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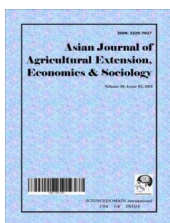
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Determinants of Utility of Short Messaging Services (SMS) by Farmers of Tamil Nadu for Agricultural Technology Transfer

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Authors' contributions

This work is the output of post graduate research study carried out by the first author who has collected data from the field in line with the objectives set forth for the study and the research design contemplated for the study. The second author is the Chairman of Advisory committee for the Post Graduate research work of first author and guided him in designing the study and facilitated him throughout the study in terms of fixing objectives, reviewing literature, designing data collection tool, data collection, tabulation of data, analysis, interpretation and report writing. The third author is the member of advisory committee for the first author for his thesis work who facilitated him to get his data analysed using SPSS.17

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ABSTRACT

Short Messaging Services (SMS) through mobile phones have redrawn the contours of Agricultural Technology transfer. In order to enable the farmers to make full use of SMS as a tool for technology delivery, the extent of influence of myriad of factors is to be ascertained. Hence, a study was conducted with the aim of analysing the factors influencing the reception and utility of Short Messaging Services among 120 farmers as respondents in Virudhunagar district of Tamil Nadu. The results of the study revealed that among the factors, readability of messages, understandability of messages, size of the messages, font size of the messages and more information in one message were found to have 'high influence' to 'moderate influence' upon the respondents to receive and

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utilise SMS. There was moderate to high influence exerted by the factor 'previous experience of receiving messages' upon the respondents while the factor 'successful experience of adopting the technologies given through the messages' had less influence. The factor analysis resulted in the extraction of three factors which got loaded based on message and season, mobile and technical aspects of message and the influence of personality on the reception of messages.

Keywords: *Short Messaging Services utility; Factor influencing SMS reception.*

1. INTRODUCTION

The Information and Communication Technology (ICT) tools offer immense scope for agricultural technology delivery within short span of time and to the clients who are geographically disadvantaged. The Mobile phones in recent past has emerged into a powerful medium which transformed the information exchange related to agriculture and allied activities. Realising the potential of mobile phones for information dissemination, numerous empirical studies were attempted by researchers in India and across the globe.

Aker found that Mobile phone service has reduced grain price dispersion across markets by a minimum of 6.4 percent and reduced intra-annual price variation by 10 percent [1]. Fafchamps and Minten studied the benefits that Indian farmers derived from SMS based markets, weather and crop advisory information through a controlled randomized experiment in 100 villages of Maharashtra and did not find statistically significant effect of treatment on the price received by farmers, on crop losses resulting from rainstorms, or on the likelihood of changing crop varieties and cultivation practices [2]. Lokanathan et al. through their study suggested that accurate, real-time price information improves farmer livelihoods. Furthermore, the service facilitated behavioural changes that enabled farmers to improve their ability to coordinate supply and demand for agricultural produce based on price signals [3].

Raj et al. found through his study that net income of the intervention farmers was 15.2% higher than that of the control group. Spending of intervention farmers on seeds, nursery, nutrient management, and weeding was significantly less than that of control farmers. The intervention group was able to reduce costs by using the recommended quantities of seeds and inputs, and realizing better market prices as they had better information available on the inputs [4]. Rizvi based on his study revealed that the annual average income of users of LifeLines was about 37% more than the control group. For 67% of the intervention group, there was an increase in

savings and earnings because of increased productivity and disease control [5]. Burgos revealed that farmers, when asked what the price would have been if they had not received this information, 87 percent said that they obtained a higher price, averaging 12.5 percent more [6]. Moeleltsi found that providing rainfall forecasts together with recommendations assists the farmers during the growing season in making decisions on planting time, weeding, fertilizing, application of pesticides and other management practices [7].

Few studies have also been attempted to unravel the factors responsible for utility of ICT services by farmers. According to a study conducted by Kante et al. farmer's perception such as the relative advantage, compatibility, simplicity, observability and social influence of ICTs and information quality had positively affected the use of ICTs on agricultural input information in developing countries. Cost, education, age and Gender play a significant role in the adoption or rejection of ICT based services [8]. Ninsima Though few literature were traced on the factors influencing the farmers to use ICT services, research on the factors governing the reception and utility of Short Messaging Services(SMS) were found to be scarce [9]. This being so, many attempts were made to use SMS to transfer technologies, market information and weather information by many Institutions. The Government of Tamil Nadu has established Agricultural Market Intelligence and Business Promotion Centre, (AMIBPC) a state level nodal body at Tiruchirappalli which is mandated to send SMS regularly to farmers all over the state related to Market information. Besides, the State Department of Agriculture of Tamil Nadu state has constituted Farm Crop Management System (FCMS), a database of farmers in all districts through which SMS is being sent.

Keeping in mind, the paucity of studies on factors influencing the utility of agriculture-related SMS by farmers and to give policy suggestions related to the interventions of Tamil Nadu Government as listed above, a study has been contemplated with the following objectives

1. To study the factors influencing the utility of Short Messaging Services (SMS) by farmer
2. To unravel the pattern between the factors and to meaningfully group them

The findings of the study will give useful suggestions to the Government institutions which are designing SMS for farmers. Further, the study will highlight the factors which have the potential to influence the utility of SMS by farmers thereby suggesting suitable policy measures for effective utilisation of SMS as a tool for agricultural technology transfer.

The diffusion theory of Rogers highlighted various factors for an innovation to get diffused in a social system [10]. This study would indirectly contribute theoretically to the emerging body of literature on the diffusion of agricultural information through mobile phone. The grouping of enabling factors which were attempted in this study would unravel the underlying pattern of relationship among these factors which would give valuable inputs for the administrators in Public and Private institutions who are entrusted with the task of sending SMS carrying myriad agricultural information to a vast number of peasants in developing countries

2. LITERATURE REVIEW

Mobile phones have become indispensable with the life of people irrespective of the habitation. The faster diffusion of mobile phones into rural hinterland could be exemplified through the increasing possession of smart phones by even small and marginal farmers [11]. Critical analysis of the mobile phone usage by the farming community revealed that farmers have been using mobiles for various purposes and their utility for Agriculture and rural development included sharing of information on weather forecasting, market price, pest and disease management, technological solutions to the problems related to crop and livestock etc. [12]

From the review of various studies on Mobile based Agricultural Technology Transfer, the following conclusions could be drawn.

1. Most of the studies were conducted on Mobile phones and its utility for transferring market information. Studies specifically on the information utility for adoption of technologies were limited.
2. Weather information through ICT has attracted most of the researchers and some studies were conducted on this

subject. But except a few, in depth studies were not there to generalize the findings. This necessitated future efforts in this line since risk due to climate threatens the farming globally

3. The content, infrastructure and tools have dominated most of the literature. One unique observation from the studies was that researchers concentrated on the tools rather than the factors affecting delivery from all angles.
4. Though roughly 40% of the studies related to ICT is being conducted in India, the Impact studies generated from foreign Universities employing Indian Scholars was on the rise. Studies from State Agricultural Universities and scientists of Indian Council of Agricultural Research (ICAR) are very limited.
5. An appreciable number of studies questioned the sustainability of the ICT projects once the project period was over

From the conclusions drawn above, the present study would try to identify the factors responsible for adoption gap, sustainability issues and the utilitarian issues pertaining to mobile usage.

3. METHODOLOGY

The research design used for the study was 'Ex-post facto design'. In Ex-post Facto design, the research instead of imposing a treatment, evaluate the effect of a naturalistically occurring phenomenon after its occurrence. In this process, the causes were earthed out considering sociological and behavioural studies. The cause might be due to the personal and impersonal variables for the resultant behaviour. In the present study, the factors which influenced the farmers to use mobile phones for getting agricultural information was analysed which has already occurred and the research was not intended to manipulate the incidence of these factors. Hence, the Ex-post facto research design was contemplated to be suitable for the research

3.1 Sampling Procedure

Mobile phones are being used by the majority of people irrespective of their income and background. Uttar Pradesh has a total of 121.60 million mobile phone connections, while, Tamil Nadu has 71.81 million subscribers and stood second according to the Telecommunications Regulatory Authority of India (TRAI) data. Over 165 services of various government departments

could be accessed through online e-sevai centres across the State of Tamil Nadu. (Marcel and Bart) IFFCO Kissan Sanchar Limited (IKSL) and Reuters Market Light (RML) are providing services through SMS and voice messages about agriculture related information [13]. Similarly, there are many private and public organizations that are disseminating agricultural related information through mobile phones of farmers. (Saravanan) Bharat Sanchar Nigam Limited (BSNL) used to pass on information related to price on agricultural commodities through SMS whereas Nokia Life Tools used to send information on seeds, fertilizer, pesticides, market prices and weather. Rubber Board used to send Short Message Service (SMS) related to price on natural rubber [14]

The research was conducted in Virudhunagar district of Tamil Nadu in India during January 2018 to March 2018. Among 32 districts in Tamil Nadu, Virudhunagar district was chosen using purposive sampling technique. Among the districts Virudhunagar district farmers were reported to receive more number of SMS sent by AMIBPC (Agricultural Market Intelligence and Business Promotion Centre), a state level nodal body to help farmers to get timely SMS on Marketing of Agricultural produce. (Source: Office of AMIBPC, Trichirappalli, Tamil Nadu). Further, the farmers of Virudhunagar have been receiving crop related advisories through SMS from Farm Crop Management System (FCMS), an online database of farmers of the district maintained by the Department of Agriculture.

In Virudhunagar district of Tamil Nadu, there are 9 blocks out of which two blocks namely Virudhunagar and Kariyapatti were purposively selected based on highest number of farmers registered for receiving SMS (Source: Office of Joint Director of Agriculture, Virudhunagar District, Tamil Nadu). In Virudhunagar block 2550 farmers and in Kariyapatti 1750 farmers were registered for the receipt of SMS from both the sources namely AMIBPC, Trichirappalli and FCMS, Joint Director of Agriculture office, Virudhunagar. One hundred and twenty respondents (120) from eight villages namely Sennelkudi, Pottalpatti, Mettukundam, Kadambankulam, Pisindi, Mallankinaru, Murungankulam and Kaluvanancherry were selected for the study using Proportionate Random Sampling procedure, the formula of which is given below

The list of farmers receiving SMS in the selected eight villages was collected from ADA office of

Virudhunagar and Kariyapatti block. Among the list of SMS receiving farmers, 120 respondents were selected through proportionate random sampling method, which took into account the proportion of SMS receiving farmers present in the selected villages besides ensuring the equal and independent chance of them to get selected into the sample. The following is the formula for the selection of respondents through proportionate random sampling method.

$$n_i = \frac{N_i}{N} \times n$$

Where

n_i – number of respondents to be selected from the i^{th} village

N_i – total number of respondents in the i^{th} village

N – Total number of respondents in eight villages

n – Total number of respondents to be selected from eight villages

3.2 Data Collection

A well structured interview schedule was constructed to collect data from respondents. The items with respect to socio-economic profile of respondents, twenty three factors to know about their influence on receiving and using SMS from Department of Agriculture were included in the schedule. Prior to the inclusion of factors, universe of factors numbering 60 was given to a group of judges and the reliability was calculated using split half method. Those factors whose reliability score was more than 0.6 were included in the schedule. The content validity of the selected factors was also assessed by assigning them to judges. Finally 23 factors with reliability score of 0.6 and above and higher content validity were included in the interview schedule. The interview schedule was pre tested in a non-sampling village and the inadequacies in the schedule were corrected. The respondents were personally contacted and consent was obtained for giving information. The interview was conducted among 120 respondents from January 2018 to March 2018.

3.3 Measurement of Variables and Data Analysis

Age, education, Area under cultivation, occupational status, annual income, Possession and utility of Mobile phones were the socio economic characteristics for which data was collected from the respondents. The operationalisation of these variables is given below in the table:

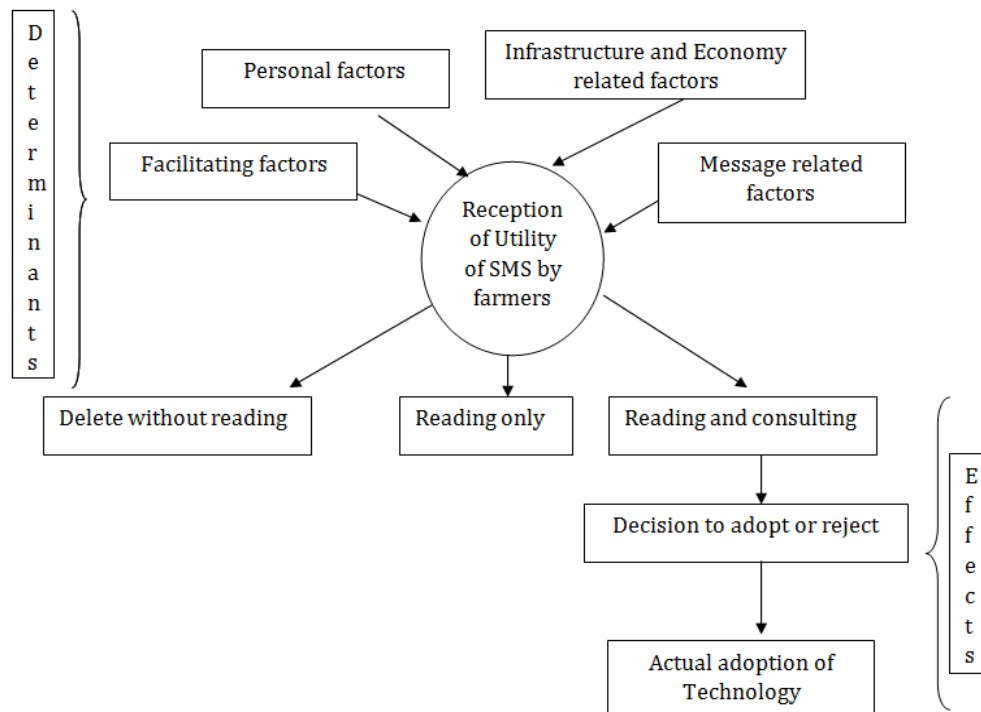
Age	:	Chronological age of the respondents at the time of interview
Education	:	The educational qualification of respondent in years
Occupational Status	:	The occupational profile of respondents which took into account not only farming but also non- farm activities.
Area under cultivation	:	Refers to an area owned and also taken on lease which is being cultivated by the respondent
Annual Income	:	The money earned by the respondent in a year through farming and non farming activities
Possession of smart phone	:	This refers to the possession of smart phone by the respondent which was measured through dichotomous response of 'yes' and 'no'
Utility of smart phone	:	The degree of utility of smart phones which was measured through three point continuum of frequently, occasionally and rarely

The data related to these variables were collected, post stratified, scored, tabulated and percentage was worked out.

The data pertaining to 23 identified factors influencing the receipt and utility of SMS by farmers from the Department of Agriculture, Virudhunagar district and AMIBPC, Trichirappalli was measured on four point continuum namely 'High influence', 'Moderate influence', 'Less influence' and 'no influence' which were given with the scores of 4,3,2 and 1 respectively. Percentage was worked out for each of the factor in four response categories.

These factors were grouped through Factor analysis which is a variable reduction technique and served the purpose of grouping variables based on underlying pattern between the variables. In the present study the determinants of influencing the reception and utility of agriculture related SMS by the farmers were grouped together into different factors using factor analysis.

A diagrammatic conceptual model of the study is given below



The conceptual model depicts that the reception and utility of SMS related to agriculture and allied technologies is being influenced by at least four sets of factors namely personal, infrastructure and economy related, message related and facilitating factors which are termed as 'determinants'. The study conceptualise that influence of these determinants, would result in the response of farmers in at least four ways namely delete without reading, reading only, reading and consulting and actual adoption of technology which are termed as 'effects'. Nevertheless, the study tried to concentrate on the exploration of determinants only for the reception and utility of SMS by farmers.

4. RESULTS AND DISCUSSION

This section has been classified into three parts. First, the socio economic profile of the respondents was discussed briefly followed by the detailed discussion on the factors influencing the reception and utility of SMS by the farmers. The last section dealt with the results of factor analysis.

4.1 Socio-Economic Profile

The socio economic profile of the respondents was studied and presented in the Table 1.

Majority of respondents were old aged (45.00%) to middle aged (40.80%). One third (33.30%) of respondents were educated up to secondary level followed by primary (20.80%) and collegiate (18.30%) level. Land holding possessed by majority of the respondents was in the range of 2.6 to 5.5 acres. Farming alone (63.30%) was reported as the primary occupation followed by farming and wage earning (30.00%). Two-third of the respondents was found to be in the annual income category of RS. 50000. Exactly half of the selected respondents possessed smart phones which were used frequently by majority of them (86.67 percent).

As detailed in methodology factors influencing the farmers to use mobile phones for receiving and to act upon the short messaging services (SMS) was studied and presented in Table 2. These factors were classified into four heads

Table 1. Socio-economic profile

S. no.	Profile	Number	Per cent
1.	Age		
	Young	17	14.20
	Middle age	49	40.80
	Old	54	45.00
2.	Education		
	Illiterate	22	18.30
	Functionally literate	11	9.20
	Primary Education	25	20.80
	Secondary Education	40	33.30
	Collegiate Education	22	18.30
3.	Area under cultivation		
	Less than 2.5 acre	20	16.70
	2.6 to 5.5 acre	93	77.50
	More than 5.6 acre	7	5.80
4.	Occupational status		
	Farming alone	76	63.30
	Farming and business	8	6.70
	Farming and wage earning	36	30.00
5.	Annual Income		
	Upto Rs.50000	72	60.00
	From Rs. 50001 to 1.00 lakh	34	28.33
	Above Rs.1.00 lakh	14	11.67
6.	Possession of Smart phones	60	50.00
7.	Utility of smart phones (n=60)		
	Frequently	52	86.67
	Occasionally	6	10.00
	Rarely	2	3.33

namely message related factors, infrastructure and economy factors, personal factors and facilitating factors.

4.2 Message Related Factors

Since the core of study is to analyse the factors influencing the SMS utility by the farmers for receiving agriculture related information, the nature, type, relevance of the messages in line with the requirement of the farmers were studied.

Among these factors readability of messages (63.30% and 25.80%), understandability of messages (55% and 31.70%), size of the messages (51.70% and 21.70%), font size of the messages (47.50% and 35.80%) and more information in one message (43.30% and 31.70%) were found to have 'high influence' to 'moderate influence' among the respondents to receive and utilize the SMS related to agricultural technologies. The respondents reported that when the messages were readable, understandable, they used to read the messages.

Along with these two factors 'the size of the messages' were also found to influence the respondents to look into the messages. The respondents opined that they were interested to look into shorter messages rather than lengthier messages. Since, most of the respondents of the study were middle aged to old aged (above 45 years), the larger font size seemed to influence them to look into the messages as it is closely related to eye sight of the respondents. They reported that most of the SMS related to agriculture information were in appropriate font size and they could read it.

The information richness is another factor or comprehensive information about a technology given in one messages was preferred by the respondents as they need not search for additional information. A considerable number of respondents were in 'moderate influence' (31.70%) and 'less influence' category (24.20%) for this factor which indicated that the SMS given was not comprehensive and the administrators who shoot up SMS need to design messages in such a way that they are comprehensive.

There was 'moderate influence' (30.80%) to high influence for the factor 'requirement or demand for technical information'. Cumulatively half of the respondents were also found to have 'less influence' to 'no influence' towards this factor which revealed that more efforts are to be

initiated by the service providers of agriculture based SMS to give demand based information. There was less influence (40.80%) to moderate influence (30.80%) of push messages which indicated that the respondents were not perturbed by the push messages.

The results from the Table 2, indicated that one third (31.70%) of respondents were 'highly influenced' by 'timeliness of message relevant to crop stage'. Though, nearly half of the respondents (29.20% and 24.20%) were found to be in 'moderate influence' and 'no influence' categories for this factor. The respondents told the researcher that often they used to receive SMS which was not relevant to the stage of crop in their field. Yet another factor supported this finding was the 'message about the crop which was present in the field' did not influence nearly two fifth (40.80%) of the respondents followed by 'less influence' (20.50%) and 'moderate influence' (20.00%).

It was also found that no influence was exerted by the factors 'continuity of message' (39.20% and 34.20%) and 'diversity of information' (37.50% and 33.30%). The respondents reported that they had been receiving messages about crop which were not in the field. Further, they told that there was neither continuity of message nor diversity of information in the SMS that they have received.

The messages related to weather forecasting was abundant than technology and market related SMS. The continuous reception of information starting from variety to market was rarely experienced by the respondents. Though there was 'less influence' (41.70%) and 'no influence' (25.80%) pertained to the usage of technical jargon in the message, nearly one fourth (25.20%) were in moderate influence category and substantiated that messages still need to be free of technical jargon which will motivate the respondents to look into the messages.

4.3 Infrastructure and Economy Related Factors

It was found from Table 2, that there was 'high influence' to 'moderate influence' experienced by the respondents for the factors 'ease in opening messages in the mobile (50.80% and 29.20%) and 'connectivity, speed of service provider' (44.30% and 36.70%). The respondents felt that certain mobile phones especially smart mobiles did not facilitate them to open the message at

once and they found difficulty in opening the message. Similarly, they were concerned about connectivity and speed which was affected by absence or limited availability of cell phone towers. There was 'moderate influence' (39.20%) which was followed by high influence (34.20%) and less influence (21.70%) exerted on the respondents by the factor 'type of mobile phone'. As discussed already the opening of message varied for different types of mobile phone and hence this factor influenced majority of the respondents.

4.4 Personal Factors

Nearly three fifth (59.20%) of respondents were found to be 'highly influenced' by the availability of time to look into the messages followed by nearly one- fourth (27.50%) who were in 'moderate influence' category. Majority of the respondents during interview reported that time availability amidst the regular work really influenced them to look into the messages. Mood and interest at the time of reception of message were found to be 'highly influencing' (41.70%) and 'moderate influencing' (40.80%) of the respondents in receiving SMS. The respondents during the interview registered their views that they had been receiving a lot of unsolicited messages from advertisers from various sources which they reported to have negative effect on the mood and interest in looking into agriculture related SMS.

There was moderate (40.00%) to high influence (35.80%) exerted by the factor 'previous experience of receiving messages' on the respondents. The factor 'successful experience of adopting the technologies given through the messages' had less influence (40.80%) on the respondents followed by nil influence (23.30%). The researcher reported that they rarely adopted the technologies given through SMS. This has clearly indicated that the adoption of technologies has rarely been achieved by the agriculture related SMS.

4.5 Facilitating Factors

Among the facilitating factors 'time in a day at which messages are being received' had a say as it 'highly influenced' (44.20%) and 'moderate influenced' (33.50%) the respondents to look into the messages which indicated that the respondents were satisfied with this factor. Majority of the respondents were in 'moderate influence' (43.30%) and 'high influence' (34.20%) categories pertaining to credibility of the sender

of the messages. This result indicated that there existed credibility gap which the Extension personnel of Department of Agriculture need to plug.

The fellow farmers, friends, relatives were found to influence moderately (34.80%) and to exert 'less influence' (32.50%) upon the respondents to receive and look into the SMS related to agriculture. This indicated that there were lesser networks among the respondents and they seemed to work in isolation. The possibility of feedback as a factor had nil influence (58.30%) to less influence (30.00%) on the respondents as there was no feedback mechanism inbuilt in the SMS received by the farmers from department of agriculture and AMIBPC. The respondents told that they did not know how to clarify the doubts related to messages as there was no feedback mechanism.

4.6 Factoring of Attributes Influencing the Farmers to Receive and Utilise the Short Messaging Services (SMS) Related to Agriculture

The factors which influence the Farmers to receive and to utilise the Short Messaging Services (SMS) related to Agriculture have been detailed in the previous section. These factors may be associated with the message related factors, personal related factors, infrastructure related factors or any other facilitating factors. In order to find out the pattern of grouping among these factors and to identify underlying relationship between them, factor analysis was run with the help of SPSS version 16.00 and the results are presented below.

As a first step, the suitability of the data for factor analysis was checked. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.704, which indicated that the data was amenable for factor analysis. Hence it was decided to proceed further. The principal component analysis extracted three factors through varimax rotation and the results revealed that 43.64 per cent variation in the reception and utility of SMS by the farmers was explained cumulatively by the extracted three factors.

The first factor accounted for variation of 19.46 in the reception and utility of SMS by farmers followed by 16.85 per cent and 7.32 per cent of variation explained by second and third factors respectively. The Table 3 showed the factors loaded into three components and the magnitude of factor loadings.

Table 2. Factors influencing utility of Mobile phones for technology delivery

S. no.	Influencing factors	High influence		Moderate influence		Less influence		No influence	
		No	Per cent	No	Per cent	No	Per cent	No	Per cent
I	Message related factors								
1.	Requirement/demand of a technical information in the form of messages	28	23.30	37	30.80	35	29.20	20	16.70
2.	Push messages sent by advertisers	19	15.80	37	30.80	49	40.80	15	12.50
3.	Font size of the messages	57	47.50	43	35.80	16	13.30	4	3.20
4.	Readability of the messages	76	63.30	31	25.80	11	9.20	2	1.70
5.	Understandability of the messages	66	55.00	38	31.70	16	13.30	-	-
6.	More information in one message	52	43.30	38	31.70	29	24.20	1	0.80
7.	Timeliness of message relevant to crop stage	38	31.70	18	15.00	35	29.20	29	24.20
8.	Message about the crop which is present in the field	22	18.30	24	20.00	25	20.80	49	40.80
9.	continuity of messages about crop operations	11	9.20	21	17.50	41	34.20	47	39.20
10.	Diversity of information given through the messages	8	6.70	27	22.50	40	33.30	45	37.50
11.	Technical jargons used in the messages	4	3.30	35	29.20	50	41.70	31	25.80
12.	Size of the messages	62	51.70	33	27.50	22	18.30	3	2.50
II	Infrastructure and economy related factors								
13.	The type of mobile phone	41	34.20	47	39.20	26	21.70	6	5.00
14.	Ease in opening a message in mobile	61	50.80	35	29.20	20	16.70	4	3.30
15.	Connectivity and speed of service provider	53	44.20	44	36.70	19	15.00	4	3.30
III	Personal factors								
16.	Availability of time to look into message	71	59.20	33	27.50	13	10.80	3	2.50
17.	Previous experience in receiving messages	43	35.80	48	40.0	26	21.70	3	2.50
18.	Successful experience of adopting the technology given through SMS	17	14.20	26	21.70	49	40.80	28	23.30
19.	Mood and interest at the time of reception of messages	50	41.70	49	40.80	12	10.00	9	7.50
IV	Facilitating factors								
20.	Time in a day at which messages are being received.	53	44.20	43	35.80	17	14.20	7	5.80
21.	Credibility of the sender of messages	41	34.20	52	43.3	21	17.50	6	5.00
22.	Influence of fellow farmers /friends/ relatives	25	20.80	43	35.8	39	32.50	13	10.80
23.	Possibility of feedback	-	-	14	11.70	36	30.00	70	58.30

Table 3. Rotated component matrix

S. no.	Factors	Component		
		1	2	3
1	Availability of time to look into message			0.555
2	Previous experience in receiving messages			0.720
3	Mood and interest at the time of reception of messages			0.734
4	Time in a day at which messages are being received.			0.568
5	Credibility of the sender of messages			
6	Demand for technical information in the form of messages	0.622		
7	Push messages sent by advertisers			
8	Type of mobile phone		0.527	
9	Ease in opening message in mobile		0.571	
10	Font size of the messages		0.725	
11	Readability of the messages		0.710	
12	Understandability of the messages		0.730	
13	More information in one message			
14	Timeliness of message relevant to crop stage	0.731		
15	Message about the crop which is present in the field	0.859		
16	Continuity of messages about crop operations	0.749		
17	Diversity of information given in the messages	0.645		
18	Technical jargons used in the messages			
19	Influence of fellow farmers /friends/ relatives			
20	Size of the messages			
21	Connectivity and speed of service provider			
22	Successful experience of adopting the technologies given through the messages	0.547		
23	Possibility of feedback	0.708		

Factor I: In the first component, as shown in Table 3, the factors which got positively loaded with highest factor loadings were message about the crop which is present in the field (0.859), Continuity of messages about crop operations (0.749), Timeliness of messages relevant to the crop stage (0.731), Possibility of feedback (0.708), diversity of information (0.645), demand for technical information in the form of SMS (0.622) and successful experience in adopting the technologies given through messages (0.547). As discussed already in the previous section, the timeliness, continuity, diversity had lesser or nil influence on the respondents. Though, these factors got loaded heavily into this component which implied that they need harnessed attention by the senders of SMS. Similarly the demand for information and successful adoption of technologies given through SMS were reported to have less or nil influence from which it is inferred that more efforts are needed by the senders of SMS to study the process of technology adoption for the technologies given through SMS, keeping in mind the location specific demands of those technologies.

Factor II: There was a clear grouping of factors observed in component II. Understandability of

messages (0.730), font size of message (0.725) and readability of the message (0.710) were the factors which got loaded positively with higher factor loadings. The findings presented in the preceding section revealed that these factors had higher to moderate influence on respondents. The striking point here is that the creators and senders of SMS should keep in mind these factors which were found to influence the farmers predominantly. The mobile related factors of type of mobile (0.527) and ease in opening messages (0.571) were moderately loaded into the second component. From this loading it could be inferred that besides the nature of messages the mobile set also had influenced the farmers to make use of the SMS effectively.

Factor III: The grouping of factors in component III lucidly explained that the factors related to individual farmer's characteristics were loaded positively. Mood and interest at the time of reception of messages (0.734), previous experience in receiving information (0.720) were loaded with higher positive factor loadings whereas time in a day at which messages are being received (0.568) and availability of time to look into the message (0.555) moderately got loaded into this component. The personal characteristics do play a pivotal role in

stimulating the farmers to devote time for looking into the message. Preferably farmer's experience and interest will go a long way in shaping their SMS reception and utility.

5. CONCLUSION AND RECOMMENDATIONS FROM THE STUDY

A study was conducted among 120 farmers as respondents in Virudhunagar district of Tamil Nadu with the objective of analysing the factors influencing the reception and utility of Short Messaging services given by two sources namely Farm Crop Management System (FCMS) of Department of Agriculture, Virudhunagar district and Agricultural Market Intelligence and Business Promotion Centre, a Tamil Nadu Government entity in Tiruchirappalli of Tamil Nadu. Ex-post facto research design was employed and the farmers were selected using proportionate random sampling procedure. The data was collected using a well-structured interview schedule.

Among the factors, readability of messages, understandability of messages, size of the messages, font size of the messages and more information in one message were found to have 'high influence' to 'moderate influence' on the respondents to receive and utilise SMS. There was little or no influence exerted by the factors 'continuity of message' and 'diversity of information'. Nearly three fifth of respondents were found to be 'highly influenced' by the availability of time to look into the messages. Mood and interest at the time of reception of message were found to be 'highly to moderately influencing' the reception of SMS. There was moderate to high influence exerted by the factor 'previous experience of receiving messages' upon the respondents while the factor 'successful experience of adopting the technologies given through the messages' had lesser influence upon the respondents. The factor analysis resulted in three factors which got loaded based on message and season, mobile and technical aspects of message and influence of personality on the reception of messages.

The following recommendation could be drawn from the findings of the study.

1. The study results revealed that timeliness, continuity of messages, messages about the crop in the field and demand based location specific SMS had little or nil influence on the respondents. This implied

that the SMS creators and senders should keep in mind the area, stage of crop and demand for technology before sending up the messages to the farmers.

2. There was no possibility of feed back in the message. Hence, the administrators of this intervention should think of including free of cost feedback mechanism to be set inbuilt into the system of SMS based technology delivery
3. Very lesser number of farmers was reported to adopt the technologies given through the SMS. Efforts are to be taken by the Extension workers of line departments to study the process of travel of information and the reception behaviour of farmers to understand the constraints in adopting those technologies.
4. The respondents of the study were found to have been influenced by readability, understandability and font size of the messages which implied that the extension workers should design the messages which are readable, understandable by the farmers.
5. The predominance of the factors like readability, font size, understandability resulted in a recommendation to Agricultural Extension researchers that a study may be commissioned for 'Participatory Designing of Messages for SMS' and this can be conducted in an Action research mode with the participation of farmers and Extension researchers.
6. The study results revealed that the utility of SMS by farmers was not influenced by friends, relatives and fellow farmers which indirectly indicated poor networking among farmers. Hence, the Extension personnel of Department of Agriculture who are already forming Farmer Producer Groups may strengthen their activities in forming farmers groups and these group members may be enrolled for receiving SMS which will be purposeful since farmers with same attitude could be networked.
7. In nut shell, the data was distributed among four categories, and there was a significant number of respondents in little or no influence categories which indicated that the respondents were not too confident about the mobile based technology delivery. Hence, it is recommended that the Extension personnel of line departments should design trainings for farmers on ICT based agricultural technology delivery along with

their regular technology oriented trainings to farmers.

CONSENT

The respondents were personally contacted and consent was obtained for giving information.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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