Enhancing Resilience: Integrated Pluralistic Agricultural Extension Approach-Blueprint for Agricultural Transformation

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Abstract: The Extension advisory systems have been playing a crucial role at the frontline of the response to the COVID-19 pandemic in rural areas. In Tamil Nadu for implementing agriculture related schemes, policy and to deliver extension advisory services to farming community there is separate wing called State Department of Agriculture. The activities of state department of agriculture were supplemented through other stakeholders such as Non-Governmental Organizations (NGOs), private sector, Farmer Producer Organizations (FPOs), farmer groups for delivering extension advisory services to farmers. The EAS provider has proven very instrumental for national and local governments as well as for rural communities during the pandemic in bridging the information gap. Service providers such as state department of agriculture and its line departments, KVK, input dealers, FPO and NGO worked together for delivering EAS to the farming community in order to combat the challenges raised during the COVID-19 pandemic. Considering the importance of EAS provided by various service providers during pandemic it is required to propose an integrated pluralistic extension approach i.e., method of using public and private organization, NGOs/ Voluntary organization for delivering service to the farming community in response to pandemic. So far there is no pluralistic extension approach for delivering services to the farming community during COVID 19 pandemic and also some unanticipated pandemic. Therefore the pluralistic approach developed through this study would be helpful for farmers, policymakers, extension professionals and the scientists to cope with not only COVID-19 pandemic situation but also any unanticipated pandemic in future that affect their normal mode of delivering extension advisory and developmental services to farmers. IPAE refers to the collaboration of extension service providers ie., State department of agriculture and its line departments, Krishi Vigyan Kendras (KVKs), input dealers, Farmer Producer Organizations (FPOs) and Non Government Organizations (NGOs) to provide forward and backward linkage to farmers.

1 INTRODUCTION

The world has significantly changed as a result of the COVID-19 pandemic and the subsequent lockdown. According to the World Health Organization, as of May 16, 2020, 44,34,653 people across 216 different countries were infected by COVID-19, and about 6.81 per cent of them had passed away. As of May 16, 2020, 85,940 individuals had been infected, and 2,752 people expired due to COVID-19 in India (WHO, 2020). The COVID - 19 pandemic may posed a serious threat to food security and the livelihoods of the world's most vulnerable (FAO, 2020b). According to the FAO, the pandemic may force another 548 million people into poverty in the coming days. The pandemic has affected all segments of the nation, and agriculture is no exception. The COVID-19 pandemic coincided with peak months for the harvest and marketing of rabi crops. In terms of labour availability for crop harvesting and logistical support for transporting the harvested produce, lockdowns have severely disrupted farmers' livelihoods (Dev and Sengupta, 2020). To ensure guaranteed food production, access to a large quantity of intermediate inputs such as seeds, feeds, fertilizers, pesticides, and logistics are essential. The food supply chain has been hampered by the COVID-19 pandemic and the lockdown. Every aspect of life has suffered greatly due to disruptions

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in the global food supply chain.

Extension and Advisory Services (EAS) and other interventions have a vital role in addressing farmers' needs during the COVID-19 pandemic (FAO, 2020). The World Bank, in collaboration with the National Rural Livelihood Mission (NRLM) in India, has provided financial support to Self-Help Groups (SHGs) to tackle issues arising from the pandemic. SHG members were mobilized to ensure a stable supply of fresh food to vulnerable populations, disseminate COVID-19 advisory services, and offer financial assistance. SHGs have also actively contributed to the establishment of around 10,000 community kitchens, production of masks, sanitizer, and hand wash (World Bank, 2020).

The government has taken initiatives to support farmers, including a substantial Rs.1.7 trillion package, distribution of Rs.6,000 to farmers through the PM-Kisan scheme, and increased wages for MGNREGA employees. Agricultural Produce Market Committees (APMCs) have been strengthened to allow farmers to sell their produce beyond allocated mandis. The government has also provided cash and other support for informal sector workers, established PM care funds, and announced relief measures. During the lockdown, the India Council of Agricultural Research (ICAR) released state-specific guidelines for farmers, covering harvest, post-harvest, and marketing practices (ICRISAT, 2020).

Debt relief measures for loanee farmers include a three-month moratorium on agricultural term and crop loans until May 31, 2020, with a 3.0% reduction in crop loan interest rates up to Rs. 3,00,000/-. In Meghalaya, the Department of Agriculture & Farmers' Welfare implemented 1917 iTEAMS in March 2020 to purchase vegetables from farmers and distribute them to retail outlets. Kerala's government has collectively procured fruits and vegetables, established networks for marketing, and connected producers to online platforms. Seeds of various vegetables were distributed to encourage kitchen gardens, and informational videos were provided during the lockdown.

Chhattisgarh introduced the Rajiv Gandhi Kisan Nyay Yojana to provide income supplements to rice, maize, and sugarcane farmers. Andhra Pradesh set up temporary Rythu Bazars and converted government buses into Mobile Rythu Bazars, ensuring direct farm-to-fork supply chains. Punjab and Haryana provided Curfew Vehicle Passes to farmers and increased purchasing centers to minimize transportation costs. The e-Pass system in Punjab facilitated mobility passes for mandi farmers.

Extension and Advisory Service providers play a crucial role in minimizing the impact of COVID-19 and the subsequent lockdowns. Several initiatives have been undertaken by public and private extension players to offer Extension and Advisory Services (EAS) to farmers to mitigate the impact of the lockdown on the agriculture sector. International and national organizations' activities and interventions helped farmers to take essential preventive steps to overcome the crisis. Stakeholders such as ICAR, state line departments, ATMA, KrishiVigyanKendras (KVKs), Farmer Producer Organisations (FPOs), agri business companies, Non Government Organisations (NGOs), Civil Society Organisations, Self Help Groups (SHGs), and input dealers have played an important role by quickly adapting to the crisis. Farmers have been able to respond to supply chain disruptions more efficiently and promptly because of stakeholder initiatives and interventions. These initiatives and interventions assisted farmers in resolving agricultural issues caused by COVID - 19 and the global lockdown.

During the lockdown, the EAS provided comprised the promotion of short value chains and growing own food - both in urban and rural areas; virtually meeting the food requirements of millions; balancing labour demand and supply - facilitating farmers' access to storage facilities, while encouraging e-commerce where applicable. In addition, some of the extension services provided during the lockdown consist of establishing linkages with social protection services, developing social safety nets, implementing insurance schemes, advising on alternative income generation opportunities and resolving local conflicts (FAO, 2020a). Extension and Advisory Services (EAS) and other interventions play a pivotal part in responding to the farmers' need (FAO, 2020). The Extension advisory systems have been playing a crucial role at the frontline of the response to the COVID-19 pandemic in rural areas.

In Tamil Nadu for implementing agriculture related schemes, policy and to deliver extension advisory services to farming community there is separate wing called State Department of Agriculture. The activities of state department of agriculture were supplemented through other stakeholders such as Non-Governmental Organizations (NGOs), private sector, Farmer Producer Organizations (FPOs), farmer groups for delivering extension advisory services to farmers. The EAS provider has proven very instrumental for national and local governments as well as for rural

communities during the pandemic in bridging the information gap. Service providers such as state department of agriculture and its line departments, KVK, input dealers, FPO and NGO worked together for delivering EAS to the farming community in order to combat the challenges raised during the COVID-19 pandemic**.** Considering the importance of EAS provided by various service providers during pandemic it is required to propose an integrated pluralistic extension approach i.e., method of using public and private organization, NGOs/ Voluntary organization for delivering service to the farming community in response to pandemic. So far there is no pluralistic extension approach for delivering services to the farming community during COVID 19 pandemic and also some unanticipated pandemic. Therefore the pluralistic approach developed through this study would be helpful for farmers, policymakers, extension professionals and the scientists to cope with not only COVID-19 pandemic situation but also any unanticipated pandemic in future that affect their normal mode of delivering extension advisory and developmental services to farmers. Therefore the study was undertaken with the objective to propose an Integrated Pluralistic Agricultural Extension Approach in response to pandemic scenario"by evaluating the effectiveness of extension and advisory services provided by various service providers in the perspectives of farmer and service provider

2 RESEARCH METHODOLOGY

A cross-sectional research design was employed for the study. Data were collected from the farmers and service providers. Paper-Pencil survey method was used to collect data from the farmers and service providers. The survey approach is useful for evaluating opinions and trends by gathering quantitative data (Newsted*et al*., 1998). The sample size was estimated using cochran's formula (n=350). The sample was selected randomly from the list of population.

A survey method was used to collect the data from the respondents. Questionnaire was pre tested to ensure objectivity and unambiguity.

2.1 Locale of Research

The study was carried out at Coimbatore and Tiruvallur districts of Tamil Nadu. The locale of the study is depicted in Figure 1.

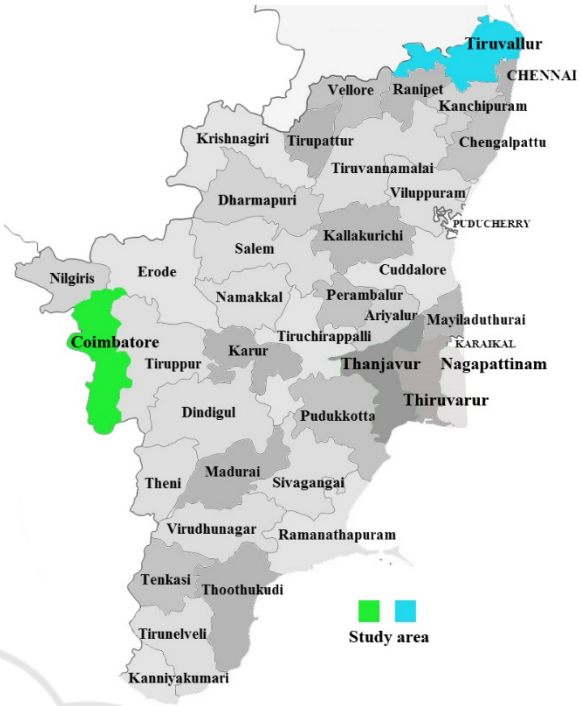

Figure 1. Map depicting study area

2.2 Selection of District

The study area was selected based on the following criteria.

i. Severity of COVID-19 pandemic i.e., incidence of maximum number of cases

ii. Domination of agricultural activity

The top five districts affected by COVID 19 in Tamil Nadu were Chennai, Coimbatore, Chengalpattu, Tiruvallur and Erode. The area under cultivation in Chennai, Coimbatore, Chengalpattu, Tiruvallur, and Erode were 416 ha, 1,75,422 ha, 78,114 ha, 1,47,641 ha, and 1,70,052 ha, respectively. Thus, the Chennai, Chengalpattu, and Tiruvallur districts were located in the northern zone. Coimbatore and Erode districts are located in the western zone. To cover different agricultural zones and to satisfy the above criteria among these districts, the Coimbatore and Tiruvallur districts were purposively selected for conducting the study.

2.3 Sample Size Estimation

2.3.1 Clientele (Farmer) Sample Size Estimation

Cochran formula calculates an ideal sample size and gives the desired level of precision, desired

confidence level and the estimated proportion of the attribute present in the population. Cochran's formula is considered especially appropriate in situation with large populations.

Clientele (Farmer) Sample size estimation

The following formula is used to determine the clientele sample size

$$N = \frac{z^2 p(1-p)}{ME^2}$$

Where

N is the Sample size
z is the z-score
p the proportion of population of interest
ME is margin of error

The proportion of population engaged in agricultural activities during COVID-19 pandemic assumed to be 65 per cent. The margin of error was assumed to be five per cent and therefore Z was equal to 1.96. Therefore, estimated clientele sample size is 350.

Therefore 175 respondents were selected from each of the selected locale namely Tiruvallur and Coimbatore. These 350 farmers were split into five equal halves for evaluating the effectiveness of EAS provided by various service providers ie., 70 farmers separately were used for measuring the perception of farmers towards the effectiveness of extension intervention provided by line department of agriculture, KVK, FPO, NGO and input dealers.

2.3.2 Service Providers Sample Size Estimation

Service providers such as extension officials, KVK scientist, input dealers and NGO officials were purposively selected for the study. Based on the availability of the service providers and also in order to maintain objectivity, 60, 10, 30 and 30 numbers of extension officials, KVK scientists, input dealers and NGO officials were considered as sample size of the respective category of service providers.

2.3.3 Selection of Respondents

Details on the number of farmers and service providers selected for measuring the perception of service providers and farmers towards the effectiveness of extension intervention provided by various service providers is given as follows.

Table 1. Distribution of farmers and service providers selected for evaluating intervention

Service providers	Service provider sample size	Clientele sample size (Farmers)
State Department of Agriculture		
Online Training	70	70
Help line services		
Mobile vehicle mode of marketing		
Sub Total	**70**	**70**
FPO		
Vellingiri FPO	-	35
Veeraraghavan	-	35
Sub Total	**-**	**70**
KrishiVigyan Kendra		
Public KVK	5	35
NGO KVK	5	35
Sub Total	**10**	**70**
Input dealers		
Input dealers	30	70
Sub Total	**30**	**70**
NGO		
IRCDS	10	70
Ramasamychinnamal trust	5	
NAF	10	
Chinmayi NGO	5	
Sub Total	**30**	**70**
Total sample size	**140**	**350**

The respondents of the investigation were farmers, extension officials of the state department of agriculture and its line departments, input dealers, NGO officials and KVK scientists. To study the information needs of farmers during the COVID-19 pandemic in Tamil Nadu, samples were selected based on a sample size estimation formula. To study the perception towards the effectiveness of the extension intervention provided by the state department of agriculture and line departments, the respondents considered were farmers and extension officials and they were selected using a purposive sampling method. To study the perception towards the effectiveness of the extension intervention provided by KVKs, the respondents considered were KVK scientists and farmers and they were selected using a purposive sampling method. Input dealers and farmers were considered as respondents to study the perception towards the effectiveness of the extension intervention provided by input dealers. NGO officials and farmers were considered

respondents to study the perception towards the effectiveness of the extension intervention provided by NGOs. Based on the results of effectiveness of extension and advisory services provided by various service provider in the perspectives of farmers and service provider a holistic Integrated pluralistic Agricultural Extension approach was developed.

3 RESULTS AND DISCUSSION

After evaluating the perspectives of both service providers and farmers regarding the effectiveness of extension and advisory services, it was evident that a single service provider is insufficient to provide all the necessary services and information needed by farmers. Consequently, there is a necessity for a pluralistic extension approach. In light of this, the current research suggests that an Integrated Pluralistic Agricultural Extension (IPAE) approach can be effectively adopted by farmers through collaboration with various service providers, including the State Department of Agriculture and its affiliated departments, KrishiVigyan Kendra (KVK), non-governmental organizations (NGOs), Farmer Producer Organizations (FPOs), and input dealers. The IPAE approach developed in this study is illustrated in Figure 2.

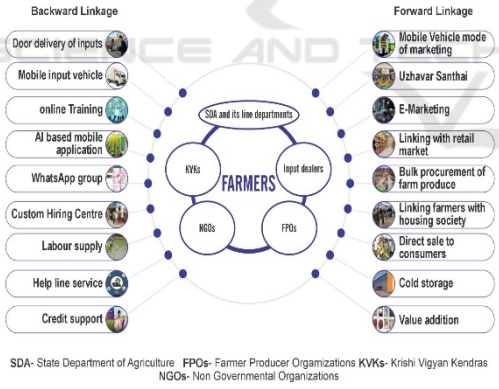

Figure 2. Integrated Pluralistic Agricultural Extension Approach

3.1 Integrated Pluralistic Agricultural Extension Approach (IPAE)

Since the 1980s, investments in public sector extension have declined, while new challenges and opportunities faced by producers have dramatically increased the need for diversified services for sustainable production, climate change adaptation, links to markets and entrepreneurship, community mobilization, nutrition-sensitive agriculture and much more. Consequently, a whole host of new extension and advisory services (EAS) providers have emerged, including non-governmental organizations (NGOs), input dealers, Farmer Producer Organizations (POs). The landscape of EAS has thus become more pluralistic. Thus, no single provider can accommodate the changing and complex needs of heterogeneous rural producers. However, such pluralism raises a number of challenges. The emergence of new providers may increase the competition for resources and decrease information and experience sharing. Multiple uncoordinated EAS providers often result in gaps and duplication of efforts, power imbalances, contradictory messages, and a failure to address the needs of certain producers. Without coordination, pluralism merely entails the presence of different providers in a country with no functional linkages among them. Coordination is thus key to harmonizing programmes and investments and to responding more efficiently and effectively to the demands of different producers. In such a landscape, the existing pluralistic approach needs to redefine its role and become more of a neutral arbiter with coordinating, regulatory and quality assurance functions. Service providers should collaborate to ensure synergy in their services towards common goals. Therefore the need for Integrate Pluralistic Extension Approach (IPAE) arises from the recognition that a singular approach to agricultural extension may not effectively address the diverse needs and challenges faced by farmers. By integrating various extension methods and incorporating multiple stakeholders, such as government agencies, NGOs, FPOs and local communities, IPAE can provide a more comprehensive and tailored support system for farmers. This approach also promotes knowledge sharing, innovation, and sustainable practices in agriculture, ultimately leading to improved productivity and resilience in the face of crises like the COVID-19 pandemic. By adopting this approach, agricultural extension services can effectively address the challenges faced by farmers and ensure the availability of essential resources and support. Additionally, the integration of diverse stakeholders and expertise through IPAE can lead to innovative solutions and resilient agricultural systems that are better equipped to handle future crises. This can lead to improved farmer productivity, sustainable practices, and ultimately, food security in times of crisis such as the COVID-19 pandemic.

Strength of IPAE Approach with respect to conventional extension approach lies in its ability to tap into a solely on top-down dissemination of information, IPAE recognizes the value of local knowledge, farmer experiences, and collaboration with various stakeholders. This inclusive approach not only fosters innovation and adaptability but also promotes ownership and empowerment among farmers. Additionally, by incorporating multiple perspectives and expertise IPAE can better address the diverse needs. This collaborative approach allows for a more comprehensive understanding of the challenges faced by the agricultural sector and promotes innovative solutions that are tailored to local contexts. By promoting collaboration and knowledge exchange, IPAE aims to create a more resilient and equitable agricultural sector that can better adapt to future challenges such as climate change. IPAE recognizes the need for a more holistic and inclusive approach that takes into account the long-term sustainability of agricultural systems, as well as the well-being of farmers and rural communities. By bringing together diverse stakeholders, IPAE fosters collaboration and knowledge exchange that can drive positive change in the agricultural sector.

IPAE refers to the collaboration of extension service providers ie., State department of agriculture and its line departments, Krishi Vigyan Kendras (KVKs), input dealers, Farmer Producer Organizations (FPOs) and Non Government Organizations (NGOs) to provide forward and backward linkage to farmers. Backward linkage in IPAE includes providing high quality agricultural inputs at consumer doorsteps (Mobile input vehicle and door delivery services), equipping farmers technical skills via online training, AI based mobile application, WhatsApp group, help line service, supplying required machineries through custom hiring centre, supplying labour for intercultural operation and providing credit assistance. Forward linkage in IPAE includes facilitating farmers to market their produce through mobile vehicle, uzhavar santhai, e marketing, retail market such as waycool, reliance, ninjakart, bulk procurement of farm produce at fair price, providing cold storage facilities for farmers and facilitating farmers to go for value addition. Individual service provider could not provide all these services on end to end basis to the farmers due to lack of time, financial and human resources. Therefore, EAS providers should collaborate to ensure synergy in their services towards common goals. This approach will be very much useful during the time of crisis like COVID-19 pandemic. Furthermore, this approach enables us to enhance collaboration and communication among different stakeholders. With the ability to share real-time data and insights, we can foster a more coordinated response to upcoming crises like the COVID-19 pandemic.

3.1.1 Backward Linkage

Backward linkage plays a crucial role in enhancing productivity, efficiency, and competitiveness in the agricultural sector. By establishing strong backward linkages, farmers can access necessary inputs such as seeds, fertilizers, and machinery, which are essential for improving crop yields. This ensures that farmers have access to high-quality inputs at affordable prices, ultimately contributing to increased agricultural production. Additionally, backward linkage promotes knowledge transfer and technology adoption among farmers by providing them with training and technical assistance. This enables them to adopt modern farming practices and techniques that can further enhance productivity and sustainability in agriculture. Moreover, backward linkage fosters collaboration between farmers and agribusinesses, creating opportunities for value addition through processing and packaging of agricultural products. This not only increases the shelf life of perishable goods but also allows farmers to capture a larger share of the market value.

3.1.2 Forward Linkage

An important component of forward linkage is the establishment of strong market connections. Farmers can leverage technology platforms to access real-time market information, connect with buyers directly, and negotiate fair prices for their produce. Additionally, forward linkage involves the development of value-added products and diversification strategies. By processing raw agricultural commodities into higher-value goods like processed foods, farmers can capture a larger share of the value chain and increase their profitability.

a) Mobile input vehicle

Mobile input vehicle should be structured in a way to provide required agro-inputs to farmers at their door steps. This innovative mobile input vehicle aims to revolutionize the way farmers' access to agro-inputs. By bringing these essential resources directly to their doorsteps, it eliminates the need for farmers to travel long distances or rely on traditional supply chains. This not only saves valuable time and

effort but also ensures that farmers have easy access to high-quality agro-inputs when they need them the most. The mobile input vehicle is equipped with a wide range of products, including fertilizers, seeds, pesticides, and machinery, catering to the diverse needs of farmers. Additionally, it will be more effective if expert agronomists are present on board to provide personalized guidance and recommendations based on the specific requirements of each farmer.

b) Door delivery services

Input dealers started adopting door delivery services of agro-inputs during the COVID-19 pandemic. Due to lack of time, financial resources and human resources they were unable to reach all the farmers. To overcome these constraints input dealers should collaborate with other service providers in such post pandemic situation and also if there is any crisis arise similar to the COVID-19 pandemic in future. Thus, door delivery services of agricultural inputs have revolutionized the way farmers' access essential resources. With the convenience of doorstep delivery, farmers no longer have to waste valuable time and effort travelling to distant stores or markets. This efficient system ensures that agricultural inputs such as seeds, fertilizers, and pesticides are readily available to farmers whenever they need them. By eliminating the need for physical visits, door delivery services also contribute to reduce transportation costs and carbon emissions.

c) Online training

Online training has become increasingly popular in recent years, as it offers a convenient and accessible way for farmers to enhance their knowledge and skills. With the advancements in technology, farmers can now access a wide range of resources and courses right from the comfort of their homes. These online training programs cover various aspects of farming, including crop management, livestock care, sustainable practices, and market trends. They provide farmers with valuable insights and techniques to improve productivity, reduce costs, and maximize profits. Additionally, online training allows farmers to connect with experts and fellow farmers from around the world through forums and virtual communities. This fosters knowledge sharing and collaboration, enabling farmers to learn from each other's experiences and gain new perspectives. Moreover, online training often offers flexibility in terms of scheduling, allowing farmers to balance their learning with their daily farming activities. Owing to emergency (mobility restrictions) aroused during the COVID-19 pandemic, stakeholders involved in agriculture started to adopt online training.

d) AI based mobile applications

AI based mobile applications for farmers have revolutionized the way agriculture is practiced. These applications provide farmers with valuable insights and information that can greatly enhance their productivity and efficiency. AI-powered mobile apps such as M-Velanmai, Kissan GPT, Outgrow App, etc… offer real-time pest and disease detection capabilities. Farmers can simply take a picture of an affected plant, and the app will quickly identify the problem and suggest appropriate remedies. This not only saves time but also helps prevent the spread of diseases to other crops. Furthermore, AI-based apps provide personalized recommendations for crop selection based on factors such as soil type, climate conditions, and market demand. By leveraging historical data and predictive analytics, these apps enable farmers to make informed decisions about which crops to grow for maximum profitability.

e) Farmers WhatsApp group

Farmers Whatsapp group is a platform where farmers come together to share their knowledge, experiences, and insights. It has become a hub of information exchange, where farmers discuss various farming techniques, crop diseases, market trends, and innovative practices. The group serves as a support system for farmers facing challenges in their agricultural endeavors. It becomes a platform for farmers to connect with buyers directly, eliminating middlemen and ensuring fair prices for their produce. The Farmers Whatsapp group has revolutionized the way farmers communicate and collaborate, empowering them to make informed decisions and enhance their farming practices. It was found from farmer's smartphone that they had separate WhatsApp group for availing EAS from the state department of agriculture, KVK, input dealers, NGO and FPO. It was recommended to create single WhatsApp group by including all the service providers in order to avoid crowding of messages and confusion. Hence, all the service providers can deliver EAS to the farmers via Whatsapp group during post pandemic and if there arises any crisis similar to COVID-19 pandemic in future.

f) Custom Hiring Centre

The Custom hiring centre for farmers is an essential facility that aims to provide convenient and cost-effective solutions to agricultural needs. With a wide range of services available, farmers can access modern machinery, equipment and tools necessary

for various farming activities. From tractors and harvesters to irrigation systems and seed drills, the centre ensures that farmers have access to the latest technology without the burden of ownership. This not only saves them from the hefty investment costs but also allows them to focus on their core farming operations. Moreover, the centre promotes efficiency by offering skilled operators who are well-versed in handling different machinery. This ensures that farmers can maximize their productivity while minimizing any potential risks or errors. Additionally, the custom hiring centre serves as a knowledge hub where farmers can gather information on best practices, crop management techniques, and market trends. By facilitating knowledge sharing and fostering a sense of community among farmers, the centre plays a crucial role in empowering them with the necessary resources and expertise to thrive in today's competitive agricultural landscape.

g) Labour supply

By utilizing MGNREGA workers for intercultural operations, we can effectively address the labor shortage that has been exacerbated by the COVID-19 pandemic. This strategic approach not only tackles the current crisis, but also prepares us for future challenges resembling the ongoing pandemic. Leveraging the skills and expertise of MGNREGA workers in diverse sectors will ensure a steady supply of labor, minimize disruptions and foster resilience at times of crisis. This innovative solution not only meets immediate needs but also lays the foundation for a more robust and adaptable workforce in and beyond the post-pandemic era.

h) Credit support

Providing financial support to farmers to carry out agricultural operations during pandemic, post-pandemic, and any other crisis that arise in the future is crucial for ensuring food security and stability in our society. By offering subsidies and low-interest loans, governments can help farmers overcome the financial burden brought about by these challenging times. Additionally, implementing comprehensive insurance policies that cover crop failures and market fluctuations can safeguard farmers' livelihoods and provide them with safety nets. Moreover, establishing a robust infrastructure for the storage, transportation, and marketing of agricultural produce will enable farmers to maximize their profits and minimize losses. By taking these proactive measures, the resilience of the agricultural sector can be ensured in the face of future crisis similar to the pandemic.

i) Help line services

Farmers were forced to distress sale because of lack of market information. They were unable to obtain fair prices for their produce. Market information provided to farmers during the COVID-19 pandemic via help line services was effective. This enables farmers to sell their produce directly to consumers at a high price. This has helped farmers increase their income and improve their livelihoods. This would ensure that farmers have access to accurate market information, allowing them to make informed decisions about when and where to sell their produce. Therefore, it is crucial to recognize the significance of help line services for farmers and make them readily accessible regardless of any crisis situation. Public service providers alone cannot provide this service regularly to farmers. They require the support of other service providers to provide market information to the farming community. Hence, all service providers should join their hands to provide this service to farmers not only during the pandemic, but also regularly.

j) 'Uzhavarsanthai' (Farmers Market)

Farmers can sell their produce directly to the consumers in 'uzhavarsanthai'. Owing to the closure of the wholesale market, commission mandis, and retail market, the use of 'uzhavarsanthai' by farmers during the COVID-19 pandemic has increased. Selling produce through 'uzhavarsanthai' will increase farmers' income. Hence, all service providers should encourage farmers to sell their produce at 'uzhavarsanthai', irrespective of the crisis time.

j) Mobile vehicle mode of marketing

Marketing farm produce through mobile vehicle is an innovative intervention provided by various service providers during the COVID-19 pandemic. This approach has revolutionized the way farmers connect with consumers, ensuring a steady supply of fresh produce while adhering to social distancing guidelines. By bringing the market directly to consumers' doorsteps, mobile vehicles have eliminated the need for crowded markets and reduced the risk of viral transmission. This initiative empowered farmers by enabling them to showcase their products and establish direct relationships with customers. The convenience offered by these mobile vehicles has been widely appreciated as it saves time and effort for both farmers and consumers. Therefore, this intervention will be instrumental during post-pandemic situation as it provides a convenient and accessible way for farmers to directly reach their customers and increase their

income. With mobile vehicles, farmers can bring their fresh produce to different neighborhoods and communities, ensuring that everyone has access to locally grown food. Hence, the mobile vehicle marketing mode has also opened new avenues for growth and resilience in the agricultural sector.

k) e-marketing

Farmers started adopting e-marketing during the COVID-19 pandemic. e-marketing of farm produce has revolutionized the agricultural industry, allowing farmers to reach a wider audience and increase their profits. Through various online platforms and social media channels, farmers can showcase their products and connect directly with consumers. This form of e-marketing enables them to highlight the quality and freshness of their farm produce, enticing customers to make purchases. e-marketing facilitates the establishment of long-term relationships with customers through personalized communication. The advent of e-marketing has transformed the way farm produce is marketed and has opened up new avenues for farmers to thrive in today's digital age.

l) Linking with retailers

Linking farmers with chain of retailers such as Waycool, Ninjakart and reliance will ensure income for the farmers in sustained manner while also providing a reliable supply chain for the retailers. By collaborating with Waycool, Ninjakart, and Reliance, farmers can tap into a vast network of retailers who are committed to sourcing fresh produce directly from them. This direct connection eliminates the need for middlemen, ensuring that farmers receive fair prices for their crops and reducing the chances of exploitation. Additionally, these partnerships offer farmers access to valuable resources such as technology-driven logistics and market insights, enabling them to optimize their production and meet consumer demands more efficiently. As a result, farmers can recive a steady income while retailers benefit from a consistent supply of high-quality products. This symbiotic relationship fosters sustainability in the agricultural sector, empowering farmers to thrive economically while meeting the evolving needs of the retail industry.

Owing to pandemic restrictions, service providers linked farmers with the available retailers during the COVID-19 pandemic. Farmers' income has been increased despite the pandemic. Therefore, service providers jointly should take all the necessary measures to link farmers with retailers even after pandemic through which farmers can receive steady income and ensure the continued growth of the agricultural sector. By establishing strong and reliable connections between farmers and retailers, service providers can create a sustainable supply chain that benefits both parties. This can be achieved through innovative technologies and platforms that facilitate direct communication and transactions between farmers and retailers. Additionally, service providers should invest in training programs and resources to enhance farmers' skills and knowledge in market trends, product quality, and sustainable farming practices. By empowering farmers with the necessary tools and support, they can adapt to changing consumer demands and contribute to a more resilient agricultural industry. By prioritizing the economic well-being of farmers while meeting the needs of the retailers, service providers can play a crucial role in building a thriving agricultural sector that benefits all stakeholders involved.

m) Bulk procurement of farm produce

Bulk procurement of farm produce by the government, assured fair price for the farmers. Government alone cannot procure all the farm produce in bulk quantity. Therefore, all the stakeholders should jointly procure farm produce in bulk quantity. This will help ensure fair prices for the farmers and stability in the agricultural sector. During pandemic, each of the service provide procured farm produe separately. But it guaranteed assured price for the farmers. Service providers were unable to reach all the farmers due to various limitations such as transportation issues and limited resources. By implementing a collaborative mechanism in the agricultural sector, service providers can overcome the challenges faced during the pandemic. Instead of procuring farm produce separately, this mechanism allows them to work together and procure in bulk quantities. This not only guarantees an assured price for the farmers but also ensures that no farmer is left out or disadvantaged. By adopting collaborative approach, service providers can efficiently reach all the farmers, overcoming limitations such as transportation issues and limited resources. By pooling their efforts and resources, they can collectively support the farming community and contribute to a more sustainable and resilient agricultural sector.

n) Linking farmers with housing society

Farmers were connected with housing board or housing society for marketing their farm produce during the COVID-19 pandemic. This linkage increased income of the farmers and farmers get

permanent consumers. This collaboration not only helped farmers market their produce effectively but also provided them with a stable income source. Additionally, it offered consumers the advantage of having access to fresh and locally sourced products. The positive outcomes of this intervention make it imperative for service providers to persistently support and promote such marketing strategies. By doing so, they can contribute to the sustainable growth of both farmers and consumers, fostering a thriving agricultural sector that benefits everyone involved. Therefore, service providers should continue to support and promote these marketing strategies to ensure sustainable growth for both farmers and consumers.

o) Direct sale to consumers

Owing to mobility restrictions imposed by the government during the COVID-19 pandemic, farmers sold their produce directly to the consumers at their village. Farmers received additional income by selling their produce directly to the consumers. Farmers preferred to go for direct sale even after pandemic. Therefore, service providers should make necessary arrangements for selling farm produce directly to the consumers. Direct sales enable farmers to establish personal relationships with their customers, fostering trust and loyalty. Consumers benefit from this arrangement as well, as they gain access to fresh, high-quality produce at reasonable prices. Furthermore, direct sales promote transparency in the food system, enabling consumers to have a better understanding of where their food comes from and how it is produced. Overall, the direct sale of farm produce serves as a mutually beneficial arrangement that promotes economic viability, sustainability, and consumer satisfaction in the agricultural sector.

p) Cold storage

Cold storage facilities allow farmers to extend the shelf life of their produce, preventing spoilage and reducing post-harvest losses. By maintaining low temperatures, these facilities slow down the natural decay process, preserving the quality and freshness of fruits, vegetables, and other perishable goods. This not only enables farmers to store their harvest for longer periods but also empowers them to access markets with higher demand and better prices throughout the year. Additionally, cold storage facilities enable farmers to take advantage of favourable market conditions by storing their produce until prices are more favourable. They can strategically release their products when demand is high or when prices surge due to seasonal fluctuations or unforeseen circumstances such as crop failures or natural disasters. At present government constructed only few cold storage facilities for the farmers. Due to lack of financial resources government were unable to construct additional cold storage infrastructure. By considering the advantage of cold storage, service providers should worked together and construct cold storage infrastructure at every village.

q) Value addition

Farmers were facilitated to go for value addition by the service providers during the COVID-19 pandemic. By providing them with the necessary resources, training, and infrastructure, farmers can transform their raw agricultural produce into processed goods that fetch higher prices in the market. This not only increases their income but also reduces post-harvest losses. Value addition techniques such as drying, canning, juicing, and packaging can enhance the shelf life of perishable crops and make them available throughout the year. Additionally, farmers can explore opportunities in agro-processing industries like dairy, poultry, and food processing to diversify their income streams. Moreover, promoting value addition empowers farmers to participate in the global supply chain by producing high-quality products that meet international standards. This opens up export opportunities and boosts foreign exchange earnings for the country. Government support through subsidies, grants, and loans can play a pivotal role in encouraging farmers to invest in value addition infrastructure and technologies. Collaborations with research institutions and private enterprises can also facilitate knowledge transfer and innovation in this sector. Therefore, even after pandemic farmers should be encouraged by the service providers to go for value addition as it provides higher price for their produce.

Starting from delivering required inputs, advisory services, online training to either marketing/ value addition/ storage of farm produce service providers such as state department of agriculture, KVKs, input dealers, NGOs and FPOs should worked together. By providing all these services they can enhance the livelihoods of farmers, retain them in agriculture, and even attract a large number of youth towards this sector. This unified approach will ultimately contribute to the development of a thriving agricultural industry that is both sustainable and prosperous. This collaboration can lead to a sustainable and prosperous agricultural sector.

4 PRACTICAL IMPLICATIONS

The Integrated Pluralistic Agricultural Extension approach is a comprehensive and inclusive method that combines various extension strategies and approaches to effectively address the diverse needs of farmers. It recognizes the importance of involving multiple stakeholders, such as government agencies, NGOs, and community-based organizations, in delivering agricultural extension services. This approach aims to enhance knowledge and skills among farmers, promote sustainable farming practices, and improve overall agricultural productivity. Additionally, it encourages active participation and collaboration among different actors in the agricultural sector to ensure the success of extension programs.

By providing high-quality agricultural inputs at the doorstep through mobile input vehicles and door delivery services, IPAE ensures that farmers have easy access to essential resources. This can lead to improved crop yields and overall agricultural productivity. Equipping farmers with technical skills through online training, AI-based mobile applications, WhatsApp groups, and helpline services enables them to stay updated on modern farming practices. This can result in increased efficiency, better resource management, and sustainable agricultural practices. Supplying required machinery through custom hiring centers allows farmers to access expensive equipment without the burden of ownership. This can lead to cost-effective and efficient farm operations, contributing to higher yields and reduced labor requirements. Providing credit assistance to farmers addresses financial constraints, allowing them to invest in inputs, machinery, and other necessary resources. This can contribute to the overall economic well-being of farmers and foster agricultural development. Facilitating farmers to market their produce through various channels such as mobile vehicles, uzhavarsanthai, e-marketing, and retail markets creates diverse market opportunities. This can lead to better price realization for farmers and reduce dependence on traditional markets. Supporting farmers in value addition processes can enhance the economic value of their produce. This includes facilitating cold storage facilities, promoting processing units, and encouraging farmers to adopt value-added practices, contributing to increased income

5 CONCLUSION

In conclusion, the Integrated Pluralistic Agricultural Extension Approach (IPAE) represents a paradigm shift in addressing the multifaceted challenges faced by farmers. By fostering collaboration among diverse stakeholders, including government agencies, NGOs, FPOs, and local communities, IPAE creates a synergistic platform for delivering essential services. The strengths of IPAE lie not only in its ability to tap into local knowledge and experiences but also in promoting innovation, sustainability, and inclusivity. As we navigate an era marked by uncertainty and change, IPAE emerges as a vital strategy to enhance the resilience of agriculture. It offers a holistic framework that goes beyond traditional top-down approaches, recognizing the importance of coordinated efforts in ensuring food security, promoting sustainable practices, and empowering farmers. The success of IPAE hinges on the commitment of all stakeholders to collaborate, share knowledge, and work collectively towards a more robust and equitable agricultural sector that can weather the challenges of the future.

In the backdrop of evolving challenges and opportunities in agriculture, the Integrated Pluralistic Agricultural Extension Approach (IPAE) emerges as a transformative strategy to address the diverse needs of farmers in the 21st century. The agricultural landscape has witnessed a proliferation of extension service providers, ranging from governmental bodies to non-governmental organizations, input dealers, and Farmer Producer Organizations (FPOs). This pluralism, while reflective of the dynamic nature of agriculture, also presents challenges such as resource competition, information gaps, and power imbalances. Recognizing the limitations of a singular approach, IPAE advocates for the integration of various extension methods and collaboration among stakeholders to create a comprehensive support system. This approach not only acknowledges the importance of local knowledge and farmer experiences but also fosters innovation, adaptability, and resilience in agriculture. As the world grapples with challenges like climate change and the aftermath of the COVID-19 pandemic, IPAE stands as a beacon for a more inclusive, collaborative, and effective agricultural extension approach.

6 CONTRIBUTION OF THE STUDY

IPAE developed through the fosters holistic development by integrating various stakeholders, services, and resources. This approach addresses multiple aspects of farming, from inputs to market access, contributing to the overall development of the agricultural sector. By providing knowledge, resources, and access to markets, IPAE empowers farmers to make informed decisions and enhance their livelihoods. This can lead to increased confidence and self-sufficiency among farmers. The use of online training, AI-based applications, and other technological tools promotes the adoption of modern farming practices. This contributes to the overall technological advancement of the agricultural sector.

7 LIMITATIONS OF THE STUDY

Coordinating multiple stakeholders and ensuring seamless collaboration can be challenging. Differences in priorities, administrative hurdles, and resistance to change may impede the effective implementation of IPAE. Availability of resources, including finance, skilled manpower, and technology infrastructure, may limit the successful implementation of IPAE. This is particularly true in regions with limited financial and technological capabilities. IPAE's success may depend on external factors such as market conditions, government policies, and the overall economic environment. Fluctuations in these factors can impact the outcomes of the approach. Despite efforts to provide services at the doorstep, there may be limitations in reaching remote or marginalized communities. This could result in unequal benefits and hinder the inclusive nature of the approach.

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