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Relative effectiveness of different audio-visual electronic media on knowledge gain of paddy farmers: An experimental study

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Abstract

India, the world's largest coconut producer with 20,535 million nuts in 2022-23 contributing significantly to its GDP, faces trade challenges despite its dominant production. Secondary data on the export and import of copra and desiccated coconut, classified under HS codes 12030000 and 08011100, respectively, was collected from sources such as the Directorate General of Foreign Trade (DGFT), Coconut Development Board (CDB), and the ITC Trade Map. This study investigates the performance and competitiveness of India's copra and desiccated coconut trade from 2011 to 2023, using Compound Annual Growth Rate (CAGR), Coefficient of Variation (CV), Cuddy-Della Valle Index (CDVI), and RCA to assess trade dynamics. While desiccated coconut exports have shown fluctuating trends, copra exports are concentrated in a few markets, primarily the UAE (56.81% share in 2023), Iran (15.72%), and Nepal (10.25%), highlighting the need for diversification. Results reveal that while copra export value has seen positive growth (3.15% CAGR), export volumes have declined (-3.44% CAGR), and imports have increased significantly (71.26% CAGR), indicating a growing dependence on external sources. Desiccated coconut exports have also experienced instability (CV of 132.50% for quantity and 113.77% for value), with declining quantities (-3.44% CAGR) despite rising value (5.83% CAGR). India's RCA for desiccated coconut has fluctuated (ranging from 0.15 to 1.82), indicating inconsistent competitiveness, while copra has shown stronger RCA (ranging from 1.9 to 16.83), though still facing competition from other major exporters. The study concludes that India needs strategic diversification, improved processing infrastructure, and supportive trade policies to enhance its competitiveness in the global coconut market and improve production strength for better trade performance.

Keywords: Electronic Media, Knowledge Gain, India

Introduction

Agriculture has long been recognized as both a science and an art. The philosopher Aristotle classified human knowledge into three broad disciplines: theoretical knowledge, which focuses on understanding and scientific inquiry; practical knowledge, which guides decisionmaking and action; and productive or creative knowledge, which is concerned with creating useful outputs, including fields such as agriculture (Blum, 1996) ^[1]. In the present era, however, agriculture extends far beyond this traditional classification. It has evolved into a multidisciplinary field that integrates scientific research, practical decision-making, technological innovation, and creative problem-solving to address the complex challenges faced by farmers. Today's agricultural sector functions in a rapidly changing environment influenced by social, economic, technological, and environmental factors. As a result, timely access to accurate and reliable information has become essential for improving farmers knowledge and enabling informed decision-making. Knowledge, which represents the cognitive domain of learning, plays a crucial role in the adoption of agricultural innovations. According to Rogers and Shoemaker (1971) ^[2], knowledge is the first stage in the innovationdecision process, forming the foundation for subsequent stages of persuasion, decision, implementation, and confirmation.

The effective dissemination of agricultural knowledge is therefore a key component of agricultural development. Farmers require timely information on improved production technologies, crop

management practices, pest and disease control, weather forecasts, and market opportunities. Over the years, electronic communication media have significantly contributed to agricultural extension by delivering such information efficiently and on a large scale. Traditional electronic media, such as television, continue to serve as important sources of agricultural information, while mobile-based applications, including WhatsApp, have transformed communication by enabling rapid exchange of text, images, videos, and advisory messages. More recently, digital platforms such as agricultural portals have emerged as comprehensive sources of technical information, government schemes, expert recommendations, and market intelligence. Previous studies have demonstrated that audiovisual electronic media can positively influence farmers' knowledge, attitudes, and adoption of improved agricultural practices. However, the effectiveness of different electronic media varies depending on factors such as accessibility, usability, content quality, and farmers' socio-economic characteristics. Understanding these differences is important for designing more effective extension communication strategies. Keeping these aspects in view, the present study was undertaken to examine the comparative effectiveness of different electronic media—television, mobile phone (WhatsApp), and agricultural portals—in enhancing the knowledge of farmers. The study specifically evaluates the extent of knowledge gained through each medium and compares their effectiveness in influencing the

cognitive behaviour of farmers. The findings are expected to provide valuable insights for strengthening digital agricultural extension services and improving the dissemination of agricultural information among farming communities.

Theoretical Framework

Agricultural extension systems in many developing countries continue to face the challenge of an inadequate extension worker-to-farmer ratio, limiting the frequency and quality of direct interactions between extension personnel and farming communities (Chandrashekar, 2001) [3]. This constraint often reduces farmers' access to timely technical guidance and scientific recommendations. Moreover, inadequate access to agricultural information has long been recognised as a major obstacle to rural development and agricultural growth (Ray, 1978) [4]. In such circumstances, mass media and digital communication platforms have become increasingly important in supplementing conventional extension services by disseminating agricultural information to a larger audience in a cost-effective and timely manner.

Rapid technological advancements have significantly transformed the communication landscape. The traditional boundaries between communication media such as radio, television, and computer-based platforms have become increasingly blurred due to the convergence of digital technologies (McQuail, 1994) [5]. The emergence of internet-based applications, smartphones, social media, and agricultural portals has further expanded the range of communication channels available for agricultural extension. Consequently, evaluating and comparing the effectiveness of different communication media has become essential for selecting the most appropriate channels to improve farmers' knowledge and encourage the adoption of recommended agricultural practices (Hornik, 1989) [6].

Communication theories suggest that the effectiveness of any communication medium depends on several factors, including the audience's understanding of the message, knowledge acquisition, perception of its usefulness, recall and retention of information, motivation to take action, and personal involvement with the message (Sudarsanam, 1979) [7].

Among these dimensions, knowledge gain has received considerable attention in agricultural communication research because it represents the first measurable outcome of successful information dissemination (Chandrakandan, 1982; Manoharan, 1988; Philip, 1995) [8,9,10]. However, Cook (1995) [11] observed that audiences may sometimes remember the communication medium itself, such as a video, rather than the actual information it conveys. This highlights the importance of assessing not only exposure to communication media but also their effectiveness in improving farmers' understanding and retention of agricultural information. Considering these aspects, the present study adopted an experimental research design to evaluate the effectiveness of selected electronic communication media in enhancing farmers' knowledge. Unlike ex-post facto studies, the experimental approach provides a more reliable assessment of the causal effect of different communication media on knowledge gain. The study specifically compares the effectiveness of television, mobile phone (WhatsApp), and agricultural portals in improving the knowledge of paddy farmers, thereby providing evidence for developing more effective digital agricultural extension strategies.

Purpose and Objectives

The purpose of the study was to experimentally find out the effectiveness of different audio-visual electronic media on the knowledge gain of paddy farmers with the hope that the results would help the workers of government departments and Nongovernmental Organizations in designing a viable strategy for disseminating farm technologies. The following three objectives guided the study. 1) Assess the relative effectiveness of television, Mobile phone (WhatsApp) and agriportal. 2) Compare the effectiveness of different audiovisual electronic media.

Methodology

The present experimental study was conducted in four randomly

selected villages—Arahatholalu, Attigunda, Dasarakallahalli, and Bilaki—located in Bhadravathi Block of Shivamogga District, Karnataka, India. The villages were selected from a list prepared in consultation with officials of the Department of Agriculture. Selection was based on factors such as accessibility, availability of communication facilities, concentration of paddy farmers, and the level of digital literacy among the farming community.

A total of 120 paddy farmers participated in the study, with 30 respondents selected from each village. Respondents were purposively chosen to ensure homogeneity in selected socioeconomic characteristics. Farmers aged between 25 and 35 years, having at least preuniversity education and a minimum of three acres under paddy cultivation, were included in the sample. These criteria were adopted to ensure that the respondents were capable of accessing and effectively using different electronic communication media.

Three electronic media—television, mobile phone (WhatsApp), and an agricultural portal—were selected as the communication channels for disseminating agricultural information. Since comparing different media requires uniformity in message content, a single instructional message on paddy cultivation practices was developed and adapted for each communication medium. As suggested by Slater (1991) [12], the message content was kept conceptually identical across all media, while only the mode of presentation differed. The communication materials were prepared in Kannada, the local language, through a collaborative effort involving scientists from the University of Agricultural Sciences, Bangalore, extension experts, communication specialists, and experienced farmers. To maintain consistency, an interview-based presentation format was used for all three media.

In the present study, knowledge was defined as the extent of scientific information possessed by respondents regarding recommended paddy cultivation practices. Knowledge gain referred to the additional information acquired by farmers after exposure to the communication treatment through the selected electronic media. A multiple randomized group experimental design with a pre-test–post-test approach was adopted. Respondents' knowledge was assessed before exposure to the communication intervention and again immediately after the intervention to measure changes in their knowledge level. A structured knowledge test was developed for this purpose. Based on item analysis using difficulty and discrimination indices, 62 items were retained in the final test instrument. The experimental treatments were randomly assigned to the groups using a randomization procedure to minimize selection bias and ensure the validity of comparisons.

To avoid contamination of the experimental treatments, respondents were individually interviewed during the pre-test without being informed about the subsequent post-test. During the experimental period, participants were requested not to discuss or share information related to the communication treatments until completion of the study. Interaction among respondents was kept to a minimum before and during the intervention, except for activities directly related to data collection.

The collected data were coded and analysed using SPSS (Statistical Package for the Social Sciences) Version 10.0. Appropriate statistical techniques, including percentage analysis, paired *t*-test, and one-way analysis of variance (ANOVA), were employed to assess knowledge gain and compare the effectiveness of the different electronic communication media.

Results and Discussion

Relative effectiveness of different treatments on knowledge level
Gain in Knowledge level of farmers on paddy cultivation practices due to television exposure.

Gain in Knowledge of Farmers on Paddy Cultivation Practices Following Television Exposure

The results presented in Table 2 indicate that television exposure significantly improved the knowledge level of farmers regarding recommended paddy cultivation practices. The effectiveness of the

intervention was assessed using the paired *t*-test, which compared respondents' knowledge before and after exposure to the treatment. The analysis revealed statistically significant improvements across all major components of paddy cultivation.

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Among the different practices, the highest mean knowledge gain was observed for farm mechanization (mean difference = 2.80), followed by disease management (1.50), manures and fertilizers (1.44), and insect pest management (1.16). These findings suggest that television, with its audio-visual presentation, effectively enhanced farmers' understanding of technically complex agricultural practices.

Gain in Knowledge of Farmers on Paddy Cultivation Practices Following Mobile Phone (WhatsApp) Exposure

The knowledge gain of farmers following exposure to agricultural information through mobile phones (WhatsApp) is presented in Table 3. The paired *t*-test demonstrated a significant increase in respondents' knowledge after the intervention.

The greatest improvement was recorded in farm mechanization (mean difference = 4.00), indicating that multimedia content delivered through WhatsApp was highly effective in explaining the use of modern agricultural machinery and equipment. This was followed by disease management (1.79), planting methods (1.59), and manures and fertilizers (1.52). The findings highlight the growing potential of mobile-based communication platforms in delivering timely, accessible, and practical agricultural information to farmers.

Gain in Knowledge of Farmers on Paddy Cultivation Practices Following Agricultural Portal Exposure

The results presented in Table 4 show that exposure to the agricultural portal also resulted in a significant improvement in farmers' knowledge. The paired *t*-test confirmed that the increase in knowledge after exposure was statistically significant.

The highest mean knowledge gain was observed for farm mechanization (3.60), followed by insect pest management (1.77) and disease management (0.90). Although the agricultural portal contributed positively to knowledge enhancement, the extent of improvement varied across different components of paddy cultivation.

The comparatively higher knowledge gain in farm mechanization across all communication media may be attributed to the practical importance of agricultural machinery in improving labour efficiency, reducing production costs, ensuring timely field operations, and increasing overall productivity. Mechanization also facilitates the efficient use of critical inputs such as seeds, fertilizers, and irrigation water.

Similarly, considerable knowledge gain in disease and insect pest management may be associated with the frequent occurrence of pests and diseases in paddy cultivation, making these topics highly relevant to farmers. Increased awareness of effective management practices enables farmers to minimize crop losses and improve productivity. Improvements in knowledge regarding planting methods may be due to the increasing shortage and rising cost of agricultural labour, encouraging farmers to explore alternative and more efficient planting techniques. Likewise, enhanced understanding of nutrient management reflects the importance of balanced fertilizer application and organic manure use for maintaining soil fertility and achieving higher crop yields.

The relatively lower improvement in certain other practices may be

attributed to limited exposure time, lower perceived relevance, or reduced interest among respondents. These findings are consistent with those reported by Shivani Dechamma (2015) ^[12].

Knowledge Gain among Control Group Farmers

The findings presented in Table 5 indicate that there was no noticeable improvement in the knowledge level of farmers in the control group. Since these respondents were not exposed to any of the communication treatments, their pre-test and post-test knowledge scores remained almost unchanged. This confirms that the observed improvements in the experimental groups were primarily due to the communication interventions rather than external influences.

Overall Relative Effectiveness of Different Electronic Media

The comparative effectiveness of the three electronic communication media is presented in Table 6. Knowledge gain was assessed using paired *t*-tests, while one-way analysis of variance (ANOVA) was employed to examine differences among the treatments.

The results showed that farmers exposed to television recorded an increase in mean knowledge score from 33.28 before exposure to 50.46 after exposure. The paired *t*-value of 20.91 was significant at the 1 per cent level, indicating a substantial improvement in knowledge following the intervention.

For the mobile phone (WhatsApp) treatment, the mean knowledge score increased from 31.38 before exposure to 41.82 after exposure. The corresponding paired *t*-value (9.43) was also significant at the 1 per cent level, demonstrating the effectiveness of mobile-based communication in enhancing farmers' knowledge.

Similarly, farmers exposed to the agricultural portal showed an increase in mean knowledge score from 14.31 to 19.92. The paired *t*-value of 5.98 was statistically significant at the 1 per cent level, confirming that the agricultural portal also contributed positively to knowledge enhancement. The ANOVA results further revealed significant differences in knowledge gain among the three communication media, indicating that their effectiveness was not uniform. Overall, television produced the highest level of knowledge improvement, followed by mobile phone (WhatsApp) and the agricultural portal. The superior performance of television may be attributed to its ability to combine visual demonstrations with audio explanations, making complex agricultural practices easier to understand and remember. Mobile phones, particularly WhatsApp, provided the advantage of instant access and repeated viewing of educational content, while agricultural portals offered comprehensive information but required greater digital literacy and internet access.

The findings support the hypothesis that different electronic communication media vary significantly in their effectiveness in enhancing farmers' knowledge of recommended paddy cultivation practices. These results are in agreement with the findings reported by Shivani Dechamma (2015) ^[12] and Priyanka (2016) ^[9], who also observed significant improvements in farmers' knowledge through electronic and digital communication interventions

Table 1: Research Design

Number of Treatments	3
Treatment 1	Television Programme
Treatment 2	WhatsApp mobile message
Treatment 3	Message through Agriportal
Control	No message
Number of Villages	4
Paddy farmer/ treatment	30
Total number of farmers	30X4= 120

Table 2: Gain in Knowledge level of farmers on paddy cultivation practices due to television exposure (n=30)

Sl. no	Paddy Cultivation Practices	Scores	Television Treatment						Paired ' t' value
			Before		After		Mean Knowledge gain		
			Mean	SD	Mean	SD	Mean	SD	
1	Recommended varieties	3	1.63	0.55	2.16	1.90	0.53	1.35	4.28**
2	Seed bed preparation	3	2.10	0.71	2.43	2.36	0.33	1.65	2.56**
3	Sowing time	3	2.00	0.78	2.33	2.30	0.33	1.52	2.76**
4	Seed selection	2	1.33	0.47	1.63	1.46	0.30	0.99	3.52**
5	Seed treatment	2	1.06	0.25	1.56	1.40	0.50	1.15	5.38**
6	Planting method	5	2.76	0.77	3.53	3.06	0.77	2.29	3.69**
7	Seed rate	2	1.43	0.62	1.8	1.56	0.37	0.94	3.26**
8	Field preparation	2	1.20	0.55	1.76	1.33	0.56	0.78	4.90**
9	Transplanting	2	1.60	0.49	1.96	1.70	0.36	1.21	2.40**
10	Manures and fertilizers	3	1.46	0.73	2.90	1.34	1.44	0.61	3.61**
11	Inter-cultural operation	4	1.73	0.69	2.76	2.06	1.03	1.37	4.76**
12	Water management	2	1.13	0.46	1.60	1.30	0.47	0.84	4.47**
13	Insect pest management	9	6.50	1.54	7.66	2.16	1.16	0.62	5.75**
14	Diseases management	5	3.46	0.86	4.96	1.02	1.50	0.16	4.69**
15	Harvesting	1	0.40	0.49	0.83	0.73	0.43	0.24	4.70**
16	Farm mechanization	12	5.63	1.77	8.43	2.07	2.80	0.30	6.60**

Min. score =0, Max. score =62, ** Significant at 1% level, * Significant at 5% level, t (0.01, 29df) =2.462, t (0.05, 29df) = 2.045

Table 3: Gain in Knowledge level of farmers on paddy cultivation practices due to mobile phone exposure. (n=30)

Sl.no	Paddy Cultivation Practices	Scores	Mobile Treatment						Paired ‘ t’ value
			Before		After		Mean Knowledge gain		
			Mean	SD	Mean	SD	Mean	SD	
1	Recommended varieties	3	1.40	0.56	2.56	0.59	1.16	0.03	4.32**
2	Seed bed preparation	3	1.86	0.68	2.84	1.02	0.98	0.34	2.87**
3	Sowing time	3	1.70	0.70	2.54	1.04	0.84	0.34	2.83**
4	Seed selection	2	1.26	0.44	1.70	1.00	0.44	0.56	3.54**
5	Seed treatment	2	1.13	0.34	1.67	0.57	0.54	0.23	5.10**
6	Planting method	5	2.43	0.89	4.02	1.30	1.59	0.41	4.02**
7	Seed rate	2	1.33	0.47	1.92	1.20	0.59	0.73	3.26**
8	Field preparation	2	1.23	0.56	1.84	0.70	0.61	0.14	4.97**
	Transplanting	2	1.46	0.62	1.85	0.93	0.39	0.31	3.01**
10	Manures and fertilizers	3	1.40	0.72	2.92	0.88	1.52	0.16	3.78**
11	Inter-cultural operation	4	1.66	0.66	2.84	1.03	1.18	0.37	4.79**
12	Water management	2	1.23	0.52	1.62	1.00	0.39	0.48	4.37**
13	Insect pest management	9	6.50	1.54	7.05	3.34	0.55	1.80	3.78**
14	Diseases management	5	3.13	1.19	4.92	1.90	1.79	0.71	3.63**
15	Harvesting	1	0.33	0.47	0.94	0.86	0.61	0.39	4.73**
16	Farm mechanization	12	5.23	1.95	9.23	3.40	4.00	1.45	3.78**

Min. score =0, Max. score =62, ** Significant at 1% level, * Significant at 5% level, t (0.01, 29df) =2.462, t (0.05, 29df) = 2.045

Table 4: Gain in Knowledge level of farmers on paddy cultivation practices due to agriportal exposure. (n=30)

Sl.no	Paddy Cultivation Practices	Scores	Agriportal Treatment						Paired ‘ t’ value
			Before		After		Mean Knowledge gain		
			Mean	SD	Mean	SD	Mean	SD	
1	Recommended varieties	3	1.20	0.48	1.50	0.73	0.30	0.25	2.52**
2	Seed bed preparation	3	1.60	0.72	1.76	0.67	0.16	0.05	2.40*
3	Sowing time	3	1.43	0.67	1.63	0.66	0.20	0.01	2.69**
4	Seed selection	2	1.23	0.43	1.43	0.50	0.20	0.07	2.69**
5	Seed treatment	2	1.06	0.25	1.20	0.40	0.14	0.15	2.11*
6	Planting method	5	2.00	0.94	2.36	1.12	0.36	0.18	2.48**
7	Seed rate	2	1.26	0.58	1.60	0.49	0.34	0.09	3.80**
8	Field preparation	2	1.33	0.47	1.63	1.46	0.30	0.02	3.52**
9	Transplanting	2	1.13	0.50	1.43	0.49	0.30	0.01	3.52**
10	Manures and fertilizers	3	1.86	0.68	2.26	0.44	0.40	0.24	3.24**
11	Inter-cultural operation	4	1.46	0.73	2.03	1.50	0.57	0.02	3.61**
12	Water management	2	1.06	0.25	1.56	1.40	0.50	0.25	5.38**
13	Insect pest management	9	5.63	1.77	7.40	6.43	1.77	0.70	3.60**
14	Diseases management	5	2.70	0.79	3.60	0.50	0.90	0.29	5.20**
15	Harvesting	1	0.40	0.49	0.80	0.40	0.40	0.09	4.39**
16	Farm mechanization	12	6.03	2.40	9.63	1.52	3.60	0.88	5.26**

Min. score =0, Max. score =62, ** Significant at 1% level, * Significant at 5% level, t (0.01, 29df) =2.462, t (0.05, 29df) = 2.045

Table 5: Gain in knowledge of farmers on paddy cultivation practices in control group (n=30)

Sl. No.	Paddy Cultivation Practices	Scores	Control group			
			Before		After	
			Mean	SD	Mean	SD
1	Recommended varieties	3	1.46	0.5.0	1.36	0.46
2	Seed bed preparation	3	1.86	0.73	1.86	0.73
3	Sowing time	3	1.86	0.68	1.86	0.68
4	Seed selection	2	1.26	0.44	1.26	0.44
5	Seed treatment	2	1.16	0.37	1.16	0.37
6	Planting method	5	2.53	1.00	1.96	0.97
7	Seed rate	2	1.40	0.49	1.40	0.49
8	Field preparation	2	1.23	0.43	1.23	0.43
9	Transplanting	2	1.53	0.50	1.53	0.50
10	Manures and fertilizers	3	1.53	0.68	1.53	0.68
11	Inter-cultural operation	4	1.93	0.82	1.93	0.82
12	Water management	2	1.26	0.54	1.26	0.54
13	Insect pest management	9	6.3	1.55	6.30	1.55
14	Diseases management	5	3.16	1.01	3.16	1.01
15	Harvesting	1	0.63	0.49	0.63	0.49
16	Farm mechanization	12	5.16	1.74	6.67	1.96

Min. score =0, Max. score =62

Table 6: Overall Relative effectiveness of knowledge level of farmers due to the exposure of different treatments.

Treatments	Before		After		Difference		Paired 't' value
	Mean	SD	Mean	SD	Mean	SD	
T₁ Television (n=30)	33.28	12.31	50.46	20.76	12.88	16.02	20.91**
T₂ Mobile (n=30)	31.38	12.15	41.82	18.71	10.44	6.56	9.43**
T₃ Agriportal (n=30)	14.31	8.11	19.92	8.24	5.61	0.13	5.98**
F-value	0.96 ^{NS}		0.54 ^{NS}		4.46*		

** Significant at 1% level, * Significant at 5% level, NS Non significant, t (0.01, 29df) =2.462, t (0.05, 29df) = 2.04

Conclusion

The results of this experimental research have direct implications for extension outreach efforts in the developing countries. The study shows that need based and interactive WhatsApp mobile phone message which was developed in local language had significantly increased the knowledge among paddy farmers, followed by television and agriportal. From the result we can also note that there was no increase in the knowledge level of control group farmers as they were not exposed to any of the treatment. So, it is highly recommended to develop such need based and interactive audio-visual messages which can enhance the knowledge of farmers. It is also suggested to the policy makers to take proper initiative to make arrangement for using the software packages at the doorstep of the farmers by providing ICT inputs such as computer with internet connectivity. This initiative will enhance the information dissemination through these communication channels and thereby resulting into the economic growth of the farmers and nation as a whole in paddy production and other similar enterprises.

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