

AWARENESS OF SHRIMP FARMERS ON PRIVATE EXTENSION SERVICES - AN EMPIRICAL MODEL FOR EFFECTIVE EXTENSION SERVICES IN ANDHRA PRADESH, INDIA

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Abstract. As shrimp farming is a commercial venture, there is a requirement for technological development, training, and transfer of technologies. Andhra Pradesh which is the dominated state in shrimp production is depending on the Private Extension Services as they are playing a key role in meeting the demands of the shrimp farmers. In connection to this, the present study was conducted to find out the awareness of the shrimp farmers on Private Extension Services and also to develop an empirical model for effective extension services. The study was undertaken in Nellore, Guntur, Krishna & West Godavari districts of Andhra Pradesh, India. A structured interview schedule was utilized to collect data from a sample of 400 farmers. Thirteen independent variables were chosen in order to determine the level of significance between the awareness of shrimp farmers and private extension services. Approximately 40.05% of the participants exhibited a high level of awareness regarding private extension services, while an additional 40.55% demonstrated some level of awareness. This finding suggests that a significant proportion of shrimp farmers engaged with private extension service professionals in order to enhance their production levels. A conceptual framework was formulated to optimize extension services of both public and private sectors, The proposed methodology aims to enhance the research and extension collaboration, as well as establish alliances with service-oriented private extension systems, in order to foster the aquaculture extension services in India.

Keywords: *shrimp farmers, awareness, Private Extension Services, public private partnership, Andhra Pradesh*

Introduction

India has exported 12,89,651 tones of seafood worth Rs.46,662.85 crore in the year 2020-21 by contributing 46.45 per cent in quantity, which is 2.48 per cent higher than the exports in 2019-20. Globally, an increase of 8.90 per cent of growth rate in shrimp production is recorded in 2020. This suggests a favorable remark about success in the shrimp farming sector. The success of shrimp culture contributes for the increased growth rate of Indian exports. Andhra Pradesh has produced 46.23 lakh MT in 2020-21, which is worth a total of Rs.55,294 crore in Gross Value Addition (GVA). The sector's contribution of GVA is 8.67 per cent and 23.80 per cent to agricultural GVA of State providing livelihood opportunities to about 16.50 lakh populations either directly or indirectly in the State (MPEDA, 2020-21).

The fisheries sector has been recognized as one of the growth engines for Andhra Pradesh, the Sun Rise State, to achieve double digit inclusive growth. (Which indicates that the production should be doubled by the next year as the state is blessed with potential and diversified water resources). Andhra Pradesh is endowed with a long coastline of 974 kms covering nine out of thirteen districts and with a continental shelf area of 33,227 Sq. kms, 0.80 lakh ha. of brackishwater area, 8.00 lakh ha. of inland waters, 352 Sq. kms of mangrove area, 555 marine fishermen villages, one fishing harbour, 350 fish landing centres, 31,147 fishing crafts, 65 cold storages, 64 processing plants, 235 ice plants, 28 feed mills, 357 hatcheries and 234 aqua laboratories (www.fisheries.ap.gov.in).

In spite of COVID-19 pandemic, Andhra Pradesh continued its leading position in shrimp production in the country and produced 5.14 LMT compared to country's production of 7.57 LMT during 2019-20 (AP Share-67.91%) and 6.40 LMT compared to the country's production of 8.52 LMT (AP Share-75.17%) during 2020-21 with a growth rate of 24.60 per cent. As such, Andhra Pradesh is one of the leading producers of alternative and other commercial species such as mud crab, sea bass and pangasius and it is also known as the "Aquaculture Hub of India"

- India's production of *Scylla serrata* (mud crab) is 4519 MT and production from Andhra Pradesh is 1709 MT contributing about 37.82 per cent of the total production.
- India's production of *Lates Calcarifer* (sea bass) is 3626 MT whereas Andhra Pradesh production is 1864 MT with a share of 51.41 percent of total production.
- India's production of *Pangasius pangasius* (pangasius) is 1,82,198 MT in which Andhra Pradesh contributed to 1,80,192 MT with a share of 98.90 per cent of the total production.

Andhra Pradesh is also continuing its leading position in marine products exports in the country. During 2020-21, Andhra Pradesh has exported marine products worth of ₹ 15831 crore against the country exports value of ₹ 43,717 crore with a share of about 36.21 per cent in terms of value and 24 per cent in terms of quantity (MPEDA, 2021).

Aquaculture extension services

The extension system persuades and assists farmers in improving their socioeconomic situations and enhancing their way of life through improved farming techniques which increase production and profitability. The process of shifting roles, additional duties and as well as resource shortages in public extension system has created a gap between the system and the end users. Private extension systems are now filling the gap as needed to accommodate the needs of the farmers, who are accepting it with welcoming hands.

Commercial aquaculture requires significant financial investment, modern technologies and a steady supply of different inputs like high-quality seeds, feed and farming equipment. Shrimp farmers in this context rely on several players to fulfil their needs. Shrimp farmers depend on input dealers for seed, feed and machinery, middlemen for finance and marketing, banks for credit support and the Department of Fisheries for welfare programmes and subsidies. They also depend on extension workers, progressive / key farmers and the media for information on shrimp farming.

Objective of the study

- To study the socioeconomic profile of shrimp farmers.
- To find out the awareness of shrimp farmers towards private extension services.
- To develop an empirical model for effective extension services.

Review of Literature

i). Awareness of shrimp farmers on private extension services

Kunchala et al. (2012) reported that farmers were aware of the following private extension services, i.e., timely availability of required information (70.83%), timely availability of inputs like pesticide, fertilizers, etc. (64.16%), marketing information (60%), timely solution of farm problems at farm level (56.66%) and availability of finance for agricultural operations (52%) in Anand district, Gujarat, India.

Kaur et al. (2014) concluded that 17.50 per cent farmers had medium level of awareness. More than three-fourth (82.50%) of farmers had high level of awareness towards privatization of agricultural extension services. It indicated that maximum percentages of the farmers were aware of private extension services in Haryana, India.

Kaur and Kaur (2018) found that the respondents of Punjab, India had 100 per cent mean knowledge regarding the services like information provided and technical services followed general services (94.43%), consultancy and diagnosis services (92.16%) and input supply (81.42%). While knowledge regarding infrastructure facilities was 52.66%.

Tripathy and Dipak (2021) concluded that majority (45.30%) of respondents of Ganjam District of Odisha, India had medium level of awareness and knowledge on private extension services. A considerable number of respondents (30%) were belonged to the high-level knowledge group and 24.17 per cent respondents were belonged to the low-level knowledge group.

ii). Available private extension services for shrimp farmers

Kumaran et al. (2011) reported that marketing was the prime objective of private extension services facilitated by offers and incentives to farmers of Andhra Pradesh, Gujarat and Tamil Nadu, India.

Mengal et al. (2012) concluded that based upon the mean score for each extension teaching methods, exhibition (3.59), seminar (3.12) and literature distribution (2.79) were some of the highly available extension services for the respondents of Balochistan, Pakistan.

Uddin and Qijie (2013) concluded that in Bangladesh, a parallel private extension system along with public extension system could increase the coverage of extension service that would address farm problems and ensure better income of the farmers.

Kumaran et al. (2017) reported that shrimp farmers of East coast of India were mostly dependent on private inputs particularly feed companies and independent consultants due to their easy accessibility, periodical visit to the farms, mobilizing inputs/services and trust gained over a period of time. Institutional sources due to their limited manpower and pre-occupation with welfare, regulatory and administrative functions could not concentrate more on providing technical advisory services to the farmers.

Maity et al. (2021) reported that government could encourage establishing supplementary feed mills in PPP mode that would also create employment opportunities.

iii). Constraints in utilizing private extension services

Kumar et al. (2012) concluded that weak research-extension linkages, inadequate support for promotion of Farmers Organizations (Fos) and farmer-led extension services were the constraints reported by the farmers.

According to Kumari (2012), all small farmers of Andhra Pradesh, India, felt that since majority of their operating holdings were small and marginal, private extension services

were not appropriate. Nearly 94 per cent of medium-sized farmers reported that using private extension services helped them get closer to markets.

Kumar (2014) reported that 85 per cent of the farmers worried that privatization would focus on progressive farmers. High charges on services by 60 per cent of respondents, 30 per cent of farmers reported the displacement of small and marginal farmers.

According to Parouha (2014), some of the major challenges faced by farmers in Rewa district, Madhya Pradesh, India was the difficulty of high input costs (59.20%), lack of information about loans and subsidies (55.25%) and issues with marketing (47.20%).

Kavyashree (2014) concluded that poor local facilities for input intensive technologies and exploitation by the input dealers were the major constraints reported by the respondents of Tumkur and Chitradurga districts of Karnataka, India.

Chowdhury et al. (2016) concluded that the main issues with public fisheries extension services in Barisal District in Bangladesh, includes bias toward wealthy and politically powerful clients, infrequent contact, lack of input supply, inability to deliver standard services, unavailability of extension agents when they were needed, etc.

Ahmed et al. (2018) reported that non-coverage of all the areas, lack of confidence in solving farmers' problem, ineffective services provided by local extension agent, not capable enough in overall dissemination of aquaculture technologies and frequent contact with only the resource-rich farmers were considered as the major constraints faced by the farmers in Bangladesh.

Kushwaha (2018) inferred that irresponsive of extension services provides to client's needs (58.33%), poor linkage between research and extension (50%), exploitation by extension service providers (70%), tendency to focus more attention on large farmers (29.17%) were some of the constraints perceived by the famers in Madhya Pradesh, India.

Tank et al. (2019) reported that lack of proper extension network and irregular training programmes were the most important extension constraints faced by 60.47 per cent of the shrimp famers of Saurashtra, Gujarat, India.

The most significant constraint according to Raghuwanshi et al. (2022a) was "marketing is the utmost priority of private extension services," which was experienced by 75.86 per cent of farmers (ranked 1st) and the least significant barrier was "less credibility of private extension services among the farmers," which was reported by 24.71 per cent of farmers (ranked 11th) Chhindwara district (M.P), India.

Materials and Methods

The objective of this study was to assess the level of awareness among shrimp farmers regarding Private Extension Services and to formulate an empirical model for enhancing the effectiveness of extension services in the districts of SPSR Nellore, Guntur, Krishna, and West Godavari in the state of Andhra Pradesh, India. A sample size of 400 farmers was chosen from each district, with selection criteria based on shrimp production. The data were collected from September 2020 to September 2022. The participants in the study were chosen through the utilization of a proportionate random sampling technique. The study employed an ex-post facto research design.

With reference to the objectives, awareness of the shrimp farmers towards private extension services was considered as dependent variable. A total of thirteen independent variables were selected and further grouped into four categories (Socio-personal, socio-economic, psychological and communicational). The scales developed by earlier researchers for measurement of variables were used with suitable modifications. Awareness

of the shrimp farmers on private extension services was measured with the pretested interview schedule containing 15 questions which were grouped into Information services, Technical services, Input supply services and Consultancy & Diagnostic services. Awareness index of Well aware, Aware and Not aware of the respondents was calculated by frequency and percentage analysis.

Developing an empirical model for effective private extension services

Considering the importance of extension services in helping the farmers to address the challenges in shrimp farming, an empirical model was developed to reduce the barriers for strengthening the aquaculture extension services. A model on extension support service system for shrimp farmers was developed representing the associated partners of extension system and their possible areas of support in shrimp farming for effective delivery of the extension services.

Relationship between independent and dependent variable (Y₁)

Table 1 shows the relationship between shrimp farmers' socio-personal, socio-economic, communicative, and psychological variables of shrimp farmers and their awareness level on private extension services.

It is concluded that a total of eight variables such as age (X1), educational status (X2), social participation (X5), information seeking behavior (X11) and mass media exposure (X12) had a high and positive relationship at 1% level of significance with the awareness level on private extension services. The study also concluded that variables such as shrimp farming experience (X3), training exposure (X6), occupational status (X7), annual income (X9), source of shrimp seed (X10) and risk orientation (X13) all found to have a positive and significant relationship with the awareness level on private extension services.

The results indicated that source of finance (X8) is non-significant with awareness of respondents. Furthermore, ownership of farm (X4) had a negative and non-significant relationship with the awareness on private extension services as they have not created any impact towards awareness of the respondents. The present results were relying with the findings of Fakayode et al. (2016).

Table 1. Correlation between independent variables and awareness of the shrimp farmers on private extension services

Variable Code	Name of the variables	Correlation coefficient (r)
Socio-personal variables		
X1	Age	0.530**
X2	Educational status	0.549**
X3	Shrimp Farming experience	0.487**
X4	Ownership of farm	-0.037 NS
X5	Social participation	0.519**
X6	Training exposure	0.297**
Socio-economic variables		
X7	Occupational status	0.462**
X8	Source of finance	0.027 NS
X9	Annual income	0.348**
X10	Source of shrimp seed	0.449**

	Communication variables	
X11	Information seeking behaviour	0.594*
X12	Mass media exposure	0.532**
	Psychological variables	
X13	Risk orientation	0.409**

NS = Non-Significant, ** = significance at 0.01 level, * = significance at 0.05 level

Multiple regression analysis on awareness of the shrimp farmers on private extension services

The Spearman regression analysis was used to find out the relationship between the independent variables and the shrimp farmers' level of awareness. The results are listed in *Table 2*.

Table 2. Multiple regression analysis on awareness of the shrimp farmers on private extension services

Variable Code	Independent variables	Regression Coefficient (B)
	Socio-personal variables	
X1	Age	-0.141
X2	Educational status	0.463
X3	Shrimp Farming experience	0.109
X4	Ownership of farm	0.031
X5	Social participation	0.592
X6	Training exposure	-0.442
	Socio-economic variables	
X7	Occupational status	0.270
X8	Source of finance	0.527**
X9	Annual income	-0.112
X10	Source of shrimp seed	-0.297
	Communication variables	
X11	Information seeking behaviour	-0.097
X12	Mass media exposure	-0.131
	Psychological variables	
X13	Risk orientation	-0.048

$R = 0.827$, $R^2 = 0.685$, $F = 28.770$

It could be seen that the R and R^2 values represents the multiple regression coefficients. R is a measure for the accuracy of prediction on the dependent variable. The coefficient of determination, denoted as R^2 , quantifies the proportion of variability in the dependent variable that can be accounted for by the independent variables.

The R -value in this study is 0.827, which showed a high level of prediction. The R^2 value is 0.685, suggested that the independent variables accounted for 68.5 per cent of the dependent variable's variability. The F -value indicated that the independent variables are statistically significant and predicts the dependent variable. The F -value = 28.77, $p = 0.005$, $R^2 = 0.685$ indicated that the regression model fits the data well.

Results and Discussion

Socio economic characteristics of the respondents

The study reveals that a significant proportion (54.50%) of the shrimp farmers surveyed fell within the middle age range of 36-50 years, with the remaining participants being predominantly older (28.50%) or younger (17.00%) individuals. Kunda (2022), Ray et al. (2021), and Booncharoen and Anal (2021) have similarly documented these findings. The majority of individuals, specifically 40.50%, had attained education up to the higher secondary school level, while 27% had completed education at the high school level. These findings are consistent with the research conducted by Patil and Sharma (2021), which revealed that 63.64 percent of the shrimp farmers possessed a postgraduate degree in fisheries science or zoology.

Shrimp farming was the sole occupation for 57.75 per cent of the respondents, while primary occupation for about 37.75 per cent. As far as the shrimp farming experience is concerned about 38 per cent had 11-15 years of experience followed by 34.50 per cent of 6-10 years of experience enabling them in improving their knowledge and skills. These results are in line with the results of Maity and Saha (2020a), Alagappan and Kumaran (2020), Durai and Alagappan (2020) and Naik and Patil (2020).

Nearly 61.75 per cent of the shrimp farmers were operating their own farms and 38.25 per cent were operating on lease basis. Majority (73.00%) of the respondents had medium level of social participation followed by 15.25 per cent of high and 17.75 per cent of low levels. Biswas et al. (2018) and Chittem and Kunda (2018) also reported the same.

About 39.25 percent of the shrimp farmers had attended two training programmes and 19.75 per cent had completed three and more. These same results were reported by Maity and Saha (2020b), Srinivas et al. (2019) and Pegu et al. (2019).

Farm size is crucial in shrimp farming since it influences crop productivity and efficiency. roughly 39.50 per cent of the respondents had a marginal sized pond (< 0.5 ha.), followed by 39 per cent who had a small pond (0.5 - 1 ha.). In addition, 18.50 per cent of respondents had medium-sized farms (1.0 - 3.0 ha.). A small percentage of respondents (3%) stated that their ponds were of large size. (> 3.00 ha.). Similar results were reported by Alagappan and Kumaran (2020), Naik and Patil (2020) and Tripathy and Dipak (2021).

From the study, it is reported that, 46.25 per cent of the shrimp farmers were depending on middlemen and 33.75 per cent on private money lenders for finance. Maity et al. (2021) reported that majority (94%) of the shrimp farmers took credits from banks, cooperatives, and private money lenders. Vadher and Manoj (2014) found that 69 per cent of the shrimp farmers had obtained their credit from private dealers.

Approximately 42.25% of the shrimp farmers surveyed reported an annual income ranging from Rs. 3-5 lakhs. This was followed by 30.25% of farmers who reported an income below 3 lakhs, and 27.50% who reported an income exceeding 5 lakhs. Similar results were reported by Tripathy and Dipak (2021), Patil et al. (2019) and Dona et al. (2016). Private hatcheries are found to be the major (81.50%) source for shrimp seed and only 17.50 per cent from government hatcheries.

The study reported that nearly 62.50 per cent of the shrimp farmers had medium level of information seeking behavior and 21 per cent of low level. Naik et al. (2020) observed that the main source of information for 27.71 per cent of the respondents were the progressive farmers and for 25.30 per cent of the farmers private technicians followed by internet/social media (17.47%).

The findings indicate that a significant proportion of the participants (59.25%) reported having a moderate level of exposure to mass media, while 21.75% reported a low level of exposure. Approximately 62.50% of the shrimp farmers exhibited a moderate level of risk orientation, while 20.25% demonstrated a low level of risk orientation. These results are in line with the results of Tripathy and Dipak (2021) and Maity and Saha (2020b).

Awareness of shrimp farmers on private extension services

To find the awareness level of the shrimp farmers on private extension services, an interview schedule was prepared with 15 questions and well aware, aware and not aware as their responses. The private extension services were categorized into four categories viz, Information services, Technical services, Input supply services and Consultancy & diagnostic services.

From the *Table 3*, it is found that 40.05 per cent of the respondents were well aware, 41.88 per cent were aware and 17.62 per cent were not aware about information services provided by the private extension services. In terms of technical service, about 40.08 per cent of the respondents had reported that they were well aware, 38.50 per cent as aware and 21.42 per cent as not aware. Regarding input supply services, it was found that 41.57 per cent of the respondents were well aware, 40.50 per cent were aware and 17.93 per cent were not aware. Around 38.06, 41.31, and 20.63 had indicated that they were well aware, aware and not aware of consulting and diagnostic services, respectively.

It is evident that, 40.05 per cent of the respondents were well aware of the private extension services followed by 40.55 per cent of aware. About 19.40 per cent of the respondents have reported that they were unaware of the private extension services (*Fig. 1*).

These findings showed that majority of shrimp farmers had contact with private extension service personnel and took advantage of their services for their economic profit. Similar results were reported by Kaur et al. (2014) and Tripathy and Dipak (2021).

Empirical model for improving private extension services

Public sector is generally responsible for funding and delivering aquaculture extension services to the farmers. At present, farmers are in need of an effective extension system for knowledge dissemination to meet the gaps in technologies, information, income and livelihood opportunities. Currently, the country has a pluralistic extension system, with partners from the public, private and corporate sectors working together to develop, promote and provide services to farmers.

Table 3. Awareness of the shrimp farmers on private extension services

Sl. No.	Private extension services	Well Aware		Aware		Not Aware	
		F	%	F	%	F	%
A. Information services							
1.	Are you aware that PES provides information on different aspects of shrimp farming?	173	43.25	172	43.00	55	13.75
2.	Do you know that PES provides information on updated market prices?	225	56.25	130	32.50	45	11.25
3.	Do you know that PES provides information on the updated technologies in shrimp farming?	222	55.50	142	35.50	36	9.00

4.	Do you know that PES provide information on credit facilities?	28	7.00	226	56.50	146	36.50
	Mean percentage		40.05		41.88		17.62
B. Technical services							
5.	Are you aware that PES provides suggestions for feed managements?	157	39.25	187	46.75	56	14.00
6.	Do you know that PES helps in value addition?	102	25.50	140	35.00	158	39.50
7.	Are you aware that PES will provide immediate solutions to the farm problems?	222	55.50	135	33.75	43	10.75
	Mean percentage		40.08		38.50		21.42
C. Input supply services							
8.	Do you know that PES supplies good quality seed?	195	48.75	162	40.50	43	10.75
9.	Are you aware that PES supplies high quality feed?	200	50.00	130	32.50	70	17.50
10.	Do you aware that PES supplies farm machineries like aerators, automatic feeders etc.?	66	16.50	195	48.75	139	34.75
11.	Do you know that PES will supply fertilizers and farm health care products like feed additives?	204	51.00	161	40.25	35	8.75
	Mean percentage		41.57		40.50		17.93
D. Consultancy and diagnostic services							
12.	Do you know that PES provides consultancy on shrimp health management?	133	33.25	183	45.75	84	21.00
13.	Do you know that PES provides demand driven extension services?	221	55.25	134	33.50	45	11.25
14.	Do you aware that PES gives advices on soil and water quality management?	84	21.00	185	46.25	131	32.75
15.	Do you aware that PES will provide diagnostic services like PCR testing, specific pathogen free seed etc. to the farmers?	171	42.75	159	39.75	70	17.50
	Mean percentage		38.06		41.31		20.63
	Total percentage		40.05		40.55		19.40

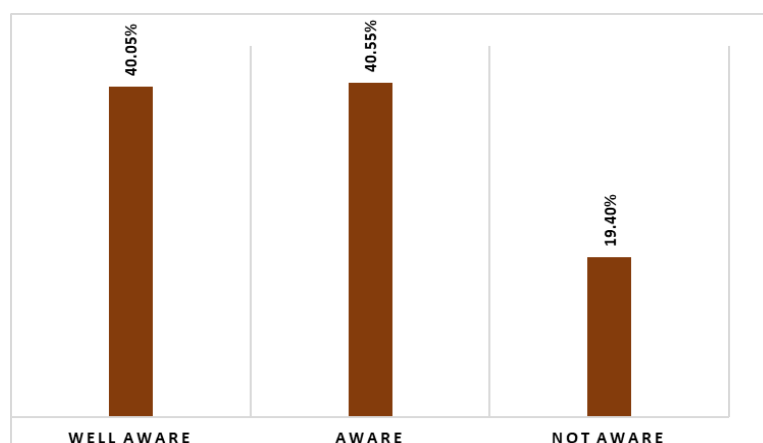


Figure 1. Awareness level of the respondents on shrimp farming

The main challenge in the aquaculture extension system is to develop a cost effective and need based long-term solutions for providing information and services to farmers. The poor research and extension linkage in the present system have created a gap between the farmer and the extension system resulting to seek an alternative way to meet their requirements. Currently, the private extension system is playing an increasingly great role in satisfying the needs of farming communities. As a result, a public-private partnership (PPP) between the private sector and the public extension system was formed with the goal of collaborating to improve extension services. This partnership has become one of the most important aspects of shrimp farming.

This approach was created for the extension delivery system to cater the requirements of farmers. Majority of shrimp farmers were aware of private extension services, as evidenced by the fact that majority of them utilized them, according to the results. Most of the shrimp farmers had sufficient expertise in shrimp farming and positive attitude towards private extension services, indicating that they were accepting these services, according to the findings. After analyzing data on shrimp farmers' awareness, knowledge and attitudes toward private extension services, a model for improving the efficiency and efficacy of the extension service delivery system was devised to remove barriers and to strengthen the efficiency of the extension delivery system, considering the constraints experienced by shrimp farmers by public and private extension services (*Fig. 2*).

The private sector concentrates mostly on technology dissemination in addition to technology generation. Public sector is primarily concerned with both technology generation and dissemination. In this scenario, collaboration between these two sectors can support in the public sector's development of cost-effective technologies and the private sector's dissemination of those same technologies. As a result, the farmers can use those innovative methods / techniques which will enhance the productivity of their farms.

In this regard, a holistic approach with the coexistence of public and private partnerships with a focus on increasing extension services to farmers is proposed for resolving the constraints faced by the farmers. The proposed strategy has the potential to enhance research and extension linkages and foster partnerships with service-oriented private agencies or individuals, thereby improving aquaculture productivity.

The developed model for sure will help the respondents to improve the private extension services as the constraints faced by the respondents from public extension services like Insufficient trainings to farmers, Lack of subject matter specialist and poor research and extension linkage can be met by the respondents through Private extension services.

Areas of support service system for shrimp farmers

Public Private Partnerships (PPPs) are termed as a collaborative effort between the public and private sectors in fulfilling the public demands for services or infrastructure through the sharing of resources, information, risks and rewards between partners. Public Private Partnerships could be a valuable strategy for improving fisheries extension services. PPPs have been most frequently used to increase access to domestic and global markets by enhancing food safety and supply chain management. Farmers can receive support to increase their farm production in various areas including monetary services, consultancy services, capacity building, training, and development. Considering this, a model has been designed to support the farming community for increasing their production as well as the services that can be offered to them by both public and private extension partners (*Fig. 3*).

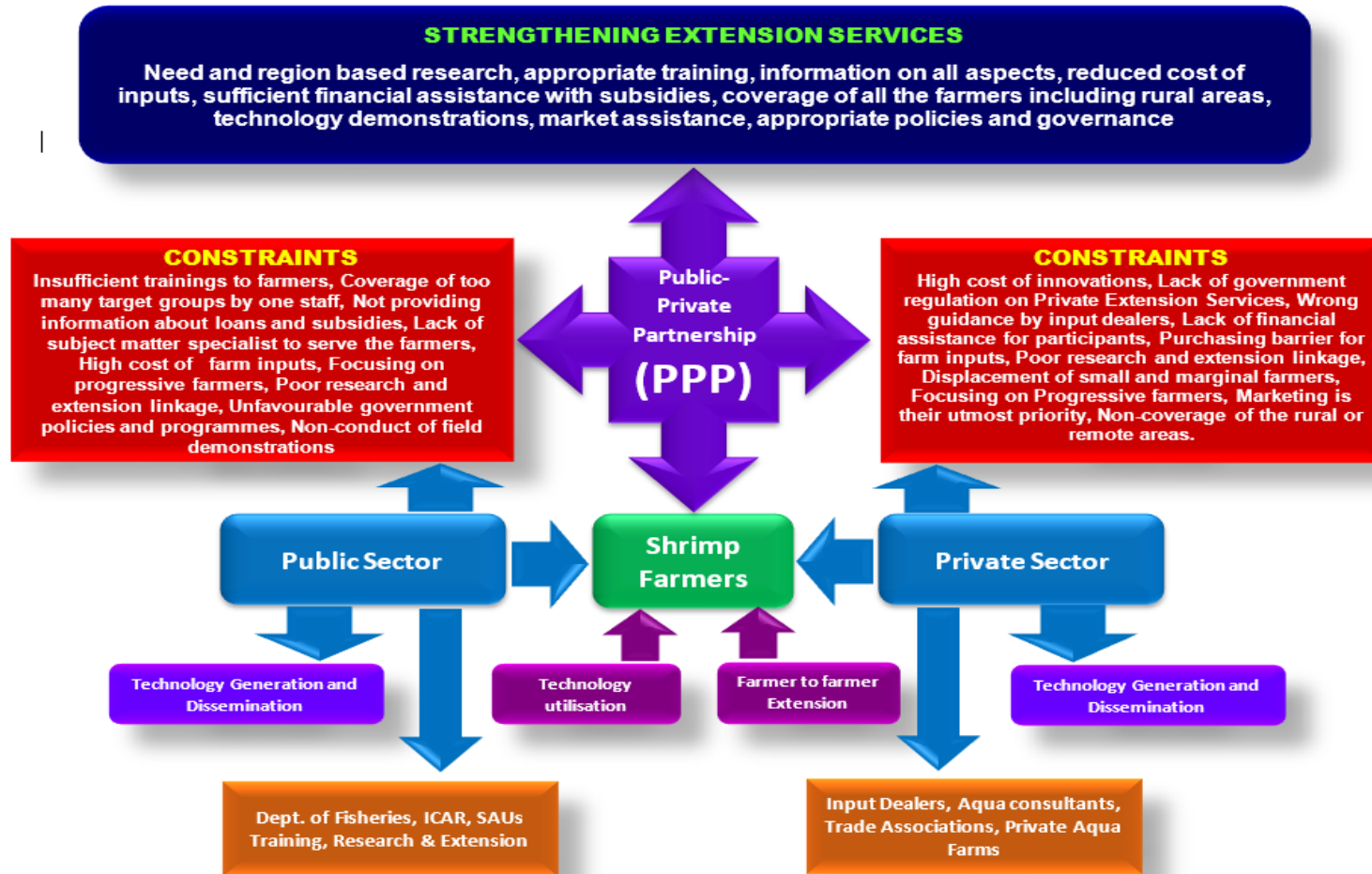


Figure 2. Model for effective extension services - constraints specific

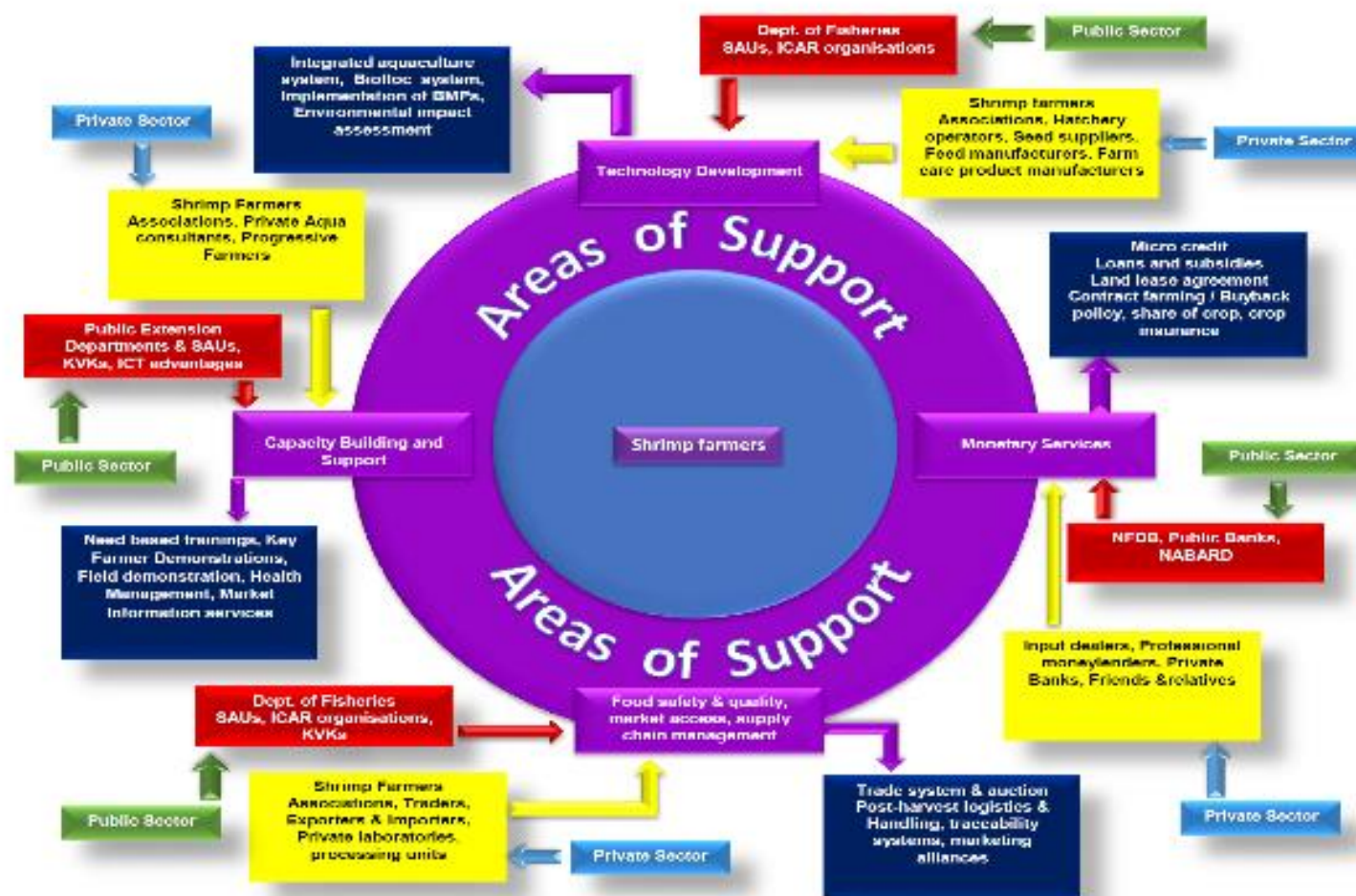


Figure 3. Possible areas of support to shrimp farmers

As depicted in the *Fig. 3*, the shrimp farmers can be supported both by the private and public sectors in the areas such as technology development, offering monetary benefits, food safety & quality, market access, supply chain management, capacity building and support.

The public sector like Department of Fisheries, ICAR organisations and State Agricultural Universities might all significantly contribute to the creation of new techniques / technologies in integrated aquaculture, bio-floc system, implementation of BMPs and environmental impact assessment for shrimp farmers. While the private sector, including Shrimp Farmers Associations, hatchery operators, seed suppliers, feed makers and farm care product manufacturers, might help to generate affordable technologies based on the field situation to increase shrimp production to the anticipated level. These kinds of partnership would facilitate in the development of need based and region-specific technology inputs for farming communities.

The provision of financial services, including micro credits, loans and subsidies as well as land lease agreements, buy-back policy, share of crop and crop insurance are the other significant source of support for shrimp farmers.

Shrimp farmers are receiving financial support from the private sector, such as input dealers, professional moneylenders, private banks, friends and relatives with varying interest rates without much hardship and collaterals. The public sector organizations like National Fisheries Development Board (NFDB), public banks and National Bank for Agriculture and Rural Development (NABARD) offers enough loan support with reasonable interest rates. However, the procedures in applying and getting the loan may further be simplified so that farmers can quickly access these services from the public sector. Those who had paid the loan fully within the loan period may also be given additional loan, if required, with lower rate of interest. As shrimp farming is a risky venture, insurance facilities may be extended to all the farmers for a reasonable premium by insurance companies. If any disasters occur, the insurance money should be provided right away to help with the next or immediate crop. The private sectors should also work along with the public sectors in order to promote the shrimp farming and enhancing the foreign exchange.

Under contract farming or buy-back policy, the private sector provides inputs, technologies, and various extension services. Additionally, they oversee the farming operations. According to the Memorandum of Understanding (MOU) that was signed, the farmer is obliged to sell his produce, as per the quality specified, at the best price. The company processes it and markets the products. The farmer receives input, technology and market support and the firm / company obtain high-quality products at reasonable prices by eliminating the intermediaries. The public sectors should also develop guidelines and policies for offering these types of supports to the farmers. Farmers' risk would be lower as a result and they would still be able to make money from their risky venture.

In the share of cropping system, private extension service providers (PESPs) handle the consulting services, inputs and technologies. All farm operations are conducted on the farmer's property, which is either leased from government or owned. However, PESPs share the crop with farmer for a profit. Hired labor and other costs are also shared. Since majority of shrimp farmers operated small- to medium-sized farms, this kind of partnership will enable the farmers to expand their shrimp farming operations, which will improve their socioeconomic status.

Food safety & quality, market access and supply chain management are also the areas of support for shrimp farmers, which include trade system, auction, post-harvest logistics

& handling, traceability systems and marketing alliances. Public sector partners include the Department of Fisheries, SAUs, ICAR organizations and Krishi Vigyan Kendras (KVKs), whereas private sector partners include Shrimp Farmers Associations, dealers, exporters and importers as well as private laboratories and shrimp processing plants.

To disseminate post-harvest technologies to shrimp farmers, the government's policies for marketing valuable produce should incorporate aquaculture extension systems along with private market-led extension systems. Additionally, it should also be offered with good transport facilities, suitable packaging material with a reasonable price. The PPP should support in the establishment of hygienic markets, cold storage facilities, processing plants, etc., in the nearby regions. Since shrimps are highly perishable commodity, it must be transported and marketed immediately, or they must be kept in a nearby cold storage facility. In addition, processing plants should also be established in the nearby areas with the PPP mode to process and export so that transportation to distant locations can be avoided thereby cutting the cost of transportation.

Providing marketing information is an essential element in any economic activity. The farmers must be guided to decide as to where, when, to whom and at what price level to market their produce. This will help the farmers to get higher prices for the produce. In order to benefit from these services, shrimp price / farm gate price can be fixed by the government in consultation with the private services so that the procurement prices could be more or less the same.

Other assistance areas to shrimp farmers are capacity building & support that includes conducting need-based training programmes, key (progressive) farmers demonstrations, field demonstrations, health management and market information services. The partners from both public extension departments, shrimp farmers associations, private aqua consultants and progressive farmers can motivate the farmers to adopt innovative technologies in shrimp farming. The recent ICT initiatives such as mobile apps, websites, Whats App, YouTube, etc., can also be effectively utilized for providing specific or need based information for shrimp farming. The mobile communication technology could also be used as an effective communication and marketing tool by both partners. Therefore, the farmer would be benefited from lower production risks and increase higher production and profit.

Conclusion

The findings of the study revealed that a significant proportion of the participants demonstrated knowledge regarding private extension services. The significance of private extension services in stimulating farmers' adoption of new technologies and facilitating the marketing of agricultural produce necessitates the dissemination of information to farmers about the services offered. This is crucial for enhancing their farming practices.

Based on the constraints mentioned in the model it is observed that none of the extension system either public or the private is not effectively reaching the farmers to meet their requirements. Therefore, the establishment of a "Co-existence of Public and Private Partnership" aimed at enhancing extension services for shrimp farmers are essential for the effectiveness of the extension system. The proposed methodology aims to enhance the research and extension collaboration, as well as establish alliances with service-oriented private extension systems, in order to foster the aquaculture extension services in India.

REFERENCES

- [1] Ahmed, Z., Sarker, A., Rahman, M. Z., Lei, B., Mukta, M. Z. N. (2018): Fisheries extension in Bangladesh and local extension agent for fisheries: A micro level assessment of farmers' Attitude. – Int. J. Fish. Aquat. Stud. 6(4): 93-103.
- [2] Alagappan, M., Kumaran, M. (2020): A study on the information sources and influence of socio-personal attributes on information seeking behaviour of aqua farmers. – Int. J. Farm Sci. 10(2): 5-12.
- [3] Biswas, B., Das, S. K., Mandal, A. (2018): Socio-economic dimensions and their impacts upon productivity of composite fish farming in North 24 Parganas district, West Bengal. – Nature 25(35): 41-67.
- [4] Booncharoen, C., Anal, A. K. (2021): Attitudes, Perceptions, and On-Farm Self-Reported Practices of Shrimp Farmers towards Adoption of Good Aquaculture Practices (GAP) in Thailand. – Sustainability 13(9): 5194.
- [5] Chittem, P. B., Kunda, S. K. (2018): Socio-economic condition of the *Litopenaeus vannamei* farmers with implementation of better management practices (BMP's) in Andhra Pradesh, India. – Int. J. Fish. Aqua. Stud. 6(6): 325-331.
- [6] Chowdhury, A. R., Mamun-ur-Rashid, M., Hossain, S. (2016): Effect of Public Fisheries Extension Service on the Selected Socioeconomic Aspects of the Clients in Two Selected Sub-districts under Barisal District in Bangladesh. – Asian J. Agric. Ext. Economics Sociol. 13: 1-13.
- [7] Department of Fisheries (2021): Govt. of Andhra Pradesh. – Accessed on 14.10.2021, www.fisheries.ap.gov.in.
- [8] Dona, P., Immanuel, S., Ojha, S. N., Ananthan, P. S. (2016): Occupational needs of shrimp farmers in Kerala. – Ind. Jn. Ext. Edu. 16(3): 20-24.
- [9] Durai, V., Alagappan, M. (2020): Study on socioeconomic analysis of white-leg shrimp, *Litopenaeus vannamei* nursery rearing in coastal districts of Tamil Nadu. – J. Pharm. Innov. 9(10): 94-97.
- [10] Fakayode, S. B., Adenuga, A. H., Yusuf, T., Jegede, O. (2016): Awareness of and demand for private agricultural extension services among small-scale farmers in Nigeria. – Int. J. Agric. Rural dev. 4(42): 521-531.
- [11] Kaur, J., Shehrawat, P. S., Peer, Q. J. A. (2014): Attitude of farmers towards privatization of agricultural extension services. – Agricultural Science Digest 34(2): 81-86.
- [12] Kaur, K., Kaur, P. (2018): Agricultural extension approaches to enhance the knowledge of farmers. – Int. J. Curr. Microbiology. Sci. 7(02): 2367-2376.
- [13] Kavyashree, S. (2014): A comparative analysis of public, private and corporate extension system. – M.Sc. Thesis submitted to University of Agricultural & Horticultural Sciences, Shivamogga, Karnataka, India.
- [14] Kushawaha, N. (2018): A study on attitude of farmers towards privatization of agricultural extension services. – M.Sc. Thesis submitted to R.A.K College of Agriculture, Sherone, Madhya Pradesh, India.
- [15] Kumaran, M., Ravisankar, T., Anand, P. R., Vimala, D. D., Balasubramanian, C. P. (2017): Knowledge level of shrimp farmers on better management practices (BMPs) of *Penaeus vannamei* farming: A comparative assessment of east and west coasts of India. – Indian J. Fish. 64(3): 93-99.
- [16] Kumar, U., Kumar, A., Thakur, P. K. (2012): Status and Constraints of Extension Services. – In: Bhatt, B. P., Sikka, A. K., Mukherjee, J., Islam, A., Dey, A. (eds.) Status of Agricultural Development in Eastern India. ICAR Research Complex for Eastern Region, Patna, pp. 479-492.
- [17] Kumar, K. G. (2014): Rights first, rights forever: small-scale fisheries and fishing communities from a human-rights perspective. – A collection of articles from SAMUDRA report. International Collective in Support of Fish workers, <http://hdl.handle.net/1834/32721>.

- [18] Kumari, S. (2012): A study on opinion of farmers on privatization of agricultural extension services in Andhra Pradesh. – M.Sc. (Agri.Extn) Thesis submitted to Orissa University of Agriculture and Technology, Bhubaneswar.
- [19] Kunchala, K. D., Patel, J. K., Desai, C. P. (2012): Advantages of private extension service and it correlates with attitude toward private extension service. – Guj. J. Ext. Edu. 23: 177-179.
- [20] Kunda, S. N. S. K. (2022): A study on socio-economic profile of *Litopenaeus vannamei* (Boone, 1931) farmers of southern Andhra districts, India. – Int. J. Fish. Aquat. Sci. 10(2): 149-153.
- [21] Maity, A., Saha, B. (2020a): Awareness of shrimp farmers towards Coastal Aquaculture Authority (CAA) guidelines regarding *Penaeus vannamei* farming. – Indian J. Ext. Educ. 56(1): 34-39.
- [22] Maity, A., Saha, B. (2020b): Economic Viability of *Penaeus vannamei* Shrimp Farming in Purba Medinipur, West Bengal. – J. Community mobilization sustain. Dev. 15(2): 396-402.
- [23] Maity, P., Panda, A. K., Ghorai, S. K. (2021): Mapping the wider impact of brackish water shrimp culture on the local environment and economy: A brief. – Int. J. Fish. Aquat. Sci. 9: 185-188.
- [24] Mengal, A. A., Mallah, M. U., Mirani, Z. A., Siddiqui, B. N. (2012): An analysis of public and private agricultural extension services in Balochistan, Pakistan. – Pakistan J. Agric. Res. 25: 307-317.
- [25] MPEDA (2020-2021): Annual Report 2020-2021. – The Marine Products Export Development Authority, Ministry of Commerce & Industry, Govt. of India, www.mpeda.gov.in.
- [26] Naik, B. V., Patil, S. V. (2020): Adoption of Better Management practices by shrimp farmers along South Konkan coast of Maharastra. – M.Sc. Thesis submitted to Dr.Balasaheb Sawant Knokan Krishi Vidyapeeth, Dapoli, India.
- [27] Naik, B. V., Patil, S. V., Shirdhankar, M. M., Yadav, B. M., Tibile, R. M., Chaudhari, K. J., Wasave, S. M., Yewale, V. G. (2020): Socio-Economic Profile of Shrimp Farmers of South Konkan Region, Maharashtra, India. – Int. J. Curr. Microbiol. App. Sci. 9(9): 1371-1380.
- [28] Patil, S., Sharma, A., Ohija, S. N., Shirdhankar, M. M., Dhaker, H. S. (2019): Emergence of shrimp farming and profile of shrimp farmers in Phalghar district, Maharashtra. – Contemporary Research in India 9: 37- 41.
- [29] Patil, S. V., Sharma, A. (2021): Prioritization of training needs of extension personnel in brackishwater shrimp aquaculture of Maharashtra, India. – Indian J. Fish. 68(4): 135-141.
- [30] Pegu, R., Singh, Y. J., Pal, P., Upadhyay, A. D., Sarkar, A., Khuman, O. N., Bharati, H. (2019): Paddy cum Fish Farming: A Case Study in Assam. – Int. J. Curr. Microbiol. App. Sci. 8(4): 373-380.
- [31] Parouha, K. K. (2014): A study on Privatization of Agricultural Extension Services as perceived by members of Farmer's Cooperative seed societies in Rewa district. – M.Sc. (Ag), Thesis submitted to J.N.K.V.V. Jabalpur, India.
- [32] Ray, S., Mondal, P., Paul, A. K., Iqbal, S., Atique, U., Islam, M. S., Mahboob, S., Al-Ghanim, K. A., Al-Misned, F., Begum, S. (2021): Role of shrimp farming in socio-economic elevation and professional satisfaction in coastal communities. – Aquac. Rep. 20: 108.
- [33] Raghuwanshi, K., Jaiswal, D. K., Dubey, M. K., Naberia, S. (2022a): Constraints faced by farmers towards use of private agricultural extension services in Chhindwara district (M.P). – J. Pharm. Innov. SP-11(4): 335-337.
- [34] Srinivas, D., Venkatrayulu, C., Swapna, B., Swathi, A. V., Venkateswarlu, V. (2019): Studies on socio-economic profile, problems, and constraints of shrimp farmers in Nellore district of Andhra Pradesh, India. – Asian Journal of Science and Technology 10(06): 9731-9735.

- [35] Tank, K. V., Yusufzai, S. I., Bajaniya, V. C. (2019): Constraints analysis of shrimp farming in Saurashtra, Gujarat, India. – J. Entomol. Zool. Stud. 7(3): 124-127.
- [36] Tripathy, H., Dipak, K. B. (2021): Farmer's View on Privatization of Agricultural Extension Services in Ganjam District of Odisha, India. – Int. J. Curr. Microbiol. App. Sci. 10(08): 756-764.
- [37] Uddin, M., Qijie, G. (2013): Prospects and challenges of privatization of agricultural extension service in Bangladesh. – Asian J. Agric. Rural Dev. 3: 477-487.
- [38] Vadher, K. H., Manoj, K. (2014): Study on socio-economic profile of shrimp farmers of Gujarat State, India. – Int. J. Fish. Aquat. Stud. 2: 202-205.