AGRICULTURAL TECHNOLOGY AND INFORMATION MANAGEMENT SYSTEM IN INDIA

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Abstract

Technology Transfer, in order to be effective, must be preceeded and succeeded by technology assessment and refinement. How reliable has the assessment and refinement can be judged by the effectiveness of transfer of a given technology. Therefore, technology assessment and technology transfer are complementary to each other. The importance of what happens prior to the beginning of a technology's diffusion is important. The problem particularly related to the technology and information management by and between research, extension and client systems remains to be understood. 57 Researchers, 81 Extensionists and 60 farmers were selected randomly from the Southern Telangana Region state of Andhra Pradesh. Appropriate inventories to measure the Agricultural Technology Management and Information management behavior and Independent variable. Data were collected by structured and pre tested instruments. Technology management behavior of researchers indicated that majority were in medium (61.40%) category followed by low (21.05%) and high (17.55%) categories. The ranking of phase wise performance of technology management behavior shown that, technology generation phase occupied first rank followed by identifying a research problem transfer of technology, consequences, utilization, commercialization, refinement, feedback and assessment. Majority of the extensionists were observed to be in the medium (59.26%) category of information management behavior and the rest of them were distributed into low (20.99%) and high (19.75%) categories. Phase wise performance of information management behavior of extensionists revealed that the respondents had concentrated much on identifying the needed technology by information processing, dissemination, information collection feedback and utilization. Majority of the farmers belonged to medium (68.34%) category of information management behavior followed by low (16.66%) and high (15%) category. Ranking of phase wise information management behavior indicated that farmers gave much importance to identifying the needed information, followed by dissemination, utilization, consequences, processing, getting information and feedback. The prediction analysis revealed that researcher – farmer – interaction was found to be significantly contributed towards technology management behavior of researchers. The age factor was found to be negatively significant, whereas information management orientation was found to be positively significant with information management behavior of extensionists. Innovativeness explained positively significant variation with information management behavior of farmers.

Introduction

Effective technology development and transfer depends on an interactive holistic system, that Roling (1988) calls the Agricultural Technology Management system. The system includes a research subsystem, a dissemination subsystem, and a user subsystem. The Agricultural Technology Management System analyses, in terms of who contributes which kind of technology and information to decision making in agriculture and what are the relationships between different individual in this system. Studying the system is useful in order to be able to manage the Agricultural Technology and Information Management System in such a way that it contributes as much as possible to generation, dissemination, transformation, utilization, storage and retrieval of technology and information which is useful for agricultural development.

The basic assumption in studying the Agricultural Technology and Information Management System is that information relevant for decision making is generated by different individuals and reaches farmers in different ways, but, often to solve a problem, research findings from different disciplines discovered by researchers at different institutions is not being synthesized, but the farmer, who make decision, has important information about resources, abilities, willingness to bear risks, the quality of his land, the labor requirements on his experience.

Objectives

1. To study the Agricultural Technology Management behavior (AIMB) of Researchers and Agricultural Information Management behavior (AIMB) of Extensionists and Farmers.
2. To analyze the factors predicting the Technology and Information Management behavior.

Methods

An "ex-post-facto" research design was used for the study conducted in the state of Andhra Pradesh wherein all the major agricultural research centers of the country are located in the state, that too in the Southern Telangana agro-climatic zone. The maximum number of research projects / schemes of the State Agricultural University are in operation in this zone. Hence the State and zone were selected purposively. All the five districts (Mahaboobnagar, Nalgonda, Ranga Reddy, Warangal and Medak) covered in the zone were selected. All the National and State Agricultural University research organizations located in the zone were included. All the researchers of these research stations who possessed a minimum of five years experience were listed out and sent questionnaires, out of which 57 numbers scrutinized in accordance with the research study objectives were selected. Similarly all the major categories of extensionists who are directly involved in managing the agricultural information of State Department of Agriculture and Horticulture were listed. Out of which 81 respondents whose questionnaires were in accordance with the research study were selected. 60 farmers, 12 from each of the five selected villages of the five districts were taken as sample.

Agricultural Technology and Information Management System (ATIMS) is operationalized as a set of agricultural organizations and / or persons, the links, interactions between them, engaged in such process as the generation, transformation, transmission, storage, retrieval, integration, diffusion and utilization of technology / information, with the purpose of working synergically to support decision making and problem solving in agriculture. Agricultural Technology Management (ATM) is a process of all of the decisions, activities and their impacts that occur from identifying a research problem through research for generation of technology and to carryout its assessment, refinement and commercialization through

dissemination and to take care of its consequences by obtaining feedback for its proper utilization. Agricultural Information Management (AIM) is a process of identifying and collecting information on agricultural technologies of origin, storing, updating, retrieve it whenever necessary, process, manipulate, and then disseminate the processed information to various users at the time they can most efficiently use it and obtain its feedback.

Extensive review of literature management behavior was carried out. Discussions with the experts in management, agricultural extension, and researchers helped the investigator to list out the phases of technology management of researchers and information management of extensionists and farmers. Likewise listing of stages along with items in each stage of technology management behavior of researchers, information management behavior of extensionists and farmers were also carried out. The items in each stage identified were subjected to editing as suggested by Edwards (1957). The set of edited items related to ATMB were administered to 30 researchers selected from International Crops Research Institute for Semi Arid Tropics (ICRISAT), Central Research Institute for Dryland Agriculture (CRIDA), Directorate of Rice Research (DRR), Directorate of Oilseeds Research (DOR) and from Acharya N.G. Ranga Agricultural University (ANGRAU), Hyderabad.

Similarly, the set of edited items on AIMB was given to 30 extensionists and 30 farmers and were requested to rate the relevancy of the items on a four point response continuum viz., "most relevant", "relevant", "least relevant", and "not relevant". The scoring pattern adopted was more relevant –3, relevant –2, least relevant –1 and zero for the not relevant response. All those items in each stage which were rated as not relevant by 90 percent and above in the three categories were deleted and only the items were either rated as "most relevant", "relevant", "least relevant" were considered for further analysis.

The procedure adopted for selection of items in stages was weighted mean method. Master code sheet was prepared separately for items in each stage for researchers, extensionists and farmers, incorporating frequency of the respondents in each response category. Means were worked out for each item in the stage separately for the three groups of respondents. Like wise weighted means were also worked out separately for items in the stages for all the three groups of respondents. Those items where the mean was equal to or more than the weighted mean were selected separately for researchers, extensionists and farmers. Content validity was established with the help of editing of statements based on Edwards (1957) criteria and later on with the help of experts opinion on refinement and selection of needs, phases and items in each phase of all the inventories for three groups of respondents. The respective inventories were administered twice to 30 researchers, 30 extensionists, and 30 farmers drawn from non-sampled area at an interval of 7 days. Test-retest method of reliability coefficient calculated 0.379, 0.683 and 0.721 for researchers, extensionists and farmers respectively implied the instruments were reliable. The respondents were grouped into three categories (Low, Medium and High) by using the response scores of respondents and applying mean and one standard deviation method. Suitable measurements were determined to quantify the independent variables. The data were collected from the researchers and extensionists with structured and pre-tested questionnaire, while the data from the farmers were collected with structured and pre-tested schedule by adopting personal interview method. Thus the collected data were analyzed by using mean, standard deviation, frequency, percentages, correlation coefficient and multiple linear regression.

Results

Agricultural Technology Management behavior of researchers

The results of the Table 1 indicated that a large section of respondents on technology management behavior were in medium (61.40%) category followed by low (21.05%) and high (17.55%) categories.

Table 1. Distribution of the researchers based on their agricultural technology management behavior (n=57).

S.No.	Category	Respondents	
		Frequency	**Percentage**
1.	Low	12	21.05
2.	Medium	35	61.40
3.	High	10	17.55
	Total	**57**	**100.00**

Mean = 263.58 SD = 49.07

As revealed in Table 2 majority of the respondents in identifying their research problem fell under medium (77.20%) category followed by low (15.79%) and high (7.01%) categories.

Similarly, majority of the respondents belonged to medium (70.18%) category followed by high (15.79%) and low (14.04%) category in their technology generation.

Further it is clear from the table that majority of the respondents were observed under medium (49.12%) category while 31.58 and 19.30 percent were distributed into low and high categories respectively in assessing their technologies. As far as refinement of the technologies is concerned majority of them were in medium (59.65%) category followed by low (28.07%) and high (12.28%) categories. Regarding commercializing the developed technologies, more percentage of respondents were in medium (42.11%) category followed by low (35.09%) and high (22.80%) category. Similarly, majority of them were observed in medium (52.63%) category and 24.50 percent and 22.81 percent were in high and low categories respectively in transferring their technologies.

It is evident that majority of the respondents were in medium (59.65%) category followed by low (26.32%) and high (14.03%) category in observing the consequences of their technologies. Similar trend was also noticed in the case of feedback where more than half (54.39%) of them were in medium category while 24.56 per cent and 21.05 per cent were in low and high categories respectively.

With regard to utilization of technologies, nearly three fourth (73.68%) of the researchers were in medium category and remaining were distributed into high and low categories with 14.04 per cent and 12.28 per cent respectively.

Ranking of phase wise agriculture technology management behavior of researchers is given in Table 3 indicated that technology generation phase was ranked first by the researchers followed by identifying a research problem, transfer of technology, consequences, utilization, commercialization, refinement, feedback and assessment.

Table 2. Distribution of the researchers based on phases of agricultural technology management behavior.

		Phases of Technology management behavior																	
Sl.	Category	Identifying research need		Technology generation		Technology assessment		Technology refinement		Technology Commercial		Technology transfer		Consequences		Feedback		Utilization	
		F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
1.	Low	9	15.79	8	14.04	18	31.58	16	28.07	20	35.09	13	22.81	15	26.32	14	24.56	7	12.28
2.	Medium	44	77.20	40	70.18	28	49.12	34	59.65	24	42.11	30	52.63	34	59.65	31	54.39	42	73.68
3.	High	4	7.01	9	15.79	11	19.30	7	12.28	13	22.80	14	24.56	8	14.03	12	21.05	8	14.04
	Total:-	57	100.00	57	100.00	57	100.00	57	100.00	57	100.00	57	100.00	57	100.00	57	100.00	57	100.00
	Mean	42.60		47.18		27.75		26.18		15.28		32.96		19.39		33.32		19.28	
	SD	4.44		13.15		10.50		8.88		6.32		9.98		4.78		7.62		3.80	

Table 3. Ranking of phase wise agricultural technology management behavior of researchers (n=57).

Sl.No.	Phases of Technology management behavior	Percentage performance	Rank
1.	Identifying a Research problem	78.82	II
2.	Technology generation	87.40	I
3.	Technology assessment	51.48	IX
4.	Technology refinement	62.38	VII
5.	Commercialization	63.75	VI
6.	Transfer of technology	68.75	III
7.	Consequences	64.66	IV
8.	Feedback	61.66	VIII
9.	Utilization	64.33	V

An observation of findings stated that majority of the researchers were able to manage the technology to the medium extent. Similar trend was noticed on all the phases of technology management behavior also. The analysis of technology management behavior of researchers at different phases of technology management present an visage trend by more than 50% researchers, exception being the technology assessment and its commercialization where the percentage was less than 50%. There appears to be some serious lapses in the technology development and management by researches, this is more evident in identifying research areas, technology generation and utilization phase which are considered to be relatively more important phases. Therefore the station heads should pay more attention to unearth reasons for such situation and initiate corrective measure to improve the management behavior of researcher.

Agricultural Information management behavior of the extensionists

An inventory was developed to study the agricultural information management behavior of the extensionists and outcome is presented in Table 4.

Table 4. Distribution of the extensionists according to their agricultural information management behaviour (n=81).

S.No.	Category	Respondents	
		Frequency	**Percentage**
1.	Low	17	20.99
2.	Medium	48	59.26
3.	High	16	19.75
	Total	**81**	**100.00**

Mean = 320.83 SD = 39.71

It is evident from the Table 4 that, majority of the respondents were observed under medium (59.26%) category of information management behavior and rest of them were distributed into low (20.99) and high (19.75%) categories.

Table 5. Distribution of the extensionists based on phases of agricultural information management behavior (n=81).

		Phases Information management behavior											
S.No	Category	Identifying Needed technologies		Information collection		Information processing		Tech. Dissemination		Feedback		Utilization	
		F	%	F	%	F	%	F	%	F	%	F	%
1.	Low	10	12.35	9	11.11	12	14.82	11	13.58	21	25.92	17	20.99
2.	Medium	60	74.07	60	74.07	61	75.30	60	74.07	48	59.26	53	65.43
3.	High	11	13.58	12	14.82	8	9.88	10	12.35	12	14.82	11	13.58
	Total	81	100.00	81	100.00	81	100.00	81	100.00	814	100.00	81	100.00
	Mean	50.99		84.06		95.07		59.35		24.00		7.37	
	SD	6.78		10.58		18.97		10.66		9.72		3.72	

It is observed from the Table 5 that majority of the respondents were in medium (74.07%) category of identifying needed technologies followed by high (13.58%) and low (12.35%) categories whereas three forth (74.07%) of them were in under medium category while 14.82 per cent and 11.11 per cent were observed in high and low categories respectively regarding collecting the information. The table also revealed that great majority of the (75.30%) respondents were in medium category of information processing and the rest were in low and high categories with 14.82 percent and 9.88 percent respectively. Similar trend was also observed in technology dissemination where majority of them fell under medium (74.07%) category followed by low (13.58%) and high (12.35%) category.

Further it was noticed from the table that regarding feedback majority of the respondents belonged to medium (59.26%) category followed by low (25.92%) and high (14.83%) category. With respect to utilizing the obtained information majority (65.43%) were observed in medium category, while 20.99 and 13.58 per cent were found in low and high respectively.

Table 6. Ranking of phase wise information management behavior of the extensionists.

Sl.No.	Phases of Technology management behavior	Percentage performance	Rank
1.	Identifying needed technologies	80.95	I
2.	Information collection	75.76	IV
3.	Information processing	77.31	II
4.	Information dissemination	76.02	III
5.	Feedback	61.53	V
6.	Utilization	49.33	VI

The results of table 6, that 'identifying the needed technologies' phase was performed better by the extensionists followed by information processing, dissemination, information collection, feedback and utilization.

An observation of Table 4 revealed that nearly sixty per cent of the extensionists have managed the agricultural information to the medium extent. A cursory examination of Table 5 explained the same trend indicating that great majority of them were observed in medium category of all phases of agricultural information management behavior namely identification, collection processing, dissemination, feedback and utilization.

Trend similar to researchers was evident in case of extensionists also. 60 per cent and more extensionists exhibited average management behavior with all phases of information management and particularly in case of identifying needed technologies, information collection process, information processing and technology dissemination phases where percentage of average behavior was exhibited by more than 75% of extensionists. It is thus evident that most of the extensionists' performance in important phases of technology management is average. Being the crucial functionary between researcher and farmer and nucleus for transfer of technology, this type of behavior shall effect the transfer of technology and feedback mechanisms.

Agricultural Information Management behavior of farmers

Table 7. Distribution of the farmers based on their agricultural information management behavior.

S.No.	Category	Respondents	
		Frequency	**Percentage**
1.	Low	10	16.66
2.	Medium	41	68.34
3.	High	9	15.00
	Total	**60**	**100.00**

The results in Table 7 indicated that majority of the respondents belonged to medium (68.34%) category of information management behavior followed by low (16.66%) and high (15.00%) categories.

It could be seen from the Table 8 that, three fourth of the respondents were in medium (75.00%) category and the rest were distributed under low (25.00%) category in identifying their needed information, whereas majority (55.00%) of them fell under medium and the remaining were distributed under low and high categories with 26.65 per cent and 18.33 per cent respectively in collection of information. The results also revealed that regarding processing the received technologies, majority of the farmer respondents (66.67%) were observed in medium category followed by low (18.33%) and high (15.0%) category, where as majority (60.00%) were in medium category in utilizing the received information followed by low (26.66%) and high (13.34%) category. With respect to dissemination of information, 41.67% of them fell under medium category, while 30 per cent were found in high and low categories respectively.

Table 8. Distribution of the farmers based on phases of agricultural information management behavior.

Sl.	Category	Identifying needed technologies		Information collection		Information processing		Information utilization		Information dissemination		Consequences		Feedback	
		F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
1.	Low	15	25.00	16	26.67	11	18.33	16	26.66	17	28.33	-	-	10	16.67
2.	Medium	45	75.00	33	55.00	40	66.67	36	60.00	25	41.67	46	76.67	33	55.00
3.	High	-	-	11	18.33	9	15.00	8	3.34	18	30.00	14	23.33	17	28.33
	Total:-	60	100	60	100	60	100	60	100	60	100	60	100	60	100
	Mean	29.53		56.30		33.32		49.40		22.03		1.23		4.28	
	SD	6.31		11.65		6.62		8.35		3.85		0.43		1.60	

It was further evident that more than three fourth of them were observed in medium (76.67%) category and remaining 23.33 percent in high category regarding experiencing

consequences of the received agricultural technologies information. It was also vivid that more than half of them (55.00%) were in medium feedback category followed by high (28.33%) and low (16.67%) categories.

Table 9. Ranking of phase wise agricultural information management behavior of the farmers.

Sl.No.	Phases of Technology management behavior	Percentage performance	Rank
1.	Identifying needed technologies	89.39	I
2.	Getting information	52.12	VI
3.	Processing	58.42	V
4.	Utilization	60.98	III
5.	Dissemination	73.33	II
6.	Consequences	60.00	IV
7.	Feedback	41.87	VII

It was observed that 'identifying the needed information' phase was performed better by the farmers followed by dissemination, utilization, consequences, processing, getting information and feedback.

As revealed from the results presented above, majority of the farmers were observed under medium category of agricultural information management behavior. The same trend was observed on all phases of information management behavior. Only in two phases of information management viz., identifying needed technologies and consequences the percentage of average behavior was more than 75%. In all the other phases, the range of average behavior was 41 to 66%. This finding indicates that farmers do not solely depend on extensionists to receive the information on crop technology. Other source have played a role in transfer of technology. Therefore, to improve the management behavior of farmers, there is a need to improve the management behavior of extensionists first.

Factors predicting the Agricultural Technology Management behavior.

In order to analyze the factors predicting the Agricultural Technology Management behavior of Researchers and the AIMB of Extensionists and Farmers, the data were subjected to correlation and regression analyses.

Experience, researcher – extensionists interaction and researcher – farmer interaction were found significantly correlated with technology management behavior of researchers.

The analysis carried out indicated that 51.27% variation in technology management behavior of researchers was explained by all their profile characteristics fitted into the regression analysis. Out of all 10 profile characteristics, only researcher-farmer interaction was found to be significantly contributing to the variation in the technology management behavior of researchers.

Table 10. Correlation and Regression co-efficients between technology management behavior and independent variables of researchers (n=57).

S.No.	Variable	Technology Management behavior		
		r	R.C	T-Value
X_1	Age	0.19288	0.411	0.214
X_2	Education	0.01376	0.5031	0.037
X_3	Cadre	0.05390	-2.1836	-0.149
X_4	Experience	0.26307*	1.3096	0.832
X_5	Training	-0.00132	2.4449	0.958
X_6	Researcher extensionists interaction	0.30132*	0.2462	0.362
X_7	Researcher farmer interaction	0.42788**	1.3517	2.061
X_8	Scientific Orientation	-0.08777	-2.2523	-0.896
X_9	Technology Management orientation	0.07550	-0.2194	-0.056
X_{10}	Information management orientation	0.13935	0.9689	0.351

R^2 0.5127; F 1.641 ** Significant at 0.05 level of probability ** Significant at 0.01 level of probability.*

Table 11. Correlation and regression coefficients between information management behavior and independent variables of extensionists.

S.No.	Variable	**IMB**		
		R – value	Regression coefficient	T - values
X_1	Age	0.2251	-2.52988	-2.349
X_2	Education	0.12467	11.7916	1.500
X_3	Cadre	0.19350	8.4220	0.898
X_4	Experience	0.13865	2.3530	1.948
X_5	Training	-0.17134	-1.5138	-1.781
X_6	Extensionist researcher interaction	0.05897	-0.3026	-0.484
X_7	Extensionist farmer interaction	0.07550	0.0602	0.153
X_8	Scientific orientation	-0.09178	-1.7491	-1.181
X_9	Information management orientation	0.30277**	3.0565**	2.782
	R^2		0.4954	
	F		2.566	

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

The independent variable namely information management orientation established positively significant relationship with the dependent variable information management

behavior. The factor age was found to be negatively significant and information management orientation was found to be positively significant in explaining the variation in dependent variable information management behavior. R^2 value shown that set of independent variables contributed to the extent of 49.54 per cent variation in the dependent variable and variation was found to be significant at 5 percent level.

A birds eye view of Table 12 indicated that education, farmer-extensionist interaction, economic motivation and innovativeness variables were positively significant with information sourcing by the farmers. Education, farmer extensionist interaction, risk orientation and innovativeness were significantly related to information processing. The variables like education, farm size, farmer-extensionist interaction and innovativeness were significantly related to information utilization. Education and innovativeness were significantly correlated with information dissemination. The variables, namely farm size and farmers-extensionist interaction were significantly correlated with consequences whereas innovativeness was negatively and significantly correlated with their feedback. Innovativeness factor explained positively significant variation. R^2 value of 0.6276 revealed that all the independent variables could explain the variation to the extent of 62.76 per cent in information management behavior of farmers.

Table 12. Correlation and Regression co-efficients between information management behavior and independent variables of farmers.

Sl.	**Variable**	**Information management behavior**		
		r - values	R.C	T - values
X_1	Age	-0.2139	0.8994	1.171
X_2	Education	0.40097**	3.6979	1.783
X_3	Experience	-017580	-1.0058	-1.351
X_4	Farm size	0.20045	-0.8044	-1.817
X_5	Training	0.09263	1.2705	0.382
X_6	Farmer extensionists interaction	0.45300**	0.6038	0.816
X_7	Farmer Researcher interaction	0.10427	-0.8266	-0.534
X_8	Scientific Orientation	0.15663	-0.9284	-0.665
X_9	Risk orientation	0.14373	1.6593	0.892
X_{10}	Economic Motivation	0.23694	2.3186	1.415
X_{11}	Innovativeness	0.47906**	3.1025*	2.751
	R^2 0.6276			
	F 2.836			

* Significant at 0.05 level of probability

Implications

The analysis of technology management behavior of researchers at different phases of technology management present an average trend. There appears some serious lapses in

technology development and management by researchers. This is more evident in identifying research areas, technology generation, utilization which are considered to be more important phases in technology management. Therefore the research station heads should pay more attention to unearth the reasons for such situation and initiate corrective measures to improve the technology management behavior of researchers.

Similar trend in case of extensionists do appear with regard to their agricultural information management behavior. Being the crucial functionaries between researchers and farmers, the average information management behavior shall effect the transfer of technology and feedback mechanisms. Therefore an indepth analysis of reasons by the extension system and suggestion of corrective measure will improve the performance of the extensionists who are often subjected to serious criticism.

The information management behavior of farmers was better when compared to researchers and extensionists, particularly incase of identifying technology and consequences of technology phase. This may be due to influence many informative sources that work around a farmer. The extension system being the prime source in information dissemination, should think of accelerating their efforts by organizing peripatetic training programs, demonstrations and discussions etc. to improve the information management behavior of farmers.

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