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Realizing Farmer's Objectives - Imperative to Adoption Process of Fish Farming Technology

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ABSTRACT

This study was conducted to investigate how realizing farmer's perception as well as objective has an influence on the adoption process of fish farming technology in Tripura. An *ex- post facto* research design was employed to collect data from 200 respondents randomly sampled from 10 villages. Instruments used for data collection included semi structured interview schedule, Participatory Rural Appraisal, researchers' observations and secondary information sources. The overall adoption index in the study area was found 59.74. Farmers who realized their objective intensified the activity and were able to produce 412 kg/kani (1kani=2.5 Acre/0.16ha) production that was considered more profitable than other crop production. Those who did not realize their objectives abandoned or practiced low level technology. This finding suggested that farmer's objective and priority should be known before introduction of the technology and efforts should be directed towards realizing the objectives. Additionally, efforts should be made to improve production technology, preparation and preservation skills and harvest strategies.

Keywords: Fish farmers, perception, technology, adoption gap.

INTRODUCTION

Tripura is a landlocked hilly state in northeastern India with altitude varying from 15 to 940 m above mean sea level. It is the second smallest state in area of around 10,492 sq. km. (after Sikkim), but second most populous state (after Assam), among the eight land-locked north-eastern states, is categorized as resource poor state with heavy pressure on land and low normal productivity because of its soil being mostly acidic. Fisheries is an important economic activity in Tripura, both from an economic and a nutritional point of view, providing income, employment and food security to the people. Around 95% of population in Tripura love to consume fish. The state is holding first rank in per capita fish consumption as inland state in the country. Moreover, Tripura reported to be highest in number of households (per thousands) consuming fish and in connection with price it has been shown that the state experienced highest retail price of fish per kg. in India. Around 1.35 lakh people depend on fisheries for their livelihood. The existing total aquatic resources of the state estimated to be 24,704 ha during 2012-13. (Fisheries Statistics 2012-13, GoT). However, current level of fish produced in the state is not able to meet the burgeoning demand and hence large amount of fish is being brought from the mainland state i.e; West Bengal, Andhra Pradesh, Bihar and even from the country Bangladesh. The total production of fish in the state during 2012-13 was about 58,655 metric tonnes and imported around 23,660 metric tones from. Per capita availability of fish was around 16.34 kg as against the requirement of 22.92 kg. The scope for horizontal expansion in aquaculture is limited in the state due to hilly topography as well as wide coverage of forest area. Therefore, to reduce the gap between demand and supply and to achieve fish self-sufficiency in the state, Importance is given to explore the vertical expansion in fish production.

According to FAO (1996) the main objective for introducing fish farming in the study area was to increase cash income and/or animal protein component in the diet of rural communities, achieved through small-scale aquaculture integrated with suitable farming system. Another objective was a pond being an efficient means of using surplus resources, thus increasing efficiency of farm activities (ibid.). The objective of improving food and income is considered more decisive to the adoption process of fish farming technology. While the rationale for adopting fish farming as stipulated above is clear, few if any researchers have attempted to assess how adopter's objectives have been realized. Most studies have concentrated on production technology giving a lesser priority to the extent to which the technology has attained

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farmer's objectives for undertaking it. Lack of balanced assessment of the two has contributed to poor understanding of why the adoption rate and level of intensification are low, and the abandonment rate is high. Review of different studies suggests that adequate attention has not been given to the study on how realizing farmer's objective has influence on the adoption process of fish farming technology. The objective of this paper therefore is to make a thorough investigation on how realizing farmer's objective and perception has influenced the adoption, abandonment and intensification of fish farming technology in the study area.

METHODOLOGY

The study was conducted out using *ex-post facto* research design in the purposively selected districts i.e.; South Tripura and West Tripura. Two blocks from each district were selected purposively and five villages were selected from each block using simple random sampling method. Ten fish farmers were selected from each village using simple random sampling method. Thus, a total 200 fish farmers constituted the respondents for the study. The instruments used for data collection were a structured interview schedule, Participatory Rural Appraisal (PRA) and researchers observation conducted in each village with a group of farmers. The interview schedule was prepared to solicit information on objectives for undertaking fish farming and assessed whether the objectives were realized or not. In addition, secondary information was collected from various sources and was used to design questionnaires and explaining a big part of this study.

Conceptual framework to realizing the farmers' adoption process

The purpose of this study it is assumed that farmers make adoption decision based upon utility consideration (Batz et al., 1999). When a technology is introduced in a given area, the decision whether to adopt, continue and intensify it or not will depend, among other things, on how a technology meets household objective of food and income security. Household resources (i.e. land, labor, cash income, on-farm inputs and knowledge/skill) are allocated across various activities based on their contribution to household food and income security (Fig. 1). The allocation of resources is often characterized as a two-stage process in which the first priority is given to meet food security requirement (Temu, 1999). The second objective is then to maximize income using the remaining resources (ibid.). Fish farming contributes to household needs through provision of fish for home consumption and cash income. However, fish farming is not the only activity, which meets the above objectives; there are other activities, which compete with fish farming to meet those objectives. For instance, it competes with livestock production to meet animal protein intake and competes with crop production, livestock production and off-farm activities to earn cash income (Fig. 1). That means fish farming competes with those activities for resources to realize household objectives. The decision whether to adopt, continue or intensify fish farming technology or not will depend on how best and easy the technology will accomplish the intended objectives.

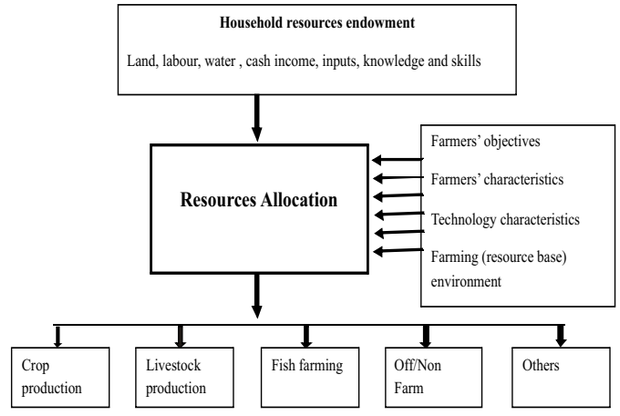

Figure 1: Farmers decision to adopt, continue or intensify fish farming technology, Source: Wetengere (2008)

RESULTS AND DISCUSSION

The age of the respondents ranged from 19 to 60 years with mean age of about 42.40 years. The results presented in Table 1 revealed that most of the respondents (88.5%) were in their late adulthood. The literacy level of the respondent is very high, i.e., 96.5 per cent. It was observed from the Table 1 that more than half of the sampled respondents (51.5%) had low to lower medium level of yield (up to 205 kg/ kani), followed by around 48 per cent respondents obtained more than 205 kg/ kani yield in their pond. The average fish yield in the study area is around 285.7 kg/kani (1kani=2.5 Acre/0.16ha) as compared to the scientific composite fish culture (i.e., 400 kg per kani) (Anonymous, 2002). The possible reason for this trend might be due to the fact that the sampled farmers did not realize the objective of fish farming and thus did not adopt the improved practices of fish production. More than 75 per cent of the respondents having pond size of 0.01-1 acre followed by 14 per cent having 1.01-2 acre. The average size of the surveyed water bodies was found 0.73 acre.

Table 1: Demographic characteristics of the respondents

Respondents characteristics		Frequency	Percentage
Age	Late adolescence (18-25 years)	6	3.0
	Early adulthood (26-40 years)	17	8.5
	Late adulthood more than 40 years	177	88.5
Experience in	Least (upto 5 years)	24	12
aquaculture	Medium (5-10 years)	30	15
	High (more than 10 years)	146	73
Yield	Low (upto 205.33 kg/kani)	50	25
	Lower medium (205.34-265 kg/kani)	53	26.5
	Higher medium (265.01-316kg/ kani)	49	24.5
	High(>316.01kg/ kani)	48	24
Pond size	0.01-1 acre	151	75.5
	1.01-2 acre	28	14
	2.01-3 acre	11	5.5
	3.01-4 acre	4	2
	4.01-5 acre	2	1
	5.01 acre and above	4	2

Farmer's Objectives for Undertaking Fish Farming:

The Figure 3 showed that more than two third of the sampled households adopted fish farming in order to obtain fish for home consumption and to generate cash income. This result is similar to those by FAO (1996), Edwards *et al.*, (1997), Wetengere *et al.,* (1998) and Wetengere (2000). This implies that household resource allocation is often characterized as a 2 stage process in which first priority is given to meet food security requirement. The second objective is then to maximize income using the remaining resources. This is consistent with finding by Temu (1999).

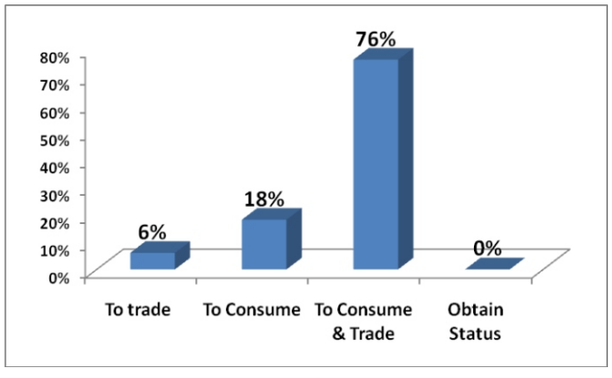

Figure 3: Farmer's objectives for undertaking fish farming

Realization of the objective of fish for home consumption/ food security

It is observed from the study that all the selected farmers are fish eater. Participants in a Participatory Rural Appraisal (PRA) conducted in this study were of the opinion that although most farmers adopted fish farming technology for both food and cash generation; it was the former objective which was more pressing and important in the study area. Farmers' perception of adoption of fish farming for home consumption was ranked first by 80% respondents, ranked second by 14% and the rest by 6%. The importance small-scale farmers attach to household food security shows that food production is a number one priority.

Realization of the objective of generating cash income/income security

It is clearly visible from the Table 2 that majority of the fish farmers (54%) earned less than 50 per cent of their earning from fish farming. It has been found that many farmers did not take fisheries in serious earning point of view.

Table 2: Distribution of sampled households as per share of fisheries to total income

Share of Fisheries to Total Income	Frequency	Percentage
More than half	92	46
Between one half and one quarter	63	31.5
Less than one quarter but more than one tenth	29	14.5
One tenth or less	16	8
Total	200	100

Further, in this study, an attempt has been made to analyze the income distribution pattern of sampled fish farmers' households. The income sources of the households were grouped into seven distinct categories according to the intensive study of the area and after consultation with several experts and are presented in Figure 4. Along with fisheries, livestock production is also carried out by almost all rural households (68%), but its contribution towards total net income of the households was reportedly somewhat lower.

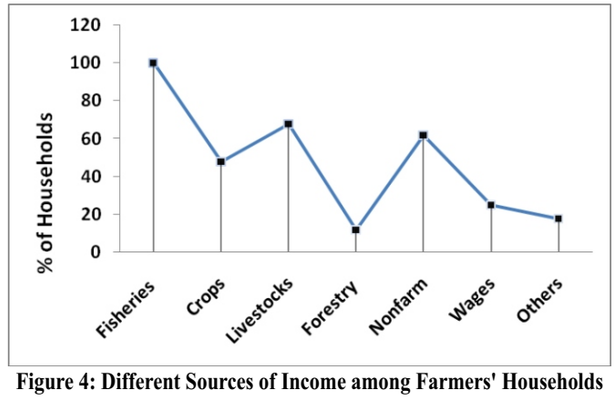

Figure 4: Different Sources of Income among Farmers' Households

The main reason behind that the households generally kept unproductive local breeds. Their businesses out look from the livestock sources were also very lower. Around 48 per cent of the fish farmers practiced crop production. The major crops were reportedly rice and vegetables. More than 60 per cent of the households participated in different non-farm income activities. In this connection, Saha (2006) reported that poor farmers generally adopt the non-farm income as their secondary or tertiary income sources as a part of a 'coping' strategy. Of the seven cash income earning activities in the study area, fish farming ranked sixth in terms of frequency in income generation. Activities, which generated cash income more frequent, include non farm income, permanent crops (i.e. sale of pineapple, banana, vegetables etc.), seasonal crops, and animal husbandry. Although fish farming had potential to generate income at any time of the year and therefore could fill the gap of income shortage, its income generation surprisingly more-or-less followed a seasonal trend of other income generating activities. The policy makers should give the priority to help the farmers understand about the greater scope of getting frequent income from fish farming by adopting multi stocking and multi harvesting policy. The above information has revealed that the objectives for undertaking fish farming was to a large extent not perceived in comparison with other competing activities. This was attributed to poor production technology, lower adoption rate, harvest strategy and lack of business outlook as hereby explained.

Table 3: Average fish yield in respect to farmers' objective for undertaking fish farming

	Farmers objective for undertaking fish farming			
	To business (12 nos.)	To consume (36)	To consume and sale (152)	Obtain status (0)
Average fish yield	412.05 kg/kani	241.58 kg/kani	285.42 kg/kani	-

As depicted in Table 3, farmers who realized their objective as fish farming as business point of view intensified the activity and were able to produce on an average 412 kg/kani (1kani=2.5 acre/0.16ha) of fish that was considered more profitable than other crop production as against the farmers who realized fisheries as only for self consumption as well as selling surplus after consuming in home.

Adoption Index and Adoption Gap of Improved Production Practices of Carp in the Study Area

The extent of adoption scores was measured for nine improved practices i.e. pond preparation, liming, manuring the pond, stocking, feeding, water exchange and quality monitoring, use of aerators, health monitoring and management, handling, storage and transportation. The overall adoption index in the study area was 59.74. The production technologies followed by the respondents were described and compared with the recommended technologies. The gap between the existing and recommended technologies was presented in Table 4. The data indicated that non adoption was more in use of aerators (54.25%) to control the oxygen deficiency in the pond. followed by supplementary feeding (51.15%), liming (43.31%), water exchange and quality monitoring (40.37%) and stocking (39.65%). Farmers in general used traditional practices instead of the recommended improved practices may be due to the lack of poor realization of objective, interest and poor financial condition.

Table 4: Adoption Gap Regarding Recommended Practices of Improved Production Technology of carp

Selected practice	Adoption gap (%)	Rank
Pond preparation	31.41	VIII
Liming	43.31	III
Manuring the pond	26.41	IX
Stocking	39.65	V
Supplementary Feeding	51.15	II
Water exchange and quality monitoring	40.37	IV
Use of aerators	54.25	I
Health monitoring and management	37.28	VII
Handling, storage and transportation	38.25	VI

Preference of Fish Species

In composite fish culture ponds are stocked with compatible indigenous and exotic carps, which have different feeding habits. Therefore, the system gives comparatively a far greater output of fish than those that are stocked with an equal number of either indigenous species or exotic species (Sivasankar *et al.,* 1990). The preferred fish species in the study area has been depicted in Table 5. Among the fish species Rohu was the most preferred fish species and cultured by all the sampled households.

The next preferred species was Catla, subsequently then comes Mrigal, Common Carp, Silver Crap and Grass Carp, respectively. Along with the major carp a few infrequent fish species namely punti, gania, bighead, tilapia, bata, calbasu, pangas, freshwater prawn were found to be cultured by around 22.48 per cent sampled fish farmers.

Table 5: Prevalence of Fish Species and Preference among Farmers

Fish Species	% Households
Rohu (Labeo rohita)	100
Catla (Catla catla)	98
Mrigal (Cirrhinus mrigala)	82.5
Common Carp(Cyprinus carpio)	77
Silver Carp (Hypophthalmichthys molitrix)	50
Grass Carp (Ctenopharyngodon idella)	20
Others	25

Others->Thai Sarpunti(Puntius gonionotus), gania (Labio genius), calbasu (L. calbasu), pangas (pungasius pungasius), tilapia (Oreochromosis mssambica), fresh water prawn etc.

Further study has been done to analyse the criteria which guides the farmers to select the species in their ponds and presented in Table 6. The criteria of preference of species shall help us to plan for future research. Yield was found as the most important critera (96%) perceived by the farmers for species preference.

Table 6: Species Preference Perceived by the Farmers

Criteria	Percentage (%)	Rank
Availability of seed	67	VI
Taste	96	I
Low cost of seed	72	V
Yield	85	II
Sale price	82	III
Growth	76	IV
Not damage to pond	54	VII
Resistance to pest & disease	45	VIII

The next important factors are availability of seed (85%), sale price (82%) and growth rate (76%), low cost of seed (72%), taste (67%) *etc*. among others influence choice of species stocked. Farmers sometimes not preferred common carp to stocked in the pond as the fish sometimes damage the pond. Fish disease was not frequent in the study area therefore, the criteria i.e., resistant to pest and disease was found least preferred criteria for species selection in the study area.

Fish species Mix and Stocking Rate Practiced by the Farmers

The species mix and the stocking rate are two important side of scientific fish culture. Selection of species ratio is generally depends on seed availability, market demand, nutrient status of pond, and management techniques. Average stocking rate and the ratio of different fish species stocked together in the pond along with percentage of sampled households following it has been depicted in Table 7. It can be described from the Table that the ideal species mix for composite fish culture i.e., Rohu+Catla+Mrigal+Silver Carp+ Common Carp+ Grass Carp were practiced by only 16 per cent of the sampled households in the average ratio of 24.12 : 19.23 : 15.45 : 16.8 : 15.4 : 9 with average stocking density of 5107 fingerlings per acre. The species mixture such as Rohu Catla and Mrigal were stocked together. Silver carp was stocked later. This could be the reason for avoiding the completion of food between Rohu and Silver Carp. No farmers examine the plankton growth by scientific manner as well as toxicity of pond water prior to stocking of the fingerlings. However, sometime by merging the hand in pond water they could identify the natural food availability. A few of farmers followed temperature acclimatization practices of seed before stocking. Some farmers did not include Common Carp in the fish species mixture to avoid damage of the pond. The adoption of grass carp is lower as comparison to other fish species mainly because the lack of preference for the growers due to unavailability of fingerlings at the major season of stocking. The underlying reason might be due to the fact that breeding season of Grass Carp starts late of monsoon in the state and mortality rate between spawn to fingerlings is very high. However, the growth rate of Grass Carp in the state was reportedly very high and it can be grown with lower cost feed such as grasses, duckweed, banana leave, carrot leave, azolla, hydrilla, wolfia etc. The consumers demand for Grass Carp is also increasing day by day. Actually huge demand for live fish has been experienced in Tripura and the preference of species is not the limiting factor at the present situation. Therefore, the productions of Grass Carp need to be promoted in the state of Tripura by overcoming the barriers in its production.

Table 7: Percentage of Fishing households, Ratio of Fish Species Stocked under Different Species Mix and Stocking Rate

Species mix	% Households	Rohu	Catla	Mrigal	Common carp	Silver carp	Grass carp	Others	Stocking rate (fingerlings /acre)
i.	19	32.25	38.26	16.25	13.24	-	-	-	4865
ii.	14	34.38	37.8	27.82	-	-	-	-	5060
iii.	12	35.25	41.25	-	23.5	-	-	-	3864
iv.	20	26.72	23.45	14.28	18.45	17.1	-	-	4770
v.	16	24.12	19.23	15.45	16.8	15.4	9	-	5107
vi	2	34.75	13.25	12.44	16.75	11.98	3.43	7.4	5218
vii	8	24.35	18.6	15.65	22.4	8.5	-	9.5	3287
viii	2.5	62.5	37.5	-	-	-	-	-	2100
ix	2	34.65	-	-	25.24	30.11	-	10	4406
x	3.5	31.22	21	17.44	25.64	-	-	4.7	4040
xi	2	31.2	25.35	-	-	14.5	18.5	10.45	4860

Others->Thai Sarpunti (Puntius gonionotus), gania (Labio genius), calbasu (L. calbasu), pangas (pungasius pungasius), tilapia (Oreochromosis mssambica), fresh water prawn *etc.*

Realizing factors influencing adoption process of fish farming technology

Further, the path analysis has been carried out to decompose the total effect of r value into direct, indirect

and residual effect of the exogenous variables on the predicted variable i.e. extent of adoption of improved production practices of carp culture and depicted in Table 9 by incorporating only the significantly correlated factors in analysis. The table revealed that information management behaviour, training programme attained, potentiality to realize opportunity, innovativeness, knowledge of scientific fish farming occupied the first five ranks in that order. It was further observed that the largest substantial positive indirect effect on adoption of fish farmers was exerted by innovativeness of the fish farmer through their information management behaviour. It was observed that higher information management behaviour combined with innovativeness can lead to higher adoption. It means that when the knowledge of respondents is more through information management, participation in training programme, the adoption of improved fish production practices is also increased. The findings is in the line with Haque(1979) and Goswami (2010).

The next important variable is potentiality to realize opportunity. The ability to foresee one's future level of occupational growth leads to successful entrepreneurs and this helps to adoption. Achievement motivation of the respondents motivated their tendency to expand his business and that ultimately change the attitude to adopt different improved practices of fish production. Further, path analysis revealed that training programme attained through Information management behaviour was giving direct effect on the adoption level of farmers. Therefore, extension programmes should concentrate on generating reasoning ability to increase knowledge, improve skills and inculcate required attitude among the fish farmers through training to improve the knowledge and innovativeness. Effort at involving farmers in the mainstream of development must include their training as entrepreneurs.

Such programmes, apart from concentrating on entrepreneurial awareness, training and credit reach for farmers must also concentrate upon bringing the new technology within the reach of farmers and acquaint them with the new avenues of entrepreneurship. Through illustrations of success stories the innovativeness of the farmers can be increased. The residual effect being 0.3786, it was to conclude that 37.86 per cent of the variables had been left unexplained. This should further suggest that inclusion of more relevant and contextual variables could have more variations than what have been in present instance.

Table 9: Path Coefficients Showing Direct, Indirect and Substantial Indirect Effects of Independent Variables on Adoption Level of Fish Farmers on Improved Practices of Carp Production.

Variables	Correlation coefficient	Direct effects	Rank	Total indirect effect	Rank	Variables through which substantial indirect effects are channeled through		
						I	II	III
Age	-0.264*	-0.094	10	0.472	2	0.1372 X20	0.0504 X17	0.0434 X18
Training programme attained	0.364**	0.298	2	0.216	6	0.1633 X20	0.0681 X11	0.0510 X17
Distance from market	-0.174*	-0.573	9	0.379	4	0.1390 X12	0.0592 X17	0.0540 X18
Average yield	0.173*	0.098	8	0.461	3	0.0601 X20	0.1390 X18	0.0529 X16
Pond size	0.386**	-0.048	11	0.495	1	0.1479 X14	0.0534 X20	0.0494 X16
Potentiality to realize opportunity	0.193**	0.256	3	0.025	11	0.2574 X20	0.1194 X18	0.067 X12
Share of fisheries to total income	0.450**	0.107	7	0.320	5	0.1037 X20	0.1237 X18	0.0516 X8
Knowledge of scientific fish farming	0.391**	0.167	5	0.166	8	0.2536 X20	0.1294 X8	0.0486 X13
Risk taking behaviour	0.235**	0.130	6	0.209	7	0.1015 X18	0.0701 X17	0.0529 X8
Innovativeness	0.245**	0.241	4	0.098	10	0.2307 X20	0.1268 X8	0.0482 X18
Information management behaviour	0.537**	0.362	1	0.129	9	0.1676 X20	0.1512 X18	0.0587 X8

Residual effect: 0.3786

CONCLUSION

The objective of this study was to make a thorough investigation on how realizing farmer's objective has influence on the adoption process of fish farming technology in the study area. The results have shown that most farmers adopted fish farming to obtain fish for home consumption as well as for sale. The result further showed that few farmers realized their objectives for adopting fish farming. Consequently, most adopters operated fish farming at low level. Farmer's objectives were not realized due to poor production technology, harvest strategy and nature of the product (i.e. farmed fish). Moreover, farmers who realized their objective intensified the activity and were able to produce 412 kg/kani (1kani=2.5 acre/0.16ha) production that was considered more profitable than other crop production.

The objective of this study was to identify the determinants for adoption of a recommended package of fish farming technology. It is expected that identifying these factors will enable planners in research and extension to advice farmers on aspects, which are compatible with their environment. This will in turn make farmers adopt the recommended package of a fish farming technology. The important conclusion to be

drawn from this study is that farmers' access to information about a technology, economic motivation and resources endowment are important in adoption of a recommended package of fish farming technology. The results show that farmers allocate resources to those activities, which meet household needs, more than others. Results reveal that unless the information is communicated clearly which is significant economically, socially to the needs, interests and values of the farmers they cannot utilize the information. The technologies are to be demonstrated in many places of villages with special emphasis on skill components. Farmers should be taken round the nearby progressive farmers' fields and research stations, so that they can accept and utilize the generated technologies. Realizing farmers' objective has influence on adoption of the technology. This suggests that farmer's objective for undertaking a technology and their priority should be known and taken on board before introducing the technology, and efforts should be made to realize those objectives. For this reason preparation and introduction stages of any technology should involve the farmers. For fish farming to realize farmers objectives, the production technology, harvesting strategy, availability of quality inputs and storage technology need to improve. Production technology including ready availability of quality inputs will ensure that more fish is produced and a farmer friendly harvest strategy will ensure that farmed fish is readily available. Accordingly, improved storage facilities will ensure that farmed fish are properly preserved and can be transported to distant market to make more profit.

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