruit is 27 percent, jam and jellies 10 percent, pickles 12 percent, ready-to-serve beverages 13 percent, synthetic syrups 8 percent, squash 4 percent, tomato products 4 percent, and canned vegetables 4 percent and others 18 percent.

Floriculture sector

The quality of flowers, which reaches the final consumer, depends on the pre-harvest and post-harvest handling. Quality is the pillar for creating value and customer satisfaction. As a result of being detached from the plant, flowers lose access to food, water, minerals and hormones and therefore, are highly perishable and need utmost care after harvesting. Generally, keeping quality of flowers vary with species and cultivars, this may be due to genetic or inherent factors like differences in anatomical, physiological, physical, biochemical and genetic makeup. Beside these, keeping quality of flowers also depends on factors like carbohydrate reserves, osmotic concentration, pressure potential of petal cells, stomatal functioning, difference in number of thick-walled supporting cells in the xylem element and phloem fibre, presence or absence of a complete ring of secondary thickening in flower peduncles, differences in the diffusive resistance of leaves in the field, level of plant hormones and susceptibility to disease and insects. Therefore, it is vital to understand the importance of post-harvest handling of flowers to keep them in good quality.

Conclusion

A wide range of physical and chemical treatments exist to maintain and extend shelf life of fruits and vegetables. The main issues to be addressed are minimization of postharvest handling losses, value addition, by-product utilization and promotion of export through public-private partnership. Due to prevailing situation of Covid the demand of health food has increased recently. The government new initiative “One District, One Product” is going to be game changer in improving the economy of the farmers. Going forward, the adoption of recent innovation and safety systems will have several positive impacts on food processing industry and result in minimizing the wastage. Further, there are ample scope of food processing employment generation in this sector.

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Public Private Partnership and Agriculture

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Introduction

The relationship between agricultural development and investment in infrastructure is long recognized as complementary to each other. An appropriate market infrastructure is essential not only to carry out marketing functions and expand the size of the market but also to communicate effective price signals that improve marketing efficiency. Infrastructure facilitates vertical and horizontal integration, thereby, bringing economies of scale and cost efficiencies in the supply chain. The Inter Ministerial Task Force on marketing reforms, 2002 set up by the Govt. of India has made an assessment of requirement of investment in agricultural marketing infrastructure to the tune of ₹ 12,400 crore by the year 2012, which indicates the kind of investment required in agricultural marketing sector. DFI Report based on the assessment made by NCCD (2016) suggests the investment requirement for specialized infrastructure for integration of cold-chains is to the tune of Rs 89,375 crores. With the involvement of private sector, besides availability of private capital, there will be optimum utilization of resources with private management expertise and sharing of risks between the private and Public sectors. This signifies the importance of introducing appropriate models of Public–Private–Partnership ventures in the sector.

Reform- A pre-condition for Public Private Partnership

Amongst different laws governing the marketing of agricultural produce in India, the Agricultural Produce Market Regulation Act is the most important one. This Act is implemented by the respective State Governments for regulation of agricultural marketing activities. Regulations were introduced with the objective to ensure proper weighing, prompt payments to farmers for their goods, and to prevent their exploitation by middlemen. However, the markets originally meant for protecting the farmers from the clutches of the middlemen ended up inhibiting the free play of market forces, pushing the interests of the farmers to the backburner.

According to the Inter-Ministerial Task Force on Market Reform, the effective reform of the agricultural marketing system of the country is critical in order to assist our farmers in facing the challenges and benefiting from the resulting changes in the trade environment due to privatization, liberalization, and

globalization. Accordingly, Ministry of Agriculture, Government of India prepared a Model Act called Agricultural Produce Marketing (Regulation & Development) Act, 2003 in consultation with all the state Governments/UTs. All the States/UTs have agreed to amend their respective State APMR Act in line with the provisions suggested in Model Act to bring about the requisite reforms in the sector. The salient features of the Model Act are setting up markets in the private/ cooperative sector, rationalization of market fees, promotion of contract farming, direct marketing and grading and standardization in each State/UT.

Impact of PPP models in agriculture

The success of PPP requires both the public and private sectors to work together and combine their best capabilities (Hisrich and Peter, 2002). In addition to improving market linkages of farm produce, building farm-family capacity, reducing risks and uncertainties and economic empowerment for farmers; PPP has the potential to make positive changes in areas as listed below –

Knowledge management

Public-Private Partnership that integrates knowledge management could result in increased production and better services. Bihar's Patna district has replaced traditional rice varieties with basmati rice, as well as grown medicinal plants and mushrooms.

Development of high end technologies

PPP can help in improving skills of managing intellectual property and public sector's technology information database. Commercialisation of Bt maize varieties based on partnership between Agricultural Genetic Engineering Institute (AGERI) of Egypt and Pioneer Hi-Bred Company, developing delayed ripening variety of Papaya between Syngenta and University of Nottingham, development of GM sweet potatoes in Kenya, development of super sorghum through nine globally respected institutions and completion of rice genome sequencing project have resulted in high end technologies through PPP approach (Khush 2005).

Reduction of risks and uncertainties

With PPPs, crops can be more reliably forecast, pests and diseases can be eliminated, natural calamities can be managed, and risks can be reduced. In green bean exports from Kenya and grape exports from India, PPPs addressed food safety-related barriers pertaining to exports. In 2009, drought insurance became truly affordable through a PPP among Syngenta East Africa and MEA (a fertilizer company) (Narrood *et al.* 2007).

Social mobilization

Development departments engaged in promoting group dynamics among the community may be benefited by creating a better social linkage through SHGs,

farmers' clubs, commodity groups, farmers' cooperative societies and federations. In Odisha's Khurda district, tribal farmers organised as a producer group having women and men as its member established a selling unit for maize under PPP in 2011 (Ponnusamy and Kishore 2012).

Productivity enhancement

ICAR and the Department of Biotechnology, Government of India, initiated discussions with Monsanto to transfer Bt cotton technology to India. Subsequently, Mahayco joined forces with Monsanto and Bt cotton was introduced in India through that partnership (APCoAB 2007). The area of Bt cotton planted in India has increased from 29000 hectares in 2002 to 9.4 million acres in 2010 (James 2010). Bt cotton technology has brought in more equality in farm-income distribution (Morse *et al.* 2007). In 2002-03, cotton productivity was 301 kg/ha which increased to 526 kg/ha in 2009-10 and the real cost of production decreased by 16 to 46 percent (Ramasundaram *et al.* 2011).

Economic empowerment of farm women

Women entrepreneurs and groups have found that public-private partnerships for service delivery have opened up a wide range of opportunities for delivering local services and creating conditions for empowerment. During the past 23 years, Cadbury India, Kerala Agricultural University, and DBT have built 28 cocoa chocolate factories in different parts of Kerala through a public-private partnership. Thirumadhuram Pineapple project through PPP involving Kudumbhasree Project Mission, Department of Agriculture, women SHGs and Nadukkora Agro-processing centre could produce 25000 tonnes of pineapple in 500 ha and directly employed 12500 women (Rajendran *et al.* 2010).

Gender mainstreaming in agriculture

Women of tribal farms in Odisha realized increased productivity and income through gender sensitized maize production using a participatory approach. Assam Agricultural University promotes organic farming through a PPP model in order to enhance farmer's skills and knowledge (Ponnusamy *et al.* 2012).

Important successful and failure PPP models

The important PPP models concerning success and failure in agriculture in India are compiled in Table 7.1.

Table 7.1. Successful and failure PPP models in agriculture

Successful PPP models	Failure PPP models
ATMA initiated PPP models in various states of India (Srinath and Ponnusamy 2011), vermicompost production involving Assam	Non-involvement of line departments of local government led to failure of PPP project on 'Bio-ethanol production from sweet sorghum in

<p>Agricultural University and District Level Rural Development Society (NGO) and farmers groups in Jorhat district (Ponnusamy <i>et al.</i> 2012), hybrid rice seed production by IARI and private parties (APCoAB 2007), promotion of mechanized farming in tribal regions of Gujarat and ICRISAT Private sector sorghum hybrid parents research consortium (Reddy and Rao 2011)</p>	<p>rainfed areas' and Safal Terminal Market in Bangalore failed due to undue advantage taken by partner (Reddy and Rao 2011)</p>
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Source: <https://www.researchgate.net/publication/290059190>

Key lessons learned for leveraging PPP in agriculture

A strong PPP is likely to enhance productivity and create new opportunities for collaboration as well as meaningful interactions among individuals, groups and organizations (National Productivity Organization 2011). It is important to abolish or reduce fees imposed on the procurement of agricultural and horticultural products procured through registered contract-farming programmes, and to develop new structures like pure returns models, in which both the government and private firms have equity investment and operate on commercial terms.

When PPP models are successfully replicated across various production hubs, the agriculture industry can transform from an inefficient, supply-led, low-value business scenario to an organized, high-tech, demand-led, and high-value situation (Patel *et al.* 2007). It is equally essential to incorporate learnings of previous PPP experiences (Soumitra 2007). PPP would be successful if the government policies provide a level playing field to all the stakeholders (Reddy and Rao 2011). Infrastructure viability gap funding should be extended to irrigation, agriculture markets, terminal markets and common infrastructure in the fertilizer sector as part of the scheme to support PPPs in infrastructure to attract private investment.

Limited participation of private sector in agricultural marketing oriented infrastructure in India

In India, the adoption of economic reforms and liberalization in the early 1990s led to a conducive environment for participation of private sector in infrastructure development. The report of sub-group on Public Private Partnership (PRIs & NGO), Planning Commission has defined Public Private Partnership as a mode of implementing government programmes / schemes in partnership with the private sector. In PPP, the term private is often understood to refer to private corporations as well as small-scale businesses like farms.

When the APMR Acts of different states of India were amended on the lines of the Model Act prepared by the Central Government in early 2000s, opportunities for PPP were created in agricultural marketing. Both the Expert Committee Report (2001), and the Inter-Ministerial Task Force (2002) set up by the Government of India have made huge assessment of infrastructure requirement. The Model Act/ Model Rules prepared by the Central Government have not been followed by different states in the right spirit therefore limiting the scope for achieving the desired result. This has been a major setback for attracting private investment to the sector.

Limited reform progress

It is heartening to note that sixteen states of India have amended their state APMR Acts, though partially, in line with the Model Act, 2003 circulated by the Government of India. However, only eight states have so far framed the rules for implementing the provisions of their respective state APMC Act, thereby limiting the reform process to reach logical conclusion. The states that have amended their Acts are Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Nagaland, Orissa, Rajasthan, Sikkim, Tripura, and Jharkhand. State rules have been formulated in Andhra Pradesh, Rajasthan, Maharashtra, Orissa, Himachal Pradesh, Karnataka, Madhya Pradesh and Haryana (only applicable to contract farming).

The states are considered to have adopted reforms if they have amended their Acts in respect of at least three areas i.e. direct marketing, contract farming, and setting up of Mandies in the private or cooperative sector. Though, these areas are focused to be the key areas and counted as the minimum reforms that a state should undertake to be eligible for funds under different reforms-linked Central Sector Schemes, it is observed that many states have introduced only cosmetic changes in their Acts in these areas, stifling the very spirit of reforms in the sector. The spirit in which the Model Act was conceived is not being fully embodied in the Rules being drafted by the different States. Imposition of restrictions such as minimum distance from the Government-owned APMCs (Maharashtra), minimum investment requirement of Rs 10 crore to ₹25 crore for setting up of private Mandis (Andhra Pradesh and Karnataka), compulsory registration of contract farming with APMCs themselves, private Mandis to collect market fees and share the same with the APMCs (e.g. in Orissa private market to share 5 percent of user fees with Marketing Board), undefined periodicity of licenses for private Mandis (Himachal Pradesh) are some of the worrying provisions that have crept into the Marketing Rules being adopted by different States.

The Model Act is captioned as Agricultural Produce Market (Development and Regulation) Act, 2003. Thus, the word development was added to the title of the Act for the first time to convey the message down the line that it is time to go beyond regulation and focus on development, thereby enabling a shift in the present paradigm of agricultural marketing system. It is observed that many states have not incorporated the word —development— in the title of their Acts and they have simply adhered to their old title with focus on regulation and control.

It is also observed that some states, while amending their Acts in line with the provisions of the Model Act, have ended up inserting some discrepancies by introducing contradictory clauses in their state Acts. For instance, some states have not adopted section 3 of the Model Act, as per which, any individual, legal person, or organization can take an initiative to set up a new market. These states have simply retained the old provision of their respective state Act, saying that only State Government can take the initiative to set up a new market. The Agricultural Produce and Livestock Marketing (Promotion & Facilitation) Act, 2017 further emphasizes on the participation of private players through provisions like restrictions of regulations only within the physical markets and warehouses to operate as sub-market yards.

Conclusion

Promotion of private investment is one of the prime motto of the process for reforms initiated by both the central and state governments. Hence, in order to evolve a public private partnership regime in the sector, all the identified reform measures need to be implemented in the right spirit by the states by bringing necessary amendments in their respective state APMC Acts. Private investment in agricultural marketing sector cannot be considered in isolation. This calls for removing glitches of the regulatory marketing system through promotion of direct marketing, contract farming and setting up of markets in the private and cooperative sector, promotion of a responsive market information system, a vibrant mechanism for price discovery and risk management, a need-based marketing extension system, promotion of grading and standardization and promotion of modern marketing system like hub-and spoke model of terminal markets. In each model, there should be clarity on sharing of fund investment, research and development components and business operations. A consortium involving unequal partners may not result in a viable partnership. In addition, the model should include the entire development chain, from concept to launch. The different operating systems existing within public and private sectors need to be recognized and to create harmonious working relations between the two. Affordability of new technologies and other interests of small farmers need to be kept under consideration while taking up PPP as an empowerment model.

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Is crop diversification an alternative?

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Introduction

Economic growth of farming communities is highly dependent on diversification of agriculture. In addition to technology, government policy, transportation and infrastructure; agricultural diversification is also supported by changes in consumer demand. Agriculturists diversify their production by adding different crops or systems to their farms in order to realize the additional returns generated by value-added crops, which provide complementary marketing opportunities for the farm. To a certain extent, diversification of crop varieties and inclusion of new ones can contribute to increasing farmers' income. By diversifying crops, farmers can earn income from multiple crops instead of depending solely on one. A farmer who chooses a single crop type is exposed to high risks if unforeseeable climate events like pest outbreaks, frost or drought wreak havoc on the crop, resulting in severe production loss. Introducing different varieties into a particular agroecosystem leads to a more diverse cropping system, which in turn increases natural biodiversity, allowing the agroecosystem to respond to these stresses more effectively. In addition to becoming more productive, more nutritious, healthier and more resilient to diseases, pests and environmental stresses, diversification allows to introduce new plants and improved varieties of crops. By reducing the risk of total crop failure, this approach also provides alternative income-generating methods, since different crops will react differently to changing climate scenarios. By diversifying crops, one can expand the production related activities on distinct crops while at the same time lowering the risks associated with the production of specific crops in a given area (Hazra et al, 2001). Diversification in India typically refers to a shift from traditionally grown less remunerative crops to more lucrative crops. The cultivation of several crops at the same time is practiced in dryland areas to reduce the probability of crops failure due to recurring droughts.

The diversification of agriculture has attracted significant attention since the 1990s, particularly in areas benefited from the green revolution. Commercial crops and horticulture crops are now more lucrative than food grains for farmers. A special plan on crop diversification was initiated under RKVY during 2013-14 in Punjab (20 districts), Haryana (10 districts) and Western Uttar Pradesh (15 districts) to shift area from paddy to alternate crops to arrest the depletion of ground water and restoration of soil fertility. The learning of this may provide a

base for further expansion of the diversification plans. Pooling of resources and synergy amongst programs of rural development (land and water issues), agriculture (production, marketing and input support), post-harvest industries (processing and abattoirs), water resources, etc., will be the prerequisite for significant success in this endeavour. It is important to provide better marketing and storage services to the alternative crops introduced in these. Reforms in agricultural marketing, land leases, tenancy laws and risk management will facilitate farmers in making investments in alternative crops and enterprises (oilseeds, pulses, horticulture and livestock) mainly in rainfed areas.

Importance of crop diversification

Diversity in agriculture provides environmental protection from depletion of biodiversity and promotes sustainable development, depending on the view of a nation or society. A country having limited number of specialized crops or crop-based enterprises is more susceptible to low-income risk due to fluctuating domestic or international prices or natural disasters which affect the system of specialized farming. In order to maintain national food security, income and price stability, and protect the bio-diversity of the nation, a delicate balance is required to be maintained between those agricultural activities that are more profitable and those that are less profitable but eco-friendly. Overall, there is general agreement that diversified farming may benefit both individuals and society if adopted in a systematic manner. Diversifying both horizontally within agriculture as well as vertically, through income-generating activities by small farms outside agriculture, is in the interest of small farmers and the nation.

Benefits of crop diversification

Diversity in crops strengthens the relationship between food production and livestock. It ensures the availability of rural employment throughout the year and sustained future of agriculture in India. Additionally, crop intensification (increased yield per hectare) happens as a result of genetic engineering. Crops grow in their natural environment may facilitate limited requirement of irrigation. Furthermore, it restores the nutrient profile of soil and improves environmental sustainability.

Some of the benefits of crop diversification are as discussed below –

- Increase income on small land holding – At present, more than 86 percent of the farmers operates on marginal and small holdings. By adding crops of high value to existing cropping patterns, such as maize and pulses, existing cropping patterns may be reversed.

- Economic stability – It may ensure economic stability of farming products if diversification of crops can better handle the ups and downs in prices of various products.
- Mitigating natural calamities – Cultivation of mixed crops may provide benefits and help in curtailing effect of erratic weather pattern such as flooding, drought, hail or epidemics of insects and pests.
- Balance food demand – Malnutrition affects the majority of the Indian population. By adding pulses, oilseeds, horticulture and vegetable crops to the food basket, we can improve food and nutritional security. National Food Security Mission (NFSM) aims to expand planting of pulses and oilseeds in India.
- Conservation – By adopting crop diversification, we can conserve natural resources, such as the introduction of legumes in rice-wheat cropping systems, which fix atmospheric nitrogen and help improve soil fertility. This process can be supplemented by covering farmers under Soil Health Card (SHC) initiatives. This may help farmers in getting better information about the nutrient status of soil and apply nutrients accordingly for improving soil health.

Efforts to promote diversification

The government of India has followed a cereal-centric price policy since the 1970s as part of its effort to improve food security. As the country has achieved self-sufficiency at national level, the government is now promoting diversification to ensure conservation of resources and making agriculture pro-poor. Though, marketing is imperative to reap desired benefits from diversification as farmers will not be able to realise the remunerative price for their crops in the absence of proper market linkages. The focus of the government is on doubling farmer's income and diversification can be used as one of the strategies to help farmers enhance their income.

In order to promote diversification, government is implementing Crop Diversification Programme (CDP) as a sub-scheme under Rashtriya Krishi Vikas Yojana (RKVY) in Original Green Revolution States. The component aims at diverting the area of paddy crop to alternate crops in paddy growing states like Punjab, Haryana and Uttar Pradesh. Whereas, the focus in tobacco growing states is to encourage tobacco farmers to shift to alternate crops/cropping system. The assistance is provided under the component for alternate crop demonstrations, farm mechanization and value addition, site-specific activities and provision for awareness, training and monitoring. However, flexibility has been given to tobacco growing states to take up suitable activities and interventions for replacing tobacco crop with alternative agricultural/ horticultural

crops. The state-wise allocation (central share) under CDP for replacing paddy / tobacco crops during 2019-20 is given in Table – 8.1.

Table 8.1. State-wise allocation (central share) under CDP for replacing paddy/ tobacco crops during 2019-20 is given below:

Sr No	State	Budget Allocation (central share) Rs in Lakhs
A	CDP for replacing Paddy crop	
	Punjab	705.76
	Haryana	301.73
	Uttar Pradesh	320.51
	Sub Total	1328.00
B	CDP for replacing Tobacco crop	
	Andhra Pradesh	212.96
	Bihar	17.80
	Gujarat	201.23
	Karnataka	160.08
	Maharashtra	0.00
	Odisha	2.45
	Tamil Nadu	5.33
	Telangana	10.47
	Uttar Pradesh	38.21
	West Bengal	18.47
	Sub Total	667.00
C	Contingency	5.00
	Total (A+B+C)	2000.00

Source: PIB New Delhi, 2020

Status of diversification

The status of diversification in different states as depicted through Effective Number of Crop Species (ENCS) is presented in Table – 8.2. The value of ENCS signifies the estimate of the number of crops dominating production in a particular region. Thus, a low value of ENCS means low crop diversity and high value corresponds to high crop diversity. The table reveals that status of diversification

is relatively higher in states like Karnataka, Maharashtra and Gujarat as suggested by the higher value of ENCS whereas low value of effective number of crops species in states like Jharkhand and Punjab suggests low level of crop diversity. Another interesting picture emerging from the table is that the diversification has improved in north-eastern region as suggested by the increased value of ENCS in states like Manipur, Mizoram, Sikkim and Tripura from 2005-06 to 2015-16. The picture though is completely revised in some of the states like Haryana, Kerala and Odisha (Gol, 2021).

Table 8.2. Measuring Crop Diversification through Effective Number of Crop Species

Effective Number of Crop Species	Value		
	2005-06	2010-11	2015-16
Goa	6.1	5.8	6.1
Gujarat	15.5	14.9	16.0
Haryana	7.4	7.1	6.1
Himachal Pradesh	6.3	6.0	6.3
Jammu & Kashmir	6.7	6.9	6.8
Jharkhand	3.7	4.4	4.8
Karnataka	20.1	21.0	21.0
Kerala	11.2	11.0	10.6
Madhya Pradesh	11.5	10.9	9.7
Maharashtra	15.8	14.7	14.7
Manipur	3.2	4.8	5.7
Meghalaya	11.6	10.8	13.3
Mizoram	5.4	10.8	10.6
Nagaland	10.0	10.2	10.5
Odisha	6.8	2.5	2.1
Punjab	4.5	4.2	4.0
Rajasthan	10.9	12.3	11.7
Sikkim	8.2	11.7	10.9
Tamil Nadu	13.6	14.1	13.3
Telangana	1.0	1.0	8.5
Tripura	1.6	6.7	7.7
Uttar Pradesh	8.3	8.1	7.9
Uttarakhand	8.5	8.2	8.4
West Bengal	5.1	5.9	6.0
Andaman and Nicobar Islands	5.1	7.2	6.8
Chandigarh	3.1	2.5	1.5
Dadra and Nagar Haveli	6.4	6.1	5.7
Daman and Diu	1.5	3.8	3.6
Lakshadweep	2.2	2.3	1.0
Puducherry	4.5	4.3	4.4

Source: *Envistats India Explainer Series – Croplands, 2021*

Policy support

In India, traditionally, agricultural development policies have not encouraged diversified farming. This has been particularly true for small farms and backward regions. In order to encourage small-scale agricultural diversification in different agro-climatic regions within the country, reforming the existing policies may be necessary. First, the agricultural price policy does not provide adequate protection to crops such as fruits and vegetables in terms of procurement and minimum support prices. A price protection system would be helpful to small farmers since production and prices of these commodities fluctuate widely. The lack of cold storage, markets and transportation facilities are some of the limitations for small farmers in backward regions. A stable electricity supply would similarly prevent the promotion of non-farm activities such as agro-processing. Government should take appropriate measures to develop these infrastructure facilities along with encouraging private players to participate in the process of infrastructure development. The tenancy laws in most of the states may need to be revised so that large farmers will be able to engage in activities other than farming, and marginal and small farmers will have better access to land through lease markets. The diversified agriculture and increase in profitability would help them become more competitive. Similarly, consolidations of more modest holdings could lead to greater economies of scale. Rural policy changes for horizontal and vertical diversification are needed to eliminate income disparities between agricultural and non-agricultural households. Small farm diversification in India has good prospects but it can only be made feasible and viable through proper support from policymakers, administrators, scientists, and extension professionals.

Conclusion

Crop diversification is important in a country like India. It is important to study all possible aspects of the concept to realise its full potential. There is need for appropriate studies (both quantitative and qualitative) mainly on its implications under conditions of fragmented agriculture. The level of crop diversification should reflect on the level of economic efficiency in terms of market and consumption pattern.

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Market challenges in doubling farm income

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Introduction

Agriculture has been playing a very important role in the overall growth of the Indian economy despite structural shift observed towards the services sector during the recent decades. Although, the share of agriculture in GDP has decreased from 55.1 per cent in 1950-51 to 19.9 per cent in 2020-21, this sector remains a major source of employment for rural workers. The dependence of the rural labour force on agriculture for employment has not decline in proportion to the falling contribution of agriculture to GDP. This has extended income inequality between the agricultural and non-agricultural sectors. India achieved self-sufficiency in food production at the macro level, but still faces massive challenge in terms of large number of malnourished children and the high incidence of rural poverty.

According to Agriculture Census 2015-16, approximately 86.8 percent of Indian farmer are small and marginal. About 46.9% of the total agriculture land area under cultivation are covered by small and marginal farmers. Irrigation facilities are scarce for most farmers living in the vast expanses of the central and eastern Indian plateaus. These factors contribute to low crop productivity leading to low marketable surplus and ultimately low income. The agriculture sector has seen a shift in focus of the government from production to marketing to income enhancement in recent past. As a result of the emergence of modern food value chains, poor farmers in developing countries have now better access to buyers, a situation that has proven to be beneficial for them. A better welfare system for farmers and raising agricultural income are essential in securing the future of agriculture and improving livelihood. In addition to eliminating persistent disparities between farm and non-farm income, doubling farmers' income by 2022 will also alleviate agrarian distress and promote inclusive growth and dynamism in the agriculture sector. Chand, R. (2017).

The Hon'ble Prime Minister has shared the vision of doubling farmers' income on 28th February, 2016 2022. The seven-point strategy for doubling farmers' income covers –

- 1) Focus on irrigation with “Per Drop, More Crop”

- 2) Providing quality seeds and nutrients based on soil health cards for each and every field
- 3) Heavy investment in warehousing and cold chains to prevent or minimize post-harvest crop losses
- 4) Creation of value addition through food processing
- 5) An e-platform to connect selected wholesale markets across the country to help emerge a national agricultural market and facilitate removal of distortions in the market
- 6) New revolutionary crop insurance scheme to mitigate risks at reasonable cost. Introducing a new crop insurance scheme – Pradhan Mantri Fasal Bima Yojana, which will provide maximum coverage for the minimum price
- 7) Promotion of ancillary activities like poultry, sericulture, beekeeping and fisheries

The shift in the focus of Government to Doubling Farmers' Income is well appreciated but it is not going to be free from challenges mainly with respect to integration of farmers with market to help them realize the best possible price for their produce. The Government has taken numerous steps in the recent past to strengthen the agricultural marketing system and make it properly equipped with right kind of infrastructure. An increase in Rural Infrastructure Development Fund from Rs 30,000 crore to Rs 40,000 crore has been announced in the Union Budget 2020-21. This rural agriculture fund will be helpful in creation of world-class agriculture infrastructure. The investment will help in reducing farm-to-fork wastage and usher scientific crop growing and post-harvest facilities. The agriculture infrastructure fund would also be made available to APMCs for enhancing their infrastructure facilities. This includes "one district one product" approach of states with emphasis on storage and cold storage in villages and the idea of Krishi Udaan and Kisan Rail. Recently, the Government expressed its intent for a liberal and integrated agricultural marketing system by introducing Farm Acts, 2020 defining trade area, framework of agreement and inclusion of commodities as essential commodities. However, the Acts have now been repealed by the Government.

Challenges in doubling farmers income

In spite of these efforts, it is going to be difficult to achieve the vision of Doubling Farmers' Income in the stipulated time for various limiting factors prevailing in agriculture sector. Some of the factors are discussed below –

Small Agricultural Land Holding

According to the Agriculture census data 2015-16, average size of agricultural land holding is 1.08 hectares, where 86.8 percent are small and marginal farmers

possessing less than 2 hectares of land. The fragmentation of land holding leads to increase in cost of inputs such as labour, fertilizers and pesticides. The small land holding size make it difficult to adopt modern technology and ensure effective management of agricultural activities. Low productivity of agricultural output coupled with wastage of land make it difficult to raise farm income which results from land fragmentation in India.

Inability of the Farmers to access Credit

More than 50 percent of the rural farmers in India have been deprived from institutional credit facility. Lack of adequate collateral with farmers and a limited number of bank branches in rural areas cause inaccessibility of institutional credit in most part of the rural areas. These conditions increase dependence of farmers on non-institutional sources of credit like village money lender, Mahajan, landlord and have to bear higher rate of interest. The inadequate credit facilities curtail the changes of farmers to adopt modern technology and farming inputs and are compelled to continue to practice old method of cultivation which results in low farm income generation by bulk of small and marginal farmers.

Poorly equipped agricultural marketing system

One of the biggest challenge in the context of doubling farm income is the poorly equipped marketing set-up for agricultural commodities. The Government in recent past taken various initiatives not only to facilitate development of an efficient and liberal system but also to equip the existing system with requisite infrastructure. Government has introduced Agricultural Infrastructure Fund, Integrated Scheme for Agricultural Marketing (ISAM) and Rural Infrastructure Development Fund. Government has also taken various initiatives to strengthen the marketing system like Electronic National Agricultural Market, provision of emergence of alternative marketing channel and upgrade of Rural Haats into GrAMs to serve as point of collection and distribution in production belt. In spite of these efforts, the agricultural marketing system is dominated by private traders' at large which many time influence the price and leave farmers with low share in consumer's rupee.

Large number of middlemen

Agriculture marketing involves taking produce from point of production to consumption through various functions like assembling, handling, storage, transport, processing, wholesaling, retailing, grading and sorting, financing, promotion and market information making it a very complex process. This movement of produce involves a large number of middlemen. The prevalence of these intermediaries varies with the commodities and the marketing channel of the products. The presence of large number of intermediaries leads to low producers share in consumer rupee.

Communication problem

Flow of information is vital for integrating farmers with appropriate markets. The poor availability of mean of communication like posts, telegraphs and telephones and internet coupled with low level of literacy curtail the smooth communication between different stakeholders.

Inadequate facility of transport

Availability of sufficient transport facility at reasonable cost is another challenge faced in marketing of agricultural produce. Lack of transportation facility refer to absence of the transport service in important agricultural marketing areas, seasonality of transport service, high freight charges due to inadequacy, lack of all-weather roads and transport vehicles, lack of suitability of the existing transport facilities for the transportation of some products mainly perishables like fruits, vegetables and eggs. Although, mechanized facility of transportation has also developed, but still not available in all areas and to all the farmers. Railways also providing transport facility, farmers and merchant have a cause of concern regarding availability of parcel vans for transport of perishable products such as fruits and vegetables. A study by CIPHET suggests that post-harvest losses in case of fruits can be in the range of 6 – 18 percent based on the kind of commodity. Out of these losses, transportation alone can be responsible for 1.1 – 1.8 percent losses in fruits. The losses during transportation in vegetables can be as high as 3.1 percent in case of tomato (Jha, et al, 2015). Transportation is considered to be an important aspect in improving agricultural marketing efficiency. It is required at each stage of marketing. To assess the welfare of farmers and the transformation of agriculture, income is the most relevant measure, agricultural investment yields the highest returns per unit even today and corporate investment lacks the scale (Sendhil, et al, 2018)

Forced sales

The financial obligation committed during production period force farmers to dispose-off the commodity immediately after harvest though prices will generally rule low due to good arrivals. Forced sales or distress sale will keep the farmers in vicious cycle of poverty. The National Planning Commission on rural marketing and finance remarked that the farmer is a person who generally sells their produce at an unfavourable place and time and often receive unfavourable terms.

Technological development problems

Technological changes in performing certain production and harvesting related activities may also lead to poor price realization. There are various examples like mechanical picking of cotton is associated with the problem of mixing trash with cotton, potato diggers machine is found to causes cuts to the potato and sugarcane harvesters leads to the problem of trash mix with cane. These types

of problems led to the quality deterioration and therefore reduction in the price of farm produces.

Lack of market information

Market information is vital for all the stakeholders ranging from producer to traders as well as the consumer and policy makers. Through, there are so many initiatives under public and private sector to facilitate collection and dissemination of market information, still it is a challenge to provide the right kind of information at right time to facilitate decision making of farmers.

High Marketing Cost Affects Small and Marginal Farmers

Higher marketing costs have direct bearing on the efficiency of marketing of agricultural produce. This impact actual price realization especially for the small and marginal farmers in a country like India where farmers generally have limited marketable surplus, higher transaction costs and least bargaining capacity. Government has taken various policy measures in recent past to make the system efficient. It is also required to distribute produce efficiently in a global and liberal market.

Need for Reforms in Agricultural Market

In order to realize the full potential of agricultural sector, it is required to have well-functioning markets. Well-developed and efficient marketing system in the country will promote competitive trade as well as facilitate farmer's access to value addition services such as grading, storage and packing. It will also help in addressing supply chain inadequacy and reduction of postharvest losses. It will need participation of private players to facilitate sufficient investment in different agri-marketing related infrastructure. Government has adopted various reforms measures to create conducive policy environment to encourage participation of private players. These includes reforms introduced during 2003 & 2017 and efforts made under schemes like national agricultural market (eNAM) and Agmarknet (MRIN). These efforts are being supported by bringing desired changes in other component of the sector like warehousing, food safety and infrastructure. Idea is to have a liberal and barrier free system operating across state boundaries. The removal of inter-state barriers would impact the realization of better prices by the Indian farmers as supply chains between the producers and consumer would be reasonably streamlined (FAO, 2005). Government has adopted a comprehensive approach covering policy changes, introduction of concept like national agricultural market, introduction of agmarknet to provide market information, introduction of concept like negotiable warehouse receipt, aggregation of farmers by promoting farmer-organizations and encouraging entrepreneurship to have better management of resources.

Conclusion

Indian agriculture is challenged by various issues like small holding size, inefficient and fragmented markets, intra and inter states movement restrictions, poor availability of infrastructure mainly for storage and transportation, lack of sufficient number of markets and poor availability of market information. These challenges will always make it difficult to have desired rate of growth in agriculture to help achieve the vision of doubling farmers' income in stipulated time. However, it is possible if conducive environment is created and full potential of the sector is realized. The Government has already taken various measures to create desired ecosystem.

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Relevance of Market led Extension

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Introduction

Agriculture in India has made tremendous progress since independence and has reached the status of self-sufficiency in food grain production. While the production has increased significantly, the remunerative incentives have failed to attract the farmers. With the globalization of commodity markets, farmers must transform themselves into producers and sellers for realising the maximum return on their investments. The majority of farmers receive production-related technologies through extension services. However, it is important for extension delivery mechanisms to shift from being production-oriented to market-oriented in the current scenario to help farmers improve their income by practicing agriculture. Farmers are required to be assisted with market-led-extension to help them increase the quality of their farm produce as well as increasing the value and marketability, thus increasing their incomes. As the concept of market-led-extension focuses on money-to-money rather than seed-to-seed, it will assist farmers in improving value and marketability of the produce, minimize cost of production and therefore, maximisation of their returns on investment. As a matter of fact, it is a paradigm shift from a supply-driven model to a demand-driven model that encourages farmers to produce as per the requirement of the market and help them realize better returns. India has made visible progress in terms of technology and that is evident from the increase in production of different categories of agricultural commodities (Table – 10.1). India is producing wide range of agri-commodities ranging from rice, wheat, pulses, oilseed crops, cash crops, millets along with medicinal and horticultural crops.

Table 10.1. Second advance estimates of principal crops

Sl. No.	Items	Production (in tonnes)
1.	Foodgrains	303.34 million (record)
2.	Rice	120.32 million (record)

3.	Wheat	109.24 million (record)
4.	Nutri / Coarse Cereals	49.36 million
5.	Maize	30.16 million (record)
6.	Pulses	24.42 million
7.	Tur	3.88 million
8.	Gram	11.62 million (record)
9.	Oilseeds	37.31 million
10.	Groundnut	10.15 million (record)
11.	Soybean	13.71 million
12.	Rapeseed and Mustard	10.43 million (record)
13.	Sugarcane	397.66 million
14.	Cotton	36.54 million bales (of 170 kg each)
15.	Jute & Mesta	9.78 million bales (of 180 kg each)

(Source: <https://pib.gov.in>)

Paradigm shift

Market led extension is the reform which advocated the production of farm produce which is more market oriented (Lahiff *et al.*, 2007). This paradigm shift in approach from production oriented to market-led-extension will require a reorientation at each level like objective envisaged to be achieved, expected output, application of technology, approach followed by the extension person for interaction, contact with farmers, networking and emphasising on the importance of maintain record and information for making appropriate decision (Table 10.2). The approach will help in shifting the focus from production to market and income enhancement i.e. from seed-to-seed to money-to-money.

Table 10.2. Paradigm Shift from Production – Led Extension to Market - Led Extension

Aspects	Production-led-extension	Market-led-extension
Purpose/ Objective	Transfer of production technologies	Enabling farmers to get optimum returns out of the enterprise
Expected end results	Delivery of messages and adoption of package of practices by most of the farmers	High returns
Farmers seen as	Progressive farmer	Farmer as an entrepreneur

Focus	Production / yields Seed to seed approach	Whole process as an enterprise / High returns - Rupee to Rupee
Technology	Fixed package This is suitable for a global agro-climatic zone with many agronomic conditions regardless of the farming conditions	Diverse baskets of package of practices suitable to local situations/ farming systems
Extensionist interactions	Messages, training, motivating and recommendations	Joint analysis of the issues and varied choices for adoption consultancy
Linkages/ liaison	Research-Extension-Farmer	Research-Extension-Farmer extended by market linkages
Role of Extensionist	Limited to delivery mode and feedback to research system	Enriched with market intelligence besides the TOT function Establishment of marketing and agro-processing linkages between farmer groups, markets and processors
Contact with farmers	Individual	Farmer's Interest Groups Commodity Interest Groups
Maintenance of Records	Not much importance as the focus is on production	Very important as agriculture viewed as an enterprise to understand the cost benefit ratio and profits generated
Information Technology support	Emphasis on production technologies	Market intelligence including price trends, demand position, current prices, market practices and communication network besides production technologies

Conversance facilitated by market oriented approach

With market oriented approach, a lot of other factors will come into play like selection of the commodity to be produced taking its importance for the region into consideration, identification of most appropriate market (place) and finding potential buyer to ensures best possible price. Government has also introduce various programs to facilitate this process. One such initiative includes one district one product for various agricultural products. By implementing "One District One Focus Produce" (ODOFP) in 728 districts across 36 states and UTs, the Ministry of Agriculture and Farmers Welfare is helping farmers to converge resources towards ODOP from ongoing centrally sponsored schemes such as Mission for Integrated Development of Horticulture (MIDH), National Food Security Mission (NFSM), Rashtriya Krishi Vikas Yojana (RKVY), *Paramparagat Krishi Vikas Yojana* (PKVY) and various schemes and programs of the Ministry of Fisheries, Animal Husbandry and Dairying.

Products like '*Kalanamak Rice*' of Siddharthanagar, Banana Fibre of Kushinagar, Banana of Kaushambi, Jaggery of Ayodhya, *Amla* of Pratapgarh, Pulses of Balrampur and Gonda, desi Ghee of Auraiya, handicraft made of wheat stalk in Bahraich, wooden toys of Chitrakoot and wooden artefacts of Saharanpur, Basti, Bijnor and Rae Bareli are included in the One District One Project scheme in the state of Uttar Pradesh. Other examples include gram of Bundelkhand, Chitrakoot, Hamirpur, Mahoba and Sonbhadra, millets of Badaun, fresh vegetables of Ghaziabad and Gautam Buddh Nagar.

This is a comprehensive and focused approach developed based on consumers demand. The whole process can be made more contextual by adding value addition to the agricultural products. This approach of producing as per the requirement of the market will not only cater the market demand but also help in creating a consumer base. The consumption pattern of different categories of consumers is required to be synchronized with appropriate mix of production portfolios at field level to realise higher return and this process will be facilitated by following market-led-extension approach.

Use of technology for improving extension

The orientation of extension towards market will make information intensive and also expect the information to be collected and delivered at appropriate stage of production and marketing. Application of technology (ICT) has the potential to device solutions for collection and dissemination of information in real time. With respect to marketing, farmers and other stakeholders need wide range of information on different aspects of marketing ranging from price-related to infrastructure to market requirement (Table 10.3). The government of India realising the important of market information to be served through a single

window has introduced Agmarknet under Marketing Research & Information Network (MRIN) component of Integrated Scheme for Agricultural Marketing (ISAM).

Table 10.3. Market related information requirement of different stakeholders

Information Area	Coverage
Market related information	Such as market fee, market charges, costs, method of sale, payment, weighment, handling, market functionaries, development programmes, market laws, dispute settlement mechanism, composition of market committees, income and expenditure, etc.
Price-related information	Such as minimum, maximum and modal prices of varieties and qualities transacted, total arrivals and dispatches with destination, marketing costs and margins, etc.
Infrastructure related information	Information comprising facilities and services available to the farmers with regard to storage and warehousing, cold storage, direct markets, grading and repacking etc.
Market requirement related information	Covering accepted standards and grades, labeling, sanitary and phyto-sanitary requirements, pledge finance, marketing credit and new opportunities available in respect of better marketing

Such initiatives in agricultural marketing reduces the search for information and provide a single window information system (Anonymous, 2017). In addition, there are various other initiatives under public and private sector to provide farmers with information on wide range of aspects related to production and marketing. Some of them are worth mentioning for their impact in improving traditional extension system as well as bringing market orientation in extension, like AGRISNET, Digital green, eSagu, Agmarknet, iKisan, Earik, Digital Mandi, Akashganga, aAQUA, Krishi, Mahindra Kisan Mitra, Haryali Kisan Bazar, Nokia Life Tools (NLT), e-choupal, e-agri kiosk, IFFCO Kisan Sanchar Limited (IKSL), Kisan Call Centres (KCC), mKrishi, mKrishi and e-Sagu.

Conclusion

Extension plays an important role in overcoming challenges faced by Indian agriculture. There is an immediate need not only for investment in extension but also to bring market oriented approach. The scope is increasingly becoming wider covering wide range of aspects of farming ranging from seeds to market. Different stakeholders need information not only on best practices and technologies for

crop production, but also information about post-harvest procedures including processing, marketing, storage and handling which are the core of market led extension. There is need for an integrated single platform or window where clarity of objective, flexibility of work plan and all quarries can be put together with the help of information and communication technology. This best fit model requires mobilization of farmers and networking with different stakeholders, providing space to agricultural innovation system, such as research institutions, input dealers, processors, buyers, and financial agencies along with customization based on local need. This has to be inclusive in nature where market intelligence and profit-oriented agriculture can strike a balance between both production aspects and increasing remunerability in agriculture so that farmers can have a better share in consumer's rupee. In the present dynamic and liberal trade environment, orientation towards market-led-extension can offer dynamic solutions to the challenges faced by farmers and other stakeholders and help them avail the benefits available.

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Extension strategies for enhancing market access

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Introduction

Indian economy is based on agriculture as it is a crucial sector for providing raw materials for rapid industrial development while providing basic ingredients to mankind. As part of the rural economy, agriculture offers great employment and entrepreneurship opportunities to rural youths, besides manufacturing sectors. Share of agriculture in the gross domestic product has decreased steadily between 1982-83 and 2015-16, falling to 17.4 percent from 36.4 percent during the period. Though, the contribution in GDP has come down but it still provides employment to 49 percent of the Indian workforce i.e. providing employment to more than half a billion people. As inputs, it is also used to produce a wide variety of industrial products including fertilizer, pesticides, agricultural implements and consumer goods. Urban population needs food and raw material which results to wider the secondary and tertiary sector of the economy, expanding markets for industrial products, securing foreign exchange, maintaining price stability and mobilizing capital for growth will be all dependent on agriculture. A cumulative growth process is thus facilitated by agricultural development.

Having opened up the market, globalization has shifted the focus from internal concerns such as monsoons, marginal landholdings, high input costs, erratic input usage, dispersed processing facilities and lack of professionalism to external concerns. From production of agricultural produce by farmers to consumers, there is a need to undertake value through primary and secondary processing and marketing of the products. This indicates that agricultural marketing management refers to all business activities covering the flow of agricultural products and services by creating market performance strategies. As a result of these emerging trends, both supply and demand have raised concerns, regardless of whether these trends are indicative of catering to an expanding consumer base with growing wealth. As a result of modern integrated value chains, producers gain from better quality, improved food safety, reduced costs and losses, increased sales, and the capacity to add value to the product. A second benefit of modern food value chains for smallholders has been the improvement of relationships between buyers and farmers in developing

countries, which has contributed to the well-being of smallholder farmers (Reddy and Rao, 2012).

Therefore, the term 'agribusiness' covers all operations involved in manufacturing and distributing farm products, undertaking production activities and post-harvest activities. Further, agriculture and allied sectors like dairy, poultry, fisheries and forestry along with the portion of the industrial sector that manufactures farm inputs or uses farm supplies, as well as the processing of these products, are included in agribusiness. The end users/ consumers are receiving the processed products/ finished products through supply chain. In order to reduce the cost of final product at the consumer level and make it more competitive, there is a need to reduce inventory with information driven integrated supply chain, increase the product value, improve the availability of resources and to facilitate market access. It is important to understand the role of agricultural extension in these emerging integrated supply chain in agriculture along with current trends in existing supply chain.

Role of agriculture in economic development

Agricultural sector provides an opportunity to wide range of stakeholders including farmers to participate in growth process all along the supply chain. Accordingly, agriculture is important for economic growth and reducing poverty and has experienced a renewed interest because of following three key issues –

- **Agri-biotechnology revolution:** Agriculture biotechnology can make a significant contribution to innovations, cost reductions, productivity improvements and new processes and products.
- **The rise of supermarkets:** Food retail markets in India have been transformed by the supermarket revolution in agri-food supply chains. As consumers' preferences and demands change, food producers and other stakeholders are increasingly connected with changing consumer preferences and demands.
- **Reducing poverty and preserving the environment:** In the wake of urbanization being observed at an unprecedented rate, rural economic growth is crucial in reducing poverty and preserving the environment. Agriculture (and the value added along the value chain) is a major driver of rural economic growth.

Cases on integration with agri value chains

This section share compilation of a few case studies conducted by NAARM, Hyderabad on Supply/ Value Chain Management.

Case 1. Value chain management of sweet oranges in Andhra Pradesh

Farmers of Nalgonda district experience difficulties in marketing oranges due to poor payment by middleman, more transport expenditure during harvest period, meagre financial share for growers and more cost for commission agent. In the study, it was suggested that the government take up various measures to ensure that a product reaches the consumer at the right time as well as adoption of better safety measures to ensure prevention of damage to the product. The study suggests that it is possible to encourage the producer to work directly with a private company under contract ensuring the agreed price even if the market price is ruling quite low. The arrangement will help in avoiding middlemen and agents and thus helping farmers realising better price.

Case 2. Supply chain and future markets for potato growers in Uttar Pradesh

Policy implications to improve farmer incomes, less price volatility, and more price transparency were proposed in the study.

- Farmers should be made aware of the futures market and the various options available.
- The commodity exchanges may appoint someone to monitor the spot markets so that they can cross check the data collected from each stakeholder.
- Participation of banks to be encouraged in the futures market since it is the best candidate to act as an aggregator.
- Trading in futures requires a PAN card, and this is a big obstacle for farmers. Farmers should be allowed to use Kisan Credit Cards to open trading accounts to overcome this problem.
- In Uttar Pradesh, about 25-30 percent of the total potato production is the Khufri Chipsona variety, and commodity exchanges should begin, or at least consider, offering futures for this variety.

Case 3. Organized agricultural retailed marketing in Andhra Pradesh

Organized retailing can result in efficiencies in the supply chain thereby giving producers (including both small as well as large producers) better access to markets. This will help in lowering consumer prices on one hand and producer realising better price on the other. A favourable government strategy and enhanced basic infrastructure would further enhance retail food chains' trade on both the domestic and export front. Additionally, sustainable production systems, postharvest handling, and consumer education are as important as policies.

Case 4. Rythu Bazars in Andhra Pradesh – an innovative approach in marketing of agricultural commodities

By establishing Rythu Bazars, or producer's markets, the government of Andhra Pradesh eliminated the role of intermediaries in the marketing of fruit and vegetable by facilitating a direct connection between producers and consumers.

Case 5. Cardamom supply chain and future trading in Kerala

Due to the long supply chain in cardamom marketing, traders reap maximum benefits at the expense of planters. There is also an increase in margin when it comes to the supply chain as well. The result is that the final consumer has to pay a higher price. Based on an analysis of unfair marketing practices adopted by cardamom growers, the study proposed an aggregation model, which will be beneficial to both the farmers as well as other stakeholders taking part in the cardamom value chain.

Role of extension personals in agri-supply chain

The extension mechanism is production-driven, putting the marketing on the backburner. In order to disseminate information about what to produce, when to sell and where to sell, an efficient marketing system covering following aspects is required –

- Procurement of inputs
- Logistics covering transportation, material management, supply of production inputs and storage
- Organizational management such as contracting, strategic alliances and partnerships and vertical integration
- Application of Efficient Consumer Response (ECR) System like digital sale point and streamline the entire distribution chain

Suggested models for agri-supply chain management

Traditional Supply Chain

'Traditional Model' is a complex chain in which the supply flow of Fruits and Vegetables, will be predominantly followed by producers. There will be many players in the model like agents (commission agents), auctioneers, wholesalers, traditional retailers, including mom and pop shops, roadside shops and pavement shops and vendors, including farmers themselves. In the F&V supply chain farmers cultivate and produce the F&V and agents, auctioneers, and wholesalers are traders. In the traditional supply chain model, farmers sell their products to the market through numerous intermediaries who eat majority of the their entire market share.

Hub and Spoke Model

Organized retailers, such as Food Bazaar and Spencer's Retail and More, have adopted the hub-and-spoke model for the supply of food and beverage. In this type of supply chain model, only a few players are involved. This chain involves farmers, grocers, wholesalers and customers as its participants. These types of models consist of buying centres, hubs and stores (retail outlets) that are operated by organized retailers. According to this model, the majority of the F&V comes from small farmers and contract farmers.

Value Chain Model

At present, there are only a few organized retail players who follow the Value Chain Model, like Reliance Fresh. In this model, organized retailers purchase fruits and vegetables from farmers directly, either through contracts or via leasing, and sell directly to customers without the use of any intermediaries. The model relies solely on backward integration and seeks to build a value chain starting from the farmers all the way to the consumers.

Policy guidelines for extension programs

It was proposed to amalgamate 17 different schemes of DAC&FW, MoA&FW, GoI, as National Mission on Agricultural Extension and Technology (NMAET) during Twelfth Five Year Plan. There are four Sub Missions proposed under NMAET covering Agricultural Extension, Seed and Planting Material, Agricultural Mechanization and Plant Protection and Plant Quarantine. The goal of the Mission is to redesign and strengthen agricultural extension which will help the farmers to get required and appropriate technologies and enhance good agricultural practices. It is envisioned that the goal will be accomplished by using a holistic mix of extensive physical outreach and information dissemination methods, ICT utilization, popularization of modern and appropriate technologies, capacity building, and institution strengthening and promotion of aggregation of farmers into Farmers Interest Groups (FIGs) to form Farmer Producer Organizations (FPOs). Functions related to technical, legal, administrative and regulatory matters, as well as any other activities, continue to be carried out independently under the respective Sub-Missions. Skill training for the farmers and extension personnel of all the four submissions will be converged with similar activities under ATMA. Considering the information requirement of wide range of stakeholders involved in the production and marketing of agricultural produce, a multi-agency approach is followed to have a sound extension system in the country.

- **Extension through Krishi Vigyan Kendra** – Farm Science Center or Krishi Vigyan Kendra (KVK) is an educational institution that focuses on multidisciplinary education at the district level as well as technical assistance from ICAR. There are 687 KVKs in India, almost one for every

district. In each of the centers, a state agricultural university, State Department of Agriculture, NGO, or national research institute is in-charge. These KVKs as frontline extension systems have created a niche for themselves by linking researchers, extension systems and farmers.

- **Extension through Private Sector** – In India, the private sector is playing an increasingly important role in extension services. It develops context-specific models and uses ICT tools to connect farmers directly with information. A wide variety of approaches are used by agricultural input companies as a form of extension. One-stop farm solution centres have been started by some private companies to provide extension services. Examples include Mahindra Krishi Vihar, Tata Kisan Sansar and Godrej Agrovet.
- **Extension through NGOs** – Farmers organizations and SHGs can play a vital role in articulating farmer needs to knowledge intermediaries, given the number of marginal and small land holdings in India. Numerous NGOs, including BAIF, Basix, and PRADAN, provide extension services.
- **Extension through ICT applications** – Kisan Call Centres (KCC), aAqua, Avaaj Otalo, Avaaj Otalo, e-Choupal etc. all harness the potential of ICT in agriculture, involving both public and private organizations to help farmers.

Conclusion

Extension personnel will function as facilitators for different stakeholders involved in agri-supply chain covering farmers (producers), input suppliers and marketers and help increase value-added activities by integrating their knowledge and skills. As a result, supply chains can generate synergy in three specific ways:

- Market expansion over traditional boundaries increases their member's sales volume
- The chain has reduced its delivery cost in comparison to competing chains and increased the gross margin for the working capital committed by members of the chain.
- Specific products are offered to specific market segments and they differentiate service quality, product reputation or brand recognition of the products so that consumers perceive greater value from the products they receive. This enables chain members to charge higher prices.

References

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