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# Analysis of Technology Transfer Efficiency and Associated Socio-personal Variables Among the Fishery Extension Personnel in Kerala

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**ABSTRACT**

This paper deals with the assessment of technology transfer efficiency and identification of influencing socio-personal characteristics among the fisheries extension personnel in Kerala. The results revealed that the overall technology transfer efficiency index was 91.70 with the standard deviation of 8.83. The extent of adoption of the identified activities in the technology transfer process was more than 90.00 per cent for almost all the items. The regression analysis revealed that three variables viz., time utilization in extension works, communication behaviour and extent of linkage with research and clientele groups had contributed significantly and positively towards the efficiency in technology transfer process. The $R^2$ value indicated that all the variables taken together served as cause for explaining 81.20 per cent of variation in the efficiency level. The highly significant 'F' value revealed the overall significance of the regression at one percent level of probability. The constraints in the technology transfer process, as perceived by the extension personnel are also discussed in the paper.

**Key words:** Technology transfer efficiency, socio-personal characteristics, fisheries extension personnel, marine fisheries

## INTRODUCTION

While the demand for fish has ever been increasing, several issues are plaguing the marine fisheries sector. They are: wide technological gaps, indiscriminate trawling for shrimp, lack of diversification in fishing, pollution of coastal waters, damaging the health of the ocean, large scale destruction of juveniles, destruction of marine biodiversity and lack of adequate protection to endangered marine fauna and flora, undue reduction in mesh sizes of trawl nets resulting in capture of juveniles, apathy to scientific advice for obtaining sustainable fishery yields, conservation, management, *etc.* It is often reported that the expected increase in the flow of fisheries technologies relevant to the need and production condition of the resource poor fishermen in India has not occurred in spite of considerable interventions in research and technology transfer. In this context, it is of utmost importance to study technology transfer efforts by the fisheries extension personnel. Fisheries extension roles are performed by the various state fisheries departments.

In this context, some of the important questions are: what are the activities in the technology transfer process? what is the present level of efficiency of the technology transfer process in terms of client orientation? how do the socio-personal and psychological characteristics of the extension personnel influence the efficiency of technology transfer process in marine fisheries? and what are the constraints in the technology transfer process? This paper attempts to fulfil these research needs.

## METHODOLOGY

Pertaining to the objectives of the study, ex-post-facto research design was followed. All the extension officials under the State Department of Fisheries, Government of Kerala, including its subsidiary organization *viz.*, Co-operative Federation for Fisheries Development Limited (MATSYAFED), who are involved in extension and extension related works at Ernakulam District in Kerala were considered for the study, and the questionnaires were handed over to them in person. From the population size of 52, responses were received in time from 40 officials, thus constituted the sample size of the study. For the present study, technology transfer process was conceptualized as the process by which technologies evolved by the research system are disseminated by the extension system to the clientele system in marine fisheries. The efficiency of technology transfer process was operationalized as the extent of adoption of the identified activities and other associated factors in the process of disseminating the technologies, with specific clients or potential end users in view for better and widespread adoption by the client system. The extension personnel were asked to indicate their response to each of the activity, ie., the extent of adoption of the identified 55 items in technology transfer process, on a two-point continuum *viz.,* 'Adopted' and 'Not Adopted' with the

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scores of two and one, respectively. The total score of an individual respondent was obtained by summing up the scores secured by him/ her for all the 55 items. Item-wise frequencies and percentages were also worked out to have an in-depth understanding about the technology transfer process.

The Technology Transfer Efficiency Index (TTEI) was calculated by using the formula:

$$TTEI = \frac{\text{Actual score obtained}}{\text{Maximum score possible}} \times 100$$

Data were collected from the respondents by using structured and pre-tested questionnaires developed for the purpose. Using Statistical Packages for Social Sciences (SPSS), the following statistical tools were employed for analyzing the data of this study viz., mean and standard deviation, frequencies and percentage analysis, cumulative frequency distribution, simple correlation coefficient, multiple regression analysis and coefficient of regression ($R^2$).

## RESULTS AND DISCUSSION

The frequency distribution of the fisheries extension personnel based on their socio-personal and psychological characteristics are given in Table 1.

**Table 1: Socio personal and psychological profile of extension personnel**

**n=40**

| Variables | Mean | SD | Frequency | Percentage |
|---|---|---|---|---|
| **Age (Years)** | 43.63 | 7.59 | - | - |
| a) Young | - | - | 6 | 15.00 |
| b) Middle | - | - | 15 | 37.50 |
| c) Old | - | - | 19 | 47.50 |
| **Educational qualification (Scores)** | 3.38 | 0.81 | - | - |
| a) Post Graduate | - | - | 21 | 52.50 |
| b) Graduate | - | - | 15 | 37.50 |
| c) Pre-degree | - | - | 2 | 5.00 |
| d) SSLC | - | - | 2 | 5.00 |
| **Rural/ urban background (Scores)** | 1.58 | 0.50 | - | - |
| a) Rural | - | - | 23 | 57.50 |
| b) Urban | - | - | 17 | 42.50 |
| **Professional experience (Years)** | 17.68 | 7.27 | - | - |
| a) Low | - | - | 7 | 17.50 |
| b) Medium | - | - | 15 | 37.50 |
| c) High | - | - | 18 | 45.00 |
| **Annual income (INR '000)** | 147.80 | 47.54 | - | - |
| a) Low | - | - | 24 | 60.00 |
| b) Medium | - | - | 10 | 25.00 |
| c) High | - | - | 6 | 15.00 |
| **Time utilization for extension works (%)** | 64.95 | 20.29 | - | - |
| a) Low | - | - | 3 | 7.50 |
| b) Medium | - | - | 15 | 37.50 |
| c) High | - | - | 22 | 55.00 |
| **Participation in professional bodies (Scores)** | 0.15 | 0.48 | - | - |
| a) Low | - | - | 36 | 90.00 |
| b) Medium | - | - | 2 | 5.00 |
| c) High | - | - | 2 | 5.00 |
| **Communication behaviour (Index in %)** | 79.17 | 9.82 | - | - |
| a) Low | - | - | 1 | 2.50 |
| b) Medium | - | - | 20 | 50.00 |
| c) High | - | - | 19 | 47.50 |
| **In-service training undergone (Scores)** | 1.53 | 1.75 | - | - |
| a) Low | - | - | 25 | 62.50 |
| b) Medium | - | - | 7 | 17.50 |
| c) High | - | - | 8 | 20.00 |
| **Extent of linkage (Index in %)** | 50.13 | 12.43 | - | - |
| a) Weak | - | - | 12 | 30.00 |
| b) Moderate | - | - | 14 | 35.00 |
| c) Strong | - | - | 14 | 35.00 |
| **Job satisfaction (Index in %)** | 71.08 | 13.76 | - | - |
| a) Low | - | - | 15 | 37.50 |
| b) Medium | - | - | 14 | 35.00 |
| c) High | - | - | 11 | 27.50 |
| **Job performance (Index in %)** | 85.06 | 11.68 | - | - |
| a) Poor | - | - | 14 | 35.00 |
| b) Average | - | - | 8 | 20.00 |
| c) Good | - | - | 18 | 45.00 |
| **Technologies transferred (Scores)** | 1.90 | 2.84 | - | - |
| a) Low | - | - | 34 | 85.00 |
| b) Medium | - | - | 3 | 7.50 |
| c) High | - | - | 3 | 7.50 |

The data presented in Table 1 showed that the mean age of the extension personnel was 43.63 years with the standard deviation of 7.59 years. Nearly fifty per cent (47.50 %) of the extension personnel were old-aged, followed by middle (37.50 %) and young (15.00 %) aged groups. More than fifty per cent of the fisheries extension personnel were post graduates (52.50 %). Nearly sixty percent of them were from rural background (57.50 %) and the remaining 42.50 per cent of them were from urban background. Their mean professional experience was 17.68 years with the standard deviation of 7.27 years. The mean annual income (Rupees '000) of the respondents was 147.80 with the standard deviation of 47.54. The mean time utilization in extension activities was 64.95 percentage with the standard deviation of 20.29 per cent. An in-depth analysis of the time utilization pattern revelaed that time utilization was reported on activities such as, training (7.08%), implementation of departmental schemes (49.00%), supply of inputs or credit facilities (8.88%), providing infrastructural facilities (1.98 %), administration (23.58 %), teaching

(3.33 %), research (1.00 %) and miscellaneous works, which include inspection of fisheries cooperative societies, arranging meetings, reviews, etc. (5.15 %). The findings established that the extension personnel spent relatively by more time for extension work.

The mean score on participation in professional bodies was 0.15 with the standard deviation of 0.48. The overall communication behaviour index was 79.17 per cent and it could be observed that almost an equal percentage of the extension personnel had medium to high level of communication behaviour, and regularly utilized most of the formal, informal and mass media sources for information input and output. More than sixty per cent of the respondents (62.50 %) had low level of exposure to in-service training programmes, followed by high (20.00 %) and medium (17.50 %) levels. An equal percentage of the respondents (35.00 % each) had strong and moderate linkage with research and clientele groups, and 30.00 per cent of them had weak linkage. They maintained linkage with researchers only when they were in need of any technological advice from the researchers, and with clientele, mainly for the purpose of implementing departmental schemes and for organizing technology transfer programmes.

The overall job satisfaction index was 71.08 per cent with the standard deviation of 13.76 per cent. The degree of job satisfaction of the employees depends on various factors. It could be found that nearly 50 per cent of the respondents were satisfied with the job factors such as self-esteem or respect (47.50 %) and attributes of the work itself (52.50 %). They were 'some what satisfied' with the job factors such as recognition for achievement (50.00 %), working conditions (47.50 %), responsibility and advancement (52.50 %), behaviour of the superiors (52.50 %) and salary and other benefits (50.00 %). Nearly half of them (47.50 %) were not satisfied with the opportunity for promotion. Forty five per cent of the extension personnel assessed themselves as good performers, 35.00 percentage of them as poor and 20.00 percentage of them as average job performers. It was found that the extent of job performance of more than fifty percent of the respondents was 'good' with reference to the job factors such as productivity (65.00%), team work (67.50%), quality of work (57.50%), job knowledge (60.00%), decision making (52.50%), problem solving (60.00%), communication skills (65.00%), initiative (75.00%), time management (75.00%), observing the values or ethics of the system (67.50 %) and achievement motivation (72.50%). Majority (85.00 %) of the extension personnel belonged to low category, followed by an equal percentage under medium and high (7.50% each) categories with reference to number of technologies disseminated. The technology transfer efficiency score, item-wise analysis on extent of adoption of various activities and other related factors in the technology transfer process are given in Table 2. The table revealed that the overall technology transfer efficiency index was 91.70 with the standard deviation of 8.83.

**Table 2: Technology transfer process: extent of adoption of activities in the technology transfer process and other related factors**

**n= 40**

| Activities | Adoption Index | Mean Score | SD | Adopted | | Not Adopted | |
|---|---|---|---|---|---|---|---|
| | | | | f | % | f | % |
| **A. Steps in the technology transfer process** | | | | | | | |
| Survey of the existing knowledge, attitude, practices and resources of the client system | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Defining the need or the market | 95.00 | 1.90 | 0.30 | 36 | 90.00 | 4 | 10.00 |
| Searching for appropriate technologies | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Assessing the perceived attributes of innovations viz., relative advantage, compatibility, complexity, trialability and observability | 92.50 | 1.85 | 0.36 | 34 | 85.00 | 6 | 15.00 |
| Prioritizing the technologies | 93.75 | 1.88 | 0.33 | 35 | 87.50 | 5 | 12.50 |
| Modifying the technologies to suit local conditions, considering social, political, cultural, as well as economic factors | 93.75 | 1.88 | 0.33 | 35 | 87.50 | 5 | 12.50 |
| Working out the strategy for dissemination in consultation with research & clientele group | 87.50 | 1.75 | 0.44 | 30 | 75.00 | 10 | 25.00 |
| Selection of various methods of dissemination | 91.25 | 1.83 | 0.38 | 33 | 82.50 | 7 | 17.50 |
| Preparing the plan of action | 96.25 | 1.93 | 0.27 | 37 | 92.50 | 3 | 7.50 |
| Developing infrastructure or procuring inputs | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Demonstrating the value of the technology in social and economic terms | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Implementing the programmes in physical terms | 97.50 | 1.95 | 0.22 | 38 | 95.00 | 2 | 5.00 |
| Conducting techno-economic assessment and adoption studies to find out the field problems in adoption of the technology | 88.75 | 1.78 | 0.42 | 31 | 77.50 | 9 | 22.50 |
| Feedback - sending back the problems identified in surveys to the researchers | 87.50 | 1.75 | 0.44 | 30 | 75.00 | 10 | 25.00 |
| Technology refinement and diffusion | 82.50 | 1.65 | 0.48 | 26 | 65.00 | 14 | 35.00 |
| Coordination and linkage for sustaining the process | 91.25 | 1.83 | 0.38 | 33 | 82.50 | 7 | 17.50 |
| Follow-up, monitoring, evaluation and impact assessment | 96.25 | 1.93 | 0.27 | 37 | 92.50 | 3 | 7.50 |
| **B. Factors considered in prioritizing the technologies for transfer** | | | | | | | |
| Organizational goals | 95.00 | 1.90 | 0.30 | 36 | 90.00 | 4 | 10.00 |
| Government policies | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Likely impact of technology-socio-cultural, economical, technical and environmental | 93.75 | 1.88 | 0.33 | 35 | 87.50 | 5 | 12.50 |
| Urgency or timeliness of the problem | 91.25 | 1.83 | 0.38 | 33 | 82.50 | 7 | 17.50 |
| Felt needs of the clients | 95.00 | 1.90 | 0.30 | 36 | 90.00 | 4 | 10.00 |
| Practical application of the innovation | 92.50 | 1.85 | 0.36 | 34 | 85.00 | 6 | 15.00 |
| Availability of supply institutions- market, credit and inputs | 95.00 | 1.90 | 0.30 | 36 | 90.00 | 4 | 10.00 |
| Culture, tradition, values and norms of the society | 92.50 | 1.85 | 0.36 | 34 | 85.00 | 6 | 15.00 |
| The success or failure of prior works | 97.50 | 1.95 | 0.22 | 38 | 95.00 | 2 | 5.00 |
| **C. Approaches followed in the technology transfer process** | | | | | | | |
| Systems approach covering research, extension, client and support systems | 88.75 | 1.78 | 0.42 | 31 | 77.50 | 9 | 22.50 |
| Participatory approach- encouraging the participation of clients in the various stages of technology transfer process | 93.75 | 1.88 | 0.33 | 35 | 87.50 | 5 | 12.50 |
| Need-based, demand-driven and bottom-up approach in extension programme planning and implementation | 95.00 | 1.90 | 0.30 | 36 | 90.00 | 4 | 10.00 |
| Pluralistic, comprehensive and multidimensional approach | 86.25 | 1.73 | 0.45 | 29 | 72.50 | 11 | 27.50 |
| SWOT approach - recognizing the Strengths, Weaknesses, Opportunities and Threats in the research, extension, clientele and support systems | 92.50 | 1.85 | 0.36 | 34 | 85.00 | 6 | 15.00 |
| Ensuring that the gain from the adoption of the innovation adequately compensates the additional expenditure of money, time, labour, etc. that its adoption may involve | 92.50 | 1.85 | 0.36 | 34 | 85.00 | 6 | 15.00 |
| Selection of extension channels according to the communication habits of clients | 97.50 | 1.95 | 0.22 | 38 | 95.00 | 2 | 5.00 |
| Sustainability of adoption - Taking efforts to sustain the process- when external support withdraws, something concrete must remain | 93.75 | 1.88 | 0.33 | 35 | 87.50 | 5 | 12.50 |
| **D. Expected outcome of the technology transfer process** | | | | | | | |
| Solving location-specific problems | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Reducing the cost of production | 97.50 | 1.95 | 0.22 | 38 | 95.00 | 2 | 5.00 |
| Effectively utilizing the resources or excess catches | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Improving productivity or work efficiency | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Increasing the income generating capabilities of clients | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Increasing the employment opportunities | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Reducing the drudgery and health hazards in working | 95.00 | 1.90 | 0.30 | 36 | 90.00 | 4 | 10.00 |
| Producing certain desired changes in the environment | 97.50 | 1.95 | 0.22 | 38 | 95.00 | 2 | 5.00 |
| Improving the standard of living of clients | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| **E. Extension methods or modes of technology transfer** | | | | | | | |
| Individual contact methods -personal calls, personal visits and reply to technical queries | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Training programmes/ workshops/ seminars | 98.75 | 1.98 | 0.16 | 39 | 97.50 | 1 | 2.50 |
| Field days/ farmers days/ field visits/ study tours | 97.50 | 1.95 | 0.22 | 38 | 95.00 | 2 | 5.00 |
| Exhibitions | 86.25 | 1.73 | 0.45 | 29 | 72.50 | 11 | 27.50 |
| Folk media | 65.00 | 1.30 | 0.46 | 12 | 30.00 | 28 | 70.00 |
| Radio talks | 70.00 | 1.40 | 0.50 | 16 | 40.00 | 24 | 60.00 |
| TV programmes | 73.75 | 1.48 | 0.51 | 19 | 47.50 | 21 | 52.50 |
| Printed literature or print media | 86.25 | 1.73 | 0.45 | 29 | 72.50 | 11 | 27.50 |
| Information & Communication Technology (ICT) based approaches | 77.50 | 1.55 | 0.50 | 22 | 55.00 | 18 | 45.00 |
| Field level demonstrations | 85.00 | 1.70 | 0.46 | 28 | 70.00 | 12 | 30.00 |
| Village adoption programmes | 73.75 | 1.48 | 0.51 | 19 | 47.50 | 21 | 52.50 |
| Consultancy services | 68.75 | 1.38 | 0.49 | 15 | 37.50 | 25 | 62.50 |

The extent of adoption of the identified steps in the technology transfer process was more than 90.00 per cent for almost all the steps, except the four steps viz., working out the strategy for dissemination in consultation with research and clientele groups, conducting techno-economic assessment and adoption studies to find out the field problems in adoption of the technology, feedback-sending back the problems identified in surveys to the researchers and technology refinement and diffusion, wherein the index scores were relatively lesser. This needs the attention of extension programme managers, so as to ensure that these steps are followed in the technology transfer process. The technology dissemination strategies, such as organizing field level demonstration or training programme can be worked out in consultation with the resource persons and clients, to suit their convenience of timing, venue, resources, *etc.* This will eliminate the constraints such as non-participation of clients in the extension programmes. Before the actual programme implementation, the technical feasibility and economic viability of the technologies chosen for dissemination, may be assessed through preliminary field visits and interaction with clients. During the course of technology transfer, proper monitoring, obtaining feedback and concurrent evaluation can be carried out to rectify or refine the technologies to ensure sustainable adoption. The extension personnel should search for appropriate technologies for transfer, based on the need or the market assessed by the survey of the existing knowledge, attitude, practices and resources of the client system. Modifying the technologies to suit local conditions, considering social, political, cultural, as well as economic factors and coordination and linkage for sustaining the process will increase the success rate of technology transfer.

The factors considered in prioritizing the technologies for transfer were in the order of, government policies (98.75%), the success or failure of prior works (97.50%), organizational goals (95.00%), felt needs of the clients (95.00%), availability of supply institutions-market, credit and inputs (95.00%), likely impact of technology-socio-cultural, economical, technical and environmental (93.75%), practical application of the innovation (92.50 %), culture, tradition, values and norms of the society (92.50 %) and urgency or timeliness of the problem (91.25 %). The results indicated an encouraging trend, as most of the important factors were considered in prioritizing the technologies for transfer. There should be flexibility in the organizational goals or government policies to accommodate change, based on the felt needs, urgency or timeliness of field problems. It is often reported that lack of organized market in fisheries poses major constraint in the adoption of new innovations. Hence the extension system has to ensure the market, while prioritizing the technologies for transfer.

An effective technology transfer process depends on the approach of the process. From the findings, it could be observed that most of the client-oriented approaches identified under the technology transfer process were followed by the respondents of this study. The concerted efforts to follow these approaches in the future extension programmes can ensure the efficient technology transfer process. The extent to which the anticipated outcomes are followed in the technology transfer process was highly encouraging. This might be one of the reasons for higher technology transfer efficiency index score. Organizational goals might have reflected in the expected outcome of the technology transfer process. In addition to the organizational goals, the autonomy for the extension system to work on practical applications of the technologies such as reducing the operational expenditure, increasing the production, better utilizing the resources, income generation, and ultimately the better livelihood for the clientele will improve the success rate of transferred technologies.

The results also revealed that the most widely used extension methods for technology transfer were individual contact methods such as personal calls, personal visits and reply to technical queries (98.75%), training programmes/ workshops/ seminars (98.75%) and field days/ farmers days/ field visits/ study tours (97.50%). It was also observed that more than eighty percent of the extension personnel used the extension methods such as exhibitions (86.25%), printed literature/ print media (86.25%) and field level demonstrations (85.00%) for technology transfer. The perusal of Table 2 revealed that some of the effective extension methods such as folk media (65.00%), radio talks (70.00%), television programmes (73.75%), Information and Communication Technology (ICT) based approaches (77.50%), village adoption programmes (73.75%) and consultancy services (68.75%) were not adequately utilized by the extension personnel for technology transfer. Though the individual contact methods were widely used, it might take more time to cover more number of clients. Hence, the effective mass media channels can be used for covering more clients at a shorter time. Lack of familiarity of using such channels might be one of the reasons for inadequate utilization of such channels. Hence, the extension personnel should be imparted training on the use of such channels and the latest methodologies in technology transfer. The selection of extension methods should match with the communication behaviour of the clientele and their access to communication facilities. The treatment of message to

suit the level of comprehension of clients is also very important to avoid distortion of the message. Based on the above findings, it could be suggested that pluralistic mode of technology transfer can ensure effective dissemination of technologies.

Simple correlation coefficients were calculated to assess the existence of relationship between the socio-personal variables of extension personnel and Technology Transfer Efficiency Index. In order to find out the relative importance of various characteristics influencing the Technology Transfer Efficiency Index, the data were subjected to multiple regression analysis. The results are given in Table 3.

**Table 3: Correlation and regression analyses between the socio-personal variables and technology transfer efficiency index**

**n=40**

| Variables | Correlation coefficients (r) | Regression coefficients (b) | SE of 'b' | 't' |
|---|---|---|---|---|
| Age | -0.146* | -0.312 | 0.459 | -0.679 |
| Educational qualification | -0.004 | -0.097 | 1.517 | -0.064 |
| Rural or urban background | -0.101 | -1.300 | 3.061 | -0.425 |
| Professional experience | -0.102* | 0.838 | 0.488 | 1.718 |
| Annual income | -0.001 | -0.060 | 0.032 | -1.906 |
| Time utilization in extension works | 0.434** | 1.997 | 0.052 | 1.997* |
| Participation in professional bodies | -0.007 | 1.228 | 2.162 | 0.568 |
| Communication behaviour | 0.648** | 1.462 | 0.248 | 5.902** |
| In-service training undergone | -0.210 | -0.192 | 0.637 | -0.301 |
| Extent of linkage with research and clientele groups | 0.490** | 2.018 | 0.471 | 4.286** |
| Job satisfaction | -0.109 | -0.730 | 0.271 | -2.688 |
| Job performance - self appraisal | 0.257* | -0.321 | 0.245 | -1.309 |
| Technologies disseminated | 0.015 | 0.265 | 0.391 | 0.679 |

(** Significant at 1% level; * Significant at 5% level; $R^2 = 0.812$; F = 6.903**)

Among the thirteen variables studied, the variables, time utilization in extension works, communication behaviour and extent of linkages with research and clientele groups showed positive and highly significant relationship at one percent level, whereas the variable job performance showed positive and significant relationship at five percent level of probability. The results indicated that when these scores improve, the technology transfer efficiency could be more and vice-versa. The variables, age and professional experience showed significant and negative relationship, from which, it could be inferred that the technology transfer efficiency declines as age and experience increase.

A perusal of the regression coefficients revealed that only two variables *viz.*, communication behaviour and extent of linkage with research and clientele groups had contributed significantly and positively towards the efficiency in technology transfer process at one percent level of probability. The variable time utilization in extension works had contributed significantly and positively towards the efficiency in technology transfer process at five percent level of probability. All the other ten regression coefficients were non-significant and they were not significantly influencing the variation in the technology transfer efficiency index scores of the extension personnel. The $R^2$ value indicated that all the variables taken together served as cause for explaining 81.20 per cent of variation in the efficiency level. The highly significant 'F' value revealed the overall significance of the regression at one percent level of probability.

Almost ninety per cent of the extension personnel (87.50%) felt lack of adequate field staff as a major constraint in the technology transfer process, considering the enormous strength of the clientele system. This was followed by lack of transport facilities (62.50 %), lack of infrastructural facilities (50.00%) and inadequacy of financial resources (45.00%). Regarding the organizational climate, lack of rewards and recognition (45.00%), non availability of time (35.00%), lack of autonomy (32.50%), inadequate pay for the job (30.00%), lack of promotion opportunities (27.50%), lack of support from colleagues and subordinates (20.00%), administrative constraints (17.50 %), stress (15.00%) and lack of conducive working climate (5.00%) were perceived as constraints by the extension personnel. Poor organizational climate may obstruct the extension personnel from working with missionary zeal.

Nearly equal percentage of the respondents perceived lack of participation of clients (37.50%) and lack of proper feedback from the clients (32.50%) as the factors limiting the outreach of technologies. A major constraint in fisheries is that timing of fishing operations in capture fisheries is early morning or late in the night. This differs from the normal time schedule of extension workers. This obstructs adequate contact and interactions to study fishing operations and problems. Moreover, many fishers are highly mobile in their activities at various locations that are not easily accessible to the extension workers and are therefore difficult to contact. Lack of periodical training was reported as constraint by 22.50 percentage of

the respondents for upgrading their skills. Inadequate exposure to the latest developments in the field of marine fisheries might affect their professional competency, ultimately the technology transfer efficiency. Lack of database on problems on social, economic and technological issues of clients, diversified socio-economic characteristics and informational and knowledge barriers among the client system were also observed as the hurdles in effective technology transfer.

## CONCLUSION

The results indicated that the technology transfer process in marine fisheries is efficient enough, though there is scope for further improvement. By studying the extent of adoption of the identified activities and other associated factors in the technology transfer process, they could be appropriately manipulated in the future extension management programmes, and organizational strategies could be evolved to improve the efficiency of the technology transfer process.

The fisheries extension management strategies should take into account the various characteristics of fisheries extension personnel, and the management techniques would have to be used accordingly to achieve the technology transfer effectiveness. In the extension organizations, appropriate technological schemes have to be planned and implemented to popularize the selected innovations. As the innovations are resource-specific and target oriented, constant monitoring and supervision are required to achieve the goals. When the technology is adopted, the production is increased. When the production is increased, there should be more facilities available for processing and marketing of the products.

If such facilities are available, the fishermen system will get higher price or profit and so, the adoption will be continued. If there are no sufficient facilities for processing and marketing of the increased output, the situation will lead to unfavourable price for the product resulting in loss. At that stage, the technology already adopted will be discontinued. This shows that continuous support from the production stage to the marketing point should be provided to the fishermen system, till it is stabilised, for effective transfer, adoption and continuation of the adoption of a technology.

The analysis *of* extension management by the various State and Central Government Organizations, and Non-Governmental Organizations would help to activate the extension delivery mechanisms and also to improve the extension organizational development programmes.

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