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Note

Analysis of innovation adoption decision process among the mechanised fishing boat operators at selected fishing harbours in India

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ABSTRACT

The study was conducted among the large mechanised wooden trawl boat operators involved in marine fishing in three selected major fishing harbours of the country *viz.,* Visakhapatnam in Andhra Pradesh, Thoothukudi in Tamil Nadu and Veraval in Gujarat. The socio-economic and psychological characteristics of fishermen were assessed. The overall innovation decision efficiency index (IDEI) score was 55.25%. The findings on centre-wise and technology-wise IDEI scores are also discussed. The respondents from the three fishing centres differed significantly ($p<0.05$) in their innovation decision behaviour pertaining to adoption of the technologies *viz.,* FRP sheathing for fishing vessels, marine anticorrosive painting, marine antifouling painting, turtle excluder device (TED), square mesh codend and use of adequate ice onboard. The regression coefficients of four variables *viz.,* investment on fishing craft and gears, innovativeness, training undergone and extent of linkage with research and extension systems significantly and positively influenced the innovation decision process ($p<0.05$). The R^2 value was found to be 0.838, indicating that the 17 characteristics taken together accounted to 83.80% of variations in the innovation decision efficiency level. The constraints in the innovation adoption decision process pertaining to the identified technologies were also documented.

Keywords: Client System, Confirmation, Innovation adoption decision process, Implementation, Knowledge, Marine Fisheries, Mechanised trawlers, Persuasion

Technologies have enabled bringing in positive changes in fisheries and the benefits include increase in catch, preservation and processing methods, infrastructure development, increased export, sustainability concern, communication and mobility, education and training facilities, development schemes and employment opportunities. Vested with the responsibility of devising suitable technologies for the scientific exploitation and utilisation of the vast fishery resources of India, the Central Institute of Fisheries Technology (CIFT), Kochi transferred several of its innovations, such as designs of various sizes of mechanised boats, alternative boat building materials such as fibre reinforced plastic (FRP), steel, aluminum and rubber wood, effective maintenance methods for wooden fishing boats, improved fishing gear designs on trawls, gillnets, purse seines, lines, and traps, fabrication of fishing nets with netting materials such as polyethylene, nylon (polyamide) and polypropylene, and proper engine maintenance, to various categories of clients over the years. The technology utilisation component encompasses the various categories of fishers such as artisanal, motorised and mechanised fishermen, fisherwomen, pre-processors and processors.

If the technologies developed and disseminated are need-based, location-specific and compatible with the resource base of the clients, widespread and successful adoption is ensured. If there is lack of adoption of technologies generated, the public expenditure on several research and development activities for fisheries will not yield fruitful returns. Hence, it is expedient in the national interest, to take up studies on these issues. Eklund (1985) indicated that adoption of new technology in agriculture remained lower than expected due to insufficiencies in conduct of research and lack of support services. Timing of adoption may vary among the clientele, reflecting, capital, availability of inputs and availability of infrastructural facilities. Various studies (Ryan and Gross, 1953; Patel *et al.,* 1991; Sunding and Zilberman, 2000; Reddy, 2003) have provided ample evidence to establish that the innovation adoption decisions are made in stages, and not all the clients are passing through all the stages of innovation adoption decision process. When a new technology is available, decision makers continuously evaluate whether or not to adopt; when the discounted expected benefits of adoption are greater than the cost, the technology will be adopted. In this context, the present study was undertaken with the aim to examine the efficiency of innovation adoption decision process among mechanised fishing boat operators, to analyse the relationship of socio-personal characteristics with their innovation adoption decision efficiencies and to document the constraints in the decision process.

Ex-post-facto research design was employed for the study. The study covered three major fishing harbours of the country *viz.,* Visakhapatnam in Andhra Pradesh and Thoothukudi in Tamil Nadu along the east coast and Veraval in Gujarat along the west coast, to get a good representation of the marine fisheries sector in the country. Large mechanised wooden trawl boat (above 40 ft overall length, O_{AL}) operators involved in marine fishing were included for the study, since most of the technologies selected for the study are pertaining to this category of vessels. Using multi-stage simple random sampling procedure, a proportionate representative sample of 34 (Visakhapatnam), 36 (Thoothukudi) and 42 (Veraval) mechanised fishing vessel operators from the three fishing centres were selected.

For this study, the innovation decision adoption process was conceptualised as the process in which a mechanised wooden fishing boat operator passes through knowledge, persuasion, decision, implementation and confirmation stages in adopting the selected innovations in marine fisheries. Totally, 11 technologies were identified for the study after discussions with subject matter specialists and based on published informations. The technologies selected were: fibre re-inforced plastic (FRP) sheathing for fishing vessels, marine anticorrosive painting, marine antifouling painting, V-form otter boards, large mesh trawl, turtle excluder device (TED), square mesh codend, use of appropriate horse power (HP) engine, boat design used (size/material), trawl designs used (size/type) and use of adequate ice onboard. The operationlisation and measurement procedure developed by Reddy (2003) was adopted with suitable modifications for studying the innovation decision process. The innovation decision efficiency index (IDEI) of a respondent was calculated for each of the eleven technologies as shown below:

$$\text{IDEI} = \frac{\text{Total score of an individual for passing through the five stages}}{\text{Maximum score } (i.e., 5)} \times 100$$

This would give an idea about the efficiency of adoption decision behaviour of a respondent for a particular innovation. This measurement procedure was followed for all the 11 innovations. The mean of 11 indices was also calculated for a respondent to know about the overall IDEI of all the 11 innovations. Structured and pre-tested interview schedules were used for data collection from the respondents. Standard statistical tools (SPSS) were used for analysing the data.

The socio-personal and psychological characteristics of the mechanised fishing boat operators are presented in Table 1, from which it is evident that the overall mean

Table 1. Socio-personal profile of mechanised fishing boat operators

Variables	Overall (n= 112)		Visakhapatnam (n=34)		Thoothukudi (n=36)		Veraval (n=42)		'F' value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Age (Years)	44.43	5.99	46.88	7.97	46.78	4.65	39.62	5.35	18.474*
Educational qualification (Scores)	4.03	1.01	3.65	1.12	4.08	0.91	4.36	1.01	4.626
Family type (Scores)	1.57	0.38	1.38	0.49	1.36	0.49	1.98	0.15	30.250*
Family size (No. of family members)	7.62	2.32	6.21	1.51	5.67	1.39	10.98	4.07	44.651**
Occupation (Scores)	1.94	0.19	2.00	0.00	1.86	0.35	1.95	0.22	3.091
Investment on fishing craft and gears (₹ in Lakhs)	16.28	3.20	16.10	2.04	17.46	5.30	15.27	2.26	3.818*
Experience in the field (Years)	22.41	6.49	25.94	7.92	24.11	6.74	17.17	4.81	19.729**
Number of fishing days in a year	202.96	13.92	202.35	12.26	195.69	12.37	210.83	17.14	10.955*
Average annual family income (₹ in '000)	303.34	233.22	106.03	23.28	80.67	21.84	723.33	654.53	32.334**
Average annual expenses on repair or maintenance of fishing craft and gears (₹ in '000)	135.11	39.86	73.09	17.10	124.86	22.41	207.38	80.07	65.974**
Innovativeness (Index in %)	73.68	11.33	66.67	0.00	80.56	16.67	73.81	17.32	8.346
Economic motivation (Index in %)	79.98	6.64	77.35	5.37	82.59	8.51	80.00	6.03	5.260
Social participation (Index in %)	18.42	5.17	19.85	6.49	13.19	5.03	22.22	3.98	30.878**
Extension participation (Index in %)	17.12	8.53	38.56	12.97	3.55	3.55	9.26	9.07	144.201**
Training undergone (Scores)	0.37	0.52	0.91	1.14	0.00	0.00	0.21	0.42	17.407**
Communication behaviour (Index in %)	64.59	7.66	71.19	4.24	66.10	6.77	56.47	11.98	28.976**
Extent of linkage (Index in %)	42.82	7.49	47.21	4.80	38.75	4.69	42.50	12.98	8.094**

(** Significant at $p<0.01$; * Significant at $p<0.05$)

age of the respondents was 44.43 years. Majority of the mechanised fishing boat operators were educated up to high school level. The declining trend in joint family system was observed in the case of fishermen communities in the study areas, except in Veraval. The mean family size was 7.62 and the mean investment on fishing craft and gears was ₹16.28 lakhs. The investment was mainly for the fishing boat (1 no.), fishing nets (8 to 10), engine (1 no. with 68-240 HP) and for the electronic instruments used in the fishing vessels such as, geographical positioning system (GPS), echosounder and wireless transmitter. The average experience of the clientele in fishing was 22.41 years. The average number of fishing days in a year was 202.96. Out of 365 days in a year, fishermen were spending only 202 days in fishing, which might be due to the facts *viz*., the mandatory seasonal fishing ban of 45 days enforced by the state departments, rough seas, climatic factors, availability of resources, lay-offs during festive seasons, frequent repair or maintenance works and the ever-increasing operational expenditure limiting their days of fishing. This is in accordance with the findings of earlier studies (Balasubramaniam *et al.,* 2000; Unnithan *et al.,* 2004) which reported 187 to 210 fishing days per year among the mechanised boat operators.

The mean annual family income of the respondents was ₹ 3.03 lakhs. The average annual expenditure on repair and maintenance of fishing craft and gears was estimated as ₹1.35 lakhs which appears to be ever increasing due to the frequent repair of engine, high costs of spare parts, damage caused to the hull of vessels and loss or damage of nets during trawling due to rocky bottom. The facilities for repair and maintenance works or availability of boat yards were found to be very limited. The mean index scores (index in %) on the variables *viz.,* innovativeness, economic motivation, social participation, extension participation, communication behaviour and extent of linkage with research and extension system were 73.68, 79.98, 18.42, 17.12, 64.59 and 42.82% respectively. The respondents in the three locations differed highly significantly ($p<0.01$) with reference to the variables *viz.,* family size, experience, average annual family income, average annual expenses on repair/maintenance of fishing craft and gears, social participation, extension participation, training undergone, communication behaviour and extent of linkage.

The overall and technology-wise IDEI scores on passing through the five stages of innovation decision process *viz.,* knowledge, persuasion, decision, implementation and confirmation are given in Table 2.

The overall IDEI score was 55.25% and technology-wise IDEI scores were more than 70% for technologies *viz.,* marine antifouling painting (82.18%), large mesh trawl (70.65%), use of appropriate HP engine (76.78%),

Table 2. Innovation decision efficiency index (IDEI) scores of mechanised fishing boat operators

Cetnres	Innovation decision stages	Innovations #											
		1	2	3	4	5	6	7	8	9	10	11	Overall
Visakhapatnam (n=34)	Knowledge	90.20	81.37	87.25	82.35	81.37	65.69	70.59	89.22	84.31	85.29	86.27	81.45
	Persuasion	87.25	68.63	83.33	66.67	78.43	0.00	38.24	86.27	82.35	70.59	85.29	63.24
	Decision	79.41	2.94	77.45	9.80	74.51	0.00	32.35	80.39	67.65	69.61	84.31	48.20
	Implementation	75.00	0.00	70.59	0.00	64.71	0.00	3.92	72.06	63.24	67.65	76.47	41.30
	Confirmation	67.65	0.00	67.65	0.00	50.98	0.00	2.94	55.88	54.90	63.73	71.57	36.19
	IDEI	80.25	32.77	77.73	34.03	70.38	14.08	31.51	77.10	71.01	71.64	81.09	54.08
Thoothukudi (n=36)	Knowledge	85.19	87.96	92.59	75.00	79.63	30.56	81.48	87.96	81.48	85.19	97.22	80.02
	Persuasion	81.48	14.81	92.59	63.89	74.07	0.00	37.96	83.33	72.22	83.33	94.44	57.87
	Decision	74.07	0.00	87.04	10.19	64.81	0.00	30.56	81.48	68.52	79.63	93.52	49.00
	Implementation	69.44	0.00	70.83	0.00	61.11	0.00	3.70	76.39	66.67	76.39	83.33	42.94
	Confirmation	68.52	0.00	67.59	0.00	54.63	0.00	2.78	62.96	62.96	62.96	72.22	37.81
	IDEI	76.19	22.02	82.94	31.94	67.26	6.55	33.33	78.57	70.24	77.58	88.49	53.53
Veraval (n=42)	Knowledge	95.24	93.65	97.62	80.95	89.68	83.33	85.71	91.27	88.89	86.51	90.48	87.57
	Persuasion	18.25	88.89	96.03	59.52	80.95	13.49	7.14	90.48	83.33	84.92	88.10	59.99
	Decision	15.87	88.10	92.06	4.76	79.37	6.35	3.97	87.30	78.57	80.95	85.71	52.84
	Implementation	0.00	66.67	71.43	2.38	60.71	0.00	0.00	52.38	70.24	70.24	82.54	50.64
	Confirmation	0.00	47.62	67.46	0.79	56.35	0.00	0.00	44.44	53.17	62.70	73.02	39.67
	IDEI	27.72	77.72	85.88	31.63	74.32	22.11	20.75	74.66	75.17	77.55	83.67	58.14
Overall IDEI (n=112)		61.39	44.17	82.18	32.53	70.65	14.25	28.53	76.78	72.14	75.59	84.42	55.25
'F' Test		212.94**	445.02**	7.53*	1.27	2.03	34.15**	8.16*	1.90	2.40	3.10	6.09*	1.83

(** Significant at $p<0.01$; * Significant at $p<0.05$)

1 - FRP sheathing for fishing vessels; 2 - Marine anticorrosive painting; 3 - Marine antifouling painting; 4 - V-form otter boards; 5 - Large mesh trawl; 6 - Turtle excluder device; 7 - Square mesh codend; 8 - Use of appropriate HP engine; 9 - Boat design used (size/ material); 10 - Trawl designs used (size/ type); 11 - Use of adequate ice onboard

boat design used (size/material) (72.14%), trawl designs used (size/type) (75.59%) and use of adequate ice onboard (84.42%). The indices were moderate pertaining to the technologies *viz.,* FRP sheathing for fishing vessels (61.39%) and application of marine anticorrosive painting (44.17%). The overall IDEI scores were poor with reference to the use of V-form otter boards (32.53%), TED (14.25%) and square mesh codend (28.53%). The respondents from the three fishing centres differed significantly ($p<0.05$) in their innovation decision behaviour pertaining to the technologies *viz.,* FRP sheathing for fishing vessels, marine anticorrosive painting, marine antifouling painting, TED, square mesh cod end and use of adequate ice onboard.

In the case of the respondents from Visakhapatnam, the IDEI score was 54.08%. The index scores on passing through the five stages of innovation decision process *viz.,* knowledge, persuasion, decision, implementation and confirmation were 81.45, 63.24, 48.20, 41.30 and 36.19% respectively. The results indicated that a vast majority of them (81.45%) had knowledge about all the 11 technologies and only a smaller proportion of 18.55% skipped this stage. Out of the 34 respondents, 63.24% of them passed through persuasion stage and the remaining skipped it. This might be possibly due to the periodical extension efforts, relatively better educational status of the clientele and their vast experience in the field. The technology-wise IDEI scores were more than 70% for technologies *viz.,* FRP sheathing for fishing vessels (80.25%), marine antifouling painting (77.73%), large mesh trawl (70.38%), use of appropriate HP engine (77.10%), boat design used (size/material) (71.01%), trawl designs used (size/type) (71.64%) and use of adequate ice onboard (81.09%). The indices were poor for technologies *viz.,* application of marine anticorrosive painting (32.77%), use of V-form otter boards (34.03%), TED (14.08%) and square mesh codend (31.51%).

In case of the respondents from Thoothukudi, the overall IDEI score was 53.53%. The index scores on passing through the five stages of innovation decision process *viz.,* knowledge, persuasion, decision, implementation and confirmation were 80.02, 57.87, 49.00, 42.94 and 37.81% respectively. The results indicated that 80% possessed knowledge about all the 11 fishing technologies and only 20% skipped this stage. The technology-wise IDEI scores were more than 70% for technologies *viz.,* FRP sheathing for fishing vessels (76.19%), marine antifouling painting (82.94%), use of appropriate HP engine (78.57%), boat design used (size/material) (70.24%), trawl designs used (size/type) (77.58%) and use of adequate ice onboard (88.49%). The index was moderate with reference to the use of large mesh trawl (67.26%). The indices were poor for the technologies *viz.,* application of marine anticorrosive painting (22.02%), use of V-form otter boards (31.94%), TED (6.55%) and square mesh codend (33.33%).

In case of the respondents from Veraval, the overall IDEI score was 58.14%. The index scores on passing through the 5 stages of innovation decision process *viz.,* knowledge, persuasion, decision, implementation and confirmation were 87.57, 59.99, 52.84, 50.64 and 39.67% respectively. Nearly 90% of them possessed knowledge about all the 11 fishing technologies and only a smaller proportion skipped this stage. Out of the 42 respondents, nearly 60% passed through persuasion stage and the remaining skipped it. Almost an equal percentage passed through decision and implementation stages, and out of which, only 40% passed through confirmation stage. The technology-wise IDEI scores were more than 70% for the technologies *viz.,* application of marine anticorrosive painting (77.72%), marine antifouling painting (85.88%), large mesh trawl (74.32%), use of appropriate HP engine (74.66%), boat design used (size/material) (75.17%), trawl designs used (size/ type) (77.55%) and use of adequate ice onboard (83.67%). The indices were poor pertaining to the technologies *viz.,* FRP sheathing for fishing vessels (27.72%), use of V-form otter boards (31.63%), TED (22.11%) and square mesh codend (20.75%).

The technology-wise IDEI scores revealed that the innovation adoption decision process was efficient pertaining to the technologies which were directly related to increasing production, labour efficiency, fuel efficiency, reducing the operational expenditure and increasing the income. Whereas in case of the technologies pertaining to the conservation of resources in the interest of sustainability parameters and environmental impact, the IDEI scores were relatively lower. From the above findings, it could be understood that the clientele group required more information regarding the practicability, feasibility and the cost-benefit ratio of technologies, in evaluating the technologies in their innovation adoption decision behaviour. The extension agencies have vital roles to play, to bridge the gap to pass through the different stages. At persuasion stage, the clientele could be motivated to form a favourable attitude towards the innovation, as they are more psychologically involved with the innovation. For passing through the decision, implementation and confirmation stages, the change agents can provide opportunities to the clientele, to witness the advantages of the innovation, to ensure the availability of technological inputs and resources, to put the innovation into practice, and to see that the clientele are not exposed to any conflicting message about the innovation.

In order to find out the degree of relationship between the socio-personal characteristics of clientele and IDEI, simple correlation coefficients were worked out. To determine the strength of various characteristics influencing the IDEI, the data were subjected to multiple regression analysis. Out of the 17 variables, investment on fishing craft and gears, innovativeness, economic motivation, training undergone and extent of linkage with research and extension system showed positive and significant relationship ($p<0.05$) (Table 3). This indicate that when these scores on the above independent variables improve, the innovation adoption decision process could be more efficient and *vice-versa*. Further, the variable, age had significant negative relationship, from which it could be concluded that the innovation adoption decision efficiency declines, as age increases. Out of the 17 variables, the regression coefficients of four variables *viz.,* investment on fishing craft and gears, innovativeness, training undergone and extent of linkage with research and extension system were significantly and positively influencing the efficiency in innovation decision process ($p<0.05$). The R^2 value was found to be 0.838, indicating that the 17 characteristics taken together accounted to 83.80% of variations in the innovation adoption decision efficiency level. The 'F' value was found to be highly significant ($p<0.05$). Earlier studies (Sheoran, 1987; Amara *et a.l,* 1999) also revealed that the variables *viz.,* education, number of days employed per year, contact with extension agency, exposure to media, perception about profitability, ownership pattern, perceived attributes of innovation type of innovation decision, communication channels and extent of change agents' promotional efforts are some of the significant variables that positively influence the innovation adoption decision process.

Lack of training, lack of access to research and extension system, lack of information on technologies, increasing cost of inputs or spare parts, lack of financial resources, increasing operational expenditure, lack of infrastructural facilities, non-availability of inputs or resources and diminishing resources were perceived as constraints in the innovation adoption decision process pertaining to most of the identified technologies.

From the preceding discussions, it could be observed that governmental initiatives to ensure the timely and adequate supply of technological inputs could improve the adoption of recent technologies. Periodical training/ field level demonstrations organised at the convenience of the fishermen might improve the innovation adoption decision behaviour. Providing adequate opportunities for the clientele to interact with researchers and extension personnel through participation in workshops, seminars, field days and brain storming sessions can increase the access of the clientele to the technological information. Technology refinement based on feedback from the clientele can improve the adaptability of developed technologies to suit the resource-base of the clients. Considering the ever-increasing diesel prices, adequate diesel subsidy can be provided. An attempt has to be made

Table 3. Correlation and regression analyses between the socio-personal variables and innovation decision efficiency index (IDEI)

Variables	Visakhapatnam (n=34)		Thoothukudi (n=36)		Veraval (n=42)		Overall (n=112)	
	Correlation coefficients (r)	Regression coefficients (b)	Correlation coefficients (r)	Regression coefficients (b)	Correlation coefficients (r)	Regression coefficients (b)	Correlation coefficients (r)	Regression coefficients (b)
Age	0.079	0.342	-0.257*	0.197	-0.263*	0.467	-0.186*	0.353
Educational status	-0.203	0.181	0.434*	1.504*	0.213*	1.297*	0.036	0.055
Family type	-0.017	0.833	0.111	0.116	0.061	0.009	0.129	0.049
Family size	0.068	0.934	0.250	0.045	-0.039	0.066	0.110	0.038
Occupational status	0.000	0.000	0.029	0.279	0.044	0.031	0.040	0.047
Investment on fishing craft and gears	0.240*	1.326*	0.273*	0.620	0.119	0.369	0.217*	0.990*
Experience in the field	0.013	0.497	0.183	0.307	-0.121	0.018	-0.104	0.307
Number of fishing days in a year	0.070	0.345	0.045	0.161	-0.122	0.208	0.002	0.068
Average annual family income	0.171	0.154	-0.118	0.168	0.015	0.130	0.121	0.006
Average annual repair or maintenance expenses	0.057	0.128	-0.197	0.651	0.048	0.153	0.143	0.247
Innovativeness	0.000	0.000	0.110	0.149	0.129	0.181	0.292*	1.035*
Economic motivation	0.218*	0.300	0.087	0.238	0.196	0.043	0.212*	0.098
Social participation	0.089	0.574	0.107	0.054	0.181	0.160	0.169	0.130
Extension participation	0.127	0.240	0.076	0.063	0.100	0.342	-0.001	0.034
Training undergone	-0.010	0.032	0.000	0.000	0.178	0.139	0.237*	1.048*
Communication behaviour	0.274*	1.149*	-0.063	0.608	0.134	0.078	-0.011	0.166
Extent of linkage	-0.056	0.200	0.054	0.171	0.236*	0.950*	0.232*	1.521*
	(R^2 = 0.488; F = 0.375)		(R^2 = 0.693; F = 1.095*)		(R^2 = 0.513; F =0.504)		(R^2 = 0.838; F = 2.713**)	

(** Significant at $p<0.01$; * Significant at $p<0.05$)

to find out an alternate fuel such as liquefied petroleum gas (LPG) /bio-fuels, *in lieu* of diesel for fishing vessels. Governmental initiatives to strengthen the infrastructural facilities at the fishing harbours and boat building yards can improve the support services for the sector.

The innovations have varied attributes such as profitability, initial investment, complexity, local compatibility, direct and indirect impact, availability of inputs, and other relative advantages of adoption. Hence, target based appropriate technologies have to be selected for wider adoption and popularisation, and on such technologies, the extension efforts will be more useful. By analysing the innovation adoption decision process on the selected fishing technologies, we can track the percolation of technologies passing through different stages of the decision process. Once the stage(s) where the innovation adoption decision has ceased is identified, appropriate follow up measures could be taken up to make it sail smoothly to the confirmation stage. This would help to develop a conceptual methodology to suggest improvements in the innovation adoption decision process.

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References

Amara Tarore, N., Landry, R. and Romain, R. 1999. Technical efficiency and farmers' attitudes toward technological innovation: The case of the potato farmers in Quebec. *Canadian J. Agri. Econ.*, 47: 3-43.

Balasubramaniam, S., Pravin, P., Sreevalsan, J. M. and Brajmohan 2000. Adoption of improved practices and annual fish catches among mechanised boat owners. *Fishery Technol.,* 37(2): 137-143.

Eklund, P. 1985. Technology development and adoption rate: systems approach for agricultural research and extension. *Agricultural Research Management Abstract*, 1(1): 47.

Patel, P. P., Sangle, S. K. and Kulkarni, R. R. 1991. Innovation decision process in relation to cotton hybrid NHH-44, *Maharashtra J. Extn. Edu.*, 10(2): 97-103.

Reddy, T. S. P. 2003. *Differential innovation decision and attitude of rice growing farmers towards eco-friendly technologies in Andhra Pradesh - a critical analysis*. Ph.D. Thesis, Acharya N. G. Ranga Agrucultural University, Hyderabad, Andhara Pradesh, India.

Ryan, B. and Gross 1953. The diffusion of hybrid seed corn in Iowa Communities. *Rural Sociology*, 8: 18-19.

Sheoran, V. K. 1987. *A study on adoption level of dairy innovations in relation to milk yield among beneficiaries of IRDP in Karnal District, Haryana*. M. Sc. Thesis, Kurukshetra University, Kurukshetra, Haryana, India

Sunding, David and Zilberman, David. 2000. *The Agricultural innovation process: research and technology adoption in a changing agricultural sector. Choices (Fourth Quarter)*. http://ideas.repec.org/e/psu157.html.

Unnithan, G. R., Nikita Gopal and Radhakrishnan Nair, V. 2004. Economics of operation of 18 m fuel efficient steel trawlers of CIFT design. *Fishery Technol.,* 41(1): 71-76.

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