Agricultural Extension and Support Systems in India: An Agricultural Innovation Systems (AIS) Perspective

(Karnataka, Maharashtra and West Bengal States of India)

Discussion Paper 20

MANAGE- Centre for Agricultural Extension Innovations, Reforms, and Agripreneurship (CAEIRA)

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The research report is based on the research conducted by MANAGE Interns under the MANAGE Internship Programme for Post Graduate students of Extension Education.

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Director General's message

Smt. G. Jayalakshmi, IAS
Director General, MANAGE

I congratulate the research team for selecting relevant topic of the day "Agricultural Extension and Support Systems in India: An Agricultural Innovation Systems (AIS) Perspective (Karnataka, Maharashtra and West Bengal States of India)" and collecting relevant data from field and analysis. The paper in detail analyses various stakeholders present in the Agricultural Extension and advisory systems. The role of these stakeholders in delivering the advisory and support services to the farmers in advisory and input support system, finance services, marketing and price policy is being identified through the study.

The impact of various stakeholders who were the facilitators for the agricultural development is highlighted. Both the public extension workers and private-sector firms, in responding to specific farmer inquiries about particular production problems, still commonly use the term advisory services. In most cases, farmers are "advised" to use a specific practice or technology to solve an identified problem or production constraint instead of holistic approach of enhancing innovation capacity of the farmers and agri-value chain development. The use of ICTs, mobile phones and SMS services, digital media is far out of reach to majority of the farmers and still the traditional methods are prevailing in providing the advisory support to the farmers. This study also emphasised the various constraints faced by the farmers in availing the extension and advisory services at the grass root level. The last mile delivery of the advisory services is needed to be more effective and innovative for ensuring the overall agricultural development.

The constraints faced by the farmers in availing the services from various stakeholders and the suggestions to overcome these constraints is detailed in the present study. This study would help the agricultural development administrators, researchers and development professionals to understand the role of various public and private stakeholders operating in agricultural support systems and their role in delivering the effective extension and advisory services.

(G. Jayalakshmi)

Preface

The farmers need new knowledge, new skills and innovative ideas to develop and manage smarter and more sustainable production systems. The various stakeholders of the agricultural extension and advisory services play a crucial role in helping the farming community to solve their problems, respond to new opportunities and innovate by providing continuous access to reliable and relevant agricultural knowledge and information and also other support services.

With the changing and diverse needs of the farming community, strengthening of the research systems and knowledge facilitation towards building innovation capacity, enhancing the use of knowledge and creating social and economic change is the need at this hour. The present study offers new insights for strengthening the interaction linkages within the Agricultural Innovation Systems in Karnataka, Maharashtra and West Bengal states of India, as perceived by a range of actors, such as farmers, cooperatives, research, advisory, credit, education, and private sector. The innovation capacity in the agricultural innovation system is studied by analysing the existence and performance of the agricultural innovation support system. The services offered by the multi-stakeholders, networks and linkages among the stakeholders and the gaps in the adoption of these services by the farming community are also highlighted. The constraints faced by the farmers in availing the services provided by the various stakeholders and the recommendations for the better performance has also been mentioned in the study.

(Saravanan Raj)
Director (Agricultural Extension)

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Abstract

Agriculture Innovation System (AIS) approach helps to make farming more profitable, sustainable, and productive. The AIS along with technical, organisational and social dimensions helps to reduce the gap between scientists and farmers. There is a dire need to understand the Agricultural Innovation System and the different support system present in it for providing more effective and efficient advisory services to the farmers. The different support systems in the Agricultural Innovation System are categorised as advisory, input, agriculture finance, agriculture logistics, agriculture market and price policies, farmers associations to organisations, agriculture technology venture support. These support systems provide knowledge regarding agriculture research, extension and advisory services, input intelligence, post-harvest technology knowledge, market intelligence, information and market forecasting, indigenous technical knowledge (ITK), innovation technology, and agri-incubation services to the farming community. The present study was conducted to understand the different Agricultural support systems in the states of Karnataka, Maharashtra and West Bengal with 3 districts from each state. A total of 450 respondents were taken for the study with 50 respondents from each district (150 respondents per state as 3 districts are selected from each state). The linkages of farmers with various stakeholders and the gaps in the support systems were analysed in the study. Majority of the farmers rely upon the friends and relatives, progressive farmers, input dealers, cooperatives, government extension officials of Agriculture and allied departments, ATMAs, KVKs, SAUs, television, radio, newspaper, mobile and internet etc for availing the advisory support. The different actors in each support system and their role in rendering the particular advisory support to the farmers is analysed through the study. Lack of Knowledge and information to farmers regarding judicious use of inputs, prevailing schemes and subsidies, new machineries and equipment's etc. are the constrains of the farmers highlighted in the study. Through this study, it is recommended that the government should promote ICTs for knowledge management, networking and capacity development and the concept of market-led extension should also be given importance in the extension system of the district. The farmers practicing different farming systems needs to contact extension personnel of different departments for information, so there should be one system coordinating different departments where the farmer can get information through a single window is emphasised. Thus, understanding the behaviour of farmers in seeking information from the various actors of the Agricultural Innovation System through this study helps to realize the extent of importance of these different support systems.

Executive Summary

1. Objectives of the study

The main objective of the study is to identify the agricultural knowledge and support systems for farmers.

Specific objectives:

- Investigate the linkages and flows of knowledge and support systems between stakeholders and channels of communication.
- Assess the usage of knowledge and information.
- To delineate the gaps through analysis and suggest improvements.

2. Methodology

The study was conducted in three states of India i.e., Karnataka, West Bengal, and Maharashtra. Three districts from each state were selected based on the agro-climatic zones for conducting the study with 450 (3 states x 150 from each state) respondents. From each district, 50 farmers were selected for the personal interview and focussed group discussions were also conducted to support the study.

All the service providers in the field of agriculture were established by the public sector, Knowledge and support services (Advisory, Input, Financial, Marketing and Logistics, Farmer Producer Organisations and Agri venture), private sector, NGOs, public-private sectors were studied. The number of extension agents from each state was restricted to 50. Three types of the interview schedules have been prepared differently for farmers, extension personnel and conduct focussed group discussions.

3. Major findings of the study

The majority of the farmers availed information related to the following aspects: Inputs, market prices, crop and animal husbandry, credit, weather and the progressive farmers of the village opted to know about the new varieties of seeds released, different subsidies and schemes, post-harvest activities, public initiatives by Agriculture and allied departments, new technologies, Agribusiness, training programmes offered by the KVKs, ATMAs or other officials of agriculture and line departments etc., from the above-mentioned stakeholders.

In Karnataka state, for availing extension and advisory services majority of the farmers in Shivamogga (100 per cent) and Kolar district (76 per cent) avail the information from friends and relatives as they find them reliable and trustworthy but in Belagavi district, mobile and internet have

taken over the major share (76 per cent) because they are found to be handy and highly effective as they provide multiple facilities for the farmers. In case of institutions in kolar district, 68 per cent of farmers avail of advisory services from the Raita Samparka Kendra (RSK) which is situated at Hubli.

In Maharashtra state, the majority of the farmers (100 per cent) from Nashik and Jalgaon do not seek any advisory support, they rely on and learn from their own experiences. In Washim, 74 per cent of the farmers approach PDKV Akola to seek advice. 46 per cent and 32 per cent of farmers acquire information from television and community radio station respectively. Many farmers of Washim are shifting towards sericulture. 12 per cent of farmers seek information from the silk department of Washim.

In West Bengal state for availing institutional extension and advisory information, 19 Per cent of the farmers from Birbum district avail information on all the package of practices of new crops, inputs, crop protection from Central Agricultural University (CAU) due to the ease in accessibility and 22 Per cent in Hoogly directs towards the ICTs to be more precise, SMS services by Bidhan Chandra Krishi Vishwavidyalaya (BCKV), IFFCO Kisan Green sim or mobile apps etc. About 22 Per cent of farmers in both Birbhum and 24 Parganas depend on KVKs for extension and advisory support.

For availing the information related to the input support system majority of the farmers depend upon the input dealers: (100 per cent) farmers of Karnataka state (in all the three districts); in Maharashtra State 56 per cent in Washim, 76 per cent in Nashik and 69 per cent in Jalgaon; (100 per cent) farmers of West Bengal state (in all the three districts).

For availing the information on the financial support system, in Karnataka state about 90 per cent of farmers in Shivamogga district avail finance from SHGs and 44 per cent of farmers in Belagavi, 40 per cent in Kolar are obtaining loans from PACS, they are obtaining only short-term loans.

In Maharashtra State, 54 per cent farmers from Washim, 66 per cent farmers of Nashik and 18 per cent farmers of Jalgaon were found to be the beneficiaries of subsidies through different government schemes and availed financial support through these schemes.

In West Bengal state, the majority of respondents 52 per cent in Bhirbum and 45 per cent in 24 Parganas are availing loans from banks whereas in Hoogly 50 per cent of farmers depend on PACs for their finance.

The majority of the farmers depend upon the market intermediaries and SMS services to avail of the information related to the price fluctuations on the various agricultural commodities in the study area. They also gather information related to market arrivals and transportation.

The market intermediaries such as traders/commission agents the main source of information providers for the market advisory services to farmers for the marketing support system (100 per cent in Belagavi, 100 per cent Shivamogga and 85 per cent in Kolar) regarding price, and arrivals in the market in Karnataka state.

The farmers are also opting for the local markets (villages, Shandies, etc.), on the farm, markets in nearby cities. None of the farmers of the study locale are selling agriculture and horticulture products by open auction and only the sericulture farmers are selling cocoons through online marketing.

For the Soil Health Card scheme launched by Central Govt., all the respondents are more or less aware about the soil health card or at least heard the name of the scheme due to extensive advertising of the soil health cards, but only some percentage of respondents are availing it in the districts taken for the study.

4. Major Recommendations through the study (State wise)

4a. Karnataka state (based on the study conducted in the Shivamogga, Kolar and Belagavi district)

Majority of the farmer's consider the agriculture and line departments as government outlets for the supply of inputs and subsidies rather than providing the extension and advisory services of the farmers. Efforts should be made by authorities to change this perception of farmers through addressing all kinds of issues of the farming community effectively instead of focussing only on input supplies and subsidies.

The government should promote ICT's for information dissemination to farmers through gross root extension functionaries. First and foremost, the government should train the extension providers for the efficient delivery of these services.

Market demands are changing rapidly and becoming more stringent. Market-oriented agricultural advisory services (MOAAS) are essential for producers to access to knowledge and information to meet the changing market needs.

Market orientation demands a value chain orientation; which in turn implies that the advisory services must meet the needs of a wide range of actors not just farmers.

4b. Maharashtra state (based on the study conducted in the Washim, Nashik, and Jalgaon district)

Extension stakeholders in the agriculture and allied sectors need to be motivated and institutions need to be strengthened. Convergence between agriculture and other developmental departments is required to provide a platform for technology dissemination and sharing of knowledge and information.

Market improvement to be taken into consideration and there is a long pending request of legal interventions of the government implementation of the MSP and FRPs announced, also delayed payments should be looked into immediately.

Schemes related to water conservation strategies should get re-modified. Schemes such as Jalayukta Shivar and Magel Tyala Sheta-Tale are not applicable in some parts of Nashik; their farmers are dependent upon rain-water only.

A policy intervention is required over the agriculture debt waiver schemes of the central and respective state governments as this intervention affects the entire farming community as the beneficiaries are often the better off farmers and thus exacerbated the inequalities across the farming community.

4c. West Bengal state (based on the study in the Hoogly, Birbhum and 24 Parganas districts)

The delay in the arrival and supply of agricultural inputs to agricultural officers should be reduced in order to increase their usefulness in a better way.

Mobile soil testing facilities should be made available at the village level for providing basic reports, and soil testing provisions should be made available at a minimum of the block level, and the reports should be delivered within a week from sample delivery.

Schemes should be provided according to the farmer's needs. The selection procedure for any schemes or programmes like training should be much more digital (online with transparent system) in nature. The list of beneficiaries is to be uploaded in the database available both offline and online and should be cross-checked with previous lists to avoid the reselection of the same beneficiaries to avoid biases.

Government, along with advertising for their key schemes, should be advertising more about the institutions and stakeholders like KVK, ATMA, ATIC, etc. in order to increase awareness of the farmers about these and when they can go, to where and to which of these institutions.

The regulated markets should be opened regularly and should be operated without any political biases in order to provide farmers a fair price for their produce.

The knowledge sharing should go beyond the formal public-sector extension system and utilize the various agents and intermediaries who interact with farmers and other stakeholders in the innovation system so that the knowledge and information required by farmers to innovate can be provided and linkages have to be developed for the development of the farming community.

Introduction

Knowledge exchange, learning and innovation approaches in agriculture are evolving rapidly. Now a days, innovative and new ways to share knowledge are essential to make agriculture and food production competitive. Knowledge is shared by farmers, scientists, advisors, enterprises, NGOs etc. The term 'Agriculture Innovation System' not only involves the ways people and organisations link and interact within a region but also, involves the whole knowledge exchange system. Agriculture Innovation System (AIS) helps to make farmers more profitable, sustainable, and productive. The AIS along with technical, organisational and social dimensions helps to reduce the gap between scientists and farmers.

Agriculture is a complicated system, closely related to natural systems and social systems. Agriculture Knowledge System is a collection of actors in research, extension services, education and training and support systems that act on the knowledge of farmers and generate innovations in response to problems and opportunities, desired outcomes, system drivers and regulatory policies and institutions (Rudman, 2010). There are three dimensions to sustainable development: social, economic, and environmental. Knowledge sharing is critical to supporting these dimensions, whereas extension and advisory services are a vital knowledge-sharing institution. Hence, agriculture knowledge and other support systems play a vital role if farmers are to increase food production and attain food security, they need better access to agricultural support systems such as credit, technology, extension services and agricultural education, as well as to the rural organizations that often channel other services (FAO).

The world is changing day by day which demands highly qualified, motivated and trained agri-professionals to fulfil the scientific approach to bridge the sustainable gap. Extension and advisory services are succeeded by their capability of transferring knowledge from scientists/researchers to farmers advising and educating farmers for better decision making. Also, it enables them to clarify their own goals and possibilities thus stimulating desirable agricultural development (Van den Ban and Hawkins, 2000).

To bring capacity development up to speed with the challenges facing agriculture in the 21st century, the partners of the Tropical Agriculture Platform (TAP) have adopted a new approach that moves away from the idea, successfully adopted during the Green Revolution, where knowledge was passed on to the farmers through the transfer of technology. Instead, TAP has embraced the so-called Agricultural Innovation Systems (AIS) perspective, which recognizes that agricultural innovation is a process involving many different actors and factors and that it can only take off if it meets the demands of its principal users. Farmers need advice and knowledge about a diverse range of rural development options including information on markets, rural industry and other income opportunities (Farrington *et al.,* 2002). The Indian Council of

Agricultural Research (ICAR) is actively participating in the agriculture innovation system through National Demonstrations.

As technology improves day by day, several approaches have evolved and been applied to ensure the effective dissemination of information and knowledge to improve the living standard of rural farmers.

1.1 Objectives of the study

The main objective of the study is to identify the agricultural knowledge source and support system behaviour of farmers.

Specific objectives:

- Investigate the linkages and flows of knowledge and support systems between stakeholders and channels of communication.
- Assess the usage of knowledge and information.
- To delineate the gaps through analysis and suggest improvements.

1.2 Importance of the Study

Why Agriculture Innovation System?

An Agriculture Innovation System (AIS) not only involves new innovations but also includes knowledge and support systems. Nowadays, the world is changing environmentally, socially and economically. So, the global, national and local level needs to adopt these changes to research, extension and developmental approaches. Research for rural areas needs to be more flexible to deal with agricultural production which is getting complicated day-by-day. A network of various institutions, organizations and people form an innovation system. The innovation system focuses on providing economically viable products. It involves the promotion and the adoption of innovation with political support and market regulations to provide extension services to larger groups. The innovation is supposed to be the social process and generally at the farmer level concept of innovation which means adoption of technologies by different farmers. Innovation system approach is not only limited to research institutes but also new technologies and innovations developed by farmers or farmers organizations. AIS, AKS, or AKIS approaches reveal how agricultural information and knowledge is exchanged or, in other words, communication is occurred and shared among the subsystems of the system through the system approach.

To transform agriculture and rural livelihood, the agriculture innovation system plays an important role. It also enables farmers to learn and evaluate alternative approaches.

Traditional role of extension and research is changing the research process. It only involves technology transfer that needs to be transformed into mechanism enabling and reward innovation. It is essential to keep agriculture and food production competitive and to make rural areas vibrant. It provides tools and tips for farmers, improves the way research and advisory services work together and make farmers profitable, sustainable and more productive.

What is an Agriculture Innovation System?

"AIS is a network of stakeholders (individuals, organisations, and businesses), as well as institutions and support policies in agricultural and related sectors that integrate products, existing and emerging processes and forms of organisation in social and economic use. Policies and institutions (formal, and informal) shape the way that these actors interact, generate, share and use knowledge as well as jointly learn."

- FAO

Support systems in AIS are categorised as, advisory, input, agricultural finance, agricultural logistics, agricultural market and price policies, farmers associations to organisations, agricultural technology venture support. These support systems provide knowledge regarding agriculture research, extension and advisory services, input intelligence, post-harvest technology knowledge, market intelligence, information and market forecasting, Indigenous Technical knowledge (ITK), innovation technology, and agri-incubation service.

1.3 Building Agriculture Knowledge

Most developing countries, where poverty is very high, rely on the agricultural sector for growth. The productivity of the agriculture sector depends on the knowledge of farmers and how they use appropriate technologies. A major constraint to enhance productivity is the availability of information and knowledge. Optimal use of extension services requires knowledge based on research. Knowledge gaps contribute to yield gaps.

There are five areas to mobilize the potential of extension and advisory services. The five areas are:

- focusing on best-fit approaches;
- embracing pluralism;
- using participatory approaches;
- developing capacity; and
- ensuring long-term institutional support.

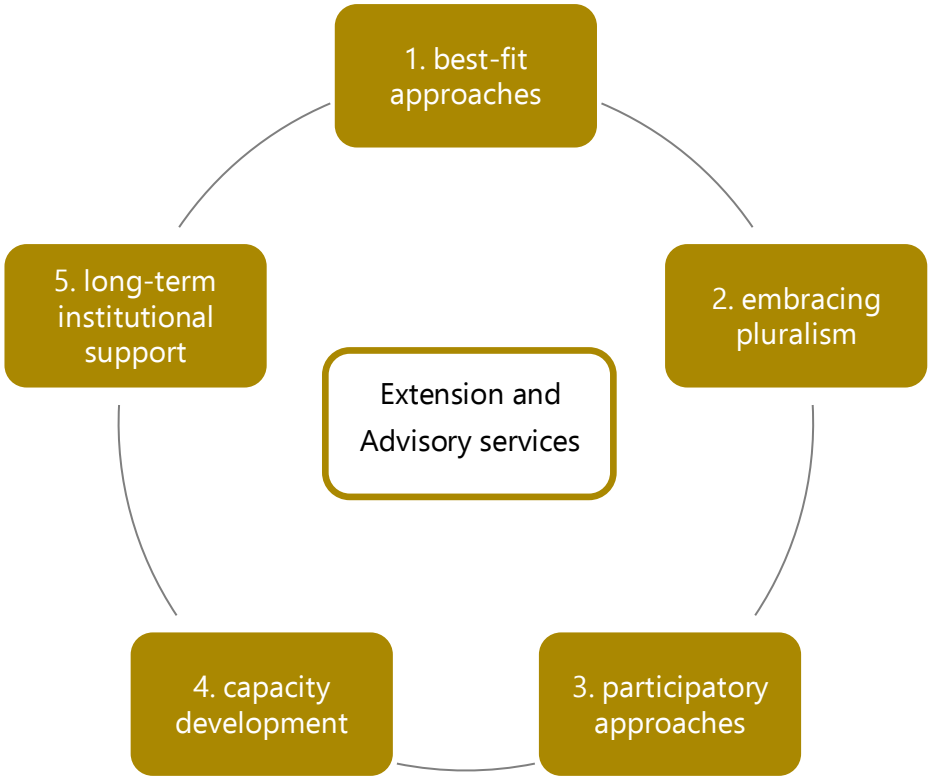
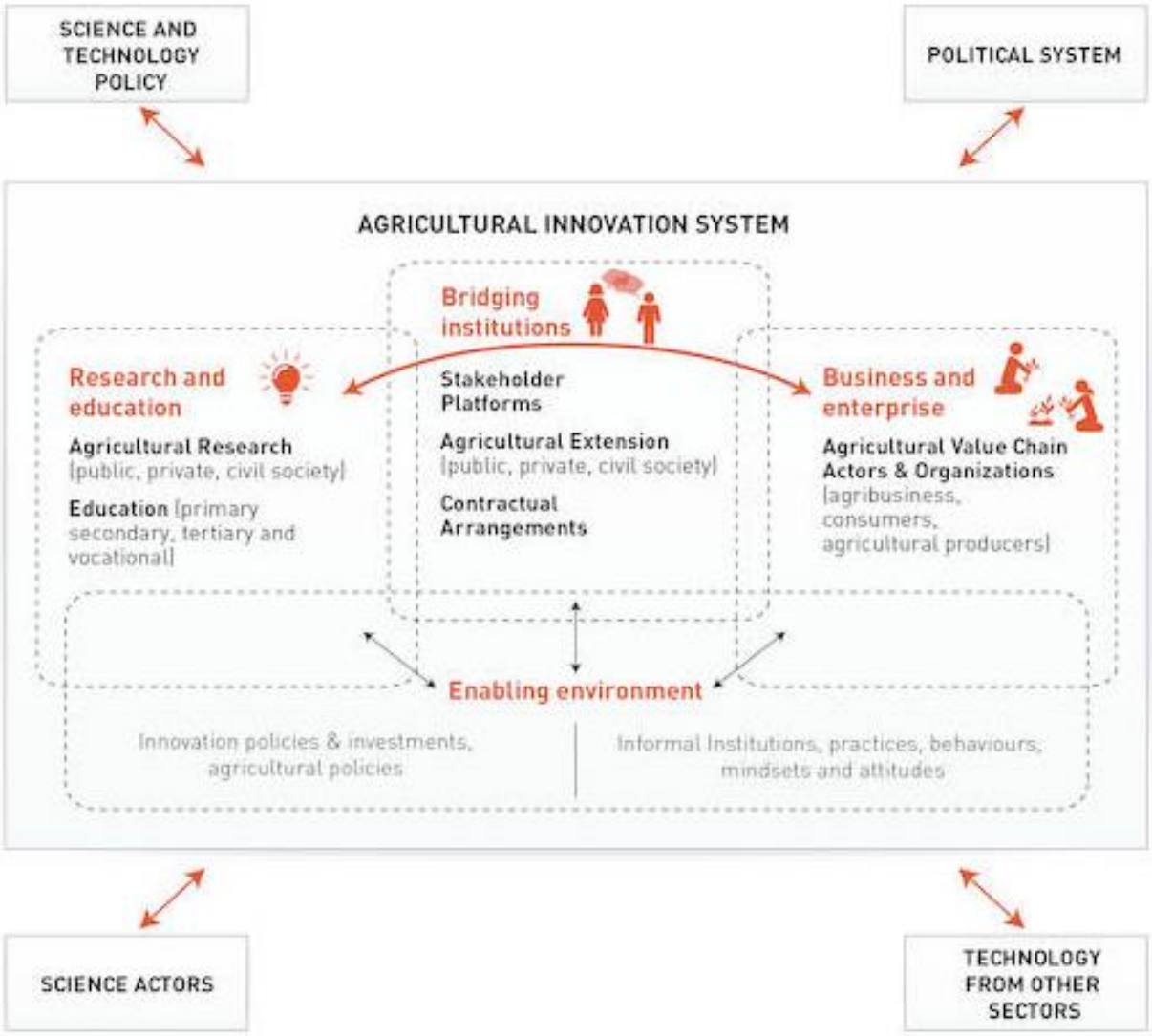


Fig 1: Five key areas to build agriculture knowledge

More and better agricultural extension and advisory services are a legacy outcome that allows knowledge-based infrastructure to adapt to changes in agriculture.



Source: Adopted from Aerni *et al.,* 2015.

Fig 2: Actors in Agriculture Innovation System

1.4 Various actors of the AIS Approach

This study intends to focus on the following Agriculture Innovation Systems as they are of key importance in understanding behaviors of multi actors of the AIS approach. They are:

- Research, Education, and Extension Services
- Input Support
- Agriculture Finance Support
- Agriculture Logistics Support
- Agriculture Market and Price policy
- Farmers' association with organizations
- Agriculture Technology Venture Support

Table 1: Various Agricultural Support systems in the Agricultural Innovation System (AIS)

To gain a better understanding of the support system within the AIS, the above categories are:

	Agriculture Knowledge Systems	Agri-Support Systems
Research, Education and Extension Services	• Agriculture Research • Agriculture Higher Education • Extension and Advisory Services	• Extension and Advisory Support
Input System	• Input intelligence	• Input sectors • Input market policy
Agriculture Finance Support		• Agri-subsidy • Credit support • Agri-insurance schemes
Agriculture market and Price policy	• Market Intelligence • Market information • Market Forecasting	• Regulated market structure • Price Policy Support
Farmers' association to organizations	• ITKs	• FPOs (PACS, FPCs etc.,) • NGOs etc.,
Agriculture Technology Venture Support	• Innovation Technology • Agri-Incubation Service	• Agri-entrepreneurship and Agri- business Support

1.4.1 Research, Education and Extension Services

A. Agricultural Research and Education

India is an agricultural country. Agriculture and its allied activities act as the main source of livelihood for more than 80% population of rural India. It provides employment to approximately 52% of labour. India has achieved significant growth in agriculture, milk, fish, oilseeds, fruits, and vegetables owing to green, white, blue, and yellow revolutions. All these revolutions have brought prosperity for the farmers. In order to sustain, diversify, and realize the potential of agriculture sectors, it is necessary to develop skilled human resources.

The Agricultural sector is getting more complex due to globalization, the impact of climate change, entry of the corporate sector in the agricultural value-chain, diversification of agriculture towards high-value commodities, expanding demand for processed food, and need for postharvest technology. To address these challenges, India will need rich human capital of highly qualified, motivated and well-trained agricultural scientists. It is the responsibility of the State

Agricultural Universities (SAUs) to provide such human resources amidst many emerging challenges in agriculture.

Agriculture Higher Education and SAUs

Agricultural Education in India is strengthened and streamlined centrally by ICAR and is imparted through 74 Agricultural Universities (State Agricultural Universities (63), Deemed to be Universities (4), Central Agricultural Universities (3), Central Universities with Agriculture Faculty (4)) and a few other institutions under private and public sectors.

Altogether there are about 35,000 faculties re-imagining higher agricultural education in India spread across these Universities who are engaged full-time in teaching, research, and extension pertaining to agricultural and allied sciences, and an estimated 1.65 lakh students are pursuing various Undergraduate, Postgraduate, and Doctoral programmes in these institutions (https://education.icar.gov.in/). The students of agricultural education across India predominantly hail from Karnataka, Uttar Pradesh, Maharashtra and Andhra Pradesh, while the majority of the faculty members hail from Maharashtra, Gujarat and Karnataka.

The **Department of Agricultural Research and Education (DARE)** was established under the Ministry of Agriculture in December, 1973. It coordinates and promotes agricultural research and education in the country. It has the following four autonomous bodies under its administrative control:

- Indian Council of Agricultural Research (ICAR)
- Central Agricultural University (CAU), Imphal
- Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar
- Rani Laxmi Bai Central Agricultural University, Jhansi, UP

DARE provides the necessary government linkages for the Indian Council of Agricultural Research (ICAR), the premier research organization for coordinating, guiding and managing research and education in agriculture. It is the nodal agency for International Cooperation in the area of agricultural research and education in India. The Department liaises with foreign governments, UN, CGIAR and other multilateral agencies for cooperation in various areas of agricultural research. DARE also coordinates admissions of foreign students in various Indian agriculture universities/ ICAR Institutes.

The **Indian Council of Agricultural Research (ICAR)** is an autonomous organization under the DARE, MoAandFW, Government of India, established on 16 July 1929 with its headquarters at New Delhi. The Council is the apex body for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country.

ICAR has played a pioneering role in developing varieties in rice, wheat, pulses, potato, sugar cane, pomegranate, tomato, etc., and the breeds, vaccines, diagnostics and nutritional protocols in animal science and fisheries, have brought Green Revolution, White Revolution, Yellow Revolution and Blue Revolution. ICAR varieties and seeds have also played a significant role in the recent revolution in pulses production, making the country almost self-sufficient in pulses.

ICAR varieties have spread to every corner of the country since the Green Revolution—the IARI (Indian Agricultural Research Institute) wheat varieties alone, yielding a total value of Rs 80,000 crore during 2019-20. The market demand for IARI varieties can be judged from the fact that over 225 seed-producing companies have signed MoU with the IARI for seed production and sale to farmers for the two recent varieties of wheat—HD 3086 and HD 3226. The 14 Basmati/aromatic rice varieties including Pusa Basmati 1121, contribute Rs 25,000 crore annually to foreign exchange earnings for the nation through exports. In mustard, IARI-bred varieties are under cultivation on a 2-million-hectare area. The neem-coated urea technology developed by ICAR-IARI reduced urea usage by 5%, saving huge resources while reducing water pollution and greenhouse gas emissions. The sugar cane variety Co 0238, having a sugar recovery level of almost 12%, covered over 65% of the sugar cane area in northern states. Some examples to cite are the silent but significant diversification with the introduction of soya bean varieties in the Malwa plateau region that revolutionised the oilseed economy 1980s onwards and the recent pulses revolution (Anil K Sharma, 2020).

It is not only crops where ICAR did well, but also several dreaded livestock diseases were eradicated in India due to diagnostics and vaccines developed by ICAR's veterinary research institute. Major diseases that have been eradicated include rinderpest, dourine, contagious bovine pleura-pneumonia, African horse sickness, etc. Efforts to develop a thermostable vaccine to produce Mukt Bharat-FMD (foot-and-mouth disease) by 2024 are underway. As the income security of farmers has taken centre stage, along with water conservation, ICAR has embarked upon developing good agricultural practices, precision farming, regional crop plans, climate-resilient and water-economising technologies, processable varieties, etc. Advances such as gene-editing and genome-assisted breeding will be pursued for a breakthrough in technologies where traditional methods have not yielded much (Anil K Sharma, 2020).

Research system in India

Currently, the public agricultural RandE system consists of ICAR and its various institutes, the SAUs and their various campuses and regional institutes. At the center, ICAR funds and manages a vast network of research institutes, including national institutes for basic and strategic research and postgraduate education central research institutes for commodity-specific research; national bureaus for conservation and exchange of germplasm and soil-survey work; and national research centers (NRCs) for applied, commodity-specific strategic research in "mission mode."

The greater emphasis given to the agricultural research could be established by the fact that the system guided by the ICAR now has (source: ICAR website):

- 65 ICAR institutes,
- 14 national research centers,
- 6 bureaus,
- 13 project directorates,
- 79 All India Coordinated Research Projects (AICRPs) and AINPs
- 716 Krishi Vigyan Kendras (KVK)
- 59 State Agricultural Universities (SAUs),
- 1 Central Agricultural University,
- 4 Central Universities having faculty of Agriculture.

The National Academy of Agricultural Research Management is another unique ICAR institution that conducts research and training on agricultural research management.

Other Organizations involved in Agricultural Research

1. General universities, about 23 of which are involved in agricultural research,
2. Scientific organizations such as the Council of Scientific and Industrial Research, the Bhabha Atomic Research Centre,
3. Government departments such as the Department of Science and Technology, the Department of Biotechnology,
4. Private and voluntary organizations,
5. Scientific Societies

All state agricultural universities and ICAR national institutes are mandated to conduct both agricultural research and extension, both activities are intertwined. Therefore, they need to be viewed as complementary segments (Gulati, 2018).

B. Extension and Advisory Services

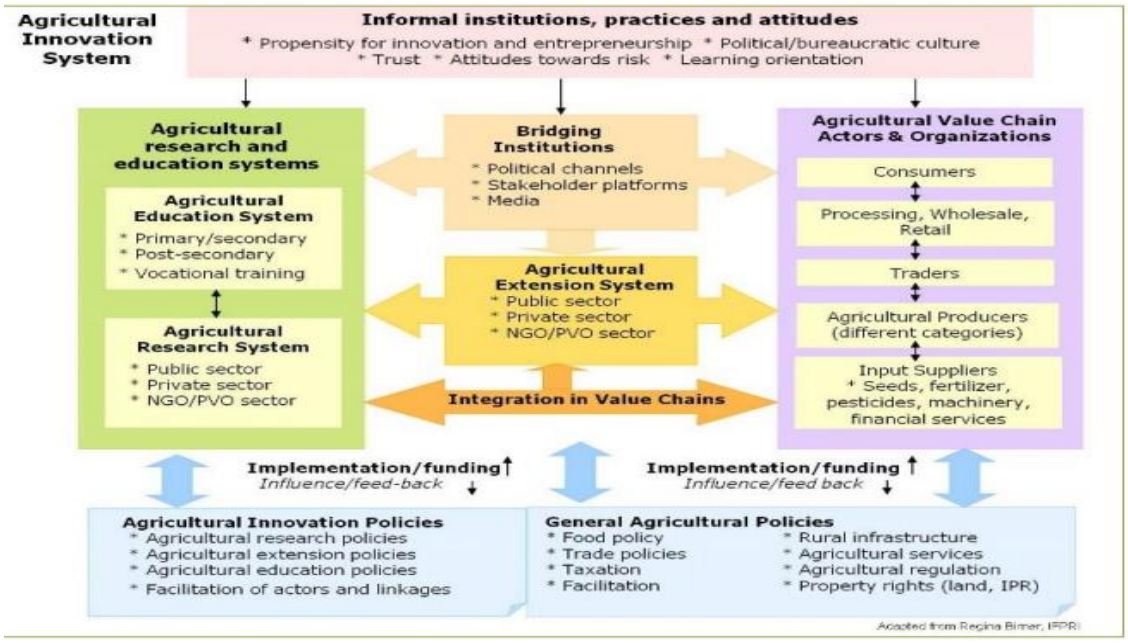
Extension and advisory services are an integral part of the AIS, where they play a brokering role now more than ever, and connecting key factors such as producer organizations, research services, and higher education. This module looks at the history and current status of extension and advisory services and examines important topics such as pluralism, new roles for the extension, and new kinds of service providers, ICTs, and agribusiness. For strong extension and advisory services, it is important to have coordination and linkage within pluralistic, multi-stakeholder AIS. Less traditional actors such as farmer organizations and agro-dealers are important extension and advisory service providers who are vital to include in the design of

investments and programs. Extension and advisory services must be ever-adapting to the needs of clients, and they must monitor and evaluate their services.

Extension and advisory services are characterised as systems that facilitate access to expertise, information and technology for farmers, their organizations and other value chain and market actors; facilitate their engagement with partners in research, education, agribusiness, and other relevant institutions; and help them develop their own technical, organizational, and management skills and practices as well as to improve the management of their agricultural activities. (Christoplos 2010).

Advisory Services

Both public extension workers and private-sector firms, in responding to specific farmer inquiries about particular production problems, still commonly use the term advisory services. In most cases, farmers are 'advised to use a specific practice or technology to solve an identified problem or production constraint. Public extension organizations should have validated information available from research about the effectiveness of different inputs or methods in solving specific problems, so that inquiring farmers receive objective and validated information. Most input supply firms provide persuasive advisory techniques while recommending specific technical inputs to farmers who want to solve a particular problem and/or maintain their productivity. Although most firms use persuasive methods to sell more products and increase their profit, an alternative private-sector model is to support out-grower schemes where export firms have field agents who both advise and supervise contract growers to ensure that specific production inputs and practices are followed.



(Source: Spielman and Birner, 2008, adapted from Arnold and Bell,2007)

Fig 3: AIS model

The Indian Scenario of Extension and Advisory services

For a long time since independence, extension services were being provided mainly by the public sector. At present, the public sector is a major extension service provider through a two-tier system. At the central level, the Indian Council of Agriculture Research (ICAR) being the nodal institute for agriculture research and extension; while at the state level, the State Agricultural Universities (SAU) via the Krishi Vigyan Kendra (KVKs) and Agriculture Technology Management Agency (ATMA) at the district level, facilitate agriculture extension. However, the public extension is highly skewed towards crop husbandry ignoring allied sectors. Besides the existing public extension service system, there are several private players, civil-society organizations including farmer-based organizations and NGOs that play a major role in providing extension services (Birner and Anderson, 2007).

Manpower in public extension system

There is a major scarcity of extension officers at various levels in India, of the 143,863 positions in the Department of Agriculture, only 91,288 posts are filled (Gulati *et al.* 2018). This huge unfilled position or gap in extension workers means that on average extension services only reach 6.8% of farmers (FAO, 2012) . Further, one extension officer served 1162 operation holding, i.e. the ratio of extension workers to operational holding is low at 1:1162 at the national level as against recommended 1:750.

As per the Doubling Farmers Income Committee Report, the minimum ratio of extension workers to the operational holding in different areas is; a) Hilly Area – 1:400, b) Irrigated areas – 1:750 and c) Rain fed areas – 1:1000. Central government sanctioned 27,937 positions, against which, only 13,672 positions were occupied, and 14,265 positions were vacant (Gulati *et al.* 2018). With the staffing of vacant positions, the ratio would improve from 1162 farmers per officer to 1037 farmers per officer.

Major Institutions Providing Extension and Advisory Services

Public Institutions

a) Department of Agriculture and Cooperation

The Department of Agriculture and Cooperation comprises several technical directorates (also called divisions) and one of them is agricultural extension. The Directorate of Extension, headed by a Joint Secretary cum Extension Commissioner, is the nodal extension organ at the national level. The Joint Secretariat shall be assisted by three Joint Members. The directorate provides policy guidelines and operational backstopping to the state level extension organizations. The directorate's technical units are extension management, extension training, farm information, and National Gender Resource Center in Agriculture (NGRCA).

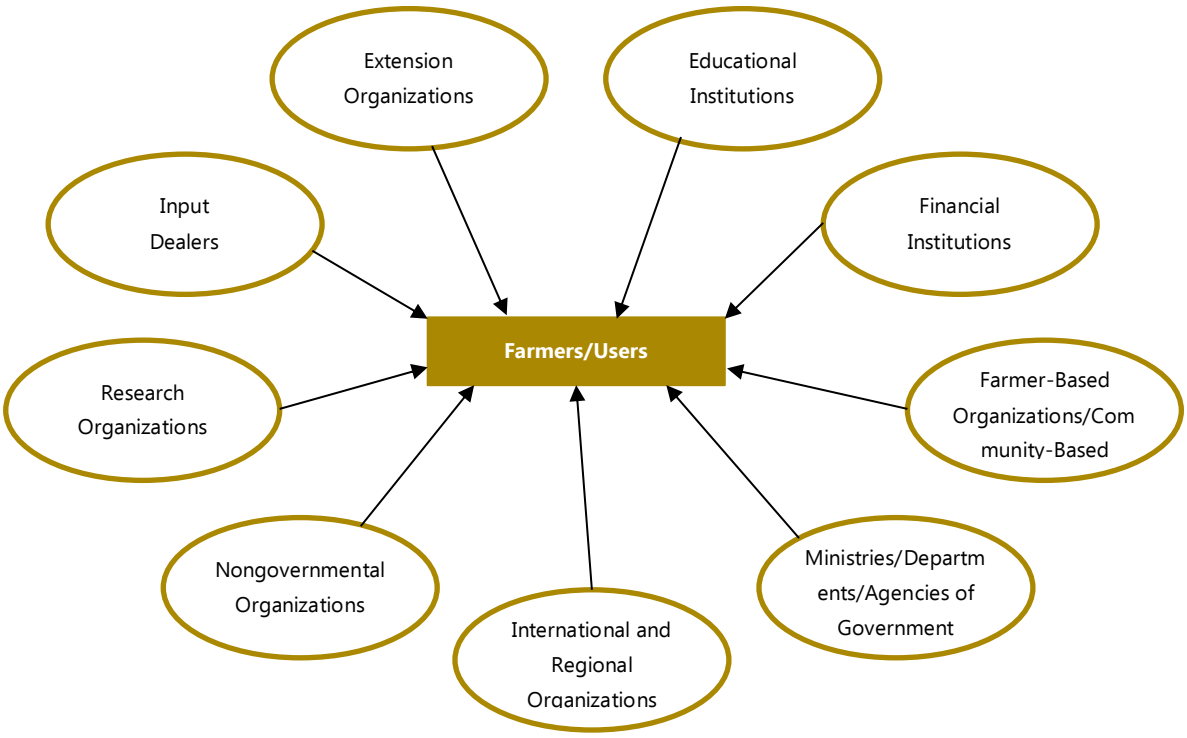


Fig 4: Linkages among various stakeholders

b) Indian Council of Agricultural Research

The Indian Council of Agricultural Research (ICAR) is an autonomous body under the Department of Agricultural Research and Education Ministry of Agriculture. The council serves as the national apex organization for coordinating, guiding and managing agricultural research and education including horticulture, fisheries and animal sciences throughout the country. It comprises 99 ICAR institutes (such as the Indian Agricultural Research Institute (IARI) and 53 agricultural universities spread across India. ICAR plays a central role in promoting excellence in higher education in agriculture. It's Agricultural Extension Division covers extension activities.

c) Agricultural Extension Division

The Agricultural Extension Division which is a part of the ICAR is headed by a Deputy Director-General (Agricultural Extension), who is supported by two Assistant Director-Generals. Activities of this Division are technology assessment and demonstrations, training of farmers, training of extension staff, and creation of awareness of improved technologies among farmers.

The Division performs extension activities through the following institutional mechanism:

- At least 716 Krishi Vigyan Kendras (KVK), is now available in India but have played a somewhat inactive role in implementing the ATMA model of extension
- About 44 Agricultural Technology Information Centers (ATIC) have been established as

parts of ICAR institutes and state agricultural universities, which are well connected with the KVKs

- National Research Center for Women in Agriculture (NRCWA), located in Bhubaneswar, Orissa.

d) State Agricultural Universities

There are about 43 state agricultural universities in India and most of them are involved in some type of extension work, that is, in addition to their academic programs. Apart from conventional universities, there are five institutes deemed to be universities (examples: Indian Agricultural Research Institute (New Delhi), Indian Veterinary Research Institute (Izatnagar), and Allahabad Agricultural Institute (Allahabad). In addition, there are four central universities with faculties of agriculture (e.g.: Banaras Hindu University and Aligarh Muslim University).

e) National Institute of Agricultural Extension Management (MANAGE)

MANAGE, which is located near Hyderabad city, is an autonomous organization established by the government in 1987. The mandate of the organization is to assist the central government and the state governments to help improve their pluralistic extension systems by bringing positive changes in policies, programs, and personnel skills. The main activities undertaken by the institute are extension capacity building, research, consultancies, education in management, and documentation.

This institute offers dozens of training courses advertised well in advance. It also offers two post-graduate diploma programs, one in general management and the other in agricultural extension management. In addition, a one-year diploma program in agricultural extension services for input dealers was started in 2004 for imparting formal agricultural education to the dealers. MANAGE is also responsible for implementing the Agri-Clinics and AgriBusiness Centers Scheme (ACABC), which aims at providing value-added extension services to the doorsteps of farmers by agricultural professionals. The scheme involves two-month residential training to eligible agricultural professionals, one-year post-training in handholding support, start-up loans by banks, and subsidy by the National Bank for Agriculture and Rural Development (NABARD).

f) State Agricultural Management and Extension Training Institutes (SAMETI)

There are SAMETI's in most Indian states and they are autonomous state level institutes with a mandate of conducting training courses on new agricultural technologies, extension management, gender issues, extension reform and new information technologies. SAMETIs provide extension management training for extension agents and functionaries for all the line departments, including how to make extension more bottom-up, farmer-led and market-driven. In addition to training, they also facilitate the infrastructure for holding workshops and journals.

g) Commodity Boards

Given the vast area and diverse agro-climatic regions, many different crops, commodities, animals and fish species are produced across India. There are a total of 20 agri-export zones within India. There are five statutory commodity boards under the Department of Commerce. These boards are responsible for the production, development and export of tea, coffee, rubber, spices and tobacco. In order to promote other commodities, several commodity development boards were established at national and state levels. In most cases, the organizational structure, research, extension, and marketing systems are in the process of changing. Thirteen centrally governed commodity boards are listed below.

- Central Silk Board (CSB)
- Coconut Development Board (CDB)
- Coffee Board (CB)
- Coir Board
- Rubber Board (RB)
- Spices Board (SB)
- Tea Board (TB)
- Tobacco Board (TB)
- National Dairy Development Board (NDDB)
- National Horticulture Board (NHB)
- Cashew Export Promotion Council (CEPC)
- National Jute Board (NJB)
- National Federation of Cooperative Sugar Factors (NFCS)

1. Non-Public Institutions

a) Private sector

Several moves have been made in India towards privatization of agricultural extension services mainly through experimental and pilot projects, as well as schemes during the past decade yet the bulk of extension services remain by and large public and free of charge for farmers. There are a large number of agricultural companies (about 2,80,000) but none can be regarded as a private agricultural consultancy company in their own right. Whatever provision of private extension services is done, it is done by farm inputs suppliers, consulting firms, and contracting companies. The forms of service obtained by farmers through payment include contract farming (mostly by commercial agricultural companies), marketing of high-value crops (usually by commercial export companies), value addition (normally by agro-processing companies), troubleshooting on farms (mostly by consultants), and charge-based services centers for farmers (usually by private agricultural companies). Names of a few private agricultural companies, which

provide one or more services like contract farming, agro-processing, inputs supply, consulting, multi-services, and export, are as follows:

- Indo-American Hybrid Seeds www.indamseeds.com/
- ASPEE India www.espee.com/
- Agro Tech www.agrotech-india.com/
- Good Earth www.goodearth.in/
- Mahindra Shubhlabh Services, Ltd. www.mahindra.com
- ITC Limited www.itcportal.com/-India
- CAICO www.caico.in/
- Rasi Seeds www.rasiseeds.com
- DuPont India
- National Agro Industries www.nationalagroinds.com/
- Poabs Organic www.poabsorganic.com
- Phalada Agro Research Foundation www.phaladaagro.com
- Advanta India, Ltd. www.advantaindia.com/
- Monsanto India Ltd. www.monsantoindia.com
- Syngenta India Ltd. www.syngenta.com/country/in/en/

2. Non-Government Organizations (NGOs)

In India, there are 3 million registered NGOs of which many are actively involved in the development of rural areas and naturally oriented themselves towards land-based livelihoods. Hence, they accommodate an essential component of extension in their intervention (Gulati *et al.*, 2018). To name a few of the NGOs which are PRADAN, BAIF, Syngenta Foundation, India, etc. are some of the leading NGOs working in agriculture.

3. Farmer-based associations, cooperatives and societies

Farmers' associations, cooperatives and societies in India have been quite active for years in ventures like self-help for development, specific commodity production, marketing, collective bargaining and many other purposes. Some of these associations have been instrumental in the fight against poverty and the empowerment of rural women. A few examples of farmers' associations are given below.

- Federation of Small Farmers' Associations of Khaddar Area, North India and Sunstar Overseas, Ltd.
- Consortium of Indian Farmers Associations.
- Turmeric Farmers' Association of India.
- Farmers' Association Pomegranate.
- Association of Farmer Companies http://www.aofcindia.org/

- Organic Farming Association of India (OFAI) http://ofai.org/
- Punjab Young Farmers' Association (India).
- Indian Farmers' Association.

India has about 5,80,000 cooperatives including 3,75,000 agricultural cooperatives with 280 million-member farmers. Types of agricultural cooperatives are primary agricultural credit/service societies, agricultural non-credit societies, agricultural cooperative marketing societies, and cooperative farming societies. They all deal in credit, inputs, marketing, agro-processing and farm extension services. There are fertilizer cooperatives, sugar cooperatives, and dairy cooperatives. The Indian Farmers Fertilizer Cooperative Limited (IFFCO) www.iffco.coop/ is one of the biggest manufacturers of fertilizers in the world. The National Agricultural Cooperative Marketing Federation of India (NAFED) www.nafed-india.com is the focal organization of marketing cooperatives for agricultural produce in the country. NAFED, founded in 1958, is under the Ministry of Agriculture and is now one of the largest procurements and marketing agencies for agricultural products in India. Issues facing primary agricultural cooperative societies include low member participation, shortage of capital for inputs, government control and interference, outdated management practices, and political influence.

4. Training options for extension professionals

Pre-service education in extension may be obtained at any of the 50+ SAUs spread across India. Also, facilities for in-service training of extension staff are available at many institutions such as MANAGE, Agriculture Extension Division of ICAR, the Department of Agriculture and Cooperation, and the Department of Agricultural Research and Education, both under the Ministry of Agriculture. Certain well-established NGOs, public agricultural universities and research institutes like the Indian Agricultural Research Institute (IARI) http://www.iari.res.in/, and some private agricultural companies can also organize in-service training courses for the extension staff under mutually agreed arrangements.

5. Infomediaries and information and communication technology (ICT) for agriculture and extension

In India, out of 179 million rural households, 47.5% has access to cell phones, while 35.4%, 19.2% and 0.8% have ownership of television, radio, and computer with internet access, respectively. The data shows that the majority of the districts in all rural districts in central India lack ICT services and fall into the category of ICT services with very low access. In 447 districts in India, where cell phones are a primary source of ICT service, covers more than 80% of farmers (primary occupation is cultivator). Coverage of ICT services such as television and radio were in second and third rank in the districts (Gangopadhyay *et al.*, 2019).

India has made impressive progress in the application of ICT to its rural and agricultural development programs. Dozens of agricultural commodities focused and technical discipline-based public and private IT networks exist, with many of them reaching the village level. A few examples are as follows:

a. **Bhoomi:** Under this program, 20 million land records of 6.7 million land owners in176 taluks of Karnataka State have been computerized. Other states have followed the suit.

b. **e-Choupal:** http://www.echoupal.com The program links farmers directly to agricultural and aquaculture products companies dealing in soya, coffee, prawns, etc. for the purchase of these commodities at competitive rates thus eliminating the middlemen. The program's principle is to inform, empower, and compete. Presently, there are more than 6,500 e- Choupals across 10 states in India.

c. **IKisan:** IKisan has been developed by the Nagarjuna Group, based in South India, with an interest in agriculture, fertilizers and insecticides, among other areas. It is a comprehensive agriculture portal addressing the information, knowledge, and business needs of farmers, traders and farm input agencies (http://www.ikisan.com).

d. **Agriwatch:** is said to be the largest agribusiness portal in India. It enables access to agribusiness information covering more than 15 sub-sectors of the agricultural and food industry. The website carries daily, weekly and fortnightly trade research reports.

e. **aAqua:** It is one of the initiatives of the Indian Institute of Technology, Bombay presenting an online multilingual, multimedia agriculture portal for disseminating information from and to the grassroots agricultural communities. The program integrates multiple databases.

f. **DEAL:** DEAL is an initiative of the Indian Institute of Technology, Kanpur. It is an ICT enhanced network based on an established telecenter system for rural institutions such as village schools and agricultural extension centers at village level. It constitutes a digital knowledge base for the farmers and agricultural practitioners.

g. **e-Sagu:** http://www.esagu.in/It is an IT-based personalized agricultural extension system for disseminating expert advice on agriculture to the farmerson time.

h. **Akshaya:** http://www.akshaya.kerala.govt.in/ The Akshaya Project is a market-driven agricultural initiative through IT-enabled Agricultural Business Centers in Kerala State. It provides web-based solutions to all categories of farmers.

i. The **National Informatics Center (NIC)** www.nic.in/ is a part of the Indian Ministry of Communications and Information Technology. It has launched several ICT initiatives for the benefit of rural people some of which are as follows:

j. **Computerized Rural Information Systems Project (CRISP)**

k. **Land Records Computerization Project (LRCP)**

l. **eNRICH** (for addressing the needs of rural people through networking, and facilitating

communication between the government and citizens)

m. **AGMARKETNET** (for providing information on marketing prices of agricultural produce).

n. **ASHA:** http://www.ashanet.org/(for providing agribusiness information for farmers and for linking buyers and sellers directly)

o. **Rural Bazar:** http://www.rural.nic.in/sites/rural-bazar.asp (for showcasing of the agricultural products for rural producers as well as facilitating offline and online payments)

p. **National Panchayat Portal** http://panchayat.nic.in: (Ensures vertical and horizontal integration in rural Panchayat raj facilities, facilitates communication, messaging, transfer of funds, monitoring of programs, etc..)

q. **e-Gram Vishwa Gram:** (Keep records on village families and provide income, caste, home, etc. certificates to the rural population.)

ICT applications are diverse and their suitability varies based on the context of their use and the type of application used. But sticking to the broad concept of ICTs for EAS, the Table below depicts a general and overall idea of their strengths, weaknesses, opportunities and challenges in EAS (Saravanan *et al.,* 2015).

Table 2: Strengths, weaknesses, opportunities and challenges of using the ICTs

Strengths	Weakness	Opportunities	Challenges
1. Better access to services 2. Cost-effective 3. Timely 4. Anytime, anywhere 5. Supplement the role of 6. extensionists 7. Better research–extension–client system linkages	1. Success depends on human commitment 2. Lack of personal touch 3. Needs ICT skill and competency 4. Lack of institutional ICT policy 5. Long-term sustainability depends on funding, champions and other factors	1. Continuous improvement of ICT infrastructure 2. Penetration of high-end mobile phones 3. Reducing cost of ICT infrastructure and services 4. Multiple players in EAS services provision using ICTs	1. Creating farmer-specific and relevant content 2. Language barriers 3. Low literacy of rural farmers 4. Imparting ICT skills to EAS stakeholders 5. Duplication and contradictory information flow

(Source: Saravanan *et al,* 2015)

Many NGOs, research organizations, and national ministries have improved access to technologies and knowledge for the rural advisory services by utilising rural telecentres and online forums. Throughout the developing world, ICTs are being integrated into rural advisory services in a variety of forms, including rural radio, television, internet and mobile services. The advice and information provided via ICTs is becoming more varied, ranging from information about specific technologies and practices to information that enables climate change mitigation and adaptation; disaster management; early warning of drought, floods, and diseases; price information; political empowerment; natural resource management; agricultural information; production efficiency; and market access. ICTs also open new channels for farmers to document and share experiences with each other and with experts.

1.4.2 Input Support System

Improving access to high-quality agricultural inputs and services are key in increasing agricultural productivity and addressing food security challenges. The backbone of any agricultural revolution is the access of farmers to modern agricultural inputs. These agricultural inputs range from improved seeds, fertilizers and crop protection chemicals to machinery, irrigation and knowledge. Seeds are critical to successful crop production and inevitability, farm productivity and profitability. Fertilizer supplies nutrients to the soil that are essential for growth. Increased use of fertilizer and improved seeds are partially credited with the large increases in agricultural productivity growth in Asia during the Green Revolution in the 1960s. Irrigation is also essential for growth as it enables off-season farming, provides the potential for multiple harvests per year and brings additional land under cultivation. Crop protection chemicals (pesticides, herbicides, insecticides and fungicides) control weed species, harmful insects and plant diseases that afflict crops. Finally, technical know-how and machines improve the efficiency of human labour and increase agricultural productivity.

Globally, Food and Agricultural Organization (FAO) is supporting food production in emergency-affected countries by providing key inputs to agricultural production, such as seeds, tools and fertilizers, often in combination with timely training of farmers and/or extension services on better land and livestock management practices. FAO is also supporting seed multiplication, the introduction of improved seed varieties, home or school gardening, etc. These are examples of FAO's emergency response that have a strong element of the transition to recovery, and which, ultimately, reduce the need for continued food aid. Agricultural inputs procured by FAO (seeds, fertilizers, etc.) are cleared by in-house technical specialists to ensure that they are appropriate for the local conditions/context where they would be distributed and used. Effective distribution to recipients is usually carried out by local NGOs, community groups or, in some cases, local government agencies.

Input Intelligence stands for the technical knowledge of the know-how about the input usage in order to increase the efficiency of inputs used which in turn read the better output. The technical know-how about the judicious use of the input is provided by the private seller, extension functionaries of the public institutions, NGOs, or even farmer to farmer. India has come up with its own models and methods of disseminating this input information to its dynamic landholdings.

One of them is the Diploma in Agricultural Extension Services for the Input Dealers (DAESI) Program of one year implemented by the National Institute of Agricultural Extension Management (MANAGE) through State Agricultural Management and Extension Training Institutions (SAMETIs) since 2003. It recognized the input dealers as the prime source of farm information to the farming community, besides the supply of the inputs and the credit. Technical information is provided by contact courses given by agricultural experts and practitioners at district level on Sunday or public holidays for 48 days, including annual field visits.

Different sectors of Input Support Systems

The inputs in the agricultural sector are many and involve natural resources, manmade inputs, and power in form of labor or mechanization, and finance. The broad areas involve soil, water, seed, pest management, agricultural mechanization, short and long-term credit, and capital formation. Utilizing these resources to the most optimal level possible, not only makes the agricultural value system more effective but also makes the system efficient and sustainable. The inputs that have been comprehensively examined and strategies suggested for enhancing total factor productivity and comprehensive coverage include:

a) Soil health management – soils and fertilizers
b) Water
c) Seed
d) Plant protection
e) Farm machinery
f) Credit

a) Soil Health and Nutrient Management have become the talk of the day post green revolution in the context of maintaining the soil health for the future despite further deterioration with non-judicious usage of fertilizers leading to soil fertility degradation. In the past two decades, interests in soil health have increased due to enhanced recognition of the fragility of natural resources and the necessity to preserve them for societal well-being.

Though India is facing the problem of deteriorating soil physical conditions along with acidification, salinization, alkalization and waterlogging problems due to various practices, imbalanced use of plant nutrients is the major driver for most of the soil issues that we face today. Non-judicious fertilizer use is the prime cause of widespread soil fertility depletion. Little attention

is paid to balanced nutrition and due to the continued exploitation of the soil's natural reserves, the number of deficient nutrients increases. In order to look into this issue, there was always a need to support the constructive programs which educates and helps the farmer in building a sustainable soil ecosystem.

Fertilizer consumption recorded modest growth in 2018-19. Total estimated nutrient consumption (N+P2O5+K2O) was 27.29 million MT in 2018-19 as against 26.59 million MT in the previous year showing a growth of 2.6%. The consumption of N, P2O5, and K2O was 17.90 million MT, 6.86 million MT and 2.53 million MT representing growth of 5.6%, 0.03%, and (-) 9%, respectively, over 2017-18. Fertilizer consumption is grossly imbalanced and skewed towards N. The NPK use ratio widened from 6.1:2.5:1 during 2017-18 to 7.1:2.7:1 during 2018-19 due to a fall in potash consumption. Per hectare use of total nutrients (N+P2O5+K2O) increased from 133.9 kg in 2017-18 to 137.4 kg in 2018-19.

The soil testing service in India has begun in 1955-56 and has constantly been expanded over the years. The present network is described by 1735 soil testing labs (STLs) (1459 static labs + 276 mobile labs) with an annual analyzing capacity of 22.24 million soil samples. Through the Government's initiative to distribute Soil Health cards (SCHs) to approximately 138 million farms once per two-year cycle, the Soil Analysis Service now occupies a central place and is now seen as an essential infrastructure for managing soil health. For effective soil health monitoring and management, the Government of India launched the Soil Health Card (SHC) Scheme during 2015, in addition to several other initiatives under on-going schemes. The SHC Scheme envisages the distribution of SHCs to ~120 million farm holdings at a 2-year interval. With the launching of the SHC Scheme, soil testing service assumed centre stage of soil health management, and expectations from this service have increased. During the first 2-year cycle (2015-16 and 2016-17) and second 2-year cycle (2017-18 and 2018-19), the achievement was impressive with a hundred percent of targeted soil sample collection. The third cycle (2019-20 and 2020-2021) has so far collected 2.01 million samples and 1.32 million SHCs are distributed (Source: Soil Health portal, 2019).

Table 3: Progress Report for State-wise Sample Registration and Test Results entry in the portal as on 01-02-2020 of all three cycles of Soil Health Card Scheme

Sr. No.	State	Target for Collection and Testing	No. of Samples Entered (%)	Test Results Entered (%)	Target for printing and distribution of SHCs	No. of Farmers Entered	SHCs Entered on Portal (%)
1	Karnataka	3,396,565	3,380,804 (99.54%)	3,238,320 (95.34%)	15,729,412	18,155,948 (115.43%)	17,313,877 (110.07%)

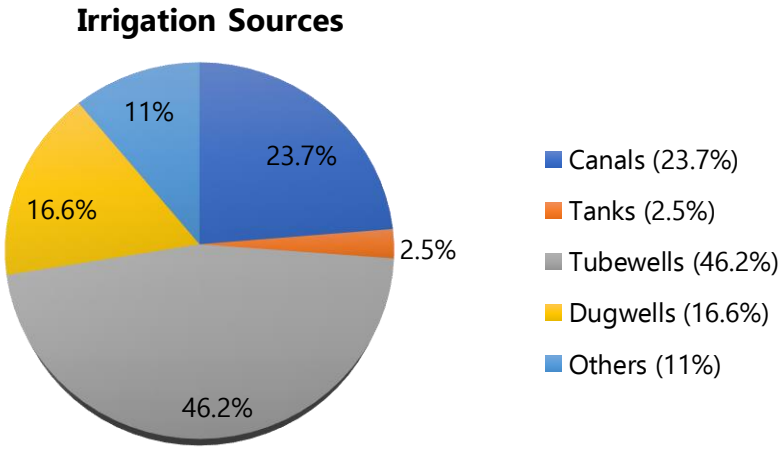
2	Maharashtra	5,407,310	5,830,582 (107.83%)	5,473,873 (101.23%)	26,284,011	20,004,362 (76.11%)	16,731,556 (63.66%)
4	West Bengal	2,743,963	364,931 (13.30%)	272,633 (9.94%)	10,283,775	1,238,082 (12.04%)	26,555 (0.26%)
India Total No		**55,362,172**	**54,317,072 (98.11%)**	**48,590,302 (87.77%)**	**234,824,068**	**198,249,390 (84.42%)**	**153,669,832 (65.44%)**

Source: Soil Health portal, 2019

Even though untiring efforts are made in the soil health sector issues are not exceptions. There is a need to revisit the soil testing services with improved facilities and maintenance of labs and hiring trained staff. Strengthening the Soil health card scheme and importantly providing advisory services based on SHC indications. Information on crop residue recycling, Integrated approach of nutrient management and capacity building of public extension functionaries, private input dealers, suppliers, NGOs, and others who are involved in the soil health sector and further sensitizing farmers on the importance of soil health management.

b) **Water Management in agriculture** is one of the most critical subjects as agriculture is highly dependent on water and increasingly subject to water risks. It is also the largest sector in terms of usage and a significant water polluter. Improving agriculture's water management is therefore essential to a sustainable and productive agro-food sector.

Agriculture in India consumes more than 80% of total consumable water available in the country. India accounts for only about 4% of the world's water supplies, providing support for 16% of the world's human population and 15% of its livestock. With 52 percent of its cultivated land being monsoon-dependent, the nation faces substantive the challenges in effective management of available water. These rain-fed regions of India are characterized by aberrant behavior of monsoon rainfall, eroded and degraded soils with multiple nutrients and water deficiencies and declining groundwater table. In India, the average grain yields in rain-fed regions are about 1 t ha^{-1}, compared to 3 t ha^{-1} in irrigated agriculture.



The Gross irrigated area in the country is about 96 Mha from nearly 650 BCM (billion cubic meters) of water which gives a delta of 0.68 meter (m) per ha. of gross irrigated area. Taking 70 percent of the average rainfall of 1,170 mm (1.17 m) as effective for crop consumptive use, the gross water use is about 1.48 m per ha. of the gross irrigated area. This is very high as compared to water use in irrigation systems in developed countries, like the USA where water allocation is about 90 cm/ha. In most surface irrigation schemes, this overuse in the country represents a low irrigation efficiency of approximately 35 percent to 45 percent, and approximately 65 percent in the case of groundwater use.

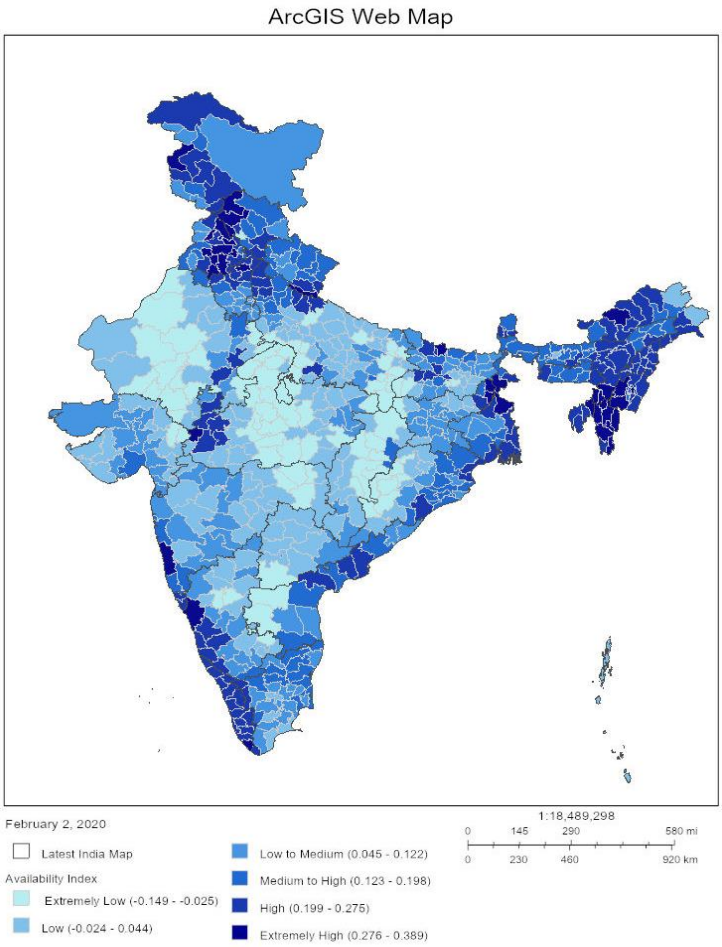


Fig 5: Groundwater availability in India by 2024

(Source: WRI Atlas-India Water tool, 2020)

Presently, the agriculture sector is using about 80 percent of the total available water resources. Not to mention the possibility of a great water allocation for agriculture, the demand for competing sectors such as industry, urban centres and infrastructure is growing. Hence, water availability for agriculture may decline to 68 percent by 2050. Water requirements for various sectors as assessed by "Standing Sub-Committee for Assessment of Availability and Requirement of Water" and by NCIWRD are given in Table.

The Pradhan Mantri Krishi Sinchayee Yojana was launched on 1st July, 2015 with the motto of *'**Har Khet Ko Paani**'* for providing end-to-end solutions in the irrigation supply chain, viz.

- water sources;
- distribution network: and
- farm-level applications.

PMKSY not only focuses on creating sources for assured irrigation, but also creating protective irrigation by harnessing rain water at the micro level through ***'Jal Sanchay'*** and ***'Jal Sinchan'***. Micro-irrigation gets due attention to ensure ***'Per drop-More crop'***. PMKSY adopts State level planning and projectile execution that allows the states to draw up their own irrigation development plans based on District Irrigation Plans (DIPs) and State Irrigation Plans (SIPs). The components of the scheme are:

- Accelerated Irrigation Benefit Programme (AIBP)
- PMKSY (Har Khet ko Pani)
- PMKSY (Per Drop More Crop)
- PMKSY (Watershed)

State specific programmes on Water management

a) Jalayukt Shivar – Maharshtra State
b) Krishi Bhagya – Karnataka State
c) Mission Kakatiya – Telangana State
d) Neeru Chetu – Andra Pradesh
e) Jala Swabhalaban Abhiyan – Rajasthan State

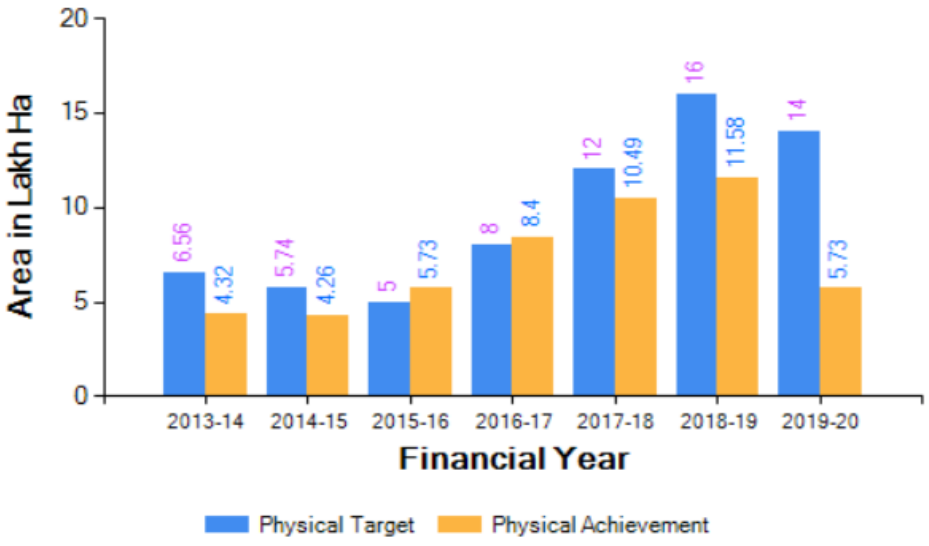


Fig 6: Physical target/ achievement of *Per crop more drop* (micro-irrigation) under PMKSY
(Source: PMKSY dashboard)

Considering the water stress in India, there is a great need to promote water conservation by promoting micro-irrigation, water footprint, artificial recharge, rainwater harvesting, emphasis on water recycling and sensitizing farmers about participatory water management and training and capacity building of farmer trainers are very much needed.

c) Seed is a critical input for enhancing the productivity of all agricultural and horticultural crops and plays a vital role in improving the income status of farmers. Seeds can serve as a vehicle of production, protection and quality enhancement technologies in a single entity and in a cost-effective way. The use of quality seeds alone can increase productivity by 15-20 percent, showcasing its importance in agriculture.

In recent decades, food production has come under increasing pressure, mainly as a result of a growing global population, climate change and structural dietary shifts. The demand for food is increasing, prompting the need for intensification of food production without depleting the world's resources and causing potentially irreversible environmental damage. The delivery of high-quality seeds to farmers is essential for improving crop production and meeting environmental challenges. Therefore, food security is dependent on seed security. The seed industry is made up of a small group of large global players and a long tail of small and medium enterprises that operate at regional, national and local levels. While the integrated seed business model of the global players includes research and development, seed production, marketing and sales, and capacity building, the small and medium companies, in many cases, only focus on three of these elements.

The **National Seeds Corporation Ltd. (NSC)** undertakes the production of foundation and certified seeds. At present, it is undertaking production of certified seeds of nearly 600 varieties of 60 crops consisting of cereals, pulses, oilseeds, fiber, fodder, green manure and vegetables in its farms and through its registered seed growers across India. There are 8 Farms and 12,500 registered seed growers all over the country who are undertaking seed production programmes in different agro-climatic zones.

RBI's Doubling Farmer's Income report recommends a robust seed production plan on 'Rolling Seed Plan', influenced by Seed Replacement Rate (SRR), Varietal Replacement Rate (VRR) and Seed Multiplication Rate (SMR). Also finds it necessary to decentralize and broad base the seed production platform by roping in SHGs, FPOs, VPOs, youth-entrepreneurs, contract-farming, etc. (DFI Vol. 7, 2018). A legal structure has been embraced well by the Indian seed industry, and seed production has robustly grown, more needs to be done so far.

d) Plant Protection Sector: The Agriculture sector is prone to various risks or threats, and pests represent one of them. Pests and diseases affect crop yields and output and pest management to protect crops, adds to the farmer's costs. To minimize the cost of cultivation and ensure

pesticide residues below threshold norms, pest management needs to be carried out in an efficient and effective manner, having selected the treatment judiciously. In this context, alternate methods to manage pests including early warning systems and preventive measures are important considerations. Regulations also impact on availability, choice, cost competitiveness, and quality of pest control systems offered to the farmers.

The central government is responsible for the registration of insecticides, whereas, the state government is responsible for licensing, and enforcement of the provisions relating to manufacture, sale, transport, distribution and use of pesticides. Both central and state governments are jointly responsible for quality control.

At present, there exists one Central Insecticide Laboratory (CIL), and two Regional Pesticide Testing Laboratories (RPTLs) in the country with an annual testing capacity of 4,700 samples. In addition, there are 68 State Pesticide Testing Laboratories (SPTLs) with an annual test capacity of 73,547 samples. There exists wide inter-state variations in the number of SPTLs. Tamil Nadu (15) has the highest no. of SPTLs followed by Rajasthan (6), Karnataka (6), Andhra Pradesh (5), Maharashtra (4), Uttar Pradesh (4), Haryana (4) and so on, whereas states like Bihar, West Bengal, Chhattisgarh, Assam, Madhya Pradesh and Odisha have only one STPL.

The total number of misbranded pesticides range around 5 percent of the total samples collected by the Inspectors and analyzed by the Analysts. Very often, the methodology followed for collection is not adhered to, and tantamounts to fulfilling a formality. Furthermore, as the analysis of newer molecules and newer formulations is challenging, it is observed that most of the Inspectors are collecting such pesticides/formulations which are easily analysed by SPTLs. Hence, capacity building programs need to be regularly conducted, and the same can be entrusted to NIPHM (National Institute of Plant Health Management), Hyderabad.

World Health Organization (WHO) estimates that there occur more than 1 million pesticide poisoning cases every year, out of which, more than 1,00,000 deaths are of spray operators in developing countries.

In order to control and reduce the hazards due to improper use of plant protection chemicals, there is a need to spread awareness and educate the dealers, suppliers, extension functionaries who are in direct contact with the farmers. Strengthening the infrastructure with more test labs, accreditation (NABL) and with well-trained manpower is required. Promotion of IPM, precision farming, cluster farming approach would be done. Generic pesticides may be brought under a price control mechanism similar to the Drug Price Control.

e) Farm Mechanization is the sector that helps in the efficient utilization of other inputs to increase the productivity of land and labour. Effective use of agriculture machinery helps to

increase productivity and production of output, undertake timely farm operations, and enable the farmers to quickly rotate crops on the same land. By raising a second crop or multi-crops from the same land, there is an improvement in the cropping intensity, and making agricultural land in sequel commercially more viable. Mechanization also helps in animal husbandry, dairying and fisheries. Agricultural mechanization can contribute a cut in cultivation cost by 25 percent and a rise in productivity by 20 percent, thereby effecting an increase in farm income, to the extent of 25-30 percent.

"Agricultural mechanization is the deployment of engineered machines and motorized tools, in lieu of manual activities to prepare, tend, protect, harvest and handle waste in the cultivation of any agricultural produce. Its efficiency and effectiveness can be further enhanced by blending the power, electronic and space technologies."

– DFI Committee.

The Government of India is promoting agricultural mechanization on farms through a Sub Mission on Agricultural Mechanization (SMAM) of Rs. 2000 cr., which started in April 2014 under the umbrella of the National Mission on Agricultural Extension and Technology (NMAET). The objectives of this Mission are:

- Increase the scope of agricultural mechanization for smallholder farmers and marginal areas with low agricultural output.
- Promoting 'Custom Hiring Centers'
- Creating hubs for hi-tech and high-value farm equipment's
- Awareness through demonstration and capacity building
- Ensuring performance testing and certification of Machines.

The pace of mechanization needs to pick up further across the sub-sectors of agriculture, across crops and regions. It is worth chasing a target of 4.0 kw/ha. by 2022-23.

Agricultural mechanization is an important input to achieve higher productivity and mitigate costs in the agricultural sector. The availability of farming labour power is reducing, due to various factors, including diversion of labour into other employment generation programs of the government. Even when available, it may not be available when needed and at an affordable price to the farmer. Mechanization of farming/agriculture needs to include past learning, as it can lead to intensive cultivation, and negatively impact long term sustainability. Access to mechanized tools, to small land parcels, is best promoted through developing common use assets at Custom Hiring Centers and Agriculture Machine Banks.

Input Market Policy is the basic need for the effective realization of the utility of any agricultural input like seeds, fertilizers, water, pesticides, farm machinery and credit. The Agricultural inputs

can be classified into Consumables and Durables/Capital inputs. The consumable Inputs can be seeds, fertilizers, pesticides, etc. On the other hand, the durable capital inputs can be tractors, harvesters, threshers, pump sets, etc. It stands as public support in enabling private actors, agri-businesses in input sectors and addressing their issues with the marketing channels by providing efficient models for input models. In the recent past, there have been numerous experiences in the input sector in terms of new distribution and marketing channels and some actors have tried to provide comprehensive solutions to farmers, including agricultural and related inputs. These new channels range from marketers' own outlets to supermarkets to franchised outlets besides traditional mainstream channels of selling through distributors and dealers/retailers.

Agriculture input marketing policy must address the 4 P's of the agri-input market. They are Product, Pricing, Place and Promotion strategy. Public intervention on market policy is always required to keep private monopoly over input market which may lead to exploitation of the farming community in turn resulting in poor production.

Much emphasis on Input marketing and policy intervention is made under the Agri-marketing chapter.

1.4.3 Agricultural Finance Support

Access to finance is a key challenge for the majority of rural poor farmers who rely on agriculture as a source of livelihood. Lack of access to financing is a key impediment for the farmers to improve the efficiency of their productions and adopting better technologies. Financial sector institutions in developing countries lend a disproportionately lower share of their loan portfolios to agriculture compared to the agriculture sector's share of GDP. Demand for food will increase by 70% by 2050; at least $80 billion annual investments will be required to meet this demand. Agriculture finance empowers poor farmers to increase their wealth and food production to be able to feed 9 billion people by 2050. Agriculture finance and agricultural insurance are strategically important for eradicating extreme poverty and boosting shared prosperity.

Agriculture financing is mainly comprised of agricultural credit, insurance support and subsidy support by the government to the agriculture and allied sectors.

a) Agriculture Subsidy Support

Among all the subsidies to agriculture input and fertilizer, the subsidy has been the most dominant amounting to Rs.71,076 cr. in FY15. The water sector receives subsidy mainly through two channels- power subsidy and irrigation subsidy. According to government estimates, the irrigation subsidy, was Rs. 37,246 cr. in FY15 whereas the power subsidy that goes to agriculture was about Rs. 53,889 cr. The expenditure on interest subvention scheme was Rs. 6000 cr. in FY15.

Besides, the premium subsidy on crop insurance was about Rs. 2600 cr., which has risen drastically to more than Rs. 20,000 cr. in FY18. The total value of input subsidies, therefore, accounts for Rs.1,70,811 cr. in FY15, which is around 8% of Agricultural GDP.

Large increases in fertilizer consumption, often driven by highly subsidized fertilizer prices, especially urea, have inflicted significant costs as unduly low pricing of urea has led to imbalanced use of soil nutrients. This has resulted in soil degradation and deficiency of secondary macronutrients and micronutrients in the soil. Subsidy on water for agriculture has resulted in inefficient usage of water resources in India (for both surface and groundwater). India cannot afford to be grossly inefficient in the use of water as it is already headed towards water scarcity. Agriculture in the energy sector has been paid well below the cost of supplying power or what other sectors have to pay, leading to unsustainable usage of groundwater, resulting in a rapid depletion of groundwater tables in several regions. Credit subsidy has been introduced by the government to provide cheap agricultural loans to farmers.

The rapidly rising input subsidies to agriculture have squeezed public investments in agriculture. The trend shows that the public investments in agriculture as a percentage of agricultural GDP has declined from 3.9% in 1980-81 to 2.2% in 2014-15, while input subsidies as a percentage of agricultural GDP, have increased from 2.8% to around 8% over the same period (Gulati *et al.*, 2018).

b) Agriculture Credit System

Agriculture Credit System is the fundamental need that enables farmers to reach several doors. Without access to institutional credit, most smallholders are restricted to farming, trading and processing practices that result in low levels of productivity.

The evolution of institutional credit for the Indian agriculture can be traced back to the pre-independence period, and broadly classified into three distinct phases:

- 1904 to1950s (predominance of co-operatives and setting up of RBI);
- 1960s to1980s (nationalization of commercial banks and setting up of Regional Rural Banks (RRBs) and NABARD) and
- 1991 onwards, when economic reforms were set in motion in the country.

The temporal trend in agriculture credit reveals that over time, significant progress has been achieved in terms of the scale and outreach of the institutional framework for agriculture credit. The share of institutional credit, which was about 10 percent in 1951, increased manifold to 64 percent in 2013 (AIDIS). Further, as a percentage of Agriculture GDP, institutional agriculture

credit went up from about 16 percent in the early 1980s to 42 percent by 2017 **(**ZEF-ICRIER working paper 184, 2019).

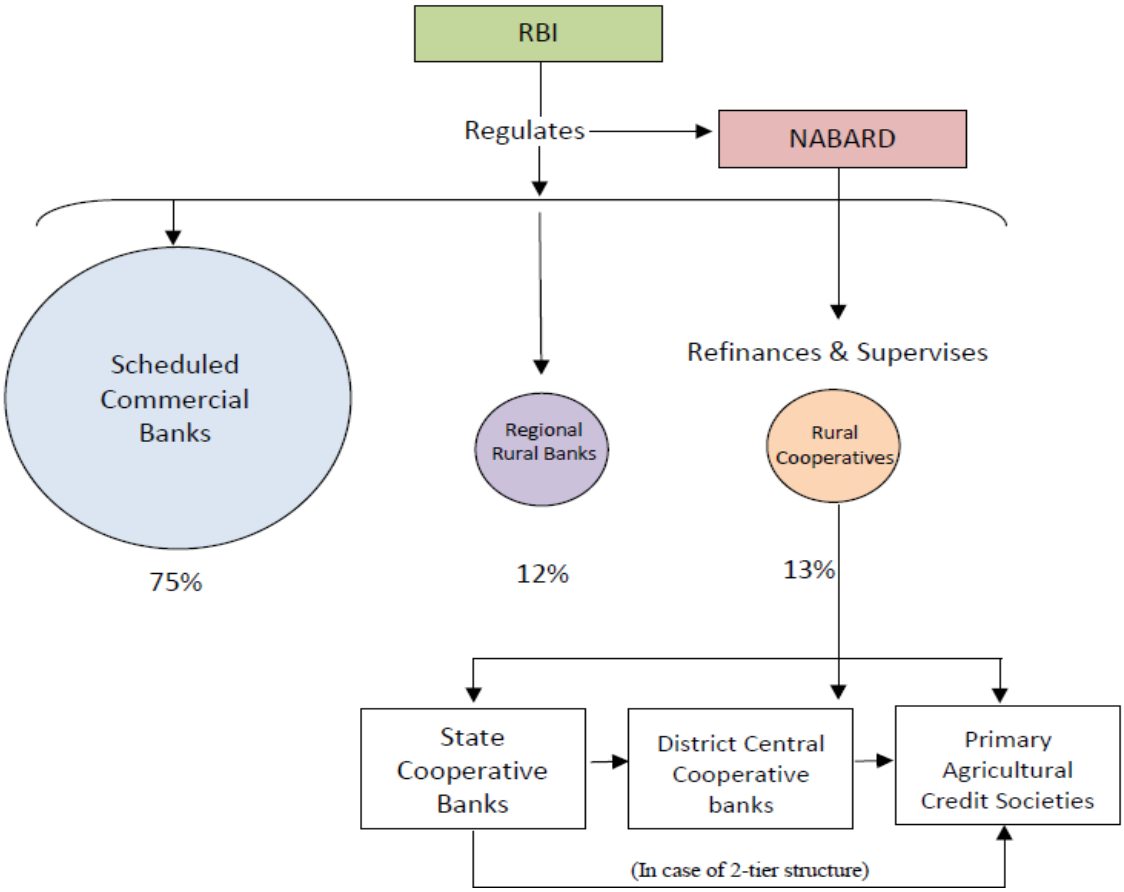


Fig 7: Institutional Structure of Agriculture Credit System in India
(Source: ZEF-ICRIER working paper 184, 2019)

A Study conducted by Ashok Gulati and Ritika Juneja (2019) sponsored by Center for Developmental Research, University of Bonn (ZEF) and Indian Council for Research on International Economic Relations (ICRIER), tried to examine the credit system in India from three angles: Efficiency, Inclusiveness and Sustainability.

The **efficiency** of credit system results shows that during the period of time, due to numerous financial/ economic policy reforms of the Government of India, the credit share of institutional credit to non-institutional credit has improved significantly at the national level. However, data at the state level indicates, in many states, that the short term agriculture credits have surpassed the value of inputs. For example, in Kerala it was 326 percent; in Andhra Pradesh 254 percent; in Tamil Nadu 245 percent; in Punjab 231 percent; and in Telangana 210 percent. This speaks about the diversion of shortterm agriculture loan towards non-agricultural usage creating a suspension about the efficiency.

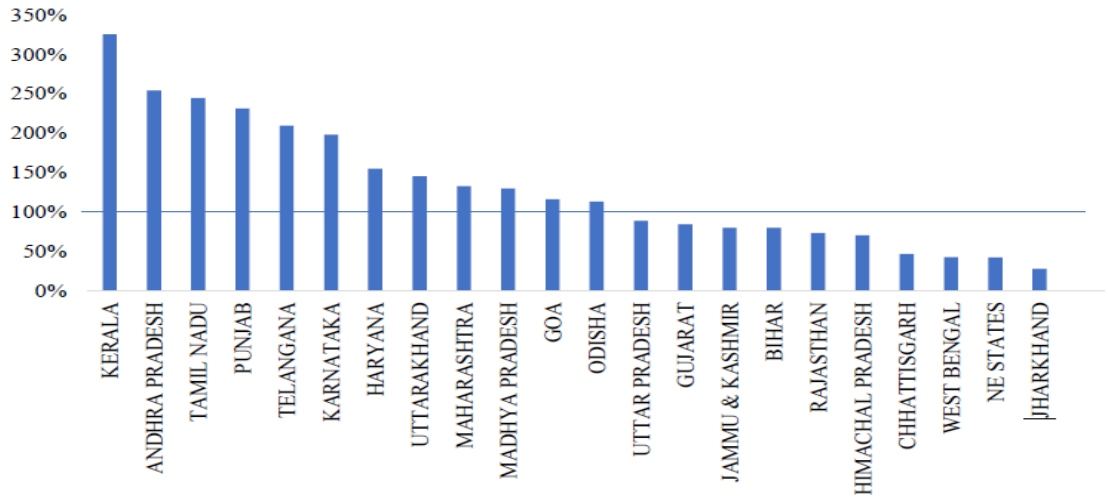


Fig 8: State-wise share of total short-term credit (loans outstanding) to agriculture and allied sectors as a proportion of input requirement (Source: RBI, 2019)

The data from the Report of the Internal Working Group to Review Agricultural Credit (RBI, 2019) says, only 41% among small and marginal farmers could be covered by public and private sector banks and 28% of the total credit is still non-institutional credit. It shows that marginal agricultural land holdings are more dependent on non-institutional sources than large-scale farmers.

The major factor that affects the **sustainability** of the credit system, in any way, is the political economy of loan waiver under the Agricultural Debt Waiver and Debt Relief Scheme (ADWDR). Many state governments have announced debt wavier in FY2017 and FY2018. As a result, the Non-Performing Assets (NPAs) in Scheduled Commercial Banks (SCBs) have risen from Rs. 71.5 Bn. to Rs. 832 Bn. between 2009 and 2018 which has caused moral hazard in the repayment behavior of the farmers.

Table 4: Amount of loan waiver announced and allocated by various states in their budget since 2017-18 (Source: RBI, 2019)

	Fiscal Year of Loan Waiver Announcement	Loan Waiver Amount Announced (INR crore)	2017-18 (RE)		2018-19 (BE)	
			Amount Budgeted (INR crore)	As percent of Agri and irrigation budget*	Amount Budgeted (INR crore)	As percent of Agri and irrigation budget*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Maharashtra	2017-18	34000	16000	55.2	8820	30.4
Uttar Pradesh	2017-18	36000	25000	44.3	4000	7.1

Punjab	2017-18	10000	370	2.8	4250	31.7
Karnataka	2018-19	44000	3910	13.5	10420	36.1
Rajasthan	2018-19	18000	-	-	1860	17.2
Madhya Pradesh	2018-19	36500	-	-	-	-
Chhattisgarh	2018-19	6100	-	-	-	-
Total		**184600**				

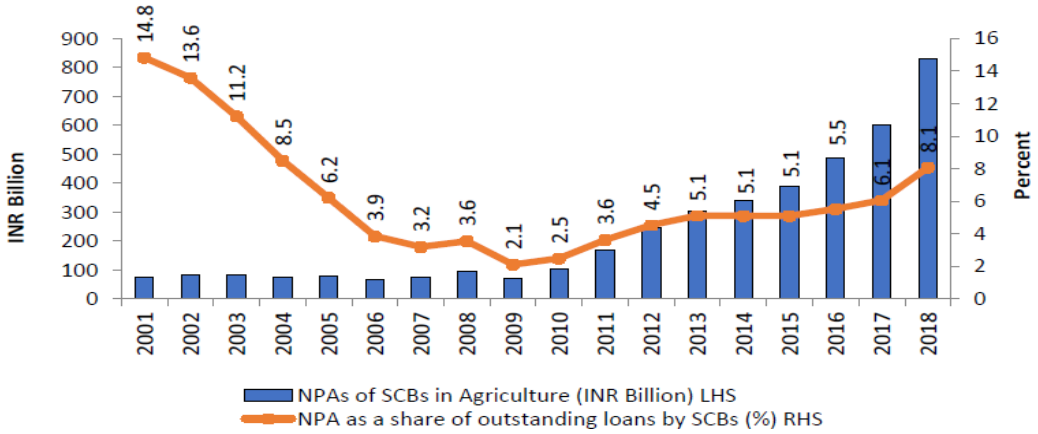


Fig 9: Agricultural loans outstanding and NPAs in agriculture from SCBs (as on 31st March)
(Source: ZEF-ICRIER wp 184, 2019)

1.4.4 Agriculture Insurance Support

In recent years, the erratic and unpredictable behavior of Monsoon, accentuated by Climate Change has caused extensive financial losses in terms of crop failures, damage to agricultural infrastructure, loss of lives and properties, etc. due to natural and manmade disasters and destruction to the environment and farmlands. This has aggravated food insecurity in the country. Insurance can help to manage these risks, and crop insurance is that branch of this financial mechanism that is explicitly intended to compensate losses from adverse weather and similar events that are beyond the control of growers. Crop insurance is not the universal solution to the risk and uncertainties which are part and parcel of farming. Rather insurance can address part of the losses resulting from some perils.

The Indian agriculture is dependent on monsoon in such a way that any deviation in the onset or departure of monsoon largely affects agricultural productivity in the entire Indian subcontinent by leaving farmers in the lurch. The vagaries of monsoon still determine the fate of farmers across the country, especially in regions vulnerable to drought. It is estimated that over 50 percent of the total population of the country is engaged in agriculture and a majority of them are still dependent on monsoonal rain for irrigation. In order to combat this challenge, there is a need to

adopt a strategy that may provide a comprehensive solution to farming communities for safeguarding agricultural productivity. Crop Insurance is one such area which is gaining momentum in the contemporary scenario and is considered as the best option to transfer the cost of potential losses due to disaster or emergency situations. By adopting crop insurance, farmers can also leverage technology and data analysis to monitor, manage, and reduce the impact of those risks.

The Government has taken several initiatives for the overall sustainable development of farmers and cultivators to protect livelihoods and enhance their agricultural productivity. These may enhance credit flow to farmers and expand the area of crop insurance and irrigation coverage, especially in the era of climate change.

Crop insurance is provided to farmers under the **Pradhan Mantri Fasal Bima Yojana (PMFBY).** The scheme covers all farmers, including tenant farmers and sharecroppers, who are growing notified crops in the notified areas. In 2020-21, the scheme has been allocated Rs 15,695 crore, a 15% increase over the 2019-20 revised estimates. The Ministry's Agriculture Insurance Company of India (AIC) shall participate in the government-sponsored agricultural / crop insurance schemes jointly with some private insurance companies. There would be one insurance company for a cluster of districts (approximately 20 districts). The policies are offered by a commercial firm, ICICI Lombard General Insurance, and are marketed to growers through micro-finance banks which are linked to an apex micro - finance entity known as BASIX (Bhartiya Samruddhi Finance Ltd.). Under this scheme, the premium would be 2% of the sum insured (SI) for Kharif season crops and 1.5% for Rabi season crops. The rates are also applicable for oilseeds. Commercial crops like cotton and other horticultural crops will attract premium rates of 5% of the sum assured.

Federation of the Indian Chambers of Commerce and Industry (FICCI,) in its Knowledge paper, recognizes major common issues of the present Agricultural Insurance framework. They are:

1. Coverage of non-loanee farmers – majority of non-loanee farmers are small and marginal holders who are not effectively reached.
2. Lack of awareness – amongst farmers.
3. Low coverage in rainfed and remote areas - the premium rates had shot up as high as 25% in some backward areas of Telangana which lead to exploitation of farmers. This situation arose due to lack of competition among the insurance companies.
4. Delayed / non-payment of claims – timely disbursement of claims.

1.4.5 Agricultural Logistics

Logistics is an area of research that has been getting increasing attention from academicians and practitioners over the last two decades since it may lead to reduced operational costs, improved

delivery performance and increased customer satisfaction levels, thereby, making an organization more competitive in terms of cost, quality, delivery and flexibility.

In the agricultural sector, shipping logistics present challenges unique to agricultural production that require heavy-duty equipment and efficient transportation. Special needs such as agricultural machinery transportation requires powerful shipping equipment operated by skilled transportation professionals. Local transportation regulations and international transport authorities can also complicate time and budget concerns by derailing your shipment schedules and adding permits and fees to our expenses.

Aggregation is the first stage requirement in agri-logistics. This is required to build viable handling loads for forwarding transport connectivity to link with the consumers. For a farmer, the consumer of the raw produce can be a processing unit or the end-consumer. The end-consumer is accessed through the distribution and retailer channel. Retailers need localised access to the produce, usually through local mandis or wholesale terminal markets at urban centres. Transport and storage systems are used to reach the prepared produce to the consumers.

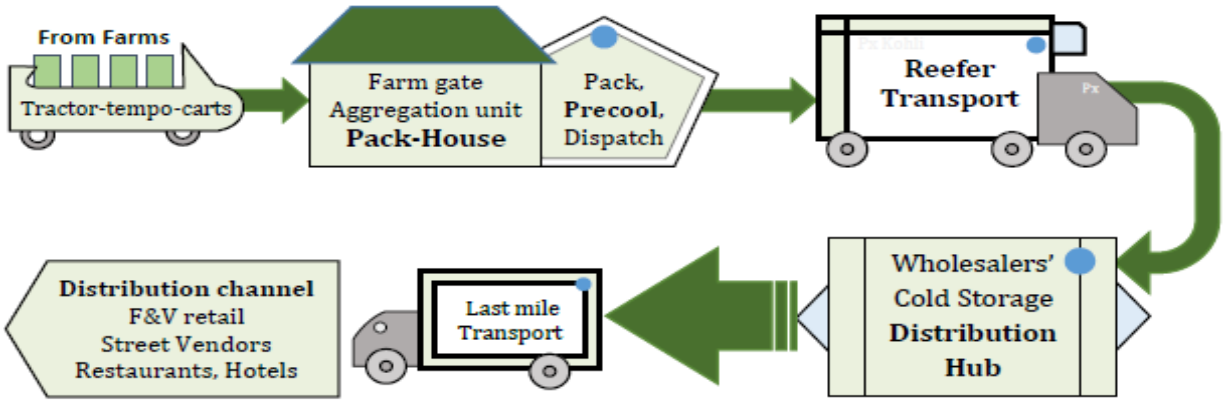
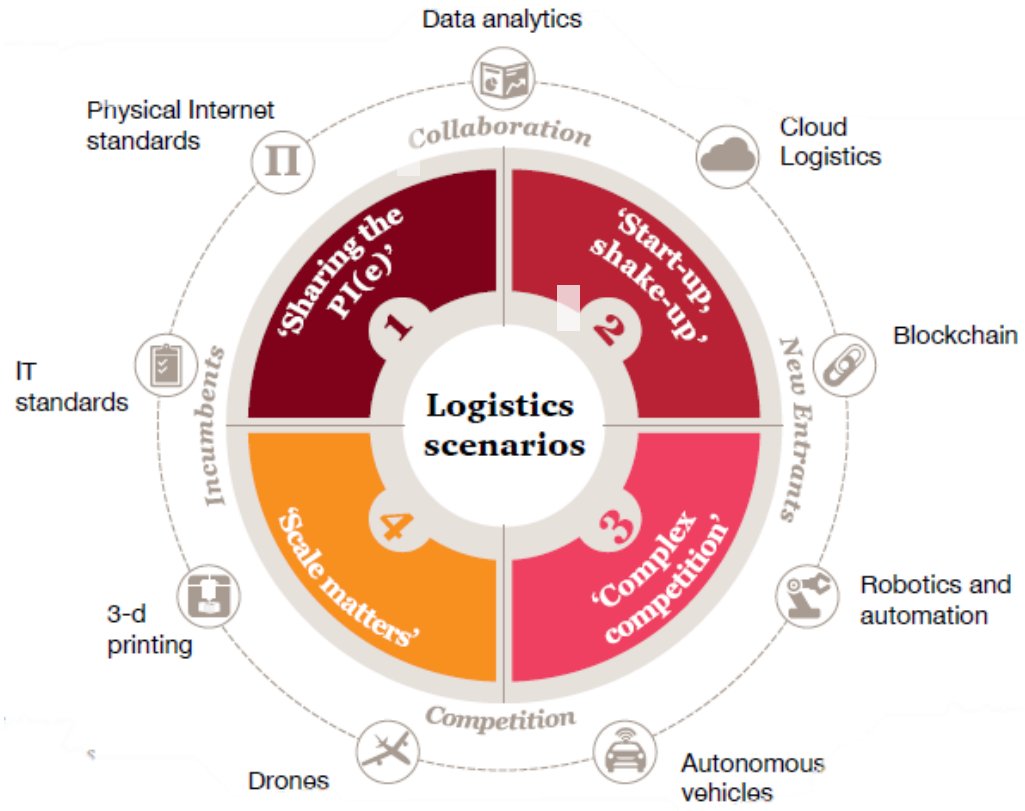


Fig 10: Desired supply chain for farm products

Farm produce needs more efficient and effective post-production logistics to establish physical connectivity with the market. The market for a farmer is normally a first stage buyer – the aggregator, the processor, the trader – depending on the type of product being handled. In some cases, farmers can also store inventory for a delayed sale with hardy crop types such as food grains.



A) Indian Scenario

The Logistics sector in India has today become an area of priority. A key reason for the same stems from the reason that years of high growth in the Indian economy have resulted in a significant rise in the volume of freight traffic moved. The large volume of traffic has provided for growth opportunities in all facets of logistics including transportation, warehousing, freight forwarding, express cargo delivery, container services, shipping services etc. The growth trajectory also suggests that increased demand is being placed on the sector to provide the necessary solutions for supporting future growth. Strength of the logistic sector is likely to be one of the key determinants of the pace of the future growth of the economy.

The market size of the logistics sector in India is estimated to be between USD 90-125 billion. Given that the Indian economy has grown to over USD 1.73 trillion, these estimates may already be well below the actual size of the industry. Sources estimate that the industry employs over 45 million people and is going at the rate of 15% with sub-sector growing at even 30-40% per annum. Due to these reasons, the Indian logistics sector is viewed as one of the most attractive in the world. Recent policies by the government attract a strong growth area for logistics in the future.

B) Logistics service in developing countries

The development of smallholder agriculture in developing countries is very sensitive to transport strategies. Many isolated farmers have little opportunity to escape poverty, as their potential marketing activities are hampered by inadequate or poor transport facilities. The rural transport planning must address the needs of people as much as possible at the household level. Such a well-planned transport system enables smallholders to move from subsistence to small-scale commercial farming. This helps them to harvest and market crops more efficiently, reduces drudgery and, by facilitating communication, helps in stimulating social integration and improving the quality of life. Availability of road infrastructure (that includes feeder roads, tracks, and paths), storage facilities and transport services increase mobility and encourage production.

Terminal Market Centre essentially comprises warehousing, food processing, logistics services and other relevant value-added services.

Warehousing, Food Processing and other Value-Added Services

The warehousing sector within the broader logistics industry for the agricultural sector, is expecting huge investment in the future to cater to the large demand for warehousing and related services. As per an industry estimate, warehousing is expected to reach approximately USD 55 billion by FY11, from USD 20 billion in FY08. Moreover, The Government of India (GoI) has shown a strong focus on this sector in its 11 five-year plan such as:

a. An in-principle decision to construct approximately 15 million tonnes of strategic storage in various phases (In the first phase, approximately 5 million tonnes of construction is underway),
b. Food Corporation of India (FCI) plans to spend approximately Rs.166 crores for construction of godowns across the state; and
c. Priority sector lending by banks now also includes construction and running of cold storage, warehouses, etc.

Increase in EXIM trade and organized retail business, along with several favourable policies such as the introduction of free trade and warehousing zones, has meant greater demand for such services in the future. Several organizations are investing huge sums to build such capacities but they require quality consulting services for effective and efficient execution.

Food Processing

India has arable land of approximately 184 million hectares and produces 90 million tons of milk (highest in the world), approximately 150 million tons of fruits and vegetables (second largest), 485 million livestock (largest), 204 million tons of food grain (third largest), 6.3 million tons of fish

(third largest), approximately 489 million poultry and 45,200 million eggs annually. India's agricultural production base is enormous; however, the processing level is very low i.e. around 2 percent in fruits and vegetables, 26 percent for marine, 6 percent for poultry and 20 percent for buffalo meat. The share of India's export of processed food in global trade is only 1.5 percent. Hence, there is an immense potential for investment in this sector.

Food processing industry can be broadly divided into two groups: a. Basic and traditional food industries comprising rice milling, wheat milling, dal milling, edible oil, sugar, etc.
b. Processed food industries such as biscuits, bakery products, confectionery, vanaspati, meat and fish processing, canning and processing fruits and vegetables, breakfast foods, dairy products including baby foods, starch, malt and maize-based products.

Processed foods industry is witnessing exponential growth in the country. The small scale and unorganized sector which constitutes about 70% of the food processing sector and where the bulk of employment lies, suffers from low efficiency due to the lack of access to credit, managerial knowledge, efficient tools/technology, marketing network etc. Intense competition from large scale players has also affected it.

The food processing industry is witnessing a shift from 'supply' to 'demand' driven sector by reducing costs, enhancing quality and safety systems, building, markets, creating and promoting efficient supply chain, developing/inducting world-class technology and management and promoting synergy between big and small companies (a large number) for export and employment. It would require single window approach to service all stake-holders engaged in the handing of agri-produce processing, marketing (including export), infrastructure development, food safety regulation etc.

"Agri-logistics infrastructure is a necessary trade tool for agricultural produce, with more development momentum indicated. The post-harvest supply chain commences at the farm gate in the form of aggregation centres and transport, which enables the farmers to access more distant markets and partake in transactions higher up the value system."

1.4.6 Agricultural Marketing and Price Policies

Marketing of agricultural produce is an important economic activity as it needs to balance the affordability and availability of food for consumers with sustained improved incomes to farmers. Although the marketed surplus of the Indian farmer is as high as 90% or more in most commodities, the returns do not seem to be remunerative. Food inflation has been a major cause of anxiety in policy circles. The influence of global commodity cycles on domestic prices of agricultural produce adds to the complexity of the issues. This necessitates a critical review of agricultural marketing in multiple dimensions. (FICCI, 2017)

In addition, the agricultural production basket has also changed with an enormous contribution from high-value agriculture that includes horticulture, dairy, fisheries and animal products. Horticultural production in the country has outgrown agricultural production. Production in dairy, poultry and fisheries truly drives primary sector production. Fish, poultry and other animal products are often sold in different markets and they may have an entirely differentiated marketing system. Their increasing production emphasizes the need for special infrastructure to address their specific product characteristics like perishability.

1) Policy Interventions in Agricultural Markets

The present policy framework for intervention in agricultural markets and prices can be broadly grouped under three categories. Those are:

a. Regulatory measures;
b. Agricultural price policy; and
c. Market infrastructure and institutions.

a. Regulatory Measures

The regulatory framework for agricultural markets consists of two sets of measures.

1. Measures for the development and regulation of wholesale markets;
2. A series of legal instruments for regulating the functioning of markets and trade activities.

The Integrated Scheme on Agriculture Marketing includes sub-schemes such as: (i) agriculture marketing infrastructure, to create storage capacity and farmer consumer markets, (ii) market research and information network, (iii) strengthening of Agmark grading facilities, (iv) agro-business development to provide market linkages to farmers, and (v) e-NAM (National Agriculture Market), which is a national electronic market platform where farmers can sell their produce.

In 2020-21, Rs. 490 crores have been allocated to the scheme. This is an increase of 48% over the revised estimate for 2019-20. However, the allocation in 2019-20 has been revised down by 45% i.e., from Rs. 600 crores to Rs. 331 crores. As of January 2019, 585 mandis across 18 states were integrated with e-NAM (Standing Committee on Agriculture, 2019).

APMCs: Agriculture marketing in most of the states is regulated by the Agriculture Produce Marketing Committees (APMCs) established by state governments. The Standing Committee on Agriculture (2018) observed that small and marginal farmers face various issues in selling their produce in APMC markets such as inadequate marketable surplus, long-distance to nearest APMC markets, and lack of transportation facilities. Many farmers lack access to government procurement facilities including APMC markets (Standing Committee on Agriculture, 2019).

The Committee observed that provisions of the APMC acts are not implemented in their true sense due to reasons such as: (i) limited number of traders in APMC markets thereby reducing competition, (ii) cartelisation of traders, and (iii) undue deductions in the form of commission charges and market fee (Standing Committee on Agriculture, 2019). It observed that APMC acts need to be reformed urgently. The acts are highly restrictive in promotion of multiple channels of marketing and competition in the system.

The total number of regulated APMC markets in **Karnataka, Maharashtra** and **West Bengal** are **513, 902** and **475** respectively (Standing Committee on Agriculture, 2019).

15th Finance Commission's recommendations on agricultural reforms

The 15th Finance Commission, in its report for 2020-21, proposed certain criteria for providing performance-linked incentives to states. The Commission included the implementation of agricultural reforms as one of the criterions. States would be eligible for certain financial incentives if they enacted and implemented the features of: (i) The Model Agricultural Produce and Livestock Marketing (Promotion and Facilitation) Act, 2017, (ii) The Model Agricultural Produce and Livestock Contract Farming and Services (Promotion and Facilitation) Act, 2018, and (iii) The Model Agricultural Land leasing Act, 2016. [45]

The Model Agricultural Produce and Livestock Marketing (Promotion and Facilitation) Act, 2017: The Act aims to create a single agricultural market for agricultural produce and livestock. It seeks to remove intermediaries by integrating farmers, exporters, consumers and others in a single supply chain and by promoting a direct interface between producers and consumers. The Act aims to encourage e-trading to promote both transparency and integration of markets within each State/UT. Inter-state trading license, grading and standardization and quality certification are provided with an aim to promote a national market for agricultural produce and livestock.

The Model Agricultural Produce and Livestock Contract Farming and Services (Promotion and Facilitation) Act, 2018: The Act aims to facilitate contract farming to improve production and marketing of agricultural produce and livestock. It constitutes "Registering and Agreement Recording Committee" at District, Block or Taluka level. It seeks to support contracting farmers by providing insurance cover and purchasing agricultural produce as per the contract. The Act aims to expand contract farming to small

and marginal farmers through the promotion of Farmer Producer Organisation or Companies.

The Model Agricultural Land Leasing Act, 2016: The Act aims to improve access to land by landless and marginal farmers by permitting and facilitating the leasing of agricultural land. It legalises land leasing in all areas. The Act provides for the automatic resumption of the land after the lease period and removes the clause of adverse possession of the land. It promotes access to institutional loans, insurance and relief to tenants and sharecroppers.

(Source: https://www.prsindia.org/parliamenttrack/budgets/demand-grants-2020-21-analysis-agriculture-and-farmers%E2%80%99-welfare#_edn21)

b. Agricultural Price Policy

The emergence of agricultural price policy in India was in the context of food scarcity and price fluctuations caused by drought, floods and international prices for exports and imports. This policy in general was directed towards ensuring reasonable (affordable to consumers') food prices for consumers' by providing food grains through Public Distribution System (PDS) and inducing adoption of the new technology for increasing yield by providing a price support mechanism through Minimum Support Price (MSP) system

The agricultural price policy is aimed at intervening in agricultural produce markets to influence the level of fluctuations in prices and the price-spread from farm gate to the retail level (GOI, 2010).

The procurement of food grains at MSP is carried out by Food Corporation of India (FCI). FCI operates in only selected states and selected districts which had surplus of food grains initially. In the current situation, several other states that have run deficits have begun to run surpluses. Farmers in these states are deprived of the benefit of MSP. Market prices in some mandies fall below MSP. Thus, there is a need to extend effective procurement operations in other states to ensure MSP to farmers.

C. Marketing Institutional Infrastructure

1. Public Sector Marketing Organizations

a. Food Corporation of India (FCI)
b. Cotton Corporation of India (CCI)
c. Jute Corporation of India (JCI)

d. State Trading Corporation (STC)
e. Commodity Boards – Tea, Coffee, Cardamom, Rubber, Tobacco, Spices, Areca nut, Horticultural Crops, Dairy Products (NDDB)
f. Directorate of Marketing and Inspection (DMI)
g. Agricultural Produce Market Committees (APMCs)
h. State Agricultural Marketing Boards (SAMBs)
i. Council of State Agricultural Marketing Boards (COSAMB)
j. Commission for Agricultural Costs and Prices (CACP)
k. Commodities Export Councils
l. Agricultural and Processed Products Export Development Authority (APEDA)

2. Cooperative Marketing Institutions

a. Primary, Central and State level Marketing Societies, Unions, and Federations.
b. Special Commodities Marketing Societies (Sugarcane, Cotton, Oilseeds, Milk etc.)
c. Processing Societies - Cotton Processing and Ginning Societies - Oilseeds Processing Societies - Fruits and Vegetables Preservation Societies - Sugarcane Crushing Societies - Milk Processing and Chilling Societies; etc.
d. National Agricultural Cooperative Marketing Federation (NAFED)
e. National Cooperative Development Corporation (NCDC)
f. Tribal Cooperative Marketing Federation (TRIFED)

3. Private sector initiatives in agricultural marketing

a. E-Choupal
b. TATA Kisan Kendra
c. Hariyali Kisaan Baazaar (HKB)
d. Contract Farming
e. Agri-business Franchising
f. Cold chains

4. Agricultural marketing boards/Directorates

a. Andhra Pradesh Agricultural Marketing
b. Andhra Pradesh- AGMARKNET
c. Commissionerate of Agricultural Marketing and Agri Business, Tamil Nadu
d. Gujarat State Agricultural Marketing Board
e. Haryana State Agricultural Marketing Board
f. Himachal Pradesh State Agricultural Marketing Board
g. Jharkhand State Agricultural Marketing Board
h. Krishi Maratavahini (Karnataka State Daily Market Price Information)

i. Madhya Pradesh State Agricultural Marketing Board
j. Maharashtra State Agricultural Marketing Board
k. Meghalaya State Agricultural Marketing Board
l. Odisha State Agricultural Marketing Board
m. Punjab State Marketing Board
n. Rajasthan State Marketing Board
o. Uttar Pradesh State Agricultural Marketing Board
p. West Bengal State Agricultural Marketing Board

2) National Institute of Agricultural Marketing (NIAM)

NIAM has been imparting training to senior and middle-level executives of agricultural and horticultural departments, agro industries, corporations, commodity and apex level cooperatives, commodity boards, export houses recognized by Agricultural and Processed Food Products Export Development Authority (APEDA), commercial banks and non-governmental organizations. Besides these clients, the NIAM also imparts training to farmers on marketing management .

3) Regulated Markets

In India, regulated markets play a major role in organized marketing of agricultural produce. The objectives of these physical markets are to ensure that farmers get reasonable profits by managing the supply and demand forces, regulation of market practices, transparency in transactions and facilitating trading in an orderly manner. To achieve an efficient system of buying and selling of agricultural commodities, most state governments and union territories have enacted Agricultural Produce Marketing Committee (APMC) Act for regulation of agricultural produce markets. There are about 2,477 principal regulated markets based on geography (the APMCs) and 4,843 sub-market yards regulated by the respective APMCs in India.

(Source: Final Report of Committee of State Ministers, In-charge of Agriculture Marketing to Promote Reforms, Agricultural Marketing Infrastructural Facilities in India, M.S.Jairath, Director NIAM)

Status of Infrastructure in Regulated Markets

There is a considerable gap in the essential facilities available to producers in market fleets. Auction platforms are needed for the settlement of the price of the produce between buyers and sellers. Both covered and open auction platforms exist only in 67% of the regulated markets. Drying yards are also an essential feature of regulated markets because some commodities, when brought for sale, contain higher moisture than the desired level and require drying. Such drying space is available only in 25% of the markets.

Shops, godowns and platforms in front of shops exist in 63% of the markets. Cold storage units are needed in the markets where perishable commodities are brought for sale. The cold storage units exist only in 9% of the markets and grading facilities exist in less than 33% of the markets. The basic facilities such as internal roads, boundary walls, electricity, loading and unloading facilities and weighing equipment are available in more than 80% of the markets. (Yes bank, 2015)

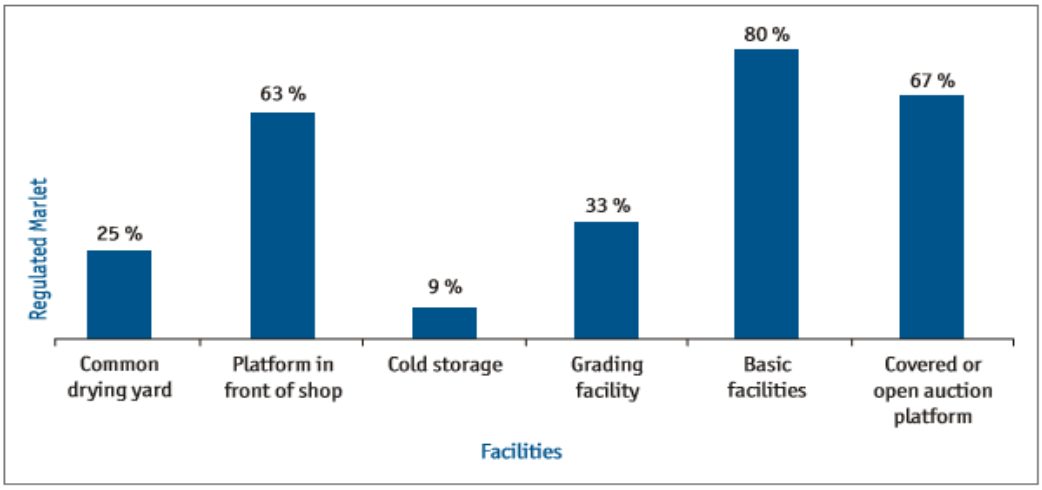


Fig 11: Status of Facilities in Regulated Market

Source: National Council of Applied Economic Research (NCAER)

4) Market Information Services

Market information systems (otherwise known as market intelligence systems or market information services) are information systems used in gathering, analyzing and disseminating information about prices and other information relevant to farmers, animal rearers, traders, processors and others involved in handling agricultural products. Market information systems play an important role in agro-industrialization and food supply chains. With the advancement of Information and Communication Technologies for development (ICTs) in developing countries, opportunities for income- generation offered by market information systems have been sought by international development organisations, non-governmental organisations (NGOs) and businesses alike.

For many years, FAO and other organizations that were involved in the development of agricultural marketing have advocated the establishment of Market Information Services (MIS) as a means of increasing the efficiency of marketing systems and promoting improved price formation. It has been argued that improved information enables farmers to plan their production more in line with market demand, schedule their harvests at the most profitable times, decide which markets they should send their produce to, and negotiate with traders on a more equal footing. Other benefits have been seen for traders. Improved information enables traders to move the produce profitably from a surplus to a deficit market and to make decisions about the viability of carrying out storage, where technically possible. With

few dissenting voices, these arguments are generally accepted and a large number of countries in the developing world and, increasingly, Eastern Europe and the former Soviet Union have established or are establishing Market Information Services.

i. AGMARKNET

Agricultural Marketing Information Network (AGMARKNET) was launched in March 2000 by the Union Ministry of Agriculture. The Directorate of Marketing and Inspection (DMI), under the Ministry, links around 7,000 agricultural wholesale markets in India with the State Agricultural Marketing Boards and Directorates for effective information exchange. This e-governance portal, AGMARKNET, implemented by National Informatics Centre (NIC), facilitates generation and transmission of prices, commodity arrival information from agricultural produce markets, and web-based dissemination to producers, consumers, traders, and policymakers transparently and quickly. The AGMARKNET website (http://www.agmarknet.nic.in) is a G2C e-governance portal that caters to the needs of various stakeholders such as farmers, industry, policymakers and academic institutions by providing agricultural marketing-related information from a single window. The portal has helped to reach farmers who do not have sufficient resources to get adequate market information. It facilitates the online flow of information on day-to-day arrivals and commodity prices to agriculture markets across the country. The data transmitted from all the markets are available on the AGMARKNET portal in 8 regional languages and English. It displays Commodity-wise, Variety-wise daily prices and arrivals information from all wholesale markets. Various types of reports can be viewed including trend reports for prices and arrivals for important commodities. Currently, about 1,800 markets are connected and work is in progress for another 700 markets. The AGMARKNET portal has a database of about 300 commodities and 2,000 varieties now.

Directorate of Marketing and Inspection (DMI) has a liaison with the State Agricultural Marketing Boards and Directorates for Agricultural Marketing Development in the country. Agricultural Produce Market Committee (APMC) displays the prices prevailing in the market on the notice boards and broadcasts this information through All India Radio and other channels. This information is also supplied to the State and Central Government from important markets. The statistics of arrivals, sales, prices etc. are generally maintained by APMCs.

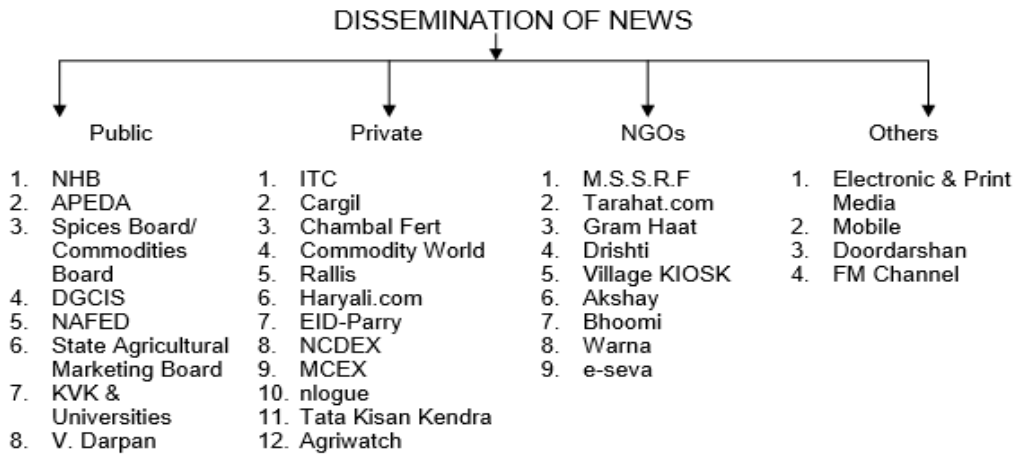
Future development involves linking all the agricultural wholesale markets in the country and establishing strategic alliances with government and non-government organizations to disseminate information to the farmers operating in these markets. The database developed under AGMARKNET would also be linked to other agricultural databases, for instance, on area, production, the yield of crops, land use, cost of cultivation, agriculture exports and imports, and so on, to evolve a data warehouse. This would provide a sound base for planning demand-driven

agriculture production. AGMARKNET is also expected to play a crucial role in enabling e-commerce in agricultural marketing.

Besides AGMARKNET, the following are some of the other information networks relevant for agricultural marketing:

- **AGRISNET:** An infrastructure network up to block-level agricultural offices facilitating agricultural extension services and agribusiness activities to usher in rural prosperity.
- **ARISNET:** Agricultural Research Information System Network
- **SeedNET:** Seed Informatics Network
- **CoopNet:** To network 93,000 Agricultural Primary Credit Societies (PACS) and Agricultural Cooperative Marketing Societies to usher in ICT enabled services and rural transformation
- **HORTNET:** Horticultural Informatics Network
- **FERTNET:** Fertilisers (Chemical, Bio and Organic Manure)
- Informatics Network facilitating "Integrating Nutrient Management" at the farm level
- **VISTARNET:** Agricultural Extension Information System Network
- **PPIN:** Plant Protection Informatics Network
- **APHNET:** Animal production and Health Informatics Network networking about 42000 Animal Primary Health Centres
- **FISHNET:** Fisheries Informatics Network
- **LISNET:** Land Information System network linking all institutions involved in land and water management for agricultural productivity and production systems, which has now evolved as the "Agricultural Resources Information System" project during the Tenth Plan being implemented through NIC.
- **AFPINET:** Agricultural and Food Processing Industries Informatics Network

Several other public agencies/NGOs/non-profit-agencies and private agencies are also disseminating information. A diagrammatic presentation of these agencies is placed below:



(Source: MANAGE, Training Programme on Agricultural Marketing – The New Paradigms)

ii. Domestic and Export Market Intelligence Cell (DEMIC)

Domestic and Export Market Intelligence Cell (DEMIC) was established under the Directorate of Centre for Agricultural and Rural Development Studies (CARDS), Tamil Nadu Agricultural University, with the main purpose of developing and disseminating commodity price forecasts for the benefits of farmers to get remunerative prices besides the use of such market intelligence for taking better farm management and marketing decisions.

Its objective is to disseminate timely, comprehensive, current and future price information on agricultural commodities for better decision-making by the farming community, traders, firms, researchers and policymakers. Currently, the organization makes a forecast for 24 major agricultural and horticultural crops of Tamil Nadu. Since its inception, DEMIC has generated more than 400 price forecasts with more than 90 per cent validity often. The validity of the DEMIC price forecasts is more than 90 per cent.

The major activities of the cell are to collect real-time data on arrivals, prices and transaction of important agricultural commodities from regulated markets in Tamil Nadu, conducting market surveys, compiling commodity reports and assessing export opportunities of agricultural commodities. Using this data, the cell forecasts the prices of different commodities on a regular basis and the same is transmitted to the farmers through radio, television, newspapers and web developed for this purpose. (www.tnagmark.tn.nic.in). Now, all the stakeholders can access the real-time price of agricultural commodities variety wise and grade wise from all the major market centers of India in English and Tamil covering more than 500 markets.

Apart from the price information, other useful information that are available on the website are export procedures, export standards for various agricultural commodities, infrastructure facilities (ports, air cargo, railways, rural godowns, etc.), agri-export zones, food processing, postharvest technology and other useful links to various related websites. An e-mail newsletter focusing on technical and market-related information at domestic and international levels has been developed by DEMIC in the banner of "DEMIC Info Series" to sensitize the stakeholders and scientists.

The price forecast is available for free for both farmers and commodity value chain participants ranging from production to trade, officials, scientist, policymakers etc. The forecasts generated are distributed through Agro Marketing Intelligence (AMI) and Business Promotion Centre (BPC) functioning at Tiruchirappalli, mass media, e-mail and SMS.

5) The various forms of alternate marketing

(a) Direct marketing
(b) Marketing through farmers' interest group

(c) Co-operative Marketing
(d) Forward and future market
(e) e-commerce
(f) Setting up of mega markets

Direct Marketing – Farmers' Markets

These networks are often used in the selling of agricultural goods, such as fruits, vegetables and flowers, which are extremely perishable. In this channel, the produce moves quickly from farmers to consumers due to a lack of middlemen. If farmers directly sell their produce to the consumers, it not only saves losses but also increases farmers' share in the price paid by the consumer. Farmers' Markets were introduced with a view to eliminate the middlemen and arrange facilities for the farmers to sell their produce directly to the consumers at reasonable rates fixed every day. On account of the scheme, both the farmers and the consumers are benefited. Direct marketing by farmers is being encouraged as an innovative channel. Some examples of these channels are as follows:

Apni Mandies in Punjab and Haryana: Punjab's and Haryana's Apni Mandis (Our Markets), established in the mid-1990s, and were the first ones directly linking vegetable producers and consumers.

Rythu Bazaars in Andhra Pradesh: Government of Andhra Pradesh initiated the Rythu Bazaars on January 26, 1999. They are located on government lands identified by the district collectors. The locations are decided in such a way as are convenient to both farmers and consumers. The criteria for opening new Rythu Bazaars are the availability of at least one acre of land in a strategic location and identification of 250 vegetable growing farmers including 10 groups.

Uzhavar Santhai in Tamil Nadu: Farmers' Markets are under the administrative control of the state's sixteen Agricultural Marketing Committees, which, in turn, are a part of the Department of Agricultural Marketing.

Hadaspar Vegetable Market in Pune: It is a model market for direct marketing of vegetables in Pune city. This sub-market yard, situated 9 km away from Pune city, belongs to Pune Municipal Corporation and the fee for using the space in the market is collected by the Municipal Corporation from the farmers. This is one of the ideal markets in the country for marketing vegetables.

Farmers' Organizations in Marketing

Farmers' organizations need to be promoted for undertaking marketing activities on behalf of the individual members of the group. The promotion of such organizations should be assisted or

helped to create basic infrastructure for their effective functioning. This could even include assistance for professional management.

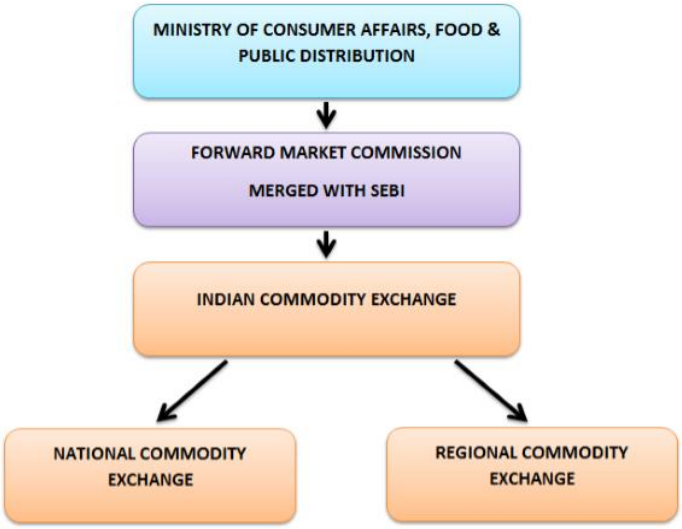
Maha Grapes: Maha Grapes came into existence in 1991. It owes its origins to the Maharashtra State Agricultural Marketing Board (MSAMB). Maha Mangoes and Maha Banana were also set up subsequently for mangoes and bananas respectively. The objective of the MSAMB was to promote the marketing of fruits by assisting farmers technically and financially and linking them to new domestic and international markets.

Amalsad and Gadat Co-operatives in South Gujarat: The Amalsad co-operative was registered in 1941 with a membership of more than 8000, out of which about 50% are active members. Out of the total business of about Rs. 8.5 crore for different fruits, chickoo dominates the scene with as much revenue as Rs. 7 crore from the crop. Similarly, the Gadat co-operative, registered in 1944, has 3152 members of which about 1800 are active members. The co-operative covers 800 hectares across 7 villages. Like Amalsad, it has chickoo as its main business through banana and mango are also procured.

HOPCOMS, Bangalore: The present HOPCOMS was established as 'The Bangalore Grape Growers' Cooperative Marketing and Processing Society Ltd.' (BGGCOMS) on 10th September 1959 with the main objective of encouraging grapevine cultivation by providing the required inputs, technical know-how, marketing facilities etc. From 1965 onwards, the firm began managing fruit and vegetables other than grapes. In 1983, the name of the society was changed to 'The Bangalore Horticultural Producers' Cooperative Marketing and Processing Society Ltd. (BHOPCOMS) and subsequently, in 1987, it became HOPCOMS.

6) Commodity Exchanges in India

A commodity market is a market that involves buying and selling hard and soft commodities. Commodity market exists more than a century. After Government approval for the operation of multiple exchanges, the exchange environment has become a highly competitive market for product development and business strategies. Private sector initiatives, seeking to tap the potential value of agricultural trading, have become key promoters in this process. There are 22 commodity futures exchanges out of which 6 are national and 16 are regional commodity exchange.



(Source: Hariharan and Karunakara, 2018)

7) Private initiatives in Agricultural Marketing

a) e-choupal

E-choupal is the brainchild of a large agricultural processing company in India, the Indian Tobacco Company (ITC) and this initiative was conceived to tackle the challenges posed by certain features of Indian agriculture, such as fragmented farms, a weak infrastructure, and the involvement of numerous intermediaries. The e-choupal system was introduced by ITC in June 2000 and this initiative links the rural farmers with the company directly for the procurement of agriculture and aquaculture products, such as soybeans, coffee, and prawns. Traditionally, these commodities were procured by such companies as ITC from mandis (major agricultural marketing centers in rural areas of India), and a long chain of intermediaries was involved in buying the produce from farmers and moving it to the mandis. Through e-choupals, these farmers can directly negotiate the sale of their produce with ITC. The PCs and internet access at these centers enable the farmers to obtain information on mandi prices and good farming practices, and to place orders for agricultural inputs, such as seeds and fertilizers. This access to information helps farmers in improving the quality of produce and obtaining better prices.

Information that can be accessed from an e-choupal includes crop prices, weather, scientific farming practices, farmer peer groups, and soil-testing services. This online information is made available in Hindi. For the farmer, the selling process works as follows: The farmer carries a sample of his produce to a local kiosk and receives a spot quote from the sanchalak. If the farmer accepts the quote, he can then transport the produce directly to an ITC collection center and get the payment within two hours.

ITC coordinates its activities with institutions such as the national meteorological department and several universities to build useful internet content, and also with companies supplying agricultural inputs (fertilizers and seeds) to enable e-commerce.

Such companies take orders and market their products on the e-choupal Website. ITC has also collaborated with an insurance company on a pilot basis, to provide insurance services specially designed for the landless, marginal farmers in more than 100 villages in the state of Madhya Pradesh.

Since the introduction of e-Choupal services, farmers have seen a rise in their income levels because of a rise in yields, improvement in the quality of output and a fall in transaction costs. Even smallholders have benefited from this initiative. Farmers can get real-time information despite their physical distance from the *mandis*. The system saves procurement costs for ITC Limited. The farmers do not pay for the information and knowledge they receive from e-Choupals. The principle is to inform, empower and compete. E-market positioning for spot trades and future trading support services. There are 6,100 e-Choupals in operation in 40,000 villages in 10 states, affecting around 4 million farmers.

b) TATA KISAN KENDRA

This portal aims to reduce knowledge asymmetry in agricultural markets and is also of considerable value to stakeholders. A venture of the renowned TATA Business house of India, TATA Kisan Kendra aims to improve the plight of the farmers in India. Some of its services are:

1. Tata Kisan Kendra provides different services like agro-input service, farm equipment leasing, agronomy services, bulk blending, training and information and a few other allied services.
2. It also provides the seeds, pesticides and fertilizers at affordable prices.
3. It has also established crop clinics to provide information regarding which crop to grow, when to grow and the specific amount of nutrients required.

c) HARIYALI KISAN BAZAR

DCM Shriram Consolidated Ltd. (DSCL), a leading diversified Indian corporate house with over 35 years of experience in the agri-input markets, has introduced an innovative business venture, Hariyali Kisaan Bazaar, which is an example of a commercially sustainable business model becoming the vehicle to bring about agricultural transformation and inclusive growth. It is the chain of agri-input retail stores and promoted by DCM Shriram Consolidated Ltd (DSCL). Its main services are:

- Last-mile delivery of relevant Agri-technology.
- Agri-Inputs: Provide a range of inputs such as seeds, fertilizers, nutrients, pesticides.

- Financial Services: Access to credit, insurance and banking services.
- Market Linkages: Access to new markets/ buyers for farmers produce.
- Warehousing and Commodity exchanges: Providing farmers with quality warehousing facilities and access to commodity exchanges.
- Household Goods: Provides a range of good quality household goods for the farmer's family.

Hariyali's alignments with objectives of inclusive growth have been:

- Investment in Rural Infrastructure
- Improving farmer's productivity and profitability
- Aggregation of Farm Produce
- Access to information and Use of IT

d) CONTRACT FARMING

Contract Farming can be considered as a viable method to enhance agricultural productivity along with the assurance to provide the pre-determined prices to the farmers. Traditionally contract farming was confined to the production of sugarcane, tea, coffee, cotton, milk, etc. Contract farming has been gaining ground as a solution for assured supplies of uniform quality for processors and traders.

Corporatization of contract farming has the potential to boost farm incomes and to increase the global trade of Indian agri-produce. Farmers, particularly small farmers, are also benefiting from the diversification process, technological improvements and a secure market. The pace of contract farming is on the rise after the amendment to the APMC Act by the state governments. Contract farming is one of the options to create a friendly environment within the private sector for agriculture development and extensions of services which deals with the system for the production and supply of agricultural and horticultural produce under forwarding contracts between producers/ suppliers and buyers.

Backward linkage and forward linkage are achieved by supermarket chains including Wall Mart, Reliance, Spencer etc. Join contract farming, provide consultancy services, quality inputs and a secured demand for goods, as well as price assurances for farmers and provide customers with healthy food, foster sustainable agricultural practices (GAP) at the pre-harvest stage (insecticide and pesticide residue) and save farmers from being abused by unscrupulous middlemen. Paty and Karim, (n.d)

Table 5: Status of contract farming in different states

State	Crop	Company/ Corporate
Karnataka	Ashwagandha Dhavana; Marigold and Caprica chili; Coleus; Gherkins Medicinal Plants	Himalaya Health Care, Mysore S.N.C. Oil Company; AVT Natural Products; Natural Remedies Private Ltd.; 20 Pvt. Companies'; Sami Labs Limited, Bangalore
Maharashtra	Soybean; Several fruits, vegetables, cereals, spices and pulses; Potato; Sugarcane, Orange	Tinna Oils and Chemicals; Ion Exchange Enviro Farms Ltd. (IEEFL); M/s Mahindra Sulabh; Cooperative Societies
Madhya Pradesh	Whet, Maize, Several fruits, vegetables, cereals, spices, pulses, Soyabean, Garlic and White onion	Cargil India; Ion Exchange; Enviro Farms; ITC-IBD; Mahindra Sulabh, Garlico Industries Limited.
Punjab	Tomato and Chilly; Barley, Basmati, Maize; Basmati, Groundnut, Potato and Tomato; Green vegetables and exotic vegetables	Nijjer Agro; United Breweries, Satnam overseas; Sukhjit Starch, Mahindra Shubhlabh Satnam Overseas, DD Intl. Amira Foods PepsiCo, Punjab Agro Foods Park Limited.
Tamil Nadu	Cotton, Maize, Paddy, Cotton, Marundu Koorkan (Medicinal Plant) (Coleus Forskholii), Maize, Gherkins	Super Spinning Mills; Bhuvi Care Pvt. Ltd.; Bhuvi Care Pvt. Ltd; Appachi Cotton Company; M/s Mahindra Sulabh
Chhattisgarh	Safed Musli; Tomato	Larson and Turbo; BEC Co.
Uttaranchal	Guar Gum	M/s Mahindra Sulabh
Haryana	Turmeric, Mentha, Sunflower, White Musli	HAFED
Andhra Pradesh	White Viagra, Fruits, Vegetables and flowers, Gherkins, Cocoa, Oil palm	Nandan Farms,.Aduri Natural products, ACE Agrotech, Mahendra ,Cadbury, Godrej, Palm Tech, Simapuri Industry
Gujarat	Processing of Medicinal Plants and Alovera	Reliance Group
Orissa	Seeds (paddy, Ragi, Green gram, arhar, ground nuts etc), Sugar, Eucalyptus	Orissa seeds Production Corporation, Shakti Sugar, J.K.Paper
Rajasthan	Exotic Vegetables	M/S Raj Tech Agro
West Bengal	Chip Quality Potato	Fritt-lay India

8) Agribusiness Franchising

An agribusiness franchise can be defined as a right, permission, or license (often established by contract) granted by an agribusiness firm (called the franchisor or franchising agency) to another agribusiness firm (called the franchisee) for the latter to distribute, manufacture, and/or use the trade name of the former's products and services usually in a specified territory assigned to the latter firm by the former firm.

There are several variations of Agri-business Franchising in India and one of them is SAPPL, which is discussed below.

CASE STUDY-1

SAPPL is a private potato supply chain company that works through the franchise model. It has set up a new network of 36 franchisees in collaboration with Sunhara India, funded by Bill and Melinda Gates Foundation and Implemented by Agribusiness Systems International (ASI), a US-based non-profit consulting firm in Uttar Pradesh that provides farm input supply and produces buyback services to smallholders. The franchisees are the hubs from which farmers seek and obtain various services like input supply, extension advice and disposal of their output of potato on a pre-agreed price and market outlet. The franchisees are appointed by SAPPL which has extensive experience with farmers and the potato crop and works in many states of India in potato seed supply and output procurement and in turn supplies to various potato processors.

The SAPPL franchise contract specifies the categories of the products to be supplied. It also specifies the related signage and display as per the preferences of the franchiser. A franchisee is supposed to spare/offer a minimum investment for the business of franchising. It also offers training to franchisees from time to time as per its contract and even to farmers who were clients of the franchisee. A minimum quantity of the products supplied by the franchiser is to be maintained by the franchisee at all times. The criteria for being a franchisee of SAPPL include: possessing a farmer's foundation, knowledge of accounting, no political or criminal record, and certain potential for investment.

In 2012-13, six new franchises paid the franchise fee on their own. SAPPL helped with training, input supply and in some cases with input licenses. SAPPL made a difference to the franchisee turnover which had 13-90% of total turnover from the potato-based business alone, it being as much as 60-90% in case of new franchisees. They had a farmer base of 200-500 farmers each. Most of them did not provide equipment rental as yet with one doing with their own equipment. The franchisees were quite appreciative of the new business brought in by potato seeds and buyback of the product as it was input-intensive and high-value business, especially seed. (Sukhpal Singh *et al.,* 2007).

9) Electronic Marketing

ReMS in Karnataka

Rashtriya e-Market Services Private Limited (ReMS) has been established as a joint venture company, with the Government of Karnataka and the NCDEX e-Market limited having equal shareholding, for implementing the Agricultural Marketing Policy to bring in efficiency and transparency in the agricultural marketing system for efficient price discovery to benefit farmers and other market participants.

The unified market platform connects all markets of the state forming **"One State – Single Market."** UMP enables automated price discovery mechanism and post e- tendering process (weighing, invoicing, market fee collection, accounting, payment of sale proceeds directly to farmers, e permit generation) in the agricultural markets. The platform also facilitates displaying assaying parameters of the commodities offered for sale, can be used for warehouse-based sales and supports commodity funding to benefit all stakeholders.

A total of 162 markets spread across 30 districts of Karnataka have been brought under the Unified Market Platform so far. Out of the 92 major notified commodities in Karnataka state 62 commodities are being traded on the platform. Till May 2018 about 151 lakh lots with a total quantity of 443 Lakh tons having a value of Rs. 97,003 crores, have been transacted on the Unified Market Platform (UMP). 47 Lakh farmers registered in UMP18, 146 Commissioning Agent and 35,536 Traders. This has created what a unified market platform (UMP) is called by the state. Through making available real-time information on the quantity of the goods available for sale in each region, the Single Market Portal has brought clarity in market activities, disseminated pricing information to market consumers and provides fair opportunities for each lot to be sold by broader participation of customers.

CASE STUDY-2

Byadgi market in Karnataka on some days received more than 1 lakh bids, the platform has the capability to handle trade for this daily big volume. On the introduction of UMP in the market, the traders' participation has increased by 225% on certain days when compared to their participation prior to the introduction of UMP. The manpower requirement for auctioning has reduced drastically from 50 to 10. The farmer's share in consumer's rupee for Tur, Green gram, and Bengal gram has increased from 40-55 % to 62-74%. In respect of Dry chilli, Groundnut, Tamarind and Paddy farmer's share has increased from 34 -50 % to 59-63%. The analysis of modal prices for the main commodities has also shown that prices have improved markedly since the UMP was implemented.

10) 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. **585** wholesale regulated markets/ Agriculture Produce Market Committee (APMC). Markets have been so far integrated with e-market (e-NAM) platform in 16 States and 2 Union Territories (UTs), who have carried out requisite reforms in their State Agriculture Produce Marketing Committee Act (APMC Act).

States desirous of linking their mandis with e-NAM are required to carry out 3 marketing reforms in their APMC Act i.e. Single point levy of mandi fee, Unified trade license valid across all mandis of State, and Provision of e-auction. After carrying out reforms, States are required to propose their wholesale regulated markets for integration with the e-NAM platform based on State priorities, which are then considered by the Government of India for integration.

1.4.7 Farmer association to Producer Companies / Organization

Small, marginal, and landless farmers in developing countries are facing challenges such as poor infrastructure, limited access to lands and services resulting in higher transaction costs, and lower participation in the market that hinder their ability to improve their productivity and livelihoods. Farmer producer organization (FPO) allows them to collaborate for economies of scale, bargaining power, lower transaction costs. The budget of India, 2019 from the Indian government announced the promotion of 10,000 FPO in the next five years with $34 million allocations for setting up a "Producers Development and Upliftment Corpus (PRODUCE)" under the National Bank for Agricultural and Rural Development (NABARD).

A farmer producer organization (FPO) is a registered organization formed by a group of producers for farm or nonfarm activities. A Farmer Producer Company (FPC) can be formed by any ten or more primary producers or by two or more producer institutions, or by a contribution of both. An FPC is a hybrid between cooperative societies and private limited companies. The Farmer Producer Firms have inclusive governance and have equal access to vote, regardless of the number of shares owned, as recorded under the Indian company Act 2013. The producers are shareholders of the organization and the organization works to benefit its members.

National Bank for Agriculture and Rural Development (NABARD) recognizes the role of Indian FPOs as the following: procuring inputs; disseminating market information; sharing technology and innovation; facilitating finance for inputs; aggregating and storing produce; engaging in processing activities such as drying, cleaning, and grading; building a brand; packaging, labeling, and standardizing products; ensuring quality control; marketing to institutional buyers; and exporting and participating in commodity 35 exchanges.

Producer Company: 'Producer Company' means a body corporate having objects or activities specified in section (581B) and registered as Producer Company under this Act.

Producer Organization registered as a Producer Company consists of main activities such as production, harvesting, processing, procurement, grading, pooling, handling, marketing, selling, the export of primary produce of the members or import of goods or services for their benefit.

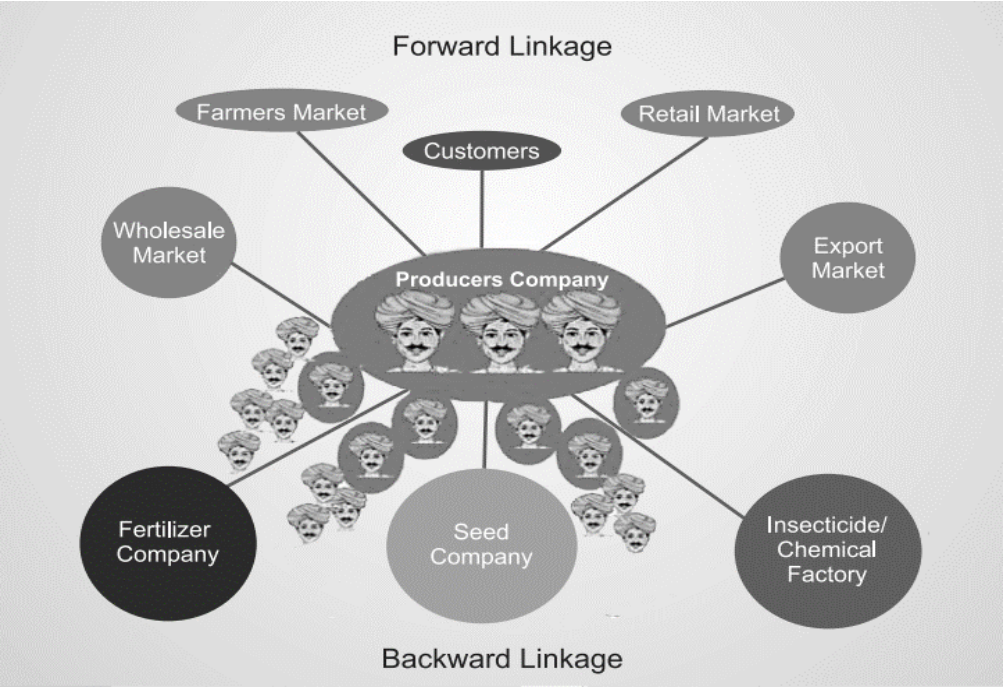
"Producer Company" means a body corporate

- registered under the amended Companies Act, 1956.
- the terms of section 465 of the Companies Act, 2013, the provisions of Part IX-A of the Companies Act, 1956 shall be applicable mutatis mutandis to a producer company.
- the objects of a producer company shall confirm to the activities included in 581B of the Companies Act, 1956.

In a producer company, only primary producers or producer organizations can become a member and the membership is acquired by purchase of the shares in a Producer Company. A Producer Company can act only through its members. Members can also wind up the company and act through their General Meetings. The company is run/governed by members/shareholders, the Board of Directors and, Office Bearers. The minimum Authorized Capital of Producer Company is Rs.5 lakh and more than Rs. 5 lakhs indicated as the Memorandum of Association in the Authorized Capital of the company.

Farmers are the company's stock investors, and PC is an entity that offers an acceptable structure for the producers themselves to own the company. The basic purpose of the PC is to collectivize small farmers or producers for

- Backward linkage for inputs like seeds, fertilizers, credit, insurance, knowledge and extension services and
- Forward linkages such as collective marketing, processing, market-led agriculture production, etc.



(Source: Extension Digest, June 2018. National Institute of Agricultural Extension Management)

Government promotion of the formation of FPOs and facilitation of lending to them has helped in allowing farmers more affordable access to inputs and creating opportunities for resource and knowledge sharing. (FPO policy 2015). FPOs are getting support both from central and state government and their agencies. The major financial support is from small farmer's agribusiness Consortium (SFAC), NABARD and state livelihood missions, which are also providing technical support from promoting NGOs and Resource Institutions.

However, achieving scale and profitability is not easy. In many cases, farmers who manage FPOs lack the business skills to produce a credible business plan or effectively market their products to large-scale buyers. Without such skills, accessing formal credit to invest in the business or developing a partnership with a larger company is extremely challenging. FPOs need substantial support to access financial resources in a phased manner, to improve production and marketing, and integrate into value chains.

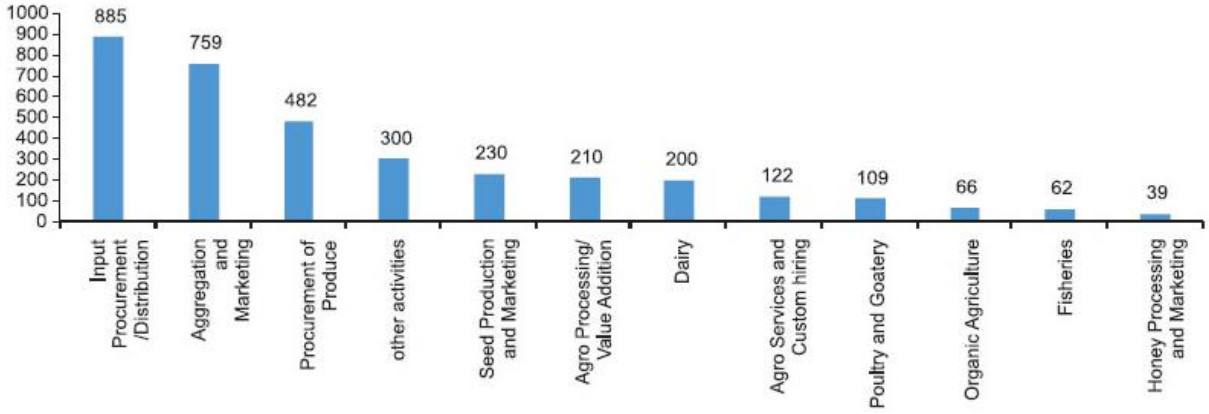
A facilitator or "chain champion" can be essential in gaining access to profitable markets; such facilitators can "serve as a catalyst for collective action and even enable farmers to renegotiate power relations along the value chain by introducing marketing and institutional innovations." Such innovations can come in the form of finding new ways to market a product, access sources of funding, and stay up-to-date on training.

Current Status of FPO in India

Presently, around 5600 FPOs (including FPCs) are in existence in the country, which was formed under various initiatives of the government of India (including SFAC which supported 819

registered FPOs), State Governments, NABARD and other organizations over the last 8-10 years. Of these, around 3200 FPOs are registered as Producer Companies and the remaining as Cooperatives/ Societies, etc. The majority of these FPOs are in the nascent stage of their operations with shareholder membership ranging from 100 to over 1000 farmers and require not only technical handholding support but also adequate capital and infrastructure facilities including market linkages for sustaining their business operations. (NABARD National Paper, 2019-20).

The topology of FPOs promoted by NABARD:



(Source: NABARD)

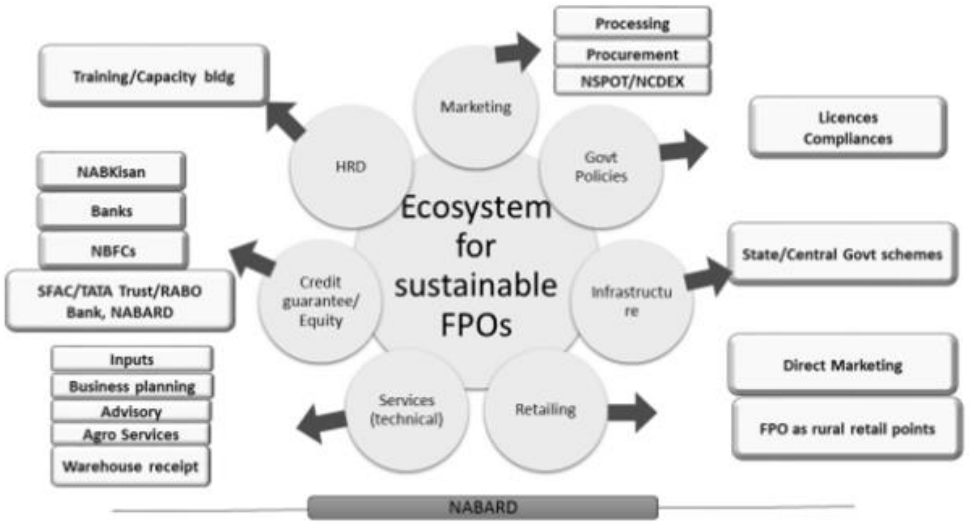
Challenges and issues building FPOs

1. Complex market linkages, price fluctuations.
2. Inadequate business acumen/management skills.
3. Inadequate Infrastructure for logistics and storage.
4. Access to credit and financials to scale-up.
5. Challenges of the right governing model.

Sustainable FPO

a. Policy Environment-Risk mitigation, licensing, agri-logistics, infrastructure arrangements, contract farming
b. Technology Support- Extension service, advisory, value addition, processing and marketing
c. Consumption/ production/ post-production credit support- Banks/ financial institutions, NBFCs, Government institutions, Developmental Agencies, Corporates, etc
d. Retail services/ Markets- Quality inputs, retail marketing, spot markets (eNAM, APMC), future's trading (NCDEX), linkages with agri corporates, exporters, direct marketing

Graphical presentation of the Ecosystem requirements is given below:



(Source: NABARD 2019)

Table 6: Success stories of FPCs in India

Name of the Farmer Producer Company (FPCs)	Location	About the PCs	Activities of PCs	Impact
Bhangar Vegetable Producers' Company Ltd.	Bhangar Block II of the District of South 24 Parganas, West Bengal	The first company registered under the NVIUC and has a membership of 1750 marginal farmers.	Provides a huge, ready and lucrative market for vegetables and provides linkages between market and producers.	Now farmers can grow more than 9500 kg and earn Rs 85000 in 120 days after the invention.
Vasundara Agricultural Horticultural Producer Company Ltd.	Located in five states viz., Gujarat, Karnataka, Madhya Pradesh, Maharashtra and Rajasthan, with its headquarters	The company supported by BAIF and 41,000 members drawn from 55 cooperatives.	Perform the activities like production, processing and marketing of their products include mangoes, cashew nuts, aonla and their by-products etc.	Achieved remarkable turnover of Rs.34 million and the migration rate come down and women are mainly organized in the

	in Pune, Maharashtra.			form of self-help groups.
Krishikabandhu Farmers Producer Company Ltd.	Gulbarga District, Bangalore, Karnataka	Indian Non-Government registered Company	Agricultural and animal husbandry service activities are done. (set up a separate nursery and grow red gram saplings and then transferred into the field.	After selling the red gram earn a total of Rs. 16,000 and also grew green gram as (an) intercrop and earned Rs. 3,000 more.

(Sources: Indranil Banerjee, Varun Prakash Dhanda and Ram Narayan Ghatak, Access Livelihoods Consulting; SFAC website.)

Extension roles for promoting FPOs

- Taking into account the economies of scale and feasibility analyses conducted by academics, the position of the farming group with a shared goal of working together should be established.
- Creating avenues to build social capital with developmental strategies.
- Bringing awareness amongst stakeholders public, private and NGOs (civil societies).
- Facilitation and instructions for registration of FPO's.
- Creating competency centers and fulfilling training requirements for FPO.
- Coordinating with NGO's, Civil and Public authorities, Promoting Women in FPOs
- Developing community-based extension system

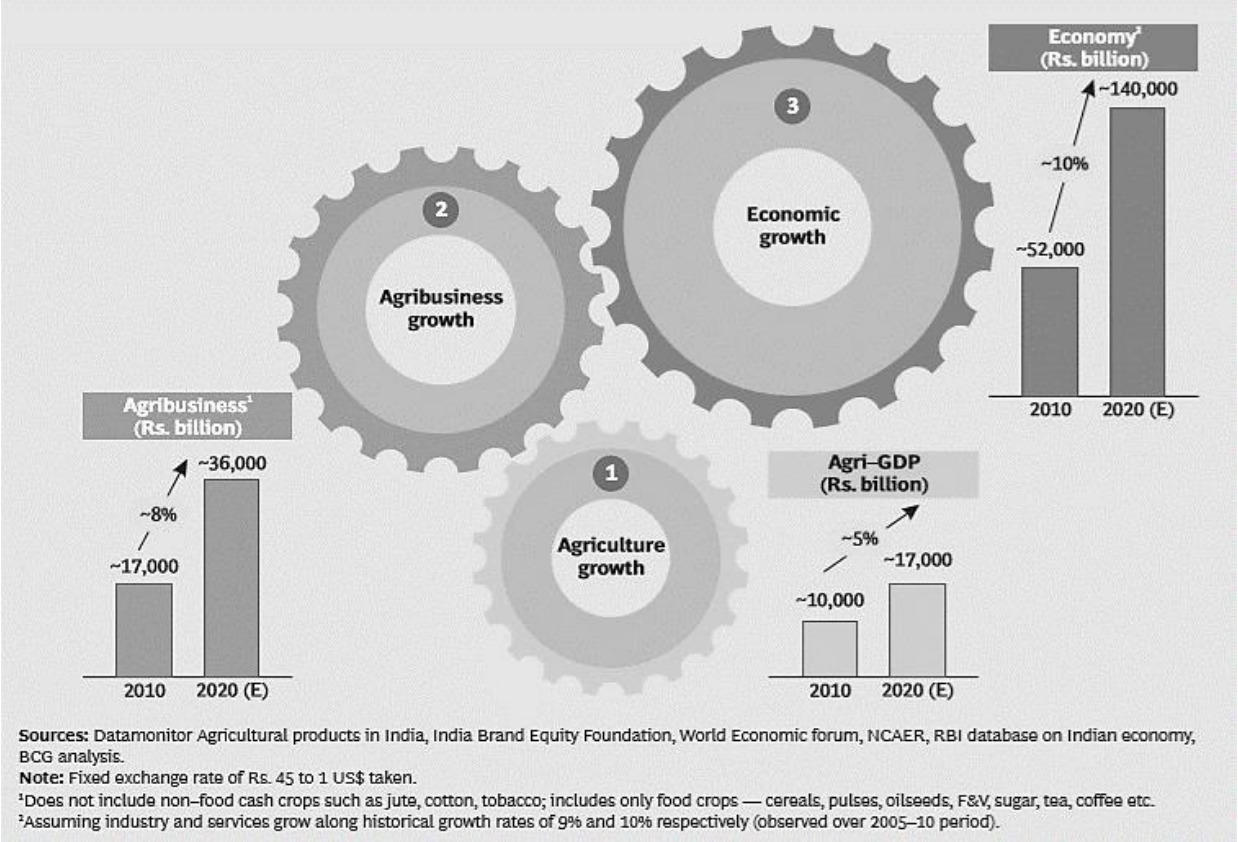
1.4.8 Agriculture Technology Venture Support

a) Agribusiness in India

The paradigm shift from agriculture to agriprenuership is indispensable to revitalize Indian agriculture. Loss of job opportunities in agriculture is the primary factor in driving people away from agriculture. Promotion of agriprenuership is the need of the hour to strengthen employment opportunities in the rural areas to sustain agriculture and agro-based industries. Agriculture needs to take a new shape by expanding its activities like crop diversification, value addition for the product-driven market, precision farming, high tech agriculture, export marketing, organic farming to make it a more viable and profitable enterprise (Padma Veni, C. and Bhagya Lakshmi, K. 2018).

The Indian agribusiness industry is an important forum for addressing the problems of unemployment and for providing new opportunities for broader parts of the population. One of the priority tactics where entrepreneurial farmers conduct productive agriculture is the turn of agriculture into agri-business. The face of Indian agriculture is being moved to new heights by new developments coupled with optimistic scope for financing, new technology and business models.

In India, agribusiness has flourished in the last two decades due to several reform measures in the economy as a whole. The recent initiatives of market reforms are yielding requisite results though in a slow phase. The doubling farming committee lays focus on different components of business in farming such as value chain system, lowering of transaction costs, market-driven production, the introduction of instruments like Farmer producer companies, contract farming and aggregation of small farmers to enable them to participate in modern instruments like the spot market and futures market.



Sources: Datamonitor Agricultural products in India, India Brand Equity Foundation, World Economic forum, NCAER, RBI database on Indian economy, BCG analysis.
Note: Fixed exchange rate of Rs. 45 to 1 US$ taken.
¹Does not include non–food cash crops such as jute, cotton, tobacco; includes only food crops — cereals, pulses, oilseeds, F&V, sugar, tea, coffee etc.
²Assuming industry and services grow along historical growth rates of 9% and 10% respectively (observed over 2005–10 period).

Fig 12: Estimated Size of Agribusiness in 2020

Agripreneurs and Rural advisory services

The progressive farmers, innovative farmers, lead farmers, and agripreneurs could be potential resources to motivate other farmers although they differ fundamentally. Many extension services choose farmers to work with them in implementing their programmes. Agripreneurs can

effectively complement the efforts of Extension and Rural Advisory Services. Thus, the government is striving hard by making efforts in strengthening the agripreneurship in rural areas and also among youth, thus transforming the agricultural sector into a business and new avenue of opportunities.

b) Agri-Startups

In India, the farming community encounters several challenges such as fragmented land holdings, seed and crop quality, availability of input, supply chain and storage, weather and climate risks as well as soil nutrition which can be addressed through tech. Technology came into the picture and changed things for farmers at the beginning of the new century. Adoption of technology in agriculture has always needed a structured institutional focus and technology firms are trying to break into the agricultural landscape using newer business models.

With over 70% of Indian households still dependent on farming, this sector holds a huge potential for agritech startups and also makes agriculture an attractive sector for the country's best young brains. With the help of high-tech drones, IoT devices and data analytics, India's agritech startups are now lending a helping hand to grow India's agriculture economy.

Globally, agri-startups are majorly prevalent in sectors like agricultural biotechnology, farm management software, mechanization equipment, robotics, remote sensing, precision agriculture, online end-to-end services, novel farming systems, food security ensuring etc. We have observed a decent growth of Agri start-ups in the country in five focus areas: supply chain, infrastructure development, finance and related solutions, farm data analytics and information platforms. Supply chain start-ups broadly involve those working in e-distribution, e-marketplace and several linking platforms. The infrastructure developer subcomponent largely encompasses those in a drip like technology solution, system or components, hydroponics, etc. Finance-related solutions are around payments, revenue sharing and innovative lending, whereas farm data analytics comprise farm mapping, field operations and remote sensing involving interventions. Information platform start-ups are connected to the information dissemination business. Currently, India hosts more than 450 start-ups in the Agri-tech segment, and the sector has received more than $248 million in funding in the first six months of 2019 (NASSCOM report 2019).

"Over recent years, the Agri-tech sector in India has witnessed some of the global and sector-focused funds investing directly in Agri-tech startups. As of June 2019, the sector has received more than $248 million funding, a massive growth of 300 percent as compared to the previous year," according to Agritech in India Emerging Trends in 2019 Report, every ninth Agri-tech startups in the world is originating from India. The study reported that there has been a 1.7-fold rise in real farm income over the last decade, encouraging farmers to test out new technical

solutions. More than 50 percent of agri-tech start-ups offer supply chain solutions like market linkage, better access to inputs (Agritech in India Emerging Trends in 2019 Report). In a bid to double the farmer's income by 2022, the Government of India is endlessly looking for ways to boost agricultural production, food processing and marketing avenues through the integration of the latest technologies and innovations; thus, creating a huge scope for food and agritech start-ups in the country (Balaji, 2018).

Key 2019 Agritech trends in India

(Source: https://nasscom.in/knowledge-center/publications/agritech-india-emerging-trends-2019)

C) Initiatives from Government in promoting Agribusiness and Agristartups

According to various schemes and programmes of the Government of India, Agri start-up projects have received very decent, mostly financial, funding. Some of these include 'Start-Up India', a flagship programme of the central govt., aiming to build a conducive ecosystem for the startups and innovators in the country, 'Atal Innovation Mission' which includes 'Self-Employment and Talent Utilization (SETU)' tries to promote a culture of innovation and entrepreneurship through innovation hubs and other self-employment activities, specifically in technology-driven sectors, along with providing 10 crore INR grant in aid to Atal Incubation Centres for covering capital and operational costs. The support from the autonomous bodies at the national level includes NewGen-Innovation and Entrepreneurship Development Centre (NewGen IEDC) under the National Science andTechnology Entrepreneurship Development Board (NSTEDB), which is implemented in educational institutions, where non-recurring financial assistance of Rs. 25 lakh INR (maximum) for the costs of setting up, furnishing the startup cubicles, PC, printers, projectors procurement books, journals etc. and the Venture Capital Finance Assistance (VCA) Scheme, as provided by Small Farmers' Agri-Business Consortium (SFAC), which enables the promoter to avail interest-free venture capital assistance, either 26% of the promoter's equity or Rs. 50 Lakh INR (maximum), whichever is lesser and the value depends upon a number of factors like project cost, promoter's status and project location etc.

With such schemes providing financial assistance, the central government is bound to provide the new startups with the best ecosystems, in order to reduce their technical difficulties as well as their gestation period. The right combination of technical and administrative support mentorship is what constitutes a successful start-up's ecosystem. For that purpose, the ASPIRE scheme has been launched by GoI, in order to set up a network of incubation Centres and technological resources available to promote agripreneurship and rural-based industries. In India, the broader scenario of the start-up ecosystem includes a number of incubation centres, think tanks, research laboratories and accelerators. Some of these are the Centre for Innovation, Incubation and Entrepreneurship (CIIE), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Food Processing Business Incubator/ Agribusiness Incubator (ABIO). Various incubation and acceleration like CIE, NAARM, MANAGE etc. offer support for Agritech start-ups.

Agriculture Clinic and Agriculture Business Centres ACABC

The ACABC scheme was launched in 2002 and was targeted at young rural agriculture graduates who wanted to turn entrepreneurs seeking to provide fee-based agriculture services to farmers. The scheme involves a 45 days of mandatory training and subsidy to set up a rural service centre, often supported by a bank loan. ACABCs were to provide a range of services, including the sale of inputs, agriculture advice, marketing support etc. to support the farming community. MANAGE has so far trained 72,784 candidates all over India under this scheme and a total of 29,618 candidates established the venture after successful completion of the training programme. (Since its inception till August 2020).

1. In West Bengal, the total number of candidates who were trained under ACABC scheme is 1,176, out of which 281 (23.89%) candidates have established ventures.
2. In Karnataka, out of 4,166 candidates who were trained, 1,616 (38.79%) have established the ventures.
3. In Maharashtra, out of 18,187 candidates who were trained, 8,619 (47.39%) have established the ventures.

(Source:- http://www.manage.gov.in/ / www.agriclinics.net)

d) Recommendations of FICCI in developing Agri startups

Agri start-ups need to connect with local entrepreneurs to enhance the trust and adaptability of the technology available. A tinge of customization of products/technology/solution that is being offered according to local needs and market is highly preferable. Moreover, financial organizations like banks need to step up and develop more creative models of financing for all stakeholders like farmers, incubation centres, accelerators and entrepreneurs. GoI's Startup Agri India scheme, the Digi Gaon (Digital Village) initiative, and Bharat Net Project can work collectively

to solve these problematic situations. Agri-hackathons and similar events also have the potential to bring together aspiring entrepreneurs from a number of varied sectors.

Last but not the least, in order to make the agri start-ups successful in India, it is now the need of the hour to build a promising 'new age distribution model' for enabling the smooth hybridization of all relevant technologies and knowledge and skills. There is a need for a unified platform where farmers can access both the procurement of produce or service and information as well as available options for credit too. With this being easy to tell and not so easy to develop, India still has a great deal of potential to develop over agribusiness as a source of rural development.

MANAGE Centre for Innovation and Agripreneurship Incubated Agri-Startups

Table 7: Agri-Startups from Maharashtra State

Offline Ventures					
Sl. No.	**Name of the Venture**	**Name of the Agripreneur**	**Place**	**Sector**	**Core Activities**
1.	Maha Fruits and Raisins	Mr. Suresh Gawali	Solapur	Production and Processing	High technology Grape farming Raisin sorting with multipurpose colour sorting machine and raisin production
2.	Pig Corner	Mr. Ajinkya Shrinivas Tipugade	Kolhapur	Livestock	Pig rearing Providing consultancy Economic yet commercial food production for good weight growth
3.	Padmini Seeds	Mr. Pradip Ramdas Makode	Amravati	Production and Marketing	Onion hybrid seed production Marketing of seeds Technical advisory and input supply
4.	Hindustan Bio Coal	Mr. Swapnil Satappa Patil	Kolhapur	Bio coal production	Manufacturing of biomass briquettes mostly made of green waste and other organic materials. Consultancy on the use of biomass in agriculture

5.	Seema Biotech	Mr. Vishwas Chavan	Kolhapur	Tissue Culture	Commercial organic production and sales of tissue cultured plantlets of banana, pomegranate and teak.
6.	Kakade Agro Equipment	Mr. Subhash Narayan Kakade	Solapur	Agro machinery	Manufacturing of user-friendly (both men and women) low cost farm machineries like sugarcane planter, seed drill, sprayer, power tiller etc.
7.	Yashwant products	Mr. Swapnil Kumbhar	Satara	Dairy by-products production	By using milk, cow dung, and cow urine, the value-added products like soap, tooth powder, dhoop, agarbati, gomutra arka, tablets, shampoo, hair oil, natsya ghee, malham (ointment) and manures are prepared for sale
8.	Rudrani Irrigation and Agro Services	Mr. Konark Bhimrao Thakur	Jalgaon	Machinery and Plasticulture	One stop solution for all types of plasticulture works in agriculture Trading dairy equipment Providing the services on trading of irrigation sets, greenhouse, shed net, PVC pipe and fitting, soil and water testing kit, solar products, landscaping, agri machinery etc.
9.	Biocrops Agro Industries	Mr. Raju Maruti Lambe	Kolhapur	Testing, Production and Consultancy	Soil and water testing laboratory Advisory on crop selection and judicious use of fertilizers based on the report Nine bio-fertilizers products manufacturing and sales

10.	Radha Agro Vet	Mr. Niranjan Madhukar Tayade	Amravati	Vet Clinic, Animal feed and medicine	Agro-Vet Services shop Trading of poultry/cattle feeds and medicine Examining the cattle and provide advisory Hatchery for the supply of one-day old poultry bird
11.	Anandraj Agro processing	Mr. Arvind Babasaheb Gadade	Sangli	Processing	Cattle feed processing unit with maize form buyback mechanism from 800 farmers
12.	Jai Malhar Farm machinery	Mr. Suresh Patalu Kodulkar	Sangli	Agro machinery	Custom hiring center with tractor, rotavator, sub-soiler, and leveler which is important in tillage operation Consultancy
13.	Vigilant Agro	Mr. Rohit Sudhakar Patil	Satara	Organic input production	Manufacturing of neem seed cake and neem oil
14.	Bhavani Poultry Farm	Mr. Girish Wamanrao Dalvi	Nagpur	Livestock farming	Poultry farming with broilers Conduct training for rural youth on all types of poultry Help the rural youth in DPR preparation
15.	Sonkusare Fisheries	Mr. Sanjay Ramdasji Sonkusare	Gadchiroli	Fisheries	Rohu, Catla, Mrigal and catfish cultivation Promoting fish farming among villagers of the surrounding villages
16.	Parth Agro Services	Mr. Sunil Diliprao Tonage	Osmanabad	Agro Machineries	One stop solution for Micro-Irrigation System Advising the orchard farmers for application of micro-irrigation system.
Online Ventures					
1.	APMC Manchar	Mr. Nilesh Shejwal	Pune	Online marketing	Digitization of the auctioning process of agri commodities in order to increase transparency, reduce manipulations, facilitating real time data entry and its

					timely dissemination to farmers.
2.	Nano Ganesh	Mr. Santosh Ostwal	Pune	Online Water Management	GSM Mobile based remote control and monitoring system exclusively for irrigation with water pump sets.

Table 8: Agri-Startups from Karnataka state

Offline ventures					
Sl. No.	**Name of the Venture**	**Name of the Agripreneur**	**Place**	**Sector**	**Core Activities**
1.	Parishvantha Dairy Farm	Mr. Pradumnya Ugar	Belgaum	Livestock farming	Dairy farming, consultancy and milk collection center
2.	Solar Agri Clinics	Mr. Sangappa Sankanagowda	Bagalkot	Agro machinery	Developing and Consultancy on innovative solar-powered farm machinery
3.	SILVIA TRADE INC.	Mr. Sharad Deshpande	Dharwad	Seed inspection	Open-field varietal testing and evaluation for a large number of crop seeds and consultancy to farmers Trading of seeds and pesticides of top brands
4.	Shri Basaveshwar Souhardha Sahakari Niyamita	Mr. Channappa Zalaki	Dharwad	Input service and cooperative	Sale of different agri input products Promotion of direct marketing through the formation of farmers' cooperatives
5.	Srushti Media	Mr. B.N. Ambrisha	Bangalore Urban	Audio-Visual Aids	Production of Video-CDs on Agriculture and Allied subjects like seasonal crops, commercial crops, patterns of crop rotation, application of fertilizers, pesticides, profitable dairying, etc.
6.	Bhakthi Agri Services	Shri Channakeshava Sharma	Bangalore Urban	Contract Farming	Contract farming of Gherkin by registered farmers

7.	VARSHA Associates	Shri S.V. Raju and Shri Venkatesh Naik	Chitradurga	Agro machinery	Manufacturing and trading of an exclusive range of farm machineries in the field of agriculture, construction and industrial usage.
8.	AgriMaa Biosciences	Shri K. K. Subramani	Bangalore Urban	Horticulture	Consultancy on scientific PoP on commercial and horticulture crops Multiplications of the F1 Red dwarf Papaya seeds
Online Ventures					
1.	Samudra Network	Mr. Rajiv Bhatia	Bangalore	Blockchain Management	Blockchain based real-time and transparent market network where FPOs, Agripreneurs and farmers network with food processors, Organized buyers, farm inputs and other supply chain services suppliers to make money while selling and saving it while buying, all while managing transparency and traceability throughout the process
2.	Yuktix Technologies	Mr. Rajeev Jha and Mr. Shailendra Singh	Bangalore	IoT and wireless sensing	Provides sensor based smart solutions for environment sensing, agriculture and smart infrastructure and also, data storage and analysis facilities with cloud, that helps in risk mitigation as well as informed decision making

Table 9: Agri-Startups from West Bengal state

Offline Ventures					
Sl. No.	**Name of the Venture**	**Name of the Agripreneur**	**Place**	**Sector**	**Core Activities**
1.	Gorain Poultry	Mr. Maheshwar Gorain	Purulia	Livestock Farming	Low cost poultry farming with thatched

					roof house and 2500 birds Consultancy
2.	Go Green Farm	Mr. Prasanta Rajbanshi	Malda	Horticulture, Seed Production	Vegetable cultivation like cabbage, chilli, tomato, peas etc. Seed production and marketing Consultancy
Online Venture					
1.	Ingreens Pvt. Ltd.	Mr. Ranadeep Das	Kolkata	Digital Extension	E-tablet (containing information on the package of practices of crops, weather reports, price etc.) Development and dissemination among extension functionaries upto grass root level

Table 10: The three imperatives driving future investments across agribusiness markets

Increasing yields	Improving Asset productivity	Enhancing sustainability
• Precision agriculture solutions • Integrated equipment • Data collection and data entry • Image management • Consultative support • Access to season trends and facts	• Enterprise resource planning (ERP) systems for the farm • Telematics • Autonomous equipment • Drones • Sensory networks • Services enablement • Predictive analytics	• Land use mapping • Managing water • Energy management • Waste tracking • Input traceability • Farm/field performance reporting • Harvest tractability

(Source: PwC, 2016)

e) Challenges of Agri-Ecosystem in India

1. Low landholding Size: small landholdings by farmers doesn't allow mechanisation of the farm to be cost-effective.

2. Return for the Investors: Agritech is a long term business that requires patience from investors before generating a return.
3. Talent Retention: Agritech start-ups and enterprises are finding it hard to retain technical talent working in this sector.
4. Long Gestation Period: Farmers will take time to develop full trust agritech technologies which might affect investors' interest.
5. Technology Affordability: Farmers' income is still a concern in major parts of India making it hard for them to afford agriculture technology.
6. Skill Adaptability: Making farmers adaptive to the required skills for working on these technologies requires a lot of effort.
7. Acquisition of Agritech companies: In India, we see a very less number of Agritech startups being acquired by large businesses that are hindering them in scaling up their levels. Global success stories like blue river climate crop got acquired by John Degree and Monsanto respectively.

Review of Literature

2.1 Research, Education and Extension Services

Gond *et al.* (2019) conducted a study on Krishi Vigyan Kendra libraries in India. The major objective of the study was to analyze KVK libraries, in terms of their training programme implementations in India and awareness on the part of farmers about KVK libraries. Major findings were, KVKs are still facing challenges at the programme implementation and there is a huge gap in the awareness amongst farmers about KVK libraries.

Tamboli and Nene (2013) conducted a study on Modernizing Higher Agricultural Education System in India to Meet the Challenges of the 21st Century. They identified major constraints facing the higher agricultural education system in India. A few important ones include (i) difficulty in attracting bright/talented students, (ii) funding crunch, (iii) large number of vacancies, (iv) inbreeding of faculty, (v) lack of autonomy to the Vice-chancellors, and (iv) poor state–center and state–SAU relationship. They also made specific suggestions to address these constraints; compares functions of Land Grant Universities in the USA with SAUs; discusses the role of external donors like USAID and the World Bank in support of HAE and few specific recommendations to modernize HAE.

Roling (1988) defined AIS as a system, in which agricultural information is generated, transformed, transferred, consolidated, received and fed back in such a manner that these processes function synergically to underpin knowledge utilization by agricultural producers.

According to Roling (1988), various vertical (top-down and bottom-up), and horizontal information flows take place within the AIS, generating a complex phenomenon. AIS serves as a tool for analysis and design of agricultural research, extension and agricultural knowledge utilization. The notion of agricultural knowledge systems relates to AIS.

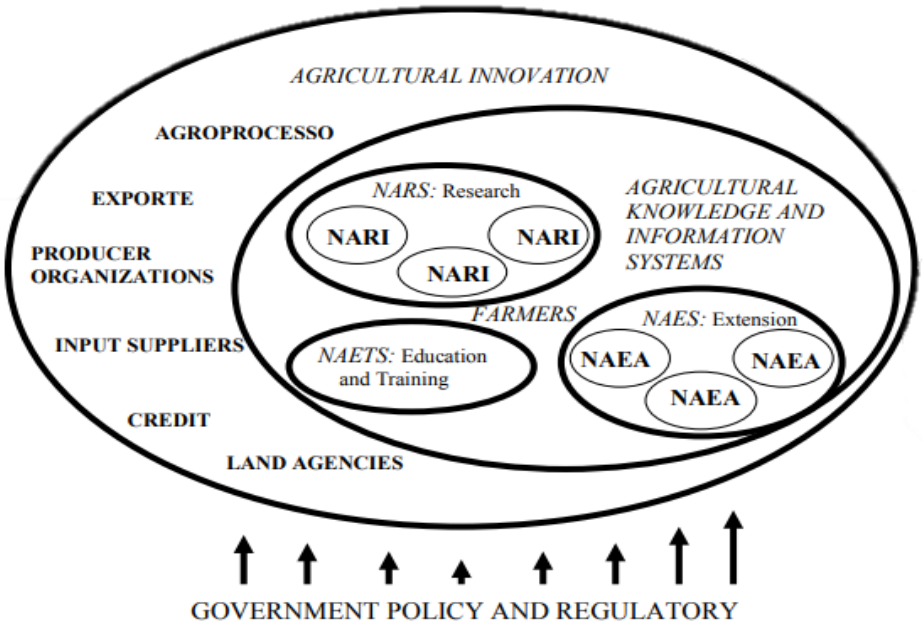
An AKS is defined as a system of beliefs, cognitions, models, theories, concepts, and other products of the mind in which the experience of a person or group with respect to agricultural production is accumulated (Röling, 1988).

Different groups of people have knowledge systems including local knowledge, which affects their perception, learning and reasoning.

The different actors in agricultural development who manage knowledge and information together to form the agricultural knowledge and information system (Salomon and Engel. 1997). An AKIS is a relatively new concept (Rivera, Qamar and Mwandemere. 2005), that addresses linkages of key actors in the agricultural sector.

Eicher (1999) described AKIS as an agricultural knowledge triangle depicting a two-way flow of information and knowledge between farmers and agricultural actors (Ramirez, 1997). AKIS is a system that links rural people and institutions to promote mutual learning and generate, share and utilize agriculture-related technology, knowledge and information (FAO and World Bank, 2000). It facilitates the interaction of the main agricultural actors (farmers, agricultural educators, researchers and extensionists), and has the potential to harness knowledge and information from various sources for better farming, improved agricultural growth and livelihoods (The World Bank, 2004; Rivera, Qamar and Mwandemere, 2005). An AKIS consists of institutions and organizations pertaining to agricultural extension, research and education that generate and disseminate knowledge and information (The World Bank, 2004).

Besides being an important part of innovation systems, extension and advisory services contribute directly to economic growth, poverty reduction, and environmental well-being. Extension is an essential tool for dealing with the serious challenges facing agriculture such as climate change, high food prices, and the degradation of natural resources while helping to increase productivity and reduce poverty (Davis, 2009).



Source: Rivera et al. (2006).
Note: NARS = National Agricultural Research System, NARI = National Agricultural Research Institute, NAETS = National Agricultural Education and Training System, NAES = National Agricultural Extension System, NAEA = National Agricultural Extension Agency.

Agricultural Innovation System

Privatisation and commercialisation in agricultural advisory systems have been ongoing processes for over 30 years now. One could question whether the public sector should still play a key role in such systems. The expected benefits of privatisation are greater efficiency of service provision in terms of cost and resource allocation, increased provider accountability, a demand-driven elaboration of contents, and an emphasis on benefits and results.

This framework can be used to develop assessment tools for agricultural advisory services, to inform processes of reforming of agricultural advisory services and to guide inter-disciplinary research. The framework is unique in combining the insights from different disciplines, which have, so far, been treated separately in the literature. The framework can help policy-makers and analysts to move from 'ideological' discussions on reform models to an evidence-based 'best fit' approach.

Van den Ban and Hawkins (2000), contend that extension advisory services are judged by their capability of transferring knowledge from researcher to farmer, advising farmers in their decision making, educating them on how to make better decisions, enabling them to clarify their own goals and possibilities, and stimulating desirable agricultural development.

Rivera (1996), found in his study that the required information differs among categories of farmers and can be based on specifics that delineate these groups of farmers. For example, land tenure, farm size or agro-climatic region.

Glendenning *et al.* (2010) noted that embedding advisory service in input sale though agri-clinics is a useful way of reaching farmers, whose most important information needs relate to agri-inputs. Swanson (2008) mentioned that apart from varied information required by different farmers and the different information sources available to them, farmers' literacy level and resource accessibility, impacts on information needs, searching behaviour, access and use of information by farmers influence the farmers' needs.

Desai *et al.* (2011), had reported that the challenge of enhancing relevance, efficiency, and effectiveness of the public sector agricultural extension system in meeting its organizational goals and objectives remains unresolved.

2.2 Input Support

Kevin Donovan (2012) examined the agricultural risk, intermediate inputs and cross-country productivity differences and found that low agricultural productivity in developing countries is a result of low use of intermediate inputs, such as fertilizers. The share of intermediate input in agriculture is related to the per-capita income of the country. He also observed that the intermediate input choices depend upon the overall income level of the country.

Yu *et al.* (2015) comparatively studied food security policy and its implications for national and global food security in India and China and observed that the two countries have different strategies to address the access to food of poor consumer, in India widely criticizes public distribution system is prevalent and in China direct income transfer and other social safety nets are in use. India is mainly dependent on price based measures which lead to more fiscal burdens,

thereby making India more vulnerable in dealing with problems such as food price strikes. These findings are having important effects on food security policy in India as well as China.

Birthal *et al.* (2015) examined the impact of information on returns from farming in India and the empirical results show that there are 12% higher net returns per hectare land of farmers who use more information compared to the small farmers having access to few information sources. Moreover, they depend on informal social networks and input dealers for the source of information.

The Standing Committee on Agriculture (2015) observed that the use of fertilizers in the country was not based on scientific analysis of soil due to the near absence of soil testing facilities, low awareness, and overreliance on urea.

Surbhi Mittal and Mamta Mehar (2015) examined the socio-economic factors affecting the adoption of modern information and communication technology by farmers in India and suggested that the farmers need to be informed widely about the various aspects such as availability of new inputs, technology, seed variety, weather forecasts, market and price information of input and output, availability of support services, government schemes related to agriculture. Also, it has been observed that farmers depend on multiple information sources but more preferably they use face-to-face interactions. They concluded that the successful use of information for agricultural development relies on accessibility and effectiveness of information source, farmer's preference and farmer's ability to use information.

Margaret Mwangi and Samuel Kariuki (2015) examined the factors determining the adoption of new agricultural technology by smallholder farmers in developing countries and concluded that agricultural technologies are important to alleviate poverty in most of the developing countries but the adoption rate of these technologies is low in most of the developing countries. They also recommended that future studies on agricultural development should focus on the perception of farmers towards new technology.

Aker *et al.* (2016) examined the information and telecommunication technology for agriculture initiatives and suggested that there is a need to have a better understanding of information and complementary market failures, in order to use ICTs effectively in the future and understand whether the information is a binding constraint. The information service provided should be of good and high quality and from trusted sources. The delivery of such sources should be from local platforms for better access and usage.

Keith Fuglie (2016) examined the growing role of the private sector in agriculture research and development worldwide and estimated the spending trends of private agricultural food research and development over the past 25 years. He observed that for agricultural research and

development, global private spending rose from $5.1billion in 1990 to $15.6billion by 2014. He also mentioned that most of the agricultural research and development is done by the companies residing in developed countries. He also found that national policies can effectively convince private sectors to invest in agricultural research and development.

Sudha Narayanan (2016) analysed the productivity of agricultural credit in India. From the findings, she suggested that all the inputs over the period of 1995-2012 were reactive to the growth in institutional credit to agriculture. An empirical study shows 10% increase in terms of credit flow leads to a 1.7% increase in fertilizers (N, P, K) use, 5.1% increase in pesticides and 10.8% increase in the purchase of a tractor. She also concluded that input use is very responsive to credit flow and credit is an enabling input that is undermined by low technical efficiency and productivity.

Abdul Rehman *et al.* (2017) examined the adoption and importance of modern agricultural technology and its role in the improvement of agriculture. He also concluded that modern technology is changing day by day as we operate machines, computers, GPS, advanced tractors and other agricultural machinery to use fuel, fertilizer, seeds, water and other inputs more precisely and more efficiently.

Zoé Druilhe and Jesús Barreiro-Hurlé (2017) studied the subsidies related to fertilizer in sub-Saharan Africa and observed that farmers in sub-Saharan African face problems such as poor output, price incentives, high fertilizer prices, lack of liquidity/credit and lack of knowledge. In the context of agricultural production, fertilizer subsidies can play a role in raising agricultural productivity.

Zoé Druilhe and Jesús Barreiro-Hurlé (2017) examined the fertilizer subsidies in sub-Saharan Africa and concluded that market friendliness should be promoted by the inclusion of private sector actors in the area of schemes such as importers, wholesalers, and retailers or dealers. To achieve this, an improved understanding is required of complementarities and trade-offs between public and private actors as well as the contribution of different supply systems (Independent agro-dealers versus vertically integrated distributor's networks).

Kiran Kumar Reddy *et al.* (2019) concluded that more than half of the agri-input dealers have a perceived medium role, followed by a high role and low role in the transfer of technology. As agri-input dealers are linked with supply and service of agri-inputs, there is more reliance on agri-input dealers by the farmers. So, the farmers will approach them with easy access, high dependence, more credibility, clear intention and less ambiguity.

2.3 Agriculture Finance Support

Golait (2007), in his study on current issues in agriculture credit, found that credit delivery to the farm sector is inadequate as the banking system is still hesitant on various grounds to purvey credit to small and marginal farmers. Thus, he suggested that concerted efforts were required to augment the flow of credit to agriculture, along with new innovations in product design and delivery methods, through better use of technology and processes. The credit flow to agriculture could be substantially improved by encouraging credit through processors, input dealers, NGOs, etc., who are directly in touch with farmers, either by contract farming, to supply them with essential inputs or to process their produce.

Curtis (2011) observed that highly subsidized agricultural exports from the developed countries exert a negative impact on the output markets of low-income or resource poor developing countries, and may have an adverse impact on the income and livelihood of farmers there.

The number of agricultural subsidies is increasing year by year but at the same time, total cultivated agricultural land and investment is also increasing. This is responsible for slow agricultural growth in India and less contribution to the GDP of the country. The agriculture subsidies are distributed by every country but its percentage is very low whereas the numbers of dependents are very large in India. (Solunkhe and Deshmush, 2012)

Ahangar *et al.* (2013) studied institutional credit in the agricultural sector and concluded that the institutional credit in India to the agriculture sector has been increased in its quantum. The credit provided by the various institutional sources has increased its advances. But the banks have to make an effort to reduce their outstanding debt so that the institutional credit recovered can be injected more into the agricultural sector for its expansion.

Sudha Narayanan (2015) investigated the relationship between institutional credit to agriculture and agricultural Gross Domestic Product (GDP)and concluded that the success of credit enabling the increase in the use of purchased inputs and effecting changes in input mix, supporting the changing face of agriculture in India has not translated fully into agricultural GDP growth as such.

Hoda *et al.* (2015) evaluated the credit policy for agriculture in India and found that the measures taken for the enhancement of institutional credit such as the opening of a large number of rural branches for commercial banks, priority sector lending with an 18% target for agriculture, Kisan Credit Cards and the financial inclusion initiative played an important role in the rise of agricultural credit. He also argued that an increase in the short-term credit leads to diversion of subsidized credit for non-agricultural purposes. To minimize such problems, they recommended that the policy review needs to be done and generalized loan waivers should be avoided.

The Economic Survey (2018-19) noted that the share of agricultural households insuring their crops was low. Insured crops account for less than 5% of the agricultural households cultivating major crops, such as rice and wheat. Lack of awareness about crop insurance among farmers was the major factor for not insuring their crops. Further, the lack of awareness about the availability of crop insurance programmes was another reason.

Data on the average loan taken by agricultural households, as per the NABARD's Financial Inclusion Survey Report 2016-17, indicated that 72% of the credit requirement was met from institutional sources and 28% from non-institutional sources. The report further states that out of the total agricultural households, approximately 30% still avail credit from non-institutional sources.

Wulandari *et al.* (2017) the results of this study can be used to design strategies to improve farmer knowledge of finance and subsequent access to finance. Awareness campaigns could enhance farmers' access to finance by increasing farmer knowledge of the diversity of requirements among the types of finance providers. Involving farmers who already have experience with different sources of finance likely increases the success of such campaigns.

Renita (2020), stated that an important reason why poor farmers are high-risk, low-quality assets in India is because they are not insulated from the vagaries of nature and do not have the wherewithal to reduce the risk of loan failure. Therefore, financial inclusion cannot stop at providing capital. It has to ensure that the probability of loan failure is minimised.

2.4 Agriculture Logistics Support

Bairwa *et al.* (2013) Gigantic events in trade are charming stashes in prime create as flourishing as continuing the gather sideways in nourishment allotment and dispersal. Systematized showcasing is budding more than 35% CAGR and thus, numerous input businesses, all of whom are challenging more gifted people to oversee advance. This progress will routinely base fundamental critical transferals within the overseeing.

Ja'afar-Furo *et al.* (2011) concluded that encouragement of rural farmers for adding value to their farm produce before marketing must be done. This will help to improve their income generation as well as sustainable agricultural development in rural areas or in developing countries.

Temitayo and Victor (2018) examine the value addition and productivity differentials in the Nigerian cassava system and recommended that necessary services that drive agriculture value addition such as extension services, agricultural training, ease of enterprise registration must be made available to the farmers.

Temitayo and Victor (2018) found that social networks with pathways capable of value addition can help to improve productivity. They also recommend policy options that accompanied the efforts of social networks in particular group training and affordable trainings.

CalestousJuma, (2015), in his book 'The New Harvest: Agriculture Innovation in Africa,' evaluated that the productivity of rural based economies is nurtured by value addition in agriculture, agriculture productivity, entrepreneurship and technical training. Strengthening rural innovation systems adds value to unprocessed raw materials and promotes value chains across various sectors such as horticulture, food storage and transportation, food processing and packaging, distribution systems and exports to generate growth, prosperity and sustainability.

Chen *et al.* (2014), studied the cold-chain logistics of mobile service application and implied that the real-time monitoring of agricultural products through transport and cold chain logistics can efficiently ensure the safety and quality of the agricultural produce and also reduction of logistic cost.

Hakan (June 2016), examined the factors affecting farmers'(cherry growers) decisions to participate in direct marketing in the district of Turkey and observed that the important limiting factor for the participation in direct marketing is the inefficiency of organizations to help farmers in meeting their direct marketing goals and inadequacy of direct marketing arrangements between themselves and consumers.

Karantininis *et al.* (2008), examined the determining factors of innovation in the agro-food industry and concluded that value chain, organization and power of market are important factors for innovation whereas wholesalers and retailers are having a large number of new products but manufacturing firms give more emphasis to research and development.

Salami *et al.* (2010), examined the trends, constraints, and opportunities in smallholder agriculture in East Africa and found that, at the national level, factors such as weak institutions, limited access to credits and markets along poor market structure constrained the productivity growth of smallholder farming. They also suggested that measures should be taken to improve the productivity of smallholder farmers which include easy land access, training to build skills, encourage technology and innovation, and dispatch the obstacles in trade. At global levels, international trade barriers should be addressed.

2.5 Agriculture Market and Price policy

Megha and Anukrati (2013) conducted a study on the changing face of Indian agriculture in a global scenario. They reported that agriculture import and export, kisan call centre, online mandi, agriculture retailing, ICT's in marketing and organic farming etc. are the various trends that are

emerging presently in the agriculture industry which are influenced by trends in the global market. Therefore, Indian agriculture turned into corporate agriculture and continues making a strong presence in the world.

Jairath and Hema (2012) conducted a study on the role of ICT in decision making in agricultural marketing. The study was purposively conducted in the arid western region of the country because of the strong presence of IFFCO – IKSL, its partnership with KVK for providing extension and advisory services to the farmers and their last mile connectivity in the region. Results reported that mobile devices provide an effective channel for dissemination of market prices, agri-specific news and inputs and advisory. The popularity of mobile devices was mainly because of user-friendly interface and the convenience of high mobility. With the integration of the local language, mobile services had been of immense use by the farmers. Mobile services were being used by all age groups. However, it was found popular among the age groups of 20-30 years (35%) and 30-40 years (24.33%). The percentage of users declined in the higher age group. It was also observed that the younger generations are adapting more to the SMS system and consult Krishi Vigyan Kendra for advice from time to time. The farmers opined that they would like to have information on weather conditions (25%) followed by crop management (24%) and crop price (17%). Information related to disease management, availability of inputs and government schemes are the other types of information for which farmers expressed keen interest. The study also explored the effect of SMS services on production, marketing and communication. Nearly 45.34 percent of farmers revealed that they received better knowledge about managing the crops and diseases which made them more capable of crop management, fertilizer dosage, and disease management. Due to this awareness, they also approached KVK to seek further solutions. On the other hand, about 20 percent of the farmers have been able to enhance their market visits, thus raising market penetration and price monitoring, which has led the producer-growers to take the marketable lot and reap the benefits of a better price, which has improved their profitability. . Majority (28%) of the farmers expressed that the information received by mobile could not be optimized due to the difficulty in the location of facilities and having access to markets, warehouses and godowns, availability of means of transportation, etc. followed by 23.27 percent who could not make use of toll-free number because of either non-response or very heavy occupancy of the phone line. Difficulty in understanding the text or voice message was also experienced as a major constraint by nearly 18 percent of the producer-growers and 14.29 percent of farmers reported language as a barrier for optimising information use.

Vineet (2016) reported that the major reforms required for the success of agricultural marketing in India are an augmentation of irrigation facilities, technology up-gradation, provision of storage, and increase in cleaning, sorting, grading and packaging facilities.

Aparajita (2010) conducted a study on information, direct access to farmers, and rural market performance in central India, the intervention implemented by a private company in Madhya Pradesh, the central Indian state, is associated with a significant increase in the monthly price of

soybeans in government-regulated wholesale agricultural markets. On average, the mandi price of soy increased by 1-3 percent after the introduction of kiosks and lending support to the predictions of the theoretical model. The dispersion in price across affected mandis in Madhya Pradesh also appears to decrease post intervention. Moreover, there is a significant increase in the area under soy cultivation due to the intervention. The findings of this paper show that information provision is crucial for increasing the efficiency of rural markets. The analysis also contributes to an understanding of the potential benefits from direct interaction between producers and processors in the context of agricultural marketing in India. The results suggest that there are net welfare gains to soy farmers as a result of this intervention. The immediate benefit of this intervention to ITC Limited was the increase in soybean procurement productivity arising from the development of a direct marketing channel and a reduction in its transaction costs.

Hariharan and Karunakara (2018) in their study, on the Indian commodity market with special reference to the commodity exchange, suggests that there is wide scope for future commodity exchange in agriculture as it is the backbone of the Indian economy where there is large scale production in various agricultural commodities. There is a need for a national exchange to function transparently and effectively. So, awareness has to be created among the farmers and traders on how to utilize commodity future exchange for hedging their risk and for a better return.

Ahmad and Jamshed (2014) conducted a study on nurturing agriculture friendly commodity derivatives marketing in India. The study stated that the market acts as a barometer to identify the status of reforms and to set a standard of achievement. From a broader perspective, the commodity derivatives market should not only be limited to facilitate price discovery and price risk management but also play a larger role against the social institutional backdrop of a liberalized economic regime. A policy intervention for smooth and transparent functioning of the commodity exchanges and integrating them with the spot markets (at regional and state level) will meet the expectations. The study proposes to reshape the future market by adopting a producer centric sustainable growth model to compete in international supply chain dynamics. The paper recommends a new trading platform to work in an autopilot mode of integrated commodity market of international repute. To lead the economy towards inclusive growth, and agriculture friendly commodity derivative market with PPP and ICT adoption should be evolved to win the trust of participants through a total transformation in the process, governance, and legislation and regulation system.

Reddy (2018) reported that increase in prices and market arrivals was more in the e-markets compared to non e-markets for all three viz., copra, rice and groundnut commodities. This indicates that e-markets have a positive impact on prices and market arrivals and also imply that the farmers have benefited from higher prices while the traders and commission agents have benefited.

Yadav *et al.* (2019) presented a unique machine learning approach for forecasting crop prices at a high frequency (daily rolling forecasts) for local markets. They were able to forecast prices for soybean, chickpea and mustard in Madhya Pradesh. An improvement of up to 19% (for Soybean prices) in forecast accuracy has been achieved when compared to traditional univariate forecasting methods. They also reported that educated farmers, selling using theirforecasts,had a rise in income of up to 14.5 percent.

Shakeel-Ul-Rehman *et al.* (2012) in their study on overview of agricultural marketing system in India, reported that past and present scenario of agricultural marketing prevailing in India, its challenges and future recommendations. The study concluded that, the present market must cover two aspects of the marketing network and actual regulation of the conduct of the market. The need to strengthen the regulated market system arises from the changing nature of linkages between agriculture and markets. It has been observed that better and easy market access and efficient information flow can bring much-desired market orientation to the production system. Indian agriculture, moving from commoditization to commercialization, drives it towards market orientation. India can claim to have the largest network of agri-business cooperatives in the world, engaging in manufacturing, procurement and marketing of agricultural produce.

These have proven to occupy an important place in our economy. The government must examine its policies and regulations with a view to strengthen the marketing network and ensure that prices are being determined on a competitive basis and markets are being manipulated. Using modern ICT can bring out better solutions as it can facilitate agricultural marketing functions and processes include buying and selling, payment, grading, standardization, transportation in an efficient manner.

Vadivelu and Kiran (2013) studied the problems related to agricultural marketing in India and suggested certain measures to bring out the agricultural marketing reforms to ensure a fair price for the farming community. Also suggested that loans should be provided to the farmers at low interest rate so as to freed them from the debt of the local money lenders. It is important that farmers should be provided a subsidized power supply to reduce a considerable amount of investment towards power consumption. Generation of new distribution networks to connect farmers directly to the consumers so that the farmers will get maximum returns and profits.
Vadivelu and Kiran (2013) recommended that the government should essentially intervene to bring profit to the farmers. At the village level, counseling centres should be for farmers to know about the worth of their stocks to get a fair price for their produce. The existing legislation needs to be updated to cope up with changing trends and technological inventions.

Vadivelu and Kiran (2013) described that the government is providing fair price shops through Public Distribution System which are monitored by the state government. It is very effective in some states such as Punjab, Haryana, and Uttar Pradesh but these should be strengthened across

the country. He also suggested that the government should impose a single entry tax rather than imposing multiple entry taxes as it would be beneficial for farmers and consumers. He concluded that it is necessary to reform price discovery mechanisms through a regulated marketing system to strengthen agricultural marketing.

Hatai and Panda (2015) studied the various patterns of awareness, sources, utilization and its benefits, constraints, and expectations to Agricultural Marketing Information (AMI) among the traders in Meghalaya were studied and the study revealed that awareness of the price in local markets was ranked 1, followed by arrivals in local markets and prices in reference market was ranked 3. Also, they observed that the traders (90%) were dependent on contacts in other markets and fellow traders (75%) for market information. Newspapers were ranked 3 on the degree of awareness about agriculture marketing information sources among the farmers. He also observed that the utilization of agricultural marketing information by traders to decide price ranked 1 followed by the quantity that need to be purchased ranked 2 and quantity to be stored ranked 3. About 75% of traders were unable to get AMI in the required form. He suggested that the delivery mechanism of information should be given more emphasis so that market information will reach effectively and timely to end users in hilly regions of Meghalaya.

Banu (2016) studied agricultural marketing in rural India and recommended that there is an urgent need to develop the agricultural sector economically in India. Allowing significant investment in agriculture retailing will ensure a tolerable flow of capital into rural economy to promote the welfare of society, especially to the farmers and consumers. It will lead to an increase in the income of farmers, improvement in agricultural growth and provides aid in lowering consumer marketing to sell their produce with at least a reasonable margin. They also suggested that farmers need to be integrated and informed with market knowledge. To make agricultural marketing effective, collective and integrative efforts should be done. Agriculture marketing with innovative and creative approaches has the ability to bring benefits to labour and farmers and there is a need to bring out significant strategies to accomplish that.

Murugesan and Rajarajan (2016) examined the problems faced by co-operative marketing societies in India and concluded that two-third of the societies are facing problems related to the scarcity of raw material. About 85% of societies are not able to use professional skills in marketing. Processing problems, financial problems, marketing problems, ineffective administration, delay in marketing decisions and poor performance of shops are the problems faced by co-operative marketing societies in India. They also suggested that marketing societies need to provide maximum storage facilities to farmers to save wastage of crops for the improvement of co-operative marketing society.

2.6 Farmers' association with organizations

Sarkar *et al.* (2011) told that agriculture is a significant sector in the Indian economy, where 16.5% of the GDP in 2016 comes from agriculture. 51% of individuals who are employed in India work in agriculture, and the role of a farmer has been important in India historically, especially since the Green Revolution in the 1960s. Since 1965, 'the gross cropped area of India has increased by approximately 15%.' Additionally, there has been a large increase in inputs related to agriculture. However, at the same time, employment on farms has decreased because of the rise in large corporate farms.

Ittyera (2013) said that the other developing nations in Southeast Asia also rely on agriculture heavily for both economic development and access to healthy food. However, both public and private investments in agriculture and rural infrastructure have decreased since the liberalization of the Indian economy in 1991, which has led to an uneven change in agricultural practices throughout India.

Trebbin, (2012) from his study, said that these uneven changes have caused issues in food accessibility for many individuals, especially small and marginal farmers who own land less than 2 ha.

Kadiyala *et al.* (2014) - from his study, said that agriculture in India is also important because it is closely linked with availability and access to healthy food. The agricultural sector in India produces more than 50% of income in rural areas, and about 58% of Indian workers state that their primary employment is within the agricultural sector.

2.7 Farmer Producer Companies

Ittyera (2013) said that other developing nations in Southeast Asia also rely on agriculture heavily for both economic development and access to healthy food. However, both public and private investments in agriculture and rural infrastructure have decreased since the liberalization of the Indian economy in 1991, which has led to an uneven change in agricultural practices throughout India.

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Rani *et al.* (2017) has conducted a study to analyze the impact of the formation of FPOs on the development of sustainable crop production in Karnataka and concluded that there was no regular and authentic source of information available to the farmers regarding market prices. The

farmers generally relied on their own past experiences and information provided by fellow farmers. It was also concluded that the benefits after forming as FPO's had increased by 10% per hectare by the end of the study. A minimum of 20 percent rise in net income of the FPO farmers is observed.

Trebin (2014), have analysed that the FPOs and market linkages have proposed that farmers' associations are effective in connecting smallholders to more complex markets. However, conditions for effective linkage cannot be summed up with these criteria alone.

Mukherjee *et al.* (2018) has stated in his study that as innovation requires the existence of networks of people as a prerequisite, creating an FPC entails a process of networking, which is crucial for innovation to take place. As a result, an FPC can generate interaction by farmers with a range of actors, 'cross wiring' them and their organizations with other actors, strengthening the social organization of innovation, both in terms of the parties involved and in terms of content, while identifying and using windows of opportunity more effectively.

Research Methodology

3.1 Description of the locale of study

The study was conducted on the purposively selected three states of India i.e. Karnataka, West Bengal, and Maharashtra.

Three districts from each state were selected based on the agro-climatic zones for conducting the study. The availability of other resources and convenience to the researcher was also considered during the selection of the study area.

States	Districts selected for the study
Karnataka	• Shivamogga, • Kolar • Belagavi
West Bengal	• Hoogly • South 24 Parganas • Birbhum
Maharashtra	• Wahim • Nasik • Jalgoan

The brief description of the study area is as follows:

Karnataka

The state is delineated into 30 districts and 176 taluks spread over 27,481 villages. In Karnataka, agriculture is the major occupation for a majority of the rural population. A total of 123,100 km^2 of land is cultivated in Karnataka constituting 64.6% of the total geographical area of the state. Agriculture engages the majority of the population. The coastal plain is intensively cultivated, with rice as the principal food crop, followed by sorghum (jowar) and millet (ragi). Sugarcane is the main cash crop, supplemented by cashews, cardamom, betel (areca) nut, and grapes. Coffee and tea plantations are located on the cool slopes of the Western Ghats. Karnataka is one of the country's chief sources of coffee. In the eastern region, irrigation enables the cultivation of sugarcane, some rubber, and such fruits as bananas and oranges. The black soil of the northwest supports cotton, oilseeds, and peanuts (groundnuts). The following is the description of the districts selected in Karnataka for study:

Belagavi or Belgaum is the largest district in the state of Karnataka with an area of 13, 433 sq.km. and has a population of 4,779,661 making it the second most popular district in Karnataka, after Bangalore. This district is located in the northern tip of Karnataka and hence, borders the states

of Maharashtra (on west and north) and Goa (on the Southwest). With rich red and black soils, the district is best suited for the production of cotton, millet, wheat and, gram. The total area sown is 10,11,264 hectares out of which 5,23,128 hectares of land are irrigated. Belagavi is recognised for its enormous contribution to sugarcane cultivation with 1.5 lakh hectares being used for commercial production. Hence, this district is known as the sugar bowl of Karnataka.

Kolar district is renowned for its residency in the Golden city of India, Kolar. It is located in the south-eastern part of Karnataka and has an area of 4,012 sq. km with a population of 1,536,401. This district is surrounded by the districts of Bangalore rural and Chikkaballapur on the West and North respectively and shares borders of other states such as Andhra Pradesh and Tamil Nadu on the remaining sides. Kolar district is also known for its production of Milk, Silk, and Mango. It is ranked No.1 in yield of horticulture crops and has the 2nd largest APMC market in Asia. The district has red loam, clay loam, gravel, and laterite type of soil structure and is best suitable for the cultivation of groundnut, paddy, chillies, sugarcane, tobacco, ragi, pulses, dry land horticulture crops, and vegetables.

Shivamogga district is a part of the Malnad region of Karnataka and has an area of 8478 sq.km. and population of 17,52,753. It is located in the central part of the state and is completely landlocked by districts of Haveri, Davangere, Chikmagalur, Udupi and Uttara Kannada. As a part of western ghats, the rivers here inundate the fertile alluvial soil round the year, making this district the breadbasket of Karnataka. Agriculture and animal husbandry are the major contributors to the economy of the district. Shivamogga district is predominantly rice producer with other major crops such as Maize, ragi, jowar, redgram, cotton, groundnut, and plantation crops such as areca nut and coconut. Total area sown is 2.61 lakh hectares out of which around 68% account for agricultural crops and 32% account for horticultural crops.

Maharashtra

Maharashtra is the second-most populous state and third-largest state by area in India. Spread over 307,713 km2 (118,809 sq mi), it is also the world's second-most populous country subdivision. The cultivated area (17.43 million ha) is about 80% of the total geographical area and the irrigated area is about 17% (2.94 million ha). The principal crops grown in the state are rice, jowar, bajara, wheat, tur, mung, urad, gram and other pulses. The state is a major producer of oilseeds. Groundnut, sunflower, soya bean are major oilseed crops. Important cash crops that are grown are cotton, sugarcane, turmeric, and vegetables. The description of the three districts taken for study in Maharashtra is as follows:

Jalgaon is located in the north-west region of Maharashtra state. It has a geographical area of 11,765 sq.km and the total population of Jalgaon is 42, 29,917. It is bounded by the Buldana district in the southeast, Aurangabad towards the south, Nashik district in the southwest and in

the north lies towards the border of Madhya Pradesh. Jalgaon is rich in volcanic soil which is well suited for cotton production. Other major crops grown are Banana, Wheat, millet, lime, groundnut, cotton, and sugarcane. It is a major business centre for tea, gold, pulses, cotton and bananas. This district has a net area sown of 8.03 lakh hectares out of which 1.92 lakh hectares is irrigated area.

Nasik has a mythological, historical and cultural importance. It is situated in the northwest part of Maharashtra state and has a geographical area of 15,530sq.km. The district is completely landlocked being surrounded by Thane district on the West and South West, Ahmednagar district on the south, Aurangabad district on the South East and East, Jalgaon district on the East, and North East, Dhulia on the North and Surat and Dang districts of Gujarat on the West. The crops like wheat, paddy and other cereals are grown in various parts of the District, but Bajra and Maize are the major crops. Vegetables and Onion were main the cash crops grown and supplied to Mumbai, because of which the District was known as the Backyard of Mumbai. After the establishment of sugar factories, Sugarcane has now acquired an important position in the agricultural economy of the District. This district has a net area sown of 8.65 lakh hectares out of which 2.44 lakh hectares is irrigated area.

Washim district falls under the Vidharbha region of Maharashtra State. It has a geographical area of 5,510 sq.km and a population of 12,97,160. It is surrounded by Akola District to the north, Yavatmal and Amravati Districts to the east, Hingoli District to the south and Buldana District to the west. The economy of the district is primarily dependent on the agricultural sector; more than 80 percent of persons are engaged in the agricultural activity (DCH-Census, 2011). The average net cropped area of the district is 4.17 lakh hectares, which is 81 percent of the geographical area. Only 17.4 percent of the gross cropped area is irrigated, and the rest of the agricultural activity is dependent on the monsoon season. With rich fertile black soil, this plateau grown crops such as pulses, wheat, cotton and jowar are in abundance.

West Bengal

The state has occupied a geographical area of about 88,75,200 hectares sharing 2.7% of land in the country but producing more than 8% of the country's food production and providing space to 7.6% of the country's population. The total cultivatable area of the state is about 56 lakhs hectares which is 63% irrigation area of the net cropped area. In paddy and vegetable production, West Bengal ranks first and second among the leading growers of jute, pineapple, litchi, mango and loose flowers.

The following are the three districts studied in the West Bengal State:

South 24 Parganas is the southernmost and largest district of West Bengal state by area of 9, 960 sq. km. It has a population of 81, 53, 176, making it the second highly populated district in the state. The district is bounded by North 24 Parganas and Kolkata in the north, Bay of Bengal in the south, Bangladesh on the east and districts of Howrah and East Medinipur towards the west. Paddy is the principal crop of the district and other major crops include wheat, jute, potato, maize, sugarcane. Apart from food crops, cash crops such as fruits like Guava, Mango, Banana, Jackfruit, Pineapple, Papaya is also grown in South 24 Parganas. The district has 3.61 lakh hectares of net sown area out of which 1.37 lakh hectares of land is irrigated.

Birbhum district is situated in the Rarh region of West Bengal state. The district is bounded by Murshidabad in the East and North-East, Burdwan in the South and South-East and Santal Parganas of Jharkhand in the West and North-West. The district is spread over an area of 4545 sq. km. and is characterized by undulating topography. The total population of the district is 35, 02, 404. Major food crops grown here are paddy, maize, wheat, mustard, groundnut, lentil. Cash crops such as sugarcane, chilli, turmeric, ginger along with horticulture crops are grown as well. The net sown area is 3.18 lakh hectares out of which 2.86 lakh hectares are irrigated.

Hoogly has a geographical area of 3149 sq.km with a population of 55,19,145. It is surrounded by West Burdwan in the north, Bankura in the northwest, East Medinipore on the west side, North 24 Parganas on the east side, and Howrah on the southern side. The great Ganges flows as Hoogly river through this district and makes the whole district more fertile with its rich alluvial. 2,12,570 hectares is the net sown area which is around 67% of the total geographical area. Paddy, Jute, Potato, Maize, Green gram, Groundnut, Mustard, sugarcane, horticulture crops and vegetables are the main crops of the district. The district has many Jute industrial centres as well as other small and big industries Textile, Tyre, Dairy, Power Plant, etc.

A study was conducted to analyse the agriculture knowledge, stakeholders, requirements and constraints of the farming community in this district during the month of February 2020. Personnel interviews, focussed group discussions and mailed questionnaires were used to collect the data from the respondents.

3.2 Sampling strategy/ procedure

For the present investigation, all the farmers of the above-mentioned States were collected as sample frames. From these three strata (States), 150 respondents from each state (equal size sampling from each stratum) were selected randomly. From each district, 50 farmers were selected for the personnel interview and few focussed group discussions were conducted for the present study, the total number of respondents being 450 (3 states x 150 from each state).

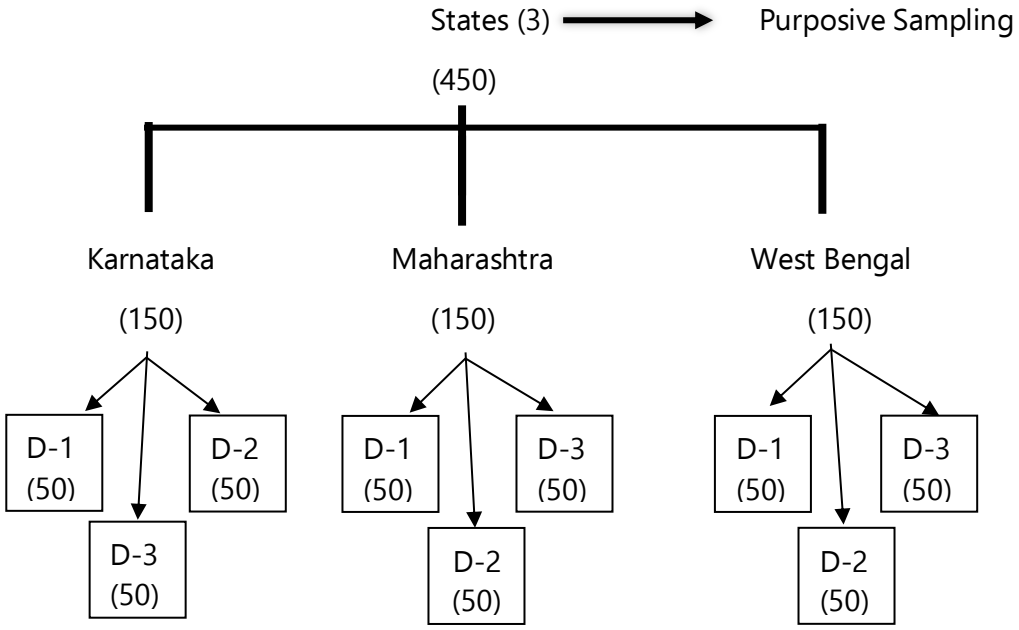
All the service providers in the field of agriculture were established by the public sector, private sector, NGOs, public-private sectors. The number of extension agents from each state was restricted to 50 for the present study.

Sampling Design

For this study, three types of the questionnaire have been constructed differently for farmers, extension agents and conduct focussed group discussions.

For the selection of the sample, Stratified Random Sampling (SRS) has been adopted and an attempt has been made to include all the age groups and gender within the various classes.

Sampling Procedure - Stratified Random Sampling (SRS)



*Districts were also selected purposively with equal sample size from each state and district

3.4 Construction of schedule

For the present study, a structured interview schedule was prepared which has been given in the Appendix. The schedule for the present investigation was divided into three parts.

3.5 Collection of data

The present study involves both primary and secondary data collection. The secondary data such as extension agents' records, monthly work reports, production statistics of major crops for previous two years, learning materials, annual work plan, demonstration plots records,

supervision reports, agents and farmers training schedules were collected from libraries, extension agents offices, District offices and the internet.

Field data was collected with the help of a structured interview schedule constructed for the present study from the respondents. The actual data collection work was carried out in the month of February 2020. After the completion of data collection, thorough checking was made on the schedule and the schedule was tabulated according to the order.

3.6 Statistical tools used in the study

The collected data were processed, classified and tabulated. Further, the statistical elements were applied in the light of objectives to arrive to a conclusion. MS Excel and SPSS 19.0 statistical package was used for data analysis in the present study. The following statistical tools were used in the present investigation for precise and meaningful analysis and interpretation of the collected data:

1. The descriptive statistics viz. frequency and percentage.
2. Ranking

3.6.1 Percentage

Percentage is used for making simple comparisons. For calculating the percentage, the frequency of the particular cell was divided by the total number of the respondents in that particular category and multiplied by 100. The percentage was calculated up to two places after the decimal point.

$$Percentage = \frac{Frequency\ (f)}{Total\ number\ of\ respondents\ (n)} \times 100$$

3.6.2 Ranking

Assume that a set of individuals may be grouped according to the degree to which they possess a given character, whether qualitative or quantitative. For example, a number of workers may be arranged in order of efficiency by their supervisor, although it may be not easy for any satisfactory measure of efficiency. Similarly, a number of students may be arranged in order of stature without measuring the height of each student. Such order management of an individual is called ranking, and the ordinal number indicating the position of a given individual in the ranking is called its rank, to be specific, rank 'r' means that, with respect to the character understudy, the individual stands r, so that (r-1) individuals have the character to a higher degree than this individual. In a given ranking, two or more individuals may be considered indistinguishable with respect to the character under study. So, the same rank may be assigned to the ranking, which is then said to include a tie.

Results and Discussion

The current chapter presents the results of the analyses that provide answers to the four research objectives of the present study. The results and subsequent discussions are arranged in view of the research objectives. The results are interpreted by making overall generalizations. The chapter begins with the discussions on the socio-economic profile of the respondents. Section two has advisory services. It is followed by section three which includes the opinion of the respondents regarding agricultural input support. In the fourth section, agricultural finance support is discussed. In the fifth section, agricultural marketing is discussed. In the sixth section, the information regarding farmer's producers' organization is discussed. In the seventh section, the farmer's linkage with the organization is discussed. In the eight and the last section, the constraints and necessities of our respondents are discussed.

The findings in this chapter are discussed in the following sections.

4.1 Socioeconomic status of the respondents
4.2 Stakeholders of the different support systems
4.3 Advisory services
4.4 Agricultural input support
4.5 Agricultural finance support
4.6 Agricultural marketing and price policy
4.7 Farmers association to organizations
4.8 Agriculture Technology Venture Support
4.9 Gaps in existing support systems
4.10 Constraints and Needs
4.11 Case Studies
4.12ocus Group Discussion

4.1 Socioeconomic status of the respondents of Karnataka, Maharashtra and West Bengal

Table-11: Socioeconomic profile of the respondents of Karnataka, Maharashtra and West Bengal.

Sl. No.	Particulars	Respondent/ Sample (Survey)		
		Karnataka	Maharashtra	West Bengal
1	No. of districts selected	3	3	3
2	Total no. of respondents	150	150	150

3	**Age group** (*WHO*)	Young (upto 35 yrs)	12%	20%	17%
		Middle (35-50 yrs)	47%	54%	50%
		Old (above 50 yrs)	41%	26%	33%
4	**Education** (*MHRD*)	Illiterate	33%	7%	23%
		High School	50%	77%	70%
		Degree/ Diploma after high school	17%	16%	7%
5	**Farm Holding**	Marginal	32%	14%	63%
		Small	33%	36%	22%
		Medium	19%	29%	12%
		Large	16%	21%	3%
6	**Membership in organization**	Yes	51%	30%	81%

From the above table 11, it is observed that, in the three states taken for the study, the majority of the farmers were aged between 35-50 years with 47% (Karnataka), 54%(Maharashtra), 50% (West Bengal) and the percentage of youth aged (below 30years) who practiced agriculture as their occupation is confined to 12% (Karnataka), 20% (Maharashtra) and 17% (West Bengal) showing the lower representation of youth in agriculture.

The majority of respondents in these three states have a high school level of education. The farmers with an educational qualification up to a degree are low in the three states. Some farmers in the Maharashtra have undergone the diploma courses offered by the agricultural universities called "GTC" or "Krishi Padavika," which was provided in mission mode a decade back under Maharashtra government's guidelines for diploma education.

It was also observed that the majority of the farmers are having small and marginal landholdings in the particular districts studied in the three states. It is also observed that the majority of the farmers (80%) in the three states don't practice any subsidiary occupations and among the farmers who do the majority, take up livestock rearing. Few farmers (6%) of West Bengal have taken up fish rearing as a subsidiary occupation.

It was observed that the majority of the respondents (81%) in West Bengal and in Karnataka (51%) had membership in the organizations whereas in Maharashtra it is only 30%.

4.2 The different stakeholders of the Advisory support system in the three states are as follows:

Table 12: Different stakeholders of the Advisory support system

Knowledge and Support systems \ Stakeholders	Self			Friends and Relatives			Agriculture officer/ Horticulture officer/ Fisheries Extension officer			Input dealers			Cooperative societies			Block Development Officer			Panchayat			Private Input Companies			Progressive farmer		
	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB
Research, Education, Extension and Advisory Services	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Input support system	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√				√	√	√	√	√	√	√
Agricultural Finance Support	√	√	√	√	√	√							√	√	√													
Agricultural marketing support and Pricing policy	√	√	√	√	√	√																			√	√	√	√

Knowledge and support systems \ Stakeholders	SAUs			Agriculture and allied Departments			KVK/Raithu Samparka Kendras (in Karnataka)			ICTs			Television and Print Media			Community radio			SHGs			Private Intermediaries			Bank		
	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB
Research, Education, Extension and Advisory Services	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√									
Input support system				√	√		√	√	√										√	√	√						
Agricultural Finance Support																									√	√	√
Agricultural marketing support and Pricing policy																						√	√	√			

Stakeholders / Knowledge and support systems	Block Level Development Officers (BLDO)			Warehouses and Cold Storages			Farmer Producer Organizations			Unregulated Market Traders			Government Procurement centres			Money Lenders			Market Intermediaries			Transporters		
	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB	K	M	WB
Research, Education, Extension and Advisory Services	√	√	√				√	√	√															
Input support system																								
Agricultural Finance Support								√								√	√	√						
Agricultural marketing support and Pricing policy				√	√	√				√	√	√	√	√	√				√	√	√	√	√	√

K= Karnataka, M= Maharashtra, WB= West Bengal

The above-mentioned stakeholders are working with grass-root level farmers, who are directly providing knowledge/support to the farmers in the states taken for the study. There are other stakeholders who are linked directly or indirectly to the identified stakeholders for delivering the services.

Active linkages of farmers with various stakeholders of knowledge and support found in Karnataka state on the basis of study:

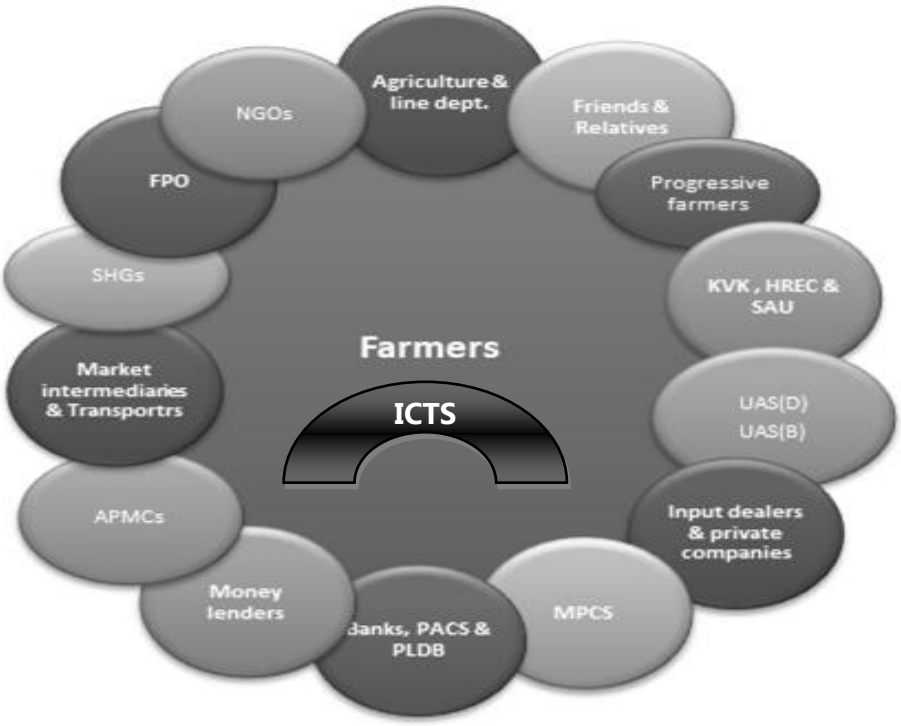


Fig 13: Identified active linkages of farmers with different stakeholders in Karnataka state

The form of information and assistance offered by each of the stakeholders as set out below:

Table 13: Services/support obtained by the farmers in Karnataka state

Sl. No.	Stakeholder	Knowledge	Support
1	Friends and relatives	• Pest and disease control • Subsidies/schemes • Market information i.e., price and arrivals	
2	Progressive farmers	• Pest and disease control • Subsidies/schemes • Market information i.e., price and arrivals	
3	RSK	• Advisory services • Conducting trainings, field demonstrations etc. through ATMA	• Supply of inputs, pesticides and fertilizers • Schemes/ subsidies implementation • Soil testing
4	**KVK**	• Research and Extension • Conducting trainings, OFT, FLD etc.	• Supply of inputs such as neem oil, planting material etc. • Soil and water testing
5	**HREC**	• Research • Advisory services • Conducting trainings, OFT, FLD etc.	• Supply of planting materials
6	Horticulture Department	• Advisory services • Conducting trainings, field demonstrations etc.	• Supply of planting materials • Implemenatation of schemes/ subsidies
7	Sericulture Department	• Advisory services • Conducting trainings, field demonstrations etc.	• Supply of planting materials, disinfectants etc. • Implemenatation of schemes/ subsidies
8	SAU's	• Conducting Krishimela's	
9	Input dealers	• Advisory services regarding pest and disease control	• Supply of all kinds of inputs such as seeds, fertilizers, pesticides etc.
10	Private companies	• Advisory services regarding pest and disease control • Information on new technology and machinery	• Supply of inputs and machinery
11	Veterinary Department	• Advisory services	• Diagnosing the health problems of animals

12	MPCS		• Inputs such as animal feed etc. • Facilities for animal health care
13	Commercial Banks		• Short and long term financial support • KCC
14	PACS		• Short term financial support
15	PLDB		• Long term finance
16	Money lenders		• Short term finance
17	Market intermediaries	• Information on market price and arrivals	• Facilitating the auction • Timely payment • Transportation facilities
18	Transporters	• Information on market price and arrivals	• Transportation facilities
19	SHGs	• Advisory on finance and ways to avail them	• Financial support with a loan
20	FPO	• Advisory services	• Supply of inputs such as seeds, fertilizers, pesticides, tarpels and sprayers.
21	ICTs	• Package of practices • Inputs	

Raitha Samparka Kendra (RSK)

Raitha Mitra Yojane is a new demand-driven agricultural extension system of Karnataka which has replaced the earlier TandV system of agricultural extension. The agricultural extension centres opened under this new programme at Hobli level are called Raitha Samparka Kendra (RSK). The scheme is implemented in all 30 districts and 745 hoblis of the Karnataka state. There are 35 RSKs operating in the Belagavi district. (http://raitamitra.kar.nic.in/)

The main objectives of RSK are:

1. Provide updated information on crop production options, practice markets etc.,
2. Facilitate onsite provision of critical inputs like seeds, bio-fertilizers, micro-nutrients etc.,
3. Provide primary seeds and soil testing facilities.
4. Provide a forum for an on-farm demonstration about new technologies developed by both public and private sector agencies.

The state agriculture department is implementing different schemes/subsidies (i.e. Krishibhagya, PMKSY, MIP, farm machineries, etc.), distributing quality seeds and fertilizers through RSK.

During 2019-20, 5,47,150 farmers have been benefitted from PM-KISAN in the district. Through the Raita Siri programme, they have promoted millet production in 1011.75 ha land of 1329 farmers where the highest area was covered in Soundatti, Ramadurg and Bailhongal taluks. Under Zero Budget Natural Farming (ZBNF), they have achieved a target area of 977.8 ha of 2126 farmers spending 36.28 lakhs. However, for promoting agro-processing, agriculture has spent 199.34 lakhs in Belagavi district in which they are provided processing implements and Tarpaulins to farmers. During 2018-19, 168667 Kgs and 93538 Kgs of sowing seeds have been distributed in kharif and rabi season respectively and 315108 tonnes of chemical fertilizers were distributed to the farmers of Belagavi district.
(Source:- http://www.manage.gov.in/)

Community Radio station, UAS, Dharwad: The first Community Radio Station in Karnataka was established in the UAS Dharwad campus on May 17, 2007. The Community Radio Station is named Krishi Community Radio Station (KCRS); the catchline of this channel is "Raitarinda-Raitarige" (from farmers to the farmers). The programme is being broadcasted for four hours daily (two hours each in the morning and two hours in the evening). The fresh programmes are aired at 6 PM to 8 PM and repeated the next day morning between 6 AM and 8 AM. The programmes of Community Radio Station have helped in providing location-specific production information to the farmers based on a day to day weather report, market analysis, out-break of pests and diseases etc. (http://uasd.edu/in/)

Initiatives by KVK, Belagavi district in Karnataka in providing extension and advisory support to farmers:

Krishi Vigyan Kendra (KLE KVK), Mattikoppa, Belagavi district

The KLES Krishi Vigyan Kendra, Mattikoppa, was established on 30th September 2011 on sprawling premises at Mattikoppa village on newly acquired instruction farm of 25.20 ha land for carrying out various research based frontline transfer of technology (ToT) programmes such as frontline demonstrations (FLD), on-farm testing (OFT) in field crops, horticulture crops, animal components, imparting hands-on training programmes to rural youth and farm women on the latest technical know-how to cater the needs of Belagavi, Khanapur, Bailhongal, Soundatti and Ramdurg taluk farmers.

Recently, during February 2020, the KVK has developed a mobile app "KLEKVK SMART FARMING", to educate more about farming for farmers. Here, farmers can get all the information regarding facilities available at KVK, farming practices (including INM and IPM) of major agricultural and horticultural crops and other information related to value addition in millets in the local language (Kannada). They are also disseminating information through mobile SMS services, Voice services, WhatsApp groups (Crop specific and region specific).

"KLEKVK SMART FARMING" Mobile App

KVK is majorly conducting on campus and off-campus trainings, through which they have reached 1039 and 1290 farmers respectively. They have trained 92 rural youth on seed production, value addition and motivation to non-chewing tobacco. KVK has conducted a skill training programme related to quality seed grower and mango grower under ASCI which has trained 40 farmers. (2019)

Active linkages of farmers with various stakeholders of knowledge and support found in Maharashtra state on the basis of study

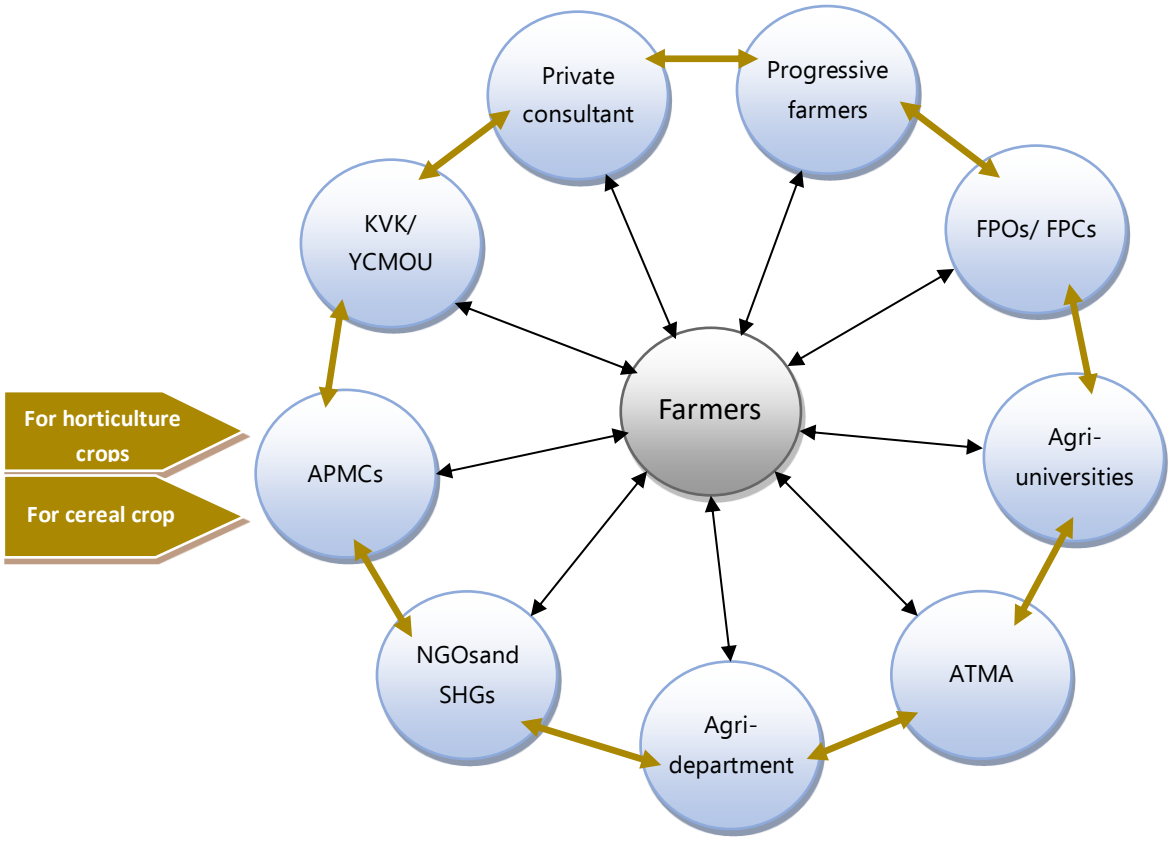


Fig. 14: Identified active linkages of farmers with different stakeholders in Maharashtra state

Table 14: Services/support obtained through stakeholders by the farmers in Maharashtra state

Sr. no.	Stakeholders	Agriculture knowledge system	Agriculture support system
1.	Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola	• Agriculture Research • Agriculture Higher Education • Technical support to newly proposed Organic Farming Mission	• Extension and advisory support on weather, a package of practice, new and improved varieties etc.,
2.	Krishi Vigyan Kendra, Karda-Washim	• Capacity building • DAESI	• Technology dissemination • Advisory • CRS – Swaranant 90.4 MHz • Field demonstrations • Meghdhoot – Agromet advisory • SHG support under women in the agriculture program • Postharvest training

3.	KVK-YCMOU, Nashik	• Annual training programs • Nursery management • Knowledge building and transfer • Women empowerment	• Drumstick, rice, wheat, cotton, mushroom and ragi etc., production technology • Soil, water, leaf and stem testing • Annual training programs • Soybean processing and home industries • On-farm testing OFT • Farm mechanization • Soil and water conservation • post-harvest lab • organic farming, micro-irrigation, protected farming, high-density plantation • poultry farm and goat rearing • Bio-control laboratory, poly house, bio fertilizer
4.	Krishi Vigyan Kendra, Mamurabad-Jalgaon	• Capacity building • Nursery management • Annual training programs	• Technology dissemination • Advisory • Field demonstrations • Meghdhoot – Agromet advisory
5.	Agriculture Department, Washim		• Schemes and subsidy implementation • Advisory through Krishi Sevak • Subsidised inputs supply
6.	Agriculture office/department, Nashik	• Capacity building • Awareness	• Tractor PFMS • Community farm pond • Mission of Integrated Development of Horticulture • Krishonnati Yojana • Shetatale, Jalayukta Shivar Yojana • Technological dissemination

			• Krishi melas, field days and exhibitions
7.	Agriculture Department, Jalgaon	• Awareness • Capacity building	• Schemes and subsidy implementation • Advisory through Krishi Sevak • Subsidised inputs supply
8.	Sericulture Department, Washim	• Trainings in collaboration with Central Silk Board, CSRTI and APSRDI	• Scheme and subsidy implementation • Advisory on silkworm rearing and mulberry cultivation
9.	ATMA, Washim	• Capacity building through trainings, field visits etc.,	• Registration of farmer groups, FPOs • Technical guidance over new agro-technics
10.	Agriculture Technology Management Agency (ATMA), Nashik	• Shetishala • Organic farming • Training programs	• Shetishala on maize, soybean, grapes, and different horticulture crops • Technological guidance • Registration of farmer groups for group farming
11.	ATMA, Jalgaon	• Capacity building through trainings, field visits etc.,	• Registration of farmer groups, FPOs • Technical guidance over new agro-technics
12.	Suvide Foundation – NGO, Washim	• Agriculture Education	• Sponsors KVK, Karda
13.	APMC, Washim		• Regulated market infrastructure • Pledge loan • Storage facility • SMS – market price
14.	APMC, Nashik		• Regulated market infrastructure • Special market for perishables • Single market fee • Storage and warehousing

15.	APMC, Jalgaon		• Regulated market infrastructure • Pledge loan • Storage facility • SMS – market price
16.	NAFED		• Procurement of food grains under MSP
17.	Maha State Warehousing Corporation, Washim		• Warehousing facility • Pledge loan
18.	Licensed Private traders, Washim		• Procurement of agriculture produce apart from APMC
19.	Input dealers, Washim		• Input supply – seeds, chemical fertilizers, pesticides, sprayers etc.,
20.	Jain Irrigations, Jalgaon		• Solar pump set through subsidy, micro-irrigation setup through subsidy
21.	SCBs, Washim		• Agriculture credit facility
22.	PACS, Washim		• Cooperative credit
23.	SHGs, Washim		• Domestic savings • Credit facility under a cooperative approach • Technical support to women farmers through KVK linkup
24.	Rishiwat FPO LTD. Washim		• Mobile advisory service • SHG formation and training • Inputs and machinery support • Storage facility
25.	FPC- Sahyadri Farms, Nashik	• Profitable and sustainable farming • Safe, healthy and affordable farm produce • Value added products	• Cold storage for fast moving and frozen products • Cooling rooms • Ripening chambers • Individually Quick Frozen (IQF) processing facility unit • Vacuum Pre-cooling System

			for leafy vegetables • Processors and exporters of frozen and aseptic fruits and vegetables • Traceability identification number
26.	FPC- Nirmal seeds, Jalgaon	• Profitable and sustainable farming • Value added products	• Cold storage facility • Bio input division • Pre-cooling chamber • Research lab
27.	FPO- Monsoon Foods, Nashik	• Safe, healthy and affordable farm produce	• Competitive pricing • Cold storage • Traceability identification number

Active linkages of farmers with various stakeholders of knowledge and support found in West Bengal state on the basis of study

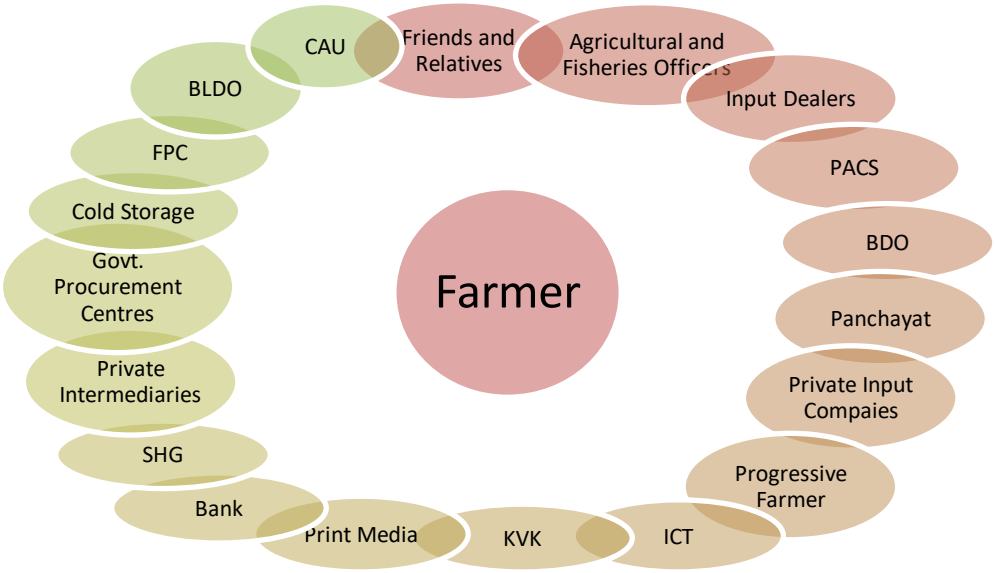


Fig. 15: Identified active linkages of farmers with different stakeholders in West Bengal state

Table 15: Services/support obtained by the farmers in West Bengal

Sl. No.	Stakeholders	Knowledge	Support
1	Friends and Relatives	• Package of Practices • Schemes • Training schedule • Inputs	

		• Market information	
2	Agricultural Officers	• Schemes • Training schedule • Package of practices	• Inputs like better seeds, fertilizers, pesticides • Training • Financial assistance for assured income
3	Input Dealers	• Advisory service about new varieties, inputs	• Inputs like normal or better seeds, fertilizers, pesticides
4	PACS	• Advisory on crop production • Advisory on finance schemes and ways to avail them	• Inputs like better seeds, fertilizers, pesticides • Financial support with a loan
5	BDO	• Advisory on crop production	• Inputs like better seeds, fertilizers, pesticides
6	Panchayat	• Advisory on crop production	• Inputs like better seeds, fertilizers, pesticides
7	Private Input Companies	• Advisory service about new varieties, inputs • Advisory on crop production	• Inputs like better seeds, fertilizers, pesticides • Marketing Support through buyback • Training
8	Progressive Farmer	• Package of Practices • Schemes • Training schedule • Inputs • Market information	• Inputs like better seeds, fertilizers, pesticides
9	ICT	• Package of practices • Inputs	
10	KVK	• Package of Practices • Schemes • Training schedule • Inputs • High value crops	• Inputs like better seeds, fertilizers, pesticides • Training
11	Print Media	• Package of Practices • Schemes • Inputs	
12	Bank	• Advisory on finance schemes and ways to avail them	• Financial support with a loan

13	SHG	• Advisory on finance and ways to avail them	• Financial support with a loan
14	Private intermediaries	• Market information	• Price support for produce
15	Government Procurement Centres	• Market information	• Price support for produce
16	Cold Storage	• Information on storage capacity • Pricings for storage	• Storage facility for perishable crops
17	FPC	• Package of Practices • Schemes • Training schedule • Inputs • High value crops	• Training
18	BLDO	• Ideal practices for rearing • Schemes • Training schedule	• Inputs like duckling, chicks, heifer and fodder • Medical support for sick animals
19	FEO	• Ideal practices for rearing • Schemes • Training schedule	• Inputs like fingerlings or fish seed • Financial assistance for house construction
20	Central Agricultural University	• Package of Practices • Schemes • Training schedule • Inputs • High value crops	• Inputs like better seeds, fertilizers, pesticides. • Trainings

The above mentioned stakeholders are the direct influencers of the farmers who provide the farmers with knowledge and support for their dispensation. Apart from the above-mentioned stakeholders, there are others who coordinate and collaborate with the above actors directly or indirectly in making the process easy and simple. The above stakeholders are discussed below for their part of support in reaching out to farmers, addressing their challenges paving for a sustainable system in place.

4.3 Advisory Systems: Stakeholders and kind of support availed by the farmers

Agriculture Education, Research and Extension Services

Agricultural Extension and Advisory Services (AEAS) refers to any organization in the public or private sectors (e.g. NGOs, farmer organizations, private firms etc.) that facilitates farmers' and other rural actors' access to knowledge, information and technologies, and their interactions with other actors. It also assists them to develop their own technical, organizational and management skills and practices to improve their livelihoods and well-being (Christoplos, 2010). Therefore, agriculture extension and advisory services play a crucial role in farming.

Table 16: Different stakeholders of the Extension and Advisory systems in the three states

Stakeholders of Advisory support		
Karnataka	**Maharashtra**	**West Bengal**
• Friends and Relatives • Progressive farmers • Input Dealers • Government Officers (Agricultural /Horticultural/Sericulture officers) • Krishi Vignan Kendra's (KVK)/ATMAs • State Agricultural Universities (UAS[D] andUHS[B]) • Newspaper/ Magazines and Television • Mobile and Internet • Others (like private companies, Raithu Samparka Kendras)	• Self • Friends and Relatives • Progressive farmers • Input Dealers • State Agricultural Universities (SAU-PDKV, Akhola) • Krishi Vignan Kendra's (KVK)/ATMAs • Television • Community Radio • Silk Department • Agricultural Officers • Private Consultants • Others (mobile apps, panchayat committees, Krishi Sahayak)	• Friends and Relatives • Input Dealers • Progressive farmers • Information and Communication Technology (ICTs) • Government Officers (Agricultural /Horticultural/Sericulture officers) • Krishi Vignan Kendra's (KVK)/ATMAs • Cooperative Societies • Others (Accelerated Development of Minor Irrigation Project -for obtaining irrigation related information)

The preferred stakeholders are different in different districts of the selected states according to the nature of the advisory support needed, ease of accessibility, availability and labiality by a majority of the farmers.

The availing extension and advisory system by the existing stakeholders in the states under study is as follows:

Karnataka: The majority of the farmers in Shivamogga (100%) and Kolar district (76%) avail the information from friends and relatives as they find them reliable and trustworthy but in Belagavi district, mobile and internet have taken over the major share (76%) because they are found to be handy and highly effective as they provide multiple facilities for the farmers. In case of institutions in kolar district, 68% of farmers avail of advisory services from the Raita Samparka Kendra (RSK) which is situated at Hubli. The farmers are also visiting the Horticulture and sericulture departments related to information on pests and diseases, new technologies etc. The input dealers are also being approached by the farmers, followed by progressive farmers, Agricultural officers, KVKs and Agricultural Universities. Few literate farmers are using newspapers, magazines etc. and few ICTs are also used for availing the advisory support.

Maharashtra: The majority of the farmers (100%) from Nashik and Jalgaon do not seek any advisory support. They rely on their own experience and learn from past experiences. However, in Washim, 38% of farmers are self-reliant to the source of advice. Farmers from Washim, Nashik and Jalgaon who seek information from input dealers have registered 0%, 16% and 48% respectively. In Nashik, 32% of the farmers seek advisory sources from private consultants as they are associated with farmers' organizations and export. In Washim, 74% of the farmers approach PDKV Akola to seek advice. 46% and 32% of farmers acquire information from television and community radio station respectively. Many farmers of Washim are shifting towards sericulture. 12% of farmers seek information from the silk department of Washim. Also, 6% of farmers avail of information from ATMA.

West Bengal: A considerable portion of farmers in Hoogly (16%), Birbhum (19%) and 24 Parganas (39%) mentions friends and relatives as their source for advisory and they take advice on all the package of practices of new crops, inputs, crop protection. While moving to the institutional sources of extension and advisory in Birbhum, 19% of the farmers avail information from Central Agricultural University (CAU) and 22% in Hoogly directs towards the ICTs to be more precise, SMS services by Bidhan Chandra Krishi Vishwavidyalaya (BCKV), IFFCO Kisan Green sim or mobile apps etc. About 22% of farmers in both Birbhum and 24 Parganas depend on KVKs and in Hoogly the KVKs are not much functional. And about 26% of farmers in 24 Parganas, 17% in Birbhum and 16% in Hoogly depend upon Input dealers. The progressive farmers, private companies, Cooperative societies, AOs, FPCs and the Accelerated Development of Minor Irrigation Projects (providing irrigation related advisory services in 24 Parganas) are also providing the Advisory information to the farmers.

Ease of access, usefulness and frequency of obtaining information from stakeholders

The majority of the farmers of Karnataka, Maharashtra and West Bengal opined that access to all the stakeholders is easy to accept a few such as officers of Agriculture and allied department at block level which is mainly due to distance and non-availability of staff for field visit due to less manpower in the institution, Krishi Vignan Kendras (KVK) and other private companies. The service from the rest of the stakeholders like friends and farmers, progressive farmers, input dealers is quite easy as expressed by the majority of farmers however difficulties arise in the case of FPCs or Cooperative Society, etc due to lack of contacts.

Regarding the usefulness of the information provided by the stakeholders, the majority of the farmers opined that information provided by the stakeholders is very useful to them, few of them expressed that the information provided by the RSK (Karnataka), input dealers are found to be moderately useful.

The majority of the information from the majority of stakeholders like KVKs, Agricultural officers, and private consultants are found to be highly effective in delivering their services. the rest of the stakeholders are more or less highly effective towards farmers since they provide information on various topics, schemes and trainings. Since all the stakeholders are easy to access, effective and useful in delivering the services, farmers are approaching them frequently as and when needed. Only a few of the farmers are approaching KVK, RSK(Karnataka), private consultants when it is very necessary.

What were the services about which the farmers availed information from the stakeholders of the Advisory Support System?

The majority of the farmers availed information related to the following aspects: Inputs, market prices, crop and animal husbandry, credit, weather and the progressive farmers of the village opted to know about the new varieties of seeds released, different subsidies and schemes, post-harvest activities, public initiatives by Agri and allied departments, new technologies, Agribusiness, training programmes offered by the KVKs, ATMAs or other officials of agriculture and line departments etc., from the above-mentioned stakeholders.

Focus points for the innovative support services by the Advisory support system for the benefit of the farmers

1. Focus on the actual needs of the majority of the farmers.
2. Direct interaction with other farmers combined with seeing practical examples of good practice/successful alternatives plus up-to-date information on profitability can encourage

farmers to expand their knowledge and test new farming methods along with the use of digital technologies.

3. Integrated approaches tend to work best: combine face-to-face, on-farm contact with web-based exchange of information using social media. However, relying more on the live contact and peer-to-peer exchanges is more effective based on the availability of the extension agents as they are already preoccupied with the official works. Group meetings must be well organized and prepared to gain the interest and credibility of the participants.
4. Good solutions "created by farmers for farmers" spread quickly.
5. Farmer groups can attract various sources of funding, especially on innovative topics – be creative!
6. Sometimes existing approaches do not provide the solutions needed. Throwing all the normal rules, systems and procedures overboard can help to discover new perspectives and to think creatively about seeking a new, unpredictable, creative solution to the problem. So, finding out the innovative approaches in solving the problems of the farmers is an important role to be played by the actors.

4.4 Agricultural input support system

The input support system in the agricultural sector involves seeds, fertilizers, plant protection, farm machinery, soil health and irrigation etc.

Karnataka: The majority of farmers (100%) of Karnataka (in all the three districts) are mainly obtaining the seeds, fertilizers and pesticides from input dealers and most of the time, the input dealers are recommending the pesticides based on the disease symptoms expressed by farmers. Apart from these farmers are also obtaining inputs, planting materials for crops, farm machinery, drip and sprinklers, etc from the Agricultural Department and KVKs at subsidized prices. Along with these, the other stakeholders like the horticulture and sericulture departments (planting materials), animal husbandry (feed and mixtures for cattle), private agribusiness firms are also providing required inputs to the farmers.

Maharashtra: The highest percentage regarding input shared by input supplier among the three districts of Maharashtra i.e. 56% in Washim, 76% in Nashik and 69% in Jalgaon. The percent share of farmers who rely on self in Washim, Nashik and Jalgaon shows 32%, 48% and 46% respectively. About 38% of farmers in Nasik are associated with farmer's organizations and they seek information from those FPOs. Farmers from Washim and Jalgaon who acquire information from agri-office/departments show 6% and 4% respectively.

West Bengal: The input dealers occupy the major share (100%) in providing inputs to farmers in the studied three districts of the state. Some farmers (23% in Birbhum and 20% in 24 Parganas) obtain inputs from KVKs and 20% in Hoogly from Agricultural Officers at block level at subsidized

prices as these farmers are progressive due to favouritism. Private input companies also play key role in these districts. The Coconut Development Board also provides planting materials.

Ease of access, usefulness and frequency of obtaining information from stakeholders

The majority of the respondents have opined that the input dealers are the easiest sources to access the agricultural inputs compared to availing them from the Agricultural officers, KVKs and private consultants due to the distance and also they are easily accessible to those farmers who are having a good rapport with them. All the inputs which are provided by different stakeholders are highly useful and highly effective since they provide complete information as well as inputs in the study areas.

However, when it comes to the frequency of availing such services majority do not approach for inputs to government officials due to the above-mentioned reason due to which farmers frequently avail inputs from input dealers as they are easily approachable.

Why the majority of farmers opt for the Input dealers in availing Agri input and advisory services?

The majority of farmers of the study area are small and marginal with smaller landholdings, these farmers find the input dealers (dealing with seeds, fertilisers, pesticides, equipments) to be easily approachable and available when and then required to avail their services. The input dealers are mostly located in the rural areas and the farmers can avail the inputs from them in credit during the cropping season and can repay back after the sale of the produce.

4.5 Agricultural Finance Support

A key challenge for the majority of these farmers is - access to finance. Lack of access to finance is a key impediment to farmers in improving the efficiency of their productions and adopting better technologies. Most of the major agriculture producing countries in the world support their agriculture and farmers through finance and subsidies aiming food security and making agriculture profitable enterprise and the main policy instruments of supporting Indian farms remain that of subsidizing key farm inputs (such as fertilizers, power for irrigation, canal waters, agriculture credit, and crop insurance).

The identified key finance providers are friends and relatives, banks, PACS (Primary Agriculture Credit Cooperative Societies, Self Help Groups (SHGs), Moneylenders, PLDB (Primary land development banks), Agricultural subsidies through schemes.

Karnataka: The majority of the farmers (94% in Shivamogga, 90% in Kolar, 26% in Belagavi) fulfilling their financial needs from commercial and regional rural banks, they mainly obtain short-term loans for crop cultivation (KCC). About 90% of farmers in Shivamogga avail finance from SHGs and 44% of farmers in Belagavi, 40% in Kolar are obtaining loans from PACS, they are obtaining only short-term loans. Very few of them obtaining finance/loan from moneylenders (short term loan), APMCs, and PLDB (long term loan).

Majority of the farmers making repayment regularly to banks, moneylenders, and PLD Banks. Only in the case of PACS farmers are not making repayment regularly, it is mainly because of loan waiver by state governments. Farmers were in the anticipation of loan waivers and wilfully they had not repaid loans.

Different schemes available for the farmers of Karnataka for providing finance

There are many schemes available from Agriculture, Horticulture, and sericulture departments to the farmers. Only one-third of the farmers availed subsidies from the different schemes of agriculture ad line departments. From the agriculture department majorly, farmers are getting inputs (seeds, fertilisers and pesticides) at subsidised prices followed by drip and sprinkler under Pradhan Mantri Krishi Sichay Yojana (PMKSY). Other schemes such as Krishibhagya where the farmers availed farm pond, diesel pump,tarpel and farm machinery at subsidised prices. Farmers were also availed drip from the horticulture department under PMKSY and around one fifth of the farmers' availed benefit of MNREGA for establishing new mulberry plantation.

Maharashtra: The majority of farmers of this state also avail of loans from friends and relatives, banks etc. There are 54%, 66% and 18% of farmers from Washim, Nashik and Jalgaon who were also found to be the beneficiaries of subsidies through different government schemes.

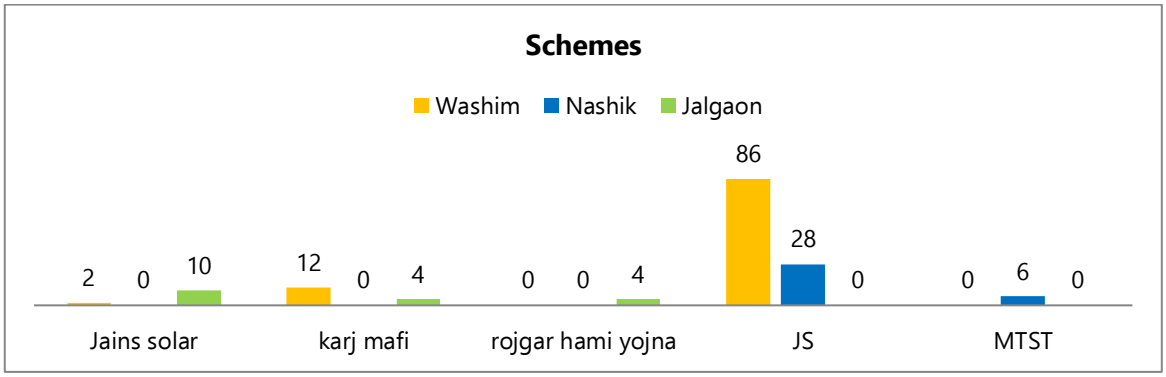


Fig. 16: Different schemes available for the farmers of Maharashtra for providing finance

The above figure depicts the percent share of different schemes availed by the farmers of Maharashtra for Finance. In Washim 86% of farmers found to be the beneficiaries of the Jalayukta Shivar scheme and 2% of farmers are the beneficiaries of Jain Solar Pump. 28% of farmers of Nashik are the beneficiaries of the Jalayukta Shivar scheme and 6% shared by the Magel Tyala Shet-Tale scheme. In Jalgaon, 10% of farmers are the beneficiaries of Jain Solar Pump.

West Bengal: The majority of respondents 52% in Bhirbum and 45% in 24 Parganas are availing loans from banks whereas in Hoogly 50% of farmers depend on PACs for their finance. A considerable portion of farmers also feels reliable in taking finance from friends and relatives. Very few farmers in 24 Parganas avail the Krisak Bandhu.

An interesting fact found is that all the respondents of Hoogly will avail the credit within the financial system only and none of them were defaulters and this shows their commitment to repaying the loans.

The majority of the farmers of West Bengal are beneficiaries of Government subsidies and insurance.

Ease of access, usefulness and frequency of obtaining information from stakeholders

Ease of access to finance was easy as expressed by the majority of the farmers and also, they opined that the obtained finance was highly useful to them. When it comes to the efficiency of service provided by stakeholder's majority of the farmers opined that except banks majority of the other stakeholders are moderately efficient, because of the lengthy procedure to sanction loans and timeliness of the release of loans. Regarding the usefulness of the finance availed; a greater portion agrees that the finance made available to them was highly useful.

The majority of the farmers are not frequently visiting financial institutions they are just visiting them as and when necessary only for getting loans and for repayment.

Why the majority of the farmers depend upon non-institutional credit sources rather than approaching the financial institutions for availing the credit facilities?

Most of the farmers tend to avail credit facilities from the local money lenders, friends, or relatives though they charge higher interest rates due to the reason that the financial institutions have lengthy loan procedures for sanctioning the credit thus becoming tedious for the uneducated farmers. As the majority of the farmers need timely credit cannot wait till their entire loan is sanctioned and disbursed. Most of the farmers are not fully aware of all the procedures and benefits of institutional credit schemes. Moreover, in the case of

natural calamities, the farmers will not be able to repay the loan amount within the stipulated time period.

4.6 Agricultural marketing and price policy

Agricultural marketing serves a greater social role in terms of raising income in rural communities. It acts as a link between the farm and non-farm sectors. With the development of means of transport and storage facilities agriculture has become commercial from subsistence in character and the farmers have also started, although not up to the desired level, growing those crops that fetch a better price. In modern marketing, the agricultural produce has to undergo a series of transfers and or exchanges from one hand to another before it finally reaches the consumer. So, in countries like India, the number of hands through which the products pass is too much, which is why an effective and efficient marketing system in order to increase the producers share in consumers rupee not only to provide the farmers their share of prices for their products but also to encourage them to continue agriculture.

Karnataka: The major identified marketing stakeholders are Market intermediaries such as traders/commission agents. They are the main source of information providers to farmers (100% in Belagavi, 100% Shivamogga and 85% in Kolar) regarding price, and arrivals in the market. Few of the farmers are also getting information on price and arrivals from APMC officials, transporters and friends and relatives also.

The majority of the farmers are selling their produce through different modes such as APMCs in the district, market intermediaries.

The farmers are also opting for the local markets (villages, Shandies, etc.), on the farm, markets in nearby cities. Place of sale is mainly determined by prices and their convenience; they have good contacts with traders/ commission agents and transporters for obtaining information regarding the price and arrivals. The majority of the farmers use hired vehicles to transport their produce to the market. None of the farmers are selling agriculture and horticulture products by open auction and only the sericulture farmers are selling cocoons through online marketing.

Maharashtra: In Nashik, 12% of farmers sell their produce on-farm and 2% each contributed from Washim and Jalgaon. Farmers from Washim, Nashik and Jalgaon show the percent share of APMC as 98%, 52% and 98% respectively. 36% of farmers from Nashik export their produce. The farmers of Maharashtra also obtain information related to the market from the market intermediaries.

Only in Nasik 40 % of farmers resort to grading and sorting as many of them are engaged in exporting their produce. In Jalgaon and Washin 8% and 4% of farmers perform value addition respectively.

West Bengal: The majority of the farmers access market-related information from friends and relatives, market intermediaries, private intermediaries/ traders for the marketing purpose. Some people access the company, direct buyers, progressive farmers, and rice mill owners in the market purpose. The farmers took price information, price support from the stakeholders.

Ease of access, usefulness, and frequency of obtaining information from stakeholders

Ease of access, usefulness, and efficiency of marketing stakeholders was very easy, useful and efficient as expressed by all the farmers. The majority of the farmers opined that the stakeholders are providing correct information regarding prices and arrivals, which helps them to plan and act accordingly. Most of the farmers are approaching these stakeholders as and when the product is ready for sale.

What information related to the market availed by the farmers from the various actors of the marketing support systems?

The majority of the farmers depend upon the market intermediaries and SMS services to avail of the information related to the price fluctuations of the various agricultural commodities. They also gather information related to market arrivals and transportation.

4.7 Farmers association with Organizations

The following are the few farmers organizations like Farmers Producer Organization (FPOs), Farmer Interest Groups (FIGs) that are serving the farmers in the districts taken for study in the states of Karnataka, Maharashtra and West Bengal.

Farmers organizations in Karnataka

Holur Horticulture Farmer Producer Company Ltd.: It was started in 2018, registered under companies act 2013. It is mainly involved in Horticultural activities (65 % mango and 35 % other vegetables). The FPO is covering 52 villages of Holur hobli, Srinivaspur taluk. Currently, it has 50 FIG's covering 1000 farmers as members in FPO. The FPO provides services like:

1. Input supply services.
2. Marketing services: Direct marketing, they supply the mango in the brand name 'Kolarda Kesari'. They are also supplying Vegetables to Dominos, Waycool, Reliance and Big Bazaar.

3. Technical services to farmers through trainings.

Sri Siddeshwara Horticultural Farmer Producers Company Ltd. (FPCs) being one of the major farmer organization attributed with all-round convergence with the farmers in the supply of inputs, advisory while the crop is in the field, plant protection, special operations to be taken up, harvest, pricing, and marketing of the produce at a relatively lesser cost of marketing compared to conventional marketing methods.

Organic Farmers Federation at Belagavi formed by converging numerous village and block level organic growers' societies in order to cater them with necessary information through capacity building, legal authorization, established market chain, and many other needs that the societies will be in need.

Organic Food Club, a certified organic club that operates in Belagavi, where organic farm-grown produced and processed food is sold every Monday and Thursdays of the week at one of their home outlets.

Sahyadri Organic Growers Society, Mugilahal of Khanapur taluk is one such society affiliated with the district organic federation which supports its growers for organic jaggery production along with all other supports they share.

Kalmeshwar Organic Sugarcane Growers Society, Itagi of Khanapur taluk again affiliated to organic federation working at Itagi village on the organic production of sugarcane for jaggery purpose.

Durgadevi Savayava Krushikara Sangha, Honnidibba at Kittur taluk of Belagavi which currently holds 80 farmers which are certified under USOCA and KSOCA and work for organic jaggery production and marketing of the members through district organic federation.

Farmers organizations in Maharashtra

SHGs, PACS, District Silk growers' associations, **Organic FPOs of Washim, Sahyadri Farms, Monsoon foods of Nashik and Jain Irrigation and Tissue Culture, Nirmal seeds of Jalgaon** that are to be formed are the major farmer associated organizations which are identified during the survey in Maharashtra. The respondents who were associated with any one of the above organizations were more motivated and open to new technologies and innovations. Farmer organizations provide farmers with all the psychological, materialistic and knowledge support needed by the farmers.

Farmers organizations in West Bengal

Pandua Krishi Biplab Agro Producer Company: It is a new FPC, with only being half a year old, still effectively disseminating information about the cultivation of unconventional high-value crops and taking responsibility for the marketing of those, providing training and changing the mindset of the people about cultivating conventional crops at an existing package of practices while facing loss due to lower market values. Presently they are promoting the contract farming of Banana with all input support and buyback in association with 'Keventer Group.'

Ease of access (to stakeholders and service), Usefulness, effectiveness and frequency of obtaining support from FPC

In case of ease of access to both stakeholders of and service from FPC, it is not at all difficult as mentioned by the respondents, since the FIGs are located either in their village or at a location close to them, and also the founders and board members of FPC being proactive, eases the access to service.

Regarding usefulness and efficiency, it is moderate due to the reason that they provide only technical advice and inputs, they are not facilitating marketing. When it comes to frequency of visitors to the FPO, the farmers are not frequently visiting; they are approaching the FPO only as and when required.

How does FPOs enable better management, increased efficiency, and enhanced productivity?

The strengthening FPOs has helped the farmer groups to solve diverse challenges about market linkages, access to financial services, internal management of members, and achieve higher farm productivity. The magnitude of farmers united under a single umbrella has further eased the adoption of technology to realise increased efficiency and enhanced productivity within the FPO.

4.8 Agriculture Technology Venture Support

Agriculture technology and venture support are being provided through ATMA, KVK and other recognized institutions by institutions like MANAGE, IIPM and many other national and ICAR institutions. None of the respondents were found to be undertaken by any of the venture support or incubation.

4.9 Gaps in existing support systems

To enhance crop productivity and deal with a variety of issues like low farmers' income, nutritional insecurity, water management, soil health management, marketing system inefficiency, etc., the Government has implemented several schemes for the farmers to be implemented at an individual level. All these should reach the farmers through the grass-root level extension agents. However, despite a variety of schemes, the number of farmers being effectively benefitted by these are very less in number. Many times, it is seen that the farmers are although aware ofthe schemes, but are unable to take benefits from it. Such gaps in various support systems in the states of Karnataka, Maharashtra and West Bengal are presented as follows:

(A) Gaps in Input Support System

In the existing input support system of the studied districts in Karnataka, Maharashtra, and West Bengal several factors are at play that denotes the gaps in several sub-systems that support the entire agricultural practices.

Table 17: The table showing the percentage of farmers aware and avail of the different services and schemes in the existing input support system

Particulars	Karnataka		Maharashtra		West Bengal	
	Awareness	Availed	Awareness	Availed	Awareness	Availed
Soil Testing/ Sampling	79%	39%	95%	42%	76%	17%
Balanced Nutrition	16%	0	58%	26%	33%	13%
Soil Health Card	88%	60%	93%	36%	77%	3%
Micro irrigation methods	91%	71%	99%	51%	59%	6%
Pesticide quality/ Testing	9%	1%	57%	19%	1%	0
Spraying precautions	64%	5%	74%	27%	81%	18%
New machineries	72%	54%	98%	55%	83%	4%

As for the factor of Soil Testing, the majority of the respondents (79% in Karnataka, 95% in Maharashtra, and 76% in West Bengal) are aware of the practice and its need and benefits about knowing the fertility status of soil, but only 39% in Karnataka, 42% in Maharashtra and 17% in West Bengal out of the total respondents avail it in reality because of the lack of a number of centres where testing facility is available, the available centres being too far away from their locale,

along the huge delay in the arrival of test reports to farmers have made the respondents unwilling to conduct soil tests.

In regards to balanced nutrition, since the majority of farmers do not possess much formal education, so only a lesser percentage of the respondents, the ones who are progressive are aware, but none of the respondents are following the practices of balanced nutrition since they don't believe in optimum quantity nutrient provision to crops can increase the crop yield at an optimum level, and they also feel more fertilizer means more yield.

For the Soil Health Card scheme launched by Central Govt., all the respondents are more or less aware about the soil health card or at least heard the name of the scheme due to extensive advertising of the soil health cards, but only some percentage of respondents are availing it due to many factors including political red tapsism, lack of soil testing centres, and the unwillingness of people to avail soil testing.

Regarding micro-irrigation practices, although the majority of respondents are aware of the systems and practice, due to awareness by the progressive farmers in the village, only a few respondents are using it, and not much are not because of the initial cost of installing it and not much finance available to marginal and small farmers for installing it. But in Karnataka and Maharashtra majority of the farmers are aware and are availing of the micro-irrigation methods like drip and sprinkler irrigation due to the water scarcity and because of their propagation among farmers by various departments through PMKSY.

In regards to the quality testing of Fertilizers and Pesticide provided by any source, none of the farmers are neither aware of such facilities are even present, nor are they availing it.

In case of the awareness about the precautions, while spraying inputs, majority of the farmers are aware of such precautions while buying inputs from any source, but only a small proportion of the total respondents are availing it since they mention about the precautionary measures and instruments are restricting movement in the field while working.

Regarding the awareness about the availability of new machinery, majority of respondents are aware of new machinery like combined harvester, paddy transplanter, etc. but only a lesser percentage of farmers are availing it in West Bengal State because of the smallholdings by a majority of farmers and high prices about machinery and from where to avail such machinery at subsidized rates. But compared to West Bengal, half of the respondents in Karnataka and Maharashtra are availing them.

(B) Gaps in Finance Support System

Since finance is one of the most important elements in the agricultural system, Govt. of India and State Govt. both have launched a number of schemes in order to provide both ease of credit as well as financial support to the farmers, especially the small and marginal holders.

Table18: The table showing the percentage of farmers aware and avail of the different services and schemes in the existing finance support system

Particulars	Karnataka		Maharashtra		West Bengal	
	Awareness	Availed	Awareness	Availed	Awareness	Availed
Nutrient based Subsidy scheme	30%	16%	35%	15%	65%	43%
Interest subvention scheme	75%	41%	55%	20%	69%	27%
Crop Insurance premium subsidy	93%	77%	70%	25%	67%	24%
Farm machinery subsidy	76%	46%	50%	10%	36%	4%
Subsidy on protected cultivation	42%	14%	30%	12%	10%	1%
Livestock insurance	99%	61%	25%	10%	12%	3%
Livestock credit	77%	42%	65%	20%	54%	7%

In the case of a nutrient-based subsidy scheme that provides subsidy in MRP of fertilizers while buying it from any source, all the respondents are knowing about the subsidies in fertilizer prices, but only 16% in Karnataka, 15% in Maharashtra, and 43% in West Bengal of the total respondents are availing it, and that too while buying Urea only, but not other fertilizers, and the rest who don't avail it, do not know that it can be availed from any sources, or that is available on any other fertilizer than Urea.

As for the Interest Subvention on Loan scheme and Crop Insurance Scheme by Central Government, popularly known as Kisan Credit Card (KCC) and Pradhan Mantri Fasal Bima Yojana (PMFBY) respectively, a majority of the respondents are knowing about it respectively since extensive advertising is done countrywide about it, both in digital and print media. However, only the ones having land possession in their own name can avail the of benefits of KCC and the PMFBY i.e. the Crop based insurance Premium is compulsory with the KCC loan, although the amount of premium varies crop-wise, so the respondents who avail the interest subvention, also are availing the crop insurance scheme, i.e. the respondents in both cases are same. However, the problem related to KCC and PMFBY will be discussed later.

About the Farm Machinery, 76% in Karnataka, 50% in Maharashtra and 36% in West Bengal are knowing about the subsidies available in machinery, most of them being small and semi medium farmers, but none are availing it because of the lack of knowledge about where to get such machinery at a subsidized rate, as well as the concept of its low profitability in smaller holdings. The subsidy on protected cultivation and Livestock insurance, moderate farmers are only aware of them who are mostly progressive, want to take up protected cultivation or livestock farming as a primary occupation in the future, but have availed the benefits due to larger investments and lengthy procedures of availing the benefits.

For the livestock credit scheme, many of the farmers know about it, however, do not avail it much, only the respondents who have access to credit facilities from the bank opt for this. And the rest who perform livestock rearing as their secondary occupation, if they need to buy livestock, they borrow from informal sources.

(c) Gaps in Marketing Support System

It is known that marketing plays a much greater role in a farmer's life than just exchanging money for his produce. So, to increase the effectiveness and efficiency of the present marketing system in the state, both the central and state government has started schemes with accordance to the specific need of the entire country and the states.

Table 19: The table showing the percentage of farmers aware and avail of the different services and schemes in the existing marketing support system

Particulars	Karnataka		Maharashtra		West Bengal	
	Awareness	Availed	Awareness	Availed	Awareness	Availed
SMS services	75%	45%	98%	61%	26%	7%
Online marketing	71%	11%	92%	36%	4%	0
Warehouse	52%	4%	100%	28%	97%	13%
Cold storages	43%	2%	88%	0	100%	34%
Pledge loan scheme	15%	3%	92%	0	0	0
MSP for produce	90%	39%	100%	35%	92%	22%
Schemes related to marketing (Raita Sanjeevni in Karnataka, Sufal Bangla in West Bengal	49%	1%	98%	0	61%	0

In case the of SMS service related to marketing, the majority of the total respondents in Karnataka (75%) and Maharashtra (98%) are aware of this and of which 45% of farmers in Karnataka and

61% of farmers in Maharashtra are using it but in West Bengal, only 27% of the total farmers are aware of these SMS services out of which only 7% of them avail who are progressive and literate farmers.

The majority of the farmers of Karnataka and Maharashtra are aware of the online marketing facilities and systems as nowhere in the districts the online marketing is in practice except for the cocoon markets in Kolar district of Karnataka. In West Bengal, the farmers are neither aware of nor avail of the online marketing services.

Regarding warehouse and cold storage, one intriguing fact is that all the respondents of the districts studied in Karnataka, Maharashtra and West Bengal are aware of these facilities. But none of them avails warehousing facilities, since there is none in the vicinity, and if they are to take at the one located far away, the transport cost gives away all the profit. In the districts growing the perishables, they can't store it for a longer time due to low self-life.

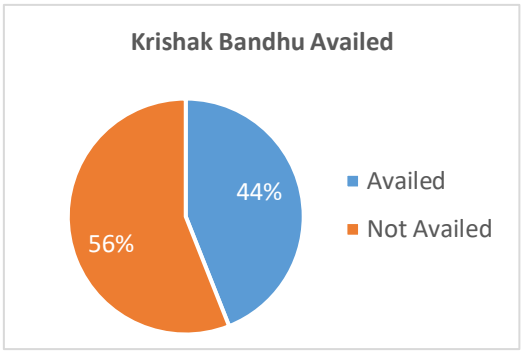
The majority of the respondents in the three states have ever heard of the Pledge loan scheme, so certainly they cannot avail of it. Though the majority of the farmers know about the Minimum Support Price (MSP) launched by Central Government, only a less percentage of farmers avail it. In West Bengal 'Sufal Bangla', a special scheme is launched by the Chief Minister which is entitled to provided assured prices like MSP in case of horticultural crops like fruits and vegetables. About 98% of the total respondents in the region have an understanding of the scheme because of its broad advertisements in a variety of media across the state as a whole.. But no one practices it because the Procurement Centre of 'Sufal Bangla' is nearly an hour's journey by train from the locale studies, and no one wants to take that much risk with perishable horticultural crops. Similarly, in Karnataka, only a few farmers (49%) are aware of Raitha Sanjeevani and only 1% of farmers use it.

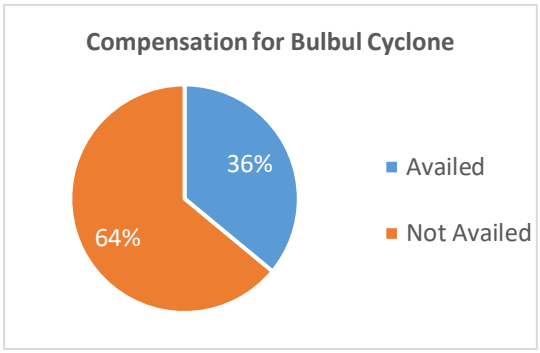
Availing of 'Krishak Bandhu' Scheme and 'Compensation amount for Crop Damage in Bulbul Cyclone' in Hoogly District of West Bengal:

The 'Krishak Bandhu' Scheme was launched on 1st January 2019 by Hon. Chief Minister of West Bengal, Mamata Banerjee in order to ensure assured income for the farmers by providing them financial assistance. There are many benefits of the 'Krishak Bandhu' scheme. Some of the benefits are given below:

- A life cover insurance of rupees 200000 will be given to every beneficiary as per the scheme.
- Insurance cover will be provided to all of the farmers who die accidentally in the process of implementation of the scheme.

- The crop cover Insurance of rupees 5000 will be given in two installments to the beneficiaries.
- A 3 thousand crores rupees budget is decided for the implementation of this scheme.
- Insurance cover will be provided between 15 days after the death of the victim.
- The premium for Crop Insurance will also be provided by the state government to all of the beneficiaries under the scheme.
- Rupees 5,000 per acre in two installments are also provided to the beneficiaries, one in Kharif and the other in Rabi season.
- Also, farmers would be given minimum assistance of Rs. 2000 per annum on a pro-rata basis.





Along with this currently popular scheme ongoing in West Bengal, another programme that is being worked on is the 'Compensation amount for Crop Damage in Bulbul Cyclone' which provides compensation amount on area coverage by crops to farmers whose crops has been damaged due to bulbul cyclone. Both the scheme and the programme are currently ongoing all throughout West Bengal.

As can be seen, that only 22 out of 50 respondents have availed of the benefits of the 'Krishak Bandhu' Scheme but only 18 has taken compensation for the Bulbul cyclone. Now, one important factor here is that in order to avail the benefit of either, the claimant must hold land in his/her own name, not in the name of any family member. But, despite many having land in their own name, have not availed any of them either. Respondents say that they did not avail 'Krishak Bandhu' Scheme not because they were unaware or unwilling, but in most cases, forgot or got confused about the dates of application submission and amount cheque distribution. As for compensation money for Bulbul, people mention a very intriguing fact that many have refused the amount, either because of a greater amount of landholding providing greater risk-taking capability, or having a stable secondary occupation as a shock absorber, leaving them with no need for the money.

The following are the key barriers to hindering the development of the Agriculture Innovation System (AIS)

- Failures or inefficiency of the different agricultural extension and advisory support systems can form a blockade for innovation in the agricultural sector.
- Infrastructure is one of the main determinants that may hinder or facilitate the performance of the AIS.
- It includes the roads, railroads, and telecommunication infrastructure, knowledge infrastructure (research and development facilities), and financial infrastructure (investments).
- Furthermore, the technical and organizational capacity of the actors to adapt and manage agricultural technologies is another barrier.
- In the same sense, market structure plays a key role in arranging the supply and demand of information and knowledge in terms of the relationships between market parties.
- Weak networks and connections between actors can also be detrimental to innovative performance.
- Finally, lack of laws and regulations affect how actors interact with each other, which in turn may hamper innovation.
- All these barriers are negatively affecting the capacity of innovation systems to coordinate policies, set priorities, engage users in setting research agendas and monitor and evaluate progress against its goals.

The barriers expressed by farmers in obtaining different services from various stakeholders of the AIS that are identified in the research area that hinder the development of farmers

Different constraints faced by the farmers in obtaining services from stakeholders and their importance in the three states of Karnataka, Maharashtra, and West Bengal on a whole is tabulated as follows:

Table 19: Synthesis of information through the study conducted in the states

Constraints	Importance	Remarks
Lack of Knowledge and information to farmers regarding judicious use of inputs, prevailing schemes and subsidies, new machineries and equipment's etc.	**Of highest importance**	Highly important constraint in all the three states.
Natural calamities like floods and perennial droughts		A major constraint in Birbhum and Hoogly districts of West Bengal and Kolar district of Karnataka; less important in Maharashtra.

Non-availability of timely information, inputs, irrigation facilities, farm equipment, labour, credit and marketing facilities.		Highly important constraint in all three states.
Land to lab gap: Gap from the technologies developed in the labs reaching the field i.e., farmers.		Highly important constraint in all the three states.
Malpractices by input dealers both in quality and price	**Very important**	Very important constraint in all the three states.
Lack of time to the government department officials to meet the farmers due to work burden of extension functionaries		
The distance of various departments related to agriculture and the allied sector at the district level is difficult for farmers to access them		
Subsidies are not reaching the needy farmers (small and marginal farmers being neglected)		
Weaker convergence between the stakeholders	**Also important**	Important in all the three states
Farmers are not interested in loan wavier from the government instead they want subsidies for buying agricultural inputs		
Lack of information related to allied sectors, trainings for improving these sectors		Important in Maharashtra Nasik for horticultural crops, dairy, poultry fisheries in west Bengal
Unstable markets, improper MSP, no effective transfer or sharing of information between the farmers and the market stakeholders		Important in all the three states

The following are the needs as expressed by the respondents as a whole in all studied districts of the three states

1. Weather and climate related information
2. Timely Credit

3. Market structure
4. Market Information Systems (MIS)
5. Farmer needy schemes
6. Subsidies on Fertilizers (Other than urea)
7. Processing and value addition
8. FPO guidance
9. Updated ICT guidance
10. Export Knowledge
11. Storage structures
12. Trainings related to poultry and sericulture
13. Farmers Court
14. Small Farm Equipment's
15. Timely production and distribution information

The tasks of the various stakeholders of agricultural Extension and support systems in the Agricultural Innovation System

Sno.	**Actors**	**Representatives**	**Tasks**
1	Research	• Horticulture research station. • Soil, water, and environment research station. • Plant protection research station. • Animal production research station. • Field crops research station. • Food technology research station. • Sericulture research station • Agricultural engineering research station.	• Production of agricultural innovations. • Capacity building and training. • Solving agricultural problems. • Provision of consultancy services.
2	Education	• ICAR • State Agricultural Universities. • Faculty of Agriculture	• Production of agricultural innovations. • Capacity building and training. • Preparing qualified graduates to labour force. • Applied education based on new research outcomes
3	Advisory	• Extension Department of Agricultural Directorates • Extension officials • ATMAs and KVKs	• Technology transfer. • Transferring problems to research. • Broker among various actors in the support systems • Providing recommendations to the farmers. • Giving assistance in farm management.

			• Monitoring and evaluation implementing • recommendations • Planning, implementing, and evaluating • different extension methods and programs.
4	Private sector	• Agricultural companies. • Export companies. • Packaging plants • Agribusiness firms • NGOs	• Provision of input supplies. • Provision of technological facilities. • Linking to local and international markets. • Capacity building and training. • Investment. • Financial support for other actors.
5	Cooperatives	• Directorate of agricultural cooperatives. • Central agricultural cooperatives. • Agricultural cooperatives.	• Provision and subsidizing input supplies. • Linking farmers to markets. • Provision of agricultural machinery. • Broker among various actors in the support system • Financial support and loans to other actors. • Technical services.
6	Credit	• Banks (RRBs, NABARD) • Local money lenders • Credit through various schemes	• Financial transactions (credit facilities- deposit- withdrawal loans etc.)
7.	Marketing	• APMCs • Mandis • Direct marketing • Agri business firms • Exports	• Procurement and sale of the agricultural • Produce from the farmers
8	Farmers	• Farmers at village level	• Implementation of recommendations. • Increasing productivity. • Enhancing crop quality. • Application of disruptive technologies. • Enhanced income levels

4.12 Focus Group Discussions (FGDs)

Maharashtra: No. of FGDs conducted: 10

No. of respondents covered: 100 (10 farmers for one FGD)

This Focus Group Discussion was conducted on the different sources of information through which the farmers avail information, the extent of satisfaction through it, and the use of communication media were studied. The result of the FGDs is represented below:

The source of information, satisfaction with the information and use of communication media by focused groups:

Table 20: Showing the result of the Focus Group Discussions (FGDs) conducted in Hoogly, Birbhum and South 24 Parganas

Source of information	Satisfied with the Information (%)		Communication media (%)			
	Yes	No	Mobile	Newspaper	Social media	Personal approach
Self	100%	-	70%	10%	20%	-
Input supplier	100%	-	30%	-	10%	90%
KVK	20%	-	-	-	-	100%
ATMA	-	-	-	-	-	-
Private consultants	100%	-	40%	-	60%	70%
Panchayat committee	50%	50%	-	-	-	100%
FPOs/ FPCs	100%	-	25%	-	70%	100%
NGOs	-	-	-	-	-	-
Agri-business firms	-	-	-	-	-	-
Friends and relatives	40%	-	80%	-	70%	60%
Progressive farmers	30%	-	60%	-	50%	70%
Labours of APMCs	100%	-	60%	20%	30%	40%
Agriculture office	70%	-	-	-	-	70%
Research institutes	-	-	-	-	-	-

1. A majority of the farmers tend to trust their self-understanding or receive advisory support and information from sources such as input suppliers, private consultants, FPOs/FPCs, Labours of APMC and are satisfied fully with the information.

2. When it comes to sources such as friends and relatives, Progressive farmers, KVKs, government officials like Agricultural officers they are willing to receive the advisory but are not completely satisfied due to a few setbacks.
3. Currently, farmers are merely exploring the options such as ATMA, NGOs, Agribusiness firms, research institutes because of distance and accessibility issues. The frequency of visits made by the farmers to these institutes is also low due to these reasons.
4. Farmers are opting for a personal approach to be more convenient for receiving the information rather than believing information from the media structures such as mobile, newspaper and social media.

Farmers receive the information from the research stations only through print media such as newspapers or magazines or Agriculture related publications from the research stations.

The shortages of the extension agents at the grass root level and as well as the extra work official work burden is making the farmers sort to input dealers and private intermediaries for the source of information.

West Bengal

No. of FGDs conducted: 4 FGDs in Birbhum, 3 in Hoogly

The FGDs conducted on the different sources of information through which the farmers avail information, the extent of satisfaction through it, and the use of communication media were studied. The result of the FGDs is represented below:

Insights on Focus Group Discussion (FGDs)

i. Birbhum

1. Four FGDs are conducted in Birbhum, among which one is done with farmers in KVK.
2. Every group contained more than 10 members, and the average number of members in a group was 12.
3. One FGD was conducted with the beneficiaries of KVK who were receiving seed on the day, and the other three are conducted through informal gatherings.
4. Majority of the farmers receive their advisory from the Input dealers, KVK, and CAU as for formal sources, where the beneficiaries of KVK prefer it more frequently but the other prefer informal sources more frequently.
5. Since KVK or CAU cannot provide seeds for the whole season for the entire field of crops, all the farmers have to depend on private input dealers to some extent, more or less.
6. The finance support is obtained either through bank or SHGs more frequently since these are more available in the locale.

7. The marketing is mainly done through unregulated markets, and only two or three persons in all the groups go to regulated ones.
8. As for the problems raised in the group discussions, the farmers raise a lot of general issues like lack of labour, unfair market prices, natural calamities' problems, etc.
9. However, one unique point was raised that KVK or CAU do not reach the remote areas, so they suggest to increasing the extent of outreach for reaching those unreached.

ii. Hoogly

The following are the outcomes of the FGDs at Hoogly

1. 3 FGDs are conducted in Hoogly and every group contained more than 10 members, and the average number of members in a group was 13.
2. The groups were a mixture of farmers of both Medium age group and Old age group, with the average farming experience of 20 – 30 years, some members even had the experience of 50 years and above.
3. The members came all from different villages like Tinna, Ilampur, Torgram, Sarai, Adibasipara, etc., with a majority of them being marginal farmers, and average landholding of 2 acres or below.
4. The crops that they mainly cultivate are – Paddy, Potato, Brinjal, Ridge Gourd, Pumpkin, Sesame, Mustard, Spinach, etc.
5. Their main advisory source is ICT (SMS service from BCKV, IFFCO Kisan Green Sim), Input Dealers, and to some extent private input companies also. The stakeholders of other systems are more or less the same as the individual respondents.
6. As for the problems, some new problems arose from these GDs that the farmers are demanding high quality certified seeds, but are unable to get that, they have no soil health card, and also they have tested their soil, but still got no report, which kind of makes them demotivated from doing it again.
7. As for their needs, except for inputs and training for as usual Paddy and Potato, they mentioned about organic farming, measures for soil rejuvenation in order to revive soil fertility, soil health card, and most of all, better communication and interlinkages between institutions and departments at the administrative level.

Karnataka

Insights of the Focus Group Discussions (FGDs) held at Shivamogga

1. Farmer's courts are needed to solve the problems linked with the stakeholders.
2. FPOs are needed to build a strong "we feeling" with valid institutional support.
3. The exploitation of the farmers by the private stakeholders has to be minimised with the official government framework.

4. Desi areca nut is fetching less price compare to the commercial growers. Hence, a standard market rate has to be fixed for the quality of the areca nut in the Malnad region of Karnataka.
5. Diversion of areca nut marketing towards gutka or pan masala has to be minimised and value addition of areca nut to other products like paints, mouth fresher, paste, facewash have to be given focus using local SHGs.
6. The availability of timely credit is a very big problem for the respondents in the FGD.
7. Biasedness of the government agricultural servants have to be minimised with the transparent structure for all the schemes and facilities provided by the government for the benefit of small and marginal farmers.
8. Loan waiving is not needed if the market price of the agricultural products is clearly managed.
9. Subsides for the fertilizer other than urea have to be given.
10. Small farm equipment is very essential for small and marginal farmers.
11. Timely pest and disease and other meteorological information have to reach the needy farmers irrespective of the situation in time through ICT or any other means is very essential for the sustainable development of the agriculture and farming community.

Recommendations/Suggestions

5.1 Recommendations for the Karnataka state

Based on the study conducted in the Shivamogga, Kolar and Belagavi district, the following are some recommendations:

1. Sufficient manpower and computer facilities need to be provided in all the agriculture and line departments for effective reach of information and services to the farmers.
2. Farmer's perception of considering agriculture and line departments as government outlets for inputs and subsidies needs to be changed. Efforts should be made by authorities to address all kinds of issues of the farming community effectively so that the farmer's perception can be changed.
3. The Government should not only promote water conservation practices and also it should initiate more effective measures to improve the groundwater level in the district so that water problems can be addressed more effectively.
4. Organic farming should be effectively promoted in the district. In spite of many schemes' farmers are not practicing it.
5. An online cocoon marketing system needs to be strengthened and necessary measures need to be taken by market authorities to protect the farmers from exploitation by reelers.
6. The Government should take policy measures to protect the interest of horticulture growers by assuring remunerative prices for the produce.
7. The government should promote ICT's for information dissemination to farmers through gross root extension functionaries. First and foremost, the govt should train the extension provides for the efficient delivery of these services.
8. The concept of market-led extension is completely lacking in the extension system of the district. The farmers are facing more challenges in getting remunerative prices so this needs to be seriously addressed.
9. The farmers practicing different farming systems need contact extension personnel of different departments for information. So there should be one system coordinating different departments where the farmer can get information through a single window.
10. Market demands are changing rapidly and becoming more stringent. Market-oriented agricultural advisory services (MOAAS) are essential for poor producers to gain knowledge and information to meet the changing market needs.
11. Market orientation demands a value chain orientation; which in turn implies that the advisory services must meet the needs of a range of actors -not just farmers.

5.2 Recommendations for the Maharashtra state

Based on the study conducted in the Washim, Nashik, and Jalgaon district, the following are some recommendations:

1. The provision of electricity in three phases during night time should get modified, and electricity should be made available in the daytime rather than night time.
2. Existing advisory systems to be publicized and made known to every farmer. ICTs and Mass media are to be promoted especially those which are part and parcels of the daily lifestyle of the farmers.
3. Market improvement to be taken into consideration and there is a long pending request of legal interventions of the government over practical implementation of the MSP and FRPs announced, also delayed payments should be looked into immediately.
4. Risk and loss of redressal assistance should be estimated with more reliable technology and not with human interventions which could reduce the biases.
5. A serious policy intervention required over the agriculture debt waiver schemes of the central and respective state governments in order to stop the farmers from being the victims of the cold holocaust harming the economic, social ethics of the farmers.
6. Capacity building programs are to be more specific and should be wide open and should be provided most probably at the doorsteps of the farmers through a unified reliable platform with live customer service.
7. Schemes related to water conservation strategies should get re-modified. Schemes such as Jalayukta Shivar and Magel Tyala Sheta-Tale are not applicable in some parts of Nashik; their farmers are dependent upon rain-water only.
8. Schemes related to MSP and FRA should take into consideration as early as possible. Improper MSP and unstable markets make farmers more susceptible to poverty and debt.
9. Awareness related to the schemes that promote on-farm selling should be created among farmers.
10. Awareness about the transport facilities should create among farmers. Many farmers are unaware of government transport facilities to reach the market. Transport facilities must be improved and made available to the farmers.
11. Convergence between line departments is required to provide a platform for technology dissemination and sharing of knowledge and information.
12. Extension in the agriculture and allied sectors need to be motivated and strengthened in Nashik.
13. Awareness about skill development needs to be created because new skills are required to make wise and effective use of new communication channels.

5.3 Recommendations for the West Bengal state

The following are the recommendations for the West Bengal state based on the study in the Hoogly, Birbhum and 24 Parganas districts:

1. The delay in the arrival of agricultural inputs to agricultural officers should be reduced in order to increase their usefulness in a better way.
2. Mobile soil testing facilities should be made available at the village level for providing basic reports, and soil testing provisions should be made available at a minimum of the block level, and the reports should be delivered within a week from sample delivery.
3. The recruitment procedure conducted by the government departments should be made faster and cleaner to recruit more workers at ground level.
4. The existing advisory systems have to be publicized in grass root level so that advice can reach every farmer. Extension staff at the grassroots level should be equipped with modern and emerging technology in order to be able to disseminate them among farmers, in particular to overlooked small and marginal farmers, and their morale should be held up by periodically motivating them based on their results.Inter and Intra level communication among all the stakeholders working in the field of agriculture and allied sector in order to avoid the spread of conflicting and confusing information.
5. Funding of the departments or organizations or institutions working on agriculture and the allied sector should be varying, based on a holistic analysis and measurement of performance by a third party in order to avoid bias.
6. Cheque distribution procedure for MSP procurement of crops should be done with more care to avoid mistakes in name of beneficiary and amount, and the processing delay should be reduced.
7. Loan waivers should be lessened and people should be made more aware of the distinction between grants and loans and how to use loans appropriately in a productive manner instead of simply consuming it.
8. The loan availing procedure and paper works should be lesser and smoother for the borrowers, especially in the case of banks.
9. Awareness should be created for farmers over schemes, support services, facilities, moral responsibilities, and also the rights of the farmers in order to reduce the exploitation of the farmers.
10. Schemes should be provided according to the farmer's needs. The selection procedure for any schemes or programmes like training should be much more digital in nature. The list of beneficiaries is to be uploaded in the database available both offline and online and should be cross-checked with previous lists to avoid the reselection of the same beneficiaries to avoid biases.
11. Government, along with advertising for their key schemes, should be advertising more about the institutions and stakeholders like KVK, ATMA, ATC, etc. in order to increase

awareness of the farmers about these and when they can go to where to which institutions.

12. Government warehouse and cold storage facilities should be created in block level for farmers to store their perishable products and prevent the post-harvest losses and their charges should be regulated by the government.
13. The regulated markets should be opened regularly and should be operated without any political biases in order to provide farmers a fair price for their produce.
14. For unemployed poor people short time training course production center/ institute for imparting in rural biotechnology is essential where people can be trained in composite fishery which includes fishery, goatery, duckery, piggery, fruits and vegetable cultivation, nursery management, making compost out of village wastes, vermin composts, low-cost food preservation, integrated pest, and fertilizer.
15. Development of food processing should be facilitated industry especially for vegetables, fruits, potato and milk by increasing the production base catering to the processing industry's requirements.

Approaches for improving the Agricultural Knowledge Supporting the farmers

1. Farmer to farmer knowledge Exchange
2. Benchmarking for better performance
3. Social media by and for the farmers
4. Innovative Agri media
5. Farmers led interactive Innovation
6. Multi actor Knowledge Networks

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