Seafood Safety - Proceedings of the Symposium on Seafood Safety - Status and Strategies, 28-30 May 2002, Cochin, India,580-588.

Technological Gap in the Adoption of Post-Harvest Technology

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The extent of technological gap in post-harvest technology adoption and its implications in seafood safety are reported based on a study conducted in Ernakulam District (Kerala). 31 post-harvest technology practices developed by Central Institute of Fisheries Technology (Cochin), 6 for trawler owners/partners, 9 for fish pre-processors and 16 for fish processors were selected. The study indicated that use of ice-water slurry, provision for insulated storage and use of deodorants were not adopted. The factors namely, education, experience, number of days employed, exposure to media, contact with extension agency and debt influenced significantly the adoption behaviour of trawler owners/partners, fish pre-processors and fish processors. The adoption behaviour of trawler owners/partners, fish pre-processors and fish processors could be improved by providing adequate training facilities, credit facilities, contact with extension agency and media exposure.

Key words: Technological gap, adoption behaviour, post-harvest technology

India has been exporting frozen seafood since 1953. Now the country has about 439 seafood processing factories of which 33% are located in Kerala. The technology used in these factories was mainly plate freezing and some factories had blast freezing facilities. Individually quick freezing technology (IQF) was introduced in the country for the first time in Kerala in 1984.

Post-harvest fisheries comprise the activities that take place from the time the fish is landed or harvested until it is consumed. Major stages, where the material is handled before shipment are: (i) onboard fishing boats, (ii) landing centre/fisheries harbour, (iii) prawn peeling/pre-processing centre and

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(iv) processing plants. Globally, the quantity of low-priced and not so popular species of fishes, which constitute wholesome protein source, is estimated to be about 10% of the annual fish catch, contributing 8 to 9 million tonnes. The processing and utilization of such fishes is engaging serious consideration throughout the world (Chari, 1994). India exports ninety varieties of seafood products to 45 countries all over the world, with Japan, USA and Europe sharing 95% of the total seafood exports. Frozen shrimps dominate the trade and account for 72.75% of the total exports in terms of value (Gopakumar, 1996). When the product goes to the consumers directly through the chain stores, one should understand the need of producing supreme quality products, free from any bacterial contamination (Jagadees, 1988). Central Institute of fisheries Technology (Cochin) has developed several post-harvest technology practices in order to improve seafood safety (Iyer, 1979; Joseph, 1979; Mathan, 1979; Thomas, 1979; Kaul *et al.*, 1989; Kandoran *et al.*, 1993; Balachandran, 1995; Kandoran & Thomas, 1997; Anon, 2000).

The present study was conducted with a view to understand the extent of adoption of improved on-board fish handling practices, improved fish pre-processing practices and improved fish processing practices and to identify strategies to overcome the technological gaps.

Materials and Methods

This study was conducted in the Ernakulam District (Kerala, India). The data were collected at random from the 40 mechanized trawler owners/ partners (on-board fish handling), prawn peeling/fish pre-processing shed owners/partners and fish freezing/fish processing plant owners/partners through interview schedules and questionnaires. Three main stages in post-harvest technology of fish, *viz.*, onboard fish handling (mechanized trawlers), fish pre-processing (prawn peeling/fish pre-processing sheds) and fish processing (fish freezing/fish processing plants) were selected for this study. In each main field, technology practices were identified and selected in consultation with subject matter specialists in fish processing technology. Altogether, 31 post-harvest technology practices constituted by 6 practices in onboard fish handling, 9 practices in fish pre-processing and 16 practices in fish processing were included in the study. Seventeen independent variables were selected for the study. Standard statistical procedures were used for analyses.

Results and Discussion

Extent of technological gap in the adoption of improved on-board fish handling practices

There was 87.50% technological gap in the adoption of use of ice-water slurry whereas the gap was 2.50 % in the adoption of storage of fish in fish boxes or fish holds with ice (Table 1). This might be probably due to the lack of facilities and the practice not needed for storage of fish in fish boxes or fish hold with ice. In respect of ice-water slurry, this might be probably due to the lack of interest and the practice not needed for selected species.

Table 1. Technological gaps in the adoption of improved on-board fish handling practices (in terms of adopters) (n=40)

Improved practices	Non-adopter		Low adopter		Partial adopter	
	No.	%	No.	%	No.	%
Sorting of fish	0	0.00	1	2.50	17	42.50
Washing of fish in sea clean seawater/freshwater	0	0.00	1	2.50	15	37.50
Storage of fish in fish boxes or fish hold with ice	1	2.50	3	7.50	18	45.00
Careful handling of catch	0	0.00	3	7.50	27	67.50
Use of ice fish ratio	0	0.00	2	5.00	27	67.50
Ice-water slurry	35	87.50	0	0.00	1	2.50

Low adopters were 7.50%, 7.50%, 5.00%, 2.50% and 2.50% and partial adopters were 67.50%, 67.50%, 45.00%, 42.50%, 37.50% and 2.50% in the adoption of careful handling of catch, use of ice fish ratio, storage of fish in fish boxes or fish hold with ice, sorting of fish, washing of fish in clean sea/fresh water and ice-water slurry respectively.

Extent of technological gap in the adoption of improved fish pre-processing practices

Technological gaps were 75.00%, 42.50%, 42.50%, 10.00%, 5.00%, 5.00%, 5.00% and 2.50% in the adoption of provision for insulated storage, provision of storage, testing of chlorine level using chloritest paper/other test procedure used, use of potable water for pre-processing of seafoods; chilling of raw materials during pre-processing at every stage; cleaning of tables, utensils, etc.; cleaning of peeling shed floor, and peeling and sorting on peeling tables or raised flat platforms, respectively (Table 2). This might be

probably due to the financial problems, lack of knowledge and facilities, practice not needed and belief in traditional practices.

Table 2. Technological gaps in the adoption of improved fish pre-processing practices (in terms of adopters) (n=40)

Improved practices	Non-adopter		Low adopter		Partial adopter	
	No.	%	No.	%	No.	%
Completely sheltered building for peeling and pre-processing	0	0.00	0	0.00	3	7.50
Peeling and sorting on peeling tables or raised flat platforms	1	2.50	5	12.50	17	42.50
Chilling of raw materials during pre-processing at every stage	2	5.00	9	22.50	6	15.00
Provision for insulated storage	30	75.00	1	2.50	2	5.00
Provision of storage for others	17	42.50	5	12.50	3	7.50
Use of potable water for pre-processing of seafoods	4	10.00	9	22.50	16	40.00
Cleaning of tables, utensils, etc.	2	5.00	1	2.50	29	72.50
Cleaning of peeling shed floor	2	5.00	0	0.00	33	82.50
Testing chlorine level using chloritest paper/other test procedure	17	42.50	2	5.00	5	12.50

Low adopters were 22.50%, 22.50%, 12.50%, 12.50%, 5.00%, 2.50% and 2.50% and partial adopters were 82.50%, 72.50%, 42.50%, 40.00%, 15.00%, 12.50%, 7.50%, 7.50%, and 5.00% in the adoption of provision for insulated storage, provision of storage, testing of chlorine level using chloritest paper/other test procedure used, use of potable water for pre-processing of seafoods; chilling of raw materials during pre-processing at every stage; cleaning of tables, utensils, etc.; cleaning of peeling shed floor, and peeling and sorting on peeling tables or raised flat platforms, respectively.

Extent of technological gap in the adoption of improved fish processing practices

There was technological gaps of 67.5%, 65.00%, 42.50%, 25.00%, 10.00%, 7.50%, 5.00% and 5.00% in the adoption of use of deodorants, use of recommended packing materials for individually quick frozen shrimps (IQF), use of antiseptic ointment, 60 gauge high molecular weight high density polythene film or 60 gauge linear low density polythene for use as

inner wrap for frozen fish/shrimp packaging, use of quick freezers, strapping materials of the master carton (12 mm wide polypropylene straps), glazing (before/after freezing the material) and use of quality assurance systems, respectively (Table 3). This might be probably due to the use of materials which are relatively economical and easily available in the area, emulation of practices adopted by peers and familiarity with the usage of certain types of material.

Low adopters were 27.50%, 17.50%, 15.00%, 7.50%, 7.50%, 2.50%, 2.50%, 2.50%, 2.50%, and 2.50% and partial adopter were 62.50%, 50.00 %, 42.50%, 30.00%, 27.50%, 25.00%, 17.50%, 15.00%, 15.00%, 15.00%, 15.00%, 10.00%, 2.50% and 2.50% in the adoption of use of deodorants, use of recommended packing materials for individually quick frozen shrimps (IQF), use of antiseptic ointment, 60 gauge high molecular weight high density polythene film or 60 gauge linear low density polythene for use as inner wrap for frozen fish/shrimp, use of quick freezers, strapping materials of the master carton, glazing and use of quality assurance systems, respectively.

Factors influencing the adoption of post-harvest technology

The relationship between the selected independent variables and the adoption behaviour of trawler owners/partners, pre-processors and processors was worked out to find out the variables which can influence the improvement of adoption. In the case of trawler owners/partners, all the selected variables did not show any significant relationship (Table 4) indicating that trawler owners/partner did not vary in there socio-economic characteristics and the adoption behaviour of on-board fish handling practices. Change in their socio-economic characteristics is needed to bring about change in their adoption behaviour.

Pre-processors showed a positive and significant relationship between education, number of days employed per year, experience, contact with extension agency, exposure to media and perception of profitability with technology adoption (Table 4). This means that giving training to the pre-processors who are having less education and improving the number of days of employment per year, improving perception of profitability by developing infrastructure, strengthening of extension agency contact and media exposure, offer scope for improving their adoption behaviour.

Adoption behaviour of processors showed positive and significant relationship with several factors (Table 4). Importance of credit facilities is

Table 3. Technological gaps in the adoption of improved fish processing practices (in terms of adopters) (n=40)

Improved practices	Non-adopter		Low adopter		Partial adopter	
	No.	%	No.	%	No.	%
Use of quick freezers	4	10.00	1	2.50	11	27.50
Glazing (before/after freezing the material)	2	5.00	1	2.50	7	17.50
Temperature of cold storage	0	0.00	3	7.50	6	15.00
Use of quality assurance systems	2	5.00	11	27.50	25	62.50
Quantity assessment of the products from the incoming raw materials to the finished products	0	0.00	7	17.50	17	42.50
The assessment of the quality of water and ice used for processing	0	0.00	0	0.00	20	50.00
Use of chloritest paper	0	0.00	0	0.00	4	10.00
Assessment of the sanitary conditions of processing unit	0	0.00	1	2.50	6	15.00
Personal hygiene of workers	0	0.00	3	7.50	6	15.00
Cleaning schedule for utensils, tables, floor, etc.	0	0.00	0	0.00	10	25.00
Use of deodorants	27	67.50	1	2.50	6	15.00
Use of antiseptic ointment	17	42.50	6	15.00	12	30.00
Use of recommended packing materials for individually quick frozen shrimps	26	65.00	0	0.00	0	0.00
Use of recommended packing materials for block frozen shrimps						
i. Strapping materials of master cartons (12 mm width polypropylene straps).	3	7.50	0	0.00	1	2.50
ii. Use of 60 gauge high molecular weight high density polythene film or 60 gauge linear low density polythene as inner wrap for frozen fish/shrimp packaging in replace of the conventional 100 gauge low density polythene film, for block frozen shrimps	10	25.00	1	2.50	1	2.50
iii. Polyester code slip, in replace of the conventional paper code slip	11	27.50	0	0.00	1	2.50
iv. Use of 20-25 kg capacity corrugated fibre board box with a maximum bursting strength of 12 $kg.cm^{-2}$, for frozen shrimp	17	42.50	0	0.00	1	2.50
Use of recommended containers (with polyurethane foam insulation) for transportation	20	50.00	0	0.00	5	12.50
Use of insulated/refrigerated vehicles for transportation	0	0.00	1	2.50	1	2.50

Table 4. Correlation of selected independent variables with adoption behaviour of trawler owners / partners, fish pre-processors and fish processors (n=40)

Trawler owners/partners		Fish pre-processors		Fish processors	
Variables	*r*	Variables	*r*	Variables	*r*
Age	0.2672	Age	-0.1484	Age	-0.2120
Education	0.1140	Education	0.5347**	Education	0.1089
Occupation	0.0403	Number of days employed/year	0.3446*	Occupation	0.0436
Size and type of family	-0.0169	Experience	0.3719*	Number of days employed/year	-0.0698
Debt	0.0954	Size & type of family	-0.1476	Experience	-0.0009
Social participation	-0.0144	Social participation	0.0555	Size & type of family	-0.2626
Crafts ownership	0.1775	Annual income	0.2571	Social Participation	0.1350
Nets ownership	0.2125	Debt	0.2353	Annual income	0.1447
Annual income	-0.0596	House owned	0.0329	Debt	0.3421*
Total investment	0.2195	Extent of land owned	-0.0889	House owned	-0.1687
Number of crew members	0.0238	Sources of information	0.2617	Extent of land owned	-0.0898
Experience	0.1069	Contact with extension agency	0.3345*	Sources of information	0.1849
Fishing days/year	0.0556	Exposure to media	0.3090*	Contact with extension agency	0.0224
Sources of information	-0.0690	Perception of profitability	0.3628*	Exposure to media	-0.0329
Contact with extension agency	-0.0423			Perception of profitability	0.2109
Exposure to media	0.0157				
Perception of profitability	0.0170				

** Significant at 0.01 level of probability; * Significant at 0.05 level of probability

Table 5. Multiple regression of selected independent variables of trawler owners/partners, fish pre-processors and fish processors with their adoption behaviour (n=40)

Trawler owners/partners		Fish pre-processors		Fish processors	
Variables	Partial regression co-efficient	Variables	Partial regression co-efficient	Variables	Partial regression co-efficient
Age	0.0163 (0.605)	Age	0.0652 (-1.321)	Age	0.0564 (-1.198)
Education	0.0082 (0.426)	Education	0.0316 (0.903)	Education	0.1405 (1.981)
Occupation	-0.0001 (0.056)	Number of days employed/year	0.0409 (1.033)	Occupation	0.0049 (-0.345)
Size and type of family	0.0074 (0.406)	Experience	0.1867 (2.396*)	Number of days employed/year	0.1462 (-2.028*)
Debt	-0.0003 (-0.081)	Size & type of family	0.0407 (-1.030)	Experience	0.0918 (1.557)
Social Participation	0.0146 (-0.571)	Social participation	0.0029 (0.271)	Size & type of family	0.0129 (0.560)
Crafts ownership	-0.0001 (-0.58)	Annual income	0.0224 (0.756)	Social Participation	0.0290 (0.847)
Nets ownership	0.0881 (1.458)	Debt	0.0344 (0.944)	Annual income	0.0731 (-1.376)
Annual income	0.0417 (-0.978)	House owned	0.0260 (0.816)	Debt	0.1180 (1.792)
Total investment	0.0062 (0.370)	Extent of land owned	0.0807 (-1.481)	House owned	0.0882 (-1.524)
Number of crew members	0.0022 (-0.220)	Source of information	0.0213 (-0.738)	Extent of land owned	0.0146 (0.595)
Experience	-0.0008 (0.138)	Contact with extension agency	0.0023 (0.241)	Sources of information	0.0170 (0.645)
Fishing days/year	0.0118 (0.512)	Exposure to media	0.0204 (0.722)	Contact with extension agency	0.0476 (-1.095)
Sources of information	0.0252 (-0.754)	Perception of profitability	0.0026 (0.256)	Exposure to media	0.0230 (-0.751)
Contact with extension agency	0.0137 (-0.552)	R^2	0.5642	Perception of profitability	0.0587 (1.224)
Exposure to media	0.0013 (0.172)	F	2.312*	R^2	0.4131
Perception of profitability	-0.0007 (-0.130)			F	1.126^{NS}
R^2	0.2545				
F	0.442 ^{NS}				

Figures in the parenthesis indicate *t*-value; * significant at 0.05 level of probability; NS = not significant

indicated by the positive correlation between debt and adoption. The results of multiple regression (Table 5) confirmed these findings.

Strategies for effective post-harvest technology transfer

Products and required quality standards for the internal market and for exports need to be assessed and based on these, technologies identified by R&D organizations like Central Institute of Fisheries Technology. Developed technologies have to be transferred to the fish processors in order to produce required quantity of the finished product for the targeted market. The requirements of inputs for the fish processors need to be identified and the required technology transferred to fish pre-processors in order to enable them to supply the needed inputs to fish processors. In the same manner, needed input requirements of fish pre-processors should be identified and the same transferred to trawler owners/partners fish pre-processors. The State Government has to regulate the intermediaries in such a way as to avoid price fluctuation in the internal market. These strategies would help to monitor and regulate the post- harvest fishery business in the state.

First author is grateful to the Dr. K. Gopakumar, former Director, CIFT, Cochin, for granting study leave.

References

Anon (2000) *Quality Assurance in Seafood Processing*, Central Institute of Fisheries Technology and Society of Fisheries Technologists (India), Cochin

Balachandran, K.K. (1995) *Fish Processing, Quality Control and Marketing*, MPEDA, Cochin

Chari, S.T. (1994) *Post-harvest Care of Fish, Fish and Fisheries*, Newsletter of the Fisheries Technocrats Forum, Madras

Gopakumar, K. (1996) *Seafood Expert J.* **97**, 7

Iyer, T.S.G (1979) in *Quality Control in Fish Processing*, CIFT, Cochin

Jegadees, K. (1988) *Seafood Expert J.* **20**, 9

Joseph, A.C. (1979) in *Quality Control in Fish Processing*, CIFT, Cochin

Kandoran, M.K., Balasubramaniam, S., Mary Thomas, Thiagarjan, R. and Nair, A.K.K. (1993) *Fish. Technol.* **30**, 147

Kandoran, M.K. and Thomas, M. (1997) *Technologies Developed at CIFT*, Special Bulletin-11, Cochin

Kaul, P.N., Iyer, H.K. and Kandoran, M.K. (1989) *Fish. Technol.* **26**, 62

Mathan, C. (1979) in *Quality Control in Fish Processing*, CIFT, Cochin

Thomas, F. (1979) in *Quality Control in Fish Processing*, CIFT, Cochin