Mysore J. Agric, Sci., **42** (2) : 356-361, 2008

Technology Factors Influencing the Adoption of Shrimp Farming

P. S. SWATHI LEKSHMI AND N. BALASUBRAMANI
Department of Agricultural Extension and Rural Sociology, Tamil Nadu Agricultural University, Coimbatore

ABSTRACT

Commercial shrimp Culture has emerged as one of the most important sectors of the aquaculture industry in India. The cultured shrimps in the country alone contribute to 50 per cent of the total shrimp exports from India. Much of this phenomenal success has been attributed to the production and dissemination of a host of improved technologies starting from pond preparation till harvest of the cultured shrimps. The existing knowledge structure of the farmers is further enhanced when they are exposed to more scientific farming technologies containing more attributes of the innovation which influence their adoption process. It is frequently asserted that as farmers gain in experience or obtain more accurate and scientific knowledge, their capacity to manage shrimp ponds in a more sustainable way is enhanced. (Saengnore and Lebel, 2002). The technology adopted ranges from traditional to improved, traditional within the coastal regulation zone and extensive shrimp farming outside the coastal regulation zone (Anon. 2002).

THE clear understanding of the multitude of components that results in adoption of shrimp culture technologies is of immense value to the shrimp industry, to the research system and the end users. Hence the present study was undertaken to determine the technology factors which are responsible for the adoption of shrimp culture.

METHODOLOGY

A total of 60 shrimp farmers were drawn, randomly from 6 villages belonging to 3 blocks of Nellore district of Andhra Pradesh, using multi stage random sampling method. A total of 17 socio-personal / socio-psychological / socio-economic characteristics and 14 shrimp farming practices were selected for the study. A well structured interview schedule was used for the data collection. A pre-testing in the form of a pilot survey was done in the non sample areas of Kalpakkam, Marakkanam, Mahabalipuram and Cuddalore areas of Tamil Nadu to probe into the relevancy of the schedule to suite the area under study. Based on the result of pre-testing, suitable modifications were made and a final interview schedule was prepared. The collected data was analysed by using factor analysis. One approach to analyzing subjective perceptions to gain insights from such responses is through Factor analysis (Kim and Mueller, 1978). It is a powerful analytical tool and using it would certainly benefit and enhance the data processing capability of any extension programme (Santos and Clegg,1999). In this study, factor analysis was used to group the variables into factors based on the communalities observed, and to find out the relative importance of each factor in accounting for the particular set of variables being analysed. The method of factor analysis used for the study was principal component analysis and the rotation method was varimax rotation.

Selection of the technologies and measurement of adoption behavior of shrimp farmers : Adoption behavior referred to the extent of adoption of selected improved shrimp farming practices recommended for shrimp farming, by the shrimp farmers. Various research workers have used several methods to quantify the adoption behavior.

In the present study to measure the adoption behavior of shrimp farmers, the adoption quotient developed by Balasubramaniam (1988) was used for this study.

$$\text{Adoption quotient} = \frac{\sum_{j=1}^{M}\left\{\frac{ej}{Ej} \times wj\right\}}{\sum_{j=1}^{M} W_j} \times 100$$

ej = Extent of adoption of jth practice in terms of magnitude

Σj = Potentiality for adoption of jth practice in terms of magnitude

Wj = Weightage assigned to jth practice

M = No. of applicable practices

S = Summation

Selection of improved shrimp farming practices : In order to select the improved shrimp farming practices, the relevant literature on shrimp farming published by the Marine Products Export Development Authority, Central Institute of Brackish Water Aquaculture and State Fisheries Department were perused. Discussions were held with aquaculture scientists, aquaculture extension personnel and shrimp farmers. The practices for which the recommendations were specific were selected. As a result, 14 improved shrimp farming practices recommended for adoption by the shrimp farmers were finally selected.

Weightages assigned to the improved shrimp farming practices : In order to find out the weightages of the practices recommended for shrimp farming towards their contribution to obtain higher yields, a proforma with a list of 14 practices was prepared. To rate each practice on a five point continuum of importance *viz.,* most important, more important, important, less important and least important, these proforma were given to 20 judges comprising of 10 scientists from Central Institute of Brackish Water Aquaculture (CIBA) and 10 from Central Marine Fisheries Research Institute (CMFRI). The judges were requested to rate each practice in terms of its degree of importance of adoption for getting higher yield and assign weightage on the five point continuum given against each practice. Based on the responses of the judges, the average mean score for each improved practice was worked out. The mean score were tabulated and ranking was given in the descending order starting from the highest score. The practice with first to twelfth rank were selected for the study. The ranks and the corresponding weightages attached to each practice are shown in the following Table.

Selection of shrimp culture practices for the study

Practices	Weightage	Rank
Health management	4.90	I
Feed management	4.85	II
Water management	4.70	III
Acclimatization and stocking	4.55	IV
Soil management	4.55	V
Liming of pond	4.55	VI
Measurement of soil pH	4.20	VII
Predator eradicator usage	3.75	VIII
Manures and fertilizer	3.40	IX
Pond bottom sterilization	3.15	X
Pond bottom conditioning	3.1	XI
Harvesting	3.0	XII
Use of pond sealing materials	2.60	XIII
Administration of antibodies	2.00	XIV

Determining the adoption behaviour of shrimp farmers : The data on the extent of adoption of shrimp farming practices were collected from the respondents. The extent of adoption of each practice was compared with the recommendation and the following scoring procedure was followed to quantify the extent of adoption.

Extent of Adoption	*Scores*
Non-adoption of a recommended practice	1
Partial adoption of a recommended practice	2
Full adoption of a recommended practice	3

Results and Discussion

An analysis of Table I, shows the factor loadings, communalities, eigen values and the percentage of variance explained by the factors. It is seen that a total of 3 factors explained the maximum percentage variance.

The factors thus extracted, were rarely interpretable and have only theoretical significance. It is therefore, necessary to rotate the factors, so that the rotated factors may be meaningfully interpreted. Hence for better interpretation of the result, the varimax rotation was used; and the results are presented in Table II.

A close observation of Table II shows the technologies, having significant factor loadings under each factor.

Scanning of each factor column for large absolute values in varimax matrix will identify a few variables with significantly high loadings and many others with insignificant loadings. For interpretation of the factors, technologies (variables) with factor loadings greater than 0.5 were considered, and the groupings of the technologies with their respective factor loadings are presented in Table III.

An analysis of Table III shows the groupings of technologies under each of the three factors.

FACTOR I : It could be observed that Factor I accounts for 42.24 per cent of the total variance among technologies. Among the technologies having significant factor loadings, are, use of predator eradicators (0.915), acclimatization and stocking of fry (0.803), feed management (0.803), use of manures and fertilizers (0.672), measurement of soil pH (0.651), water management (0.558) and health management (0.545). Since all the technologies under this factor are vital for getting increased yield, and a healthy crop, Factor I was

TABLE I

Factor loadings of technologies with respect to overall extent of adoption

Technologies	Factor I	Factor II	Factor III	Communalities
Pond bottom conditioning	0.522	0.253	-0.679	0.797
Pond bottom sterilization	0.524	0.234	0.117	0.343
Measurement of soil pH	0.818	-0.124	-0.117	0.698
Application of lime	0.050	0.915	0.187	0.875
Predator eradication	-0.087	0.902	0.180	0.854
Use of manures and fertilizers	0.760	0.025	0.522	0.851
Acclimatization and stocking of fry	0.702	-0.384	0.079	0.647
Water management	0.804	-0.239	0.348	0.825
Soil management	0.602	0.186	0.113	0.409
Feed management	0.878	0.045	0.108	0.785
Health management	0.737	0.035	-0.162	0.570
Harvesting	0.670	0.217	-0.569	0.820
Eigen values	5.069	2.075	1.330	8.464
% variation explained	42.24	17.29	11.08	70.61
Cumulative % variation explained	42.24	59.53	70.61	70.61

TABLE II

Rotated factor (varimax) matrix of the 12 shrimp culture technologies

Technologies	Factor I	Factor II	Factor III
Technology I	0.080	**0.887**	0.065
Technology II	0.490	0.224	0.229
Technology III	**0.651**	0.490	-0.187
Technology IV	-0.053	0.073	**0.930**
Technology V	0.915	0.006	**0.923**
Technology VI	**0.672**	-0.036	0.108
Technology VII	**0.885**	0.211	-0.389
Technology VIII	**0.558**	0.072	-0.191
Technology IX	**0.803**	0.257	0.177
Technology X	**0.803**	0.257	0.177
Technology XI	**0.545**	0.521	-0.039
Technology XII	0.266	**0.864**	0.048
Eigen values	4.075	2.356	2.043
% variation explained	33.961	19.630	17.025
Cumulative % variation explained	33.961	53.592	70.617

TABLE III

Technologies (Variables) with factor loadings under different factors for overall extent of adoptions

Factor	Technologies	Rotated Factor Loadings
Factor I	3	0.651
	6	0.672
	7	0.885
	8	0.558
	9	0.803
	10	0.803
	11	0.545
Factor II	1	0.887
	12	0.864
Factor III	4	0.930
	5	0.923

termed as "PRIME" Factor. Studies conducted by Saengnore and Lebel, (2002) revealed that the most important factor to be considered for successful shrimp culture are water quality, and production inputs such as feed, fry and culture management . Moreover their findings have revealed that there is a systematic interdependence among these variables. Eg. Excessive feeding affects the water quality due to the accumulation of uneaten feed along with the shrimp excreta at the pond bottom. Besides their studies undertaken among shrimp farmers in Vietnam showed that disease management and water management had significantly higher factor loadings when compared to the other technologies adopted by them.

Factor II : Factor II explained 17.30 per cent of the total variance among the technologies. The technologies that have significant loadings on Factor II were Technology I (0.887), and

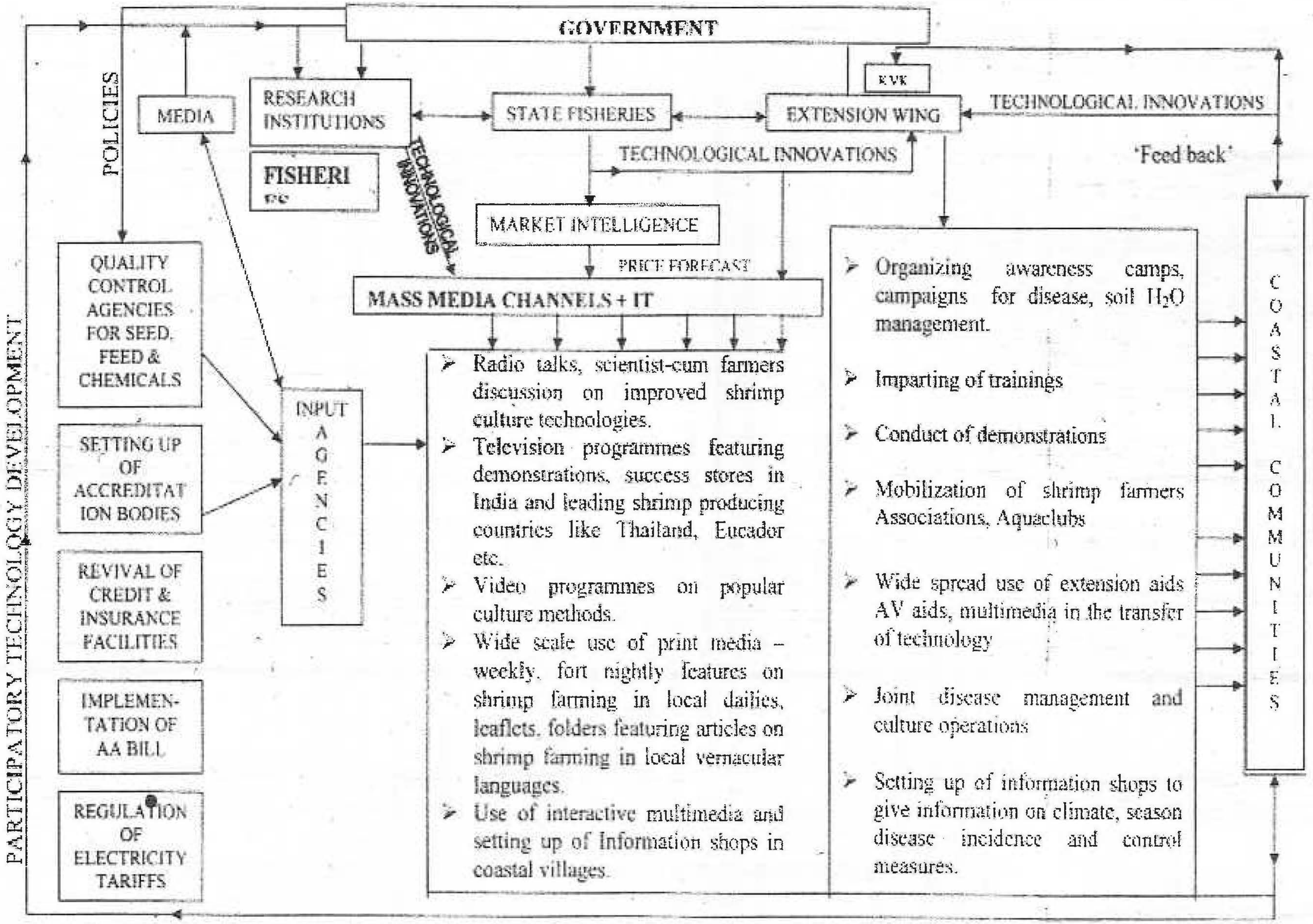

Fig. 1. Futuristic model for populatisation of shrimp farming technologies

Technology 12 (0.864). Technology 1 was pond bottom conditioning and Technology 12 was harvesting. Since these two technologies are routinely practiced they were labelled as "ROUTINE" factor.

FACTOR III : Factor III accounted for 11.08 per cent of the total variance among the technologies. Among the technologies which have significant factor loadings are Technology 4, *i.e* application of lime having a factor loading of 0.930, followed by the technology 5 *i.e.* use of predator eradicators having a factor loading of 0.923. Since these two technologies essentially deal with the application of chemicals, the factor was termed as "CHEMICAL" factor.

Futuristic model for popularization of shrimp farming technologies

— The model recommends the setting up of a separate, dedicated, organized extension wing, which comes under the purview of State Fisheries Department.

— The strengthing of Research - Extension - Clientele linkage.

— Extension wing can make use of mass media channels and information technology methods for transfer of technology to coastal communities, representing the shrimp farmers.

♦Future research priorities to be based on

♦Production of disease resistant brood stock,

♦Production of hybrid genetically engineered disease resistant tiger shrimp sp,

♦Development of new disease control measures for White Spot Syndrome Virus (WSSV)

♦Research on polyculture of shrimp with compatible fish and seaweed species.

— Rigorous training of extension personnel at all levels of hierarchy in Research Institutes and Fisheries Colleges.

— Training of farmers by extension agents in joint disease management and culture operations.

The futuristic model also recommends the setting up of quality control agencies, accreditation bodies by the government; and the revival of credit and insurance facilities, reduction in electricity tariffs and implementation of the Aquaculture Authority Bill. (Fig. 1).

The foregoing study revealed that the prime factor was crucial in controlling and manipulating 42.24 per cent of the total variation in the consequent variable namely adoption of shrimp culture technologies. Since shrimp farming in India has gained the status of an industry and a commercial enterprise, it necessitates the simultaneous use and adoption of a number of scientific interventions such as aclimatisation and stocking of fry, feed and water management and health management for ensuring healthy and sustainable yields. Generation of feasible and cost effective technologies pertaining to the components delineated under the prime factor and successful transfer of these technologies should be the focus of any extension programme aimed at improving the production and productivity of shrimp farms in the country.

References

Anonymous, Aquaculture Authority News., 2002, **1** : 1-4.

Balasubramaniam, 1988, Analysis of Technology Transfer Effectiveness in Inland Fish Farming, *Ph.D Thesis,* Tamil Nadu Agricultural University, Coimbatore.

Kim, J. O. and Mueller, C. N., 1978, *Factor analysis: Statistical methods and Practical issues.* Beverly Hills.

Saengnore Amnuay and Lebel Louis, 2002, Experience, Knowledge and the Technology Choices of Shrimp Farmers in Thailand and Vietnam. Research supported by Grant No 60176, John D and Catherine T. Mac Arthur Foundation to Louis Lebel, ChiangMai University.

Santos J. Reynaldo and Clegg, D. Max, 1999, Factor analysis adds new dimensions to Extension surveys. *J. Extension* **37** : 5.