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REVIEW ARTICLE

The role of podcasts in agricultural extension: Enhancing farmer-to-farmer learning

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Abstract

The rise of digital communication tools has opened new avenues for agricultural extension, with podcasts emerging as a powerful medium for farmer-to-farmer learning. This study explores the effectiveness of podcast-based agricultural education in enhancing knowledge dissemination among farmers in the Coimbatore region. Adopting an action research design, podcast interviews were created with 30 farmers, including both pesticide-using and innovative practitioners. These podcasts were then disseminated to another group of 30 purposively selected farmers to evaluate awareness and attitudinal changes. The study employed ranking techniques like Garrett ranking and word cloud analysis using NVivo software to interpret the responses. The results revealed that podcasts significantly contributed to creating awareness, improving knowledge, shaping positive attitudes and encouraging symbolic and actual adoption of agricultural innovations. Respondents found the content relatable, easy to understand and accessible, highlighting the value of localized and experience-based communication. Despite these positive outcomes, the study identifies research gaps, such as limited understanding of long-term behavioural changes and the need for scalability across diverse farming communities. The findings suggest that podcasts can be a cost-effective and impactful tool in agricultural extension when integrated with participatory approaches and supported by ICT infrastructure. Future research should focus on measuring the economic benefits, enhancing content delivery in multiple languages and fostering community-driven content creation to sustain interest and impact.

Keywords: communication; farmer-to-farmer learning; Garrett ranking; NVivo software; podcast-based learning

Introduction

Imagine a small-holder farmer in Tamil Nadu struggling to manage a pest outbreak. Although aware of recent technological developments, he lacks access to timely agricultural training due to constraints in time, mobility and financial resources. Consequently, like many others, he relies on outdated or ineffective advice from peers. In India, where 42.3 % of the population depends on agriculture for livelihood, this scenario reflects a larger issue in agricultural knowledge dissemination (1). Despite government efforts to introduce innovations and promote sustainable practices, a significant proportion of farmers remain unaware of these resources due to inefficient communication channels (2).

This challenge underscores a critical gap-not the absence of innovation, but the lack of effective, accessible and inclusive communication strategies. Traditional extension methods such as field demonstrations, printed pamphlets and in-person training often fail to reach remote or marginalized communities. They are constrained by logistics, cost and often a mismatch between message format and farmers' literacy or lifestyle patterns. There is a growing need for communication tools that are flexible, scalable and non-disruptive to daily farm routines. Here, digital audio media, especially podcasts, emerge as a promising medium.

Rooted in the diffusion of innovations theory, the uptake of agricultural innovations heavily depends on how information is communicated across social systems (3). According to this theory, effective communication through opinion leaders and accessible media can accelerate the adoption process. Podcasts, as an on-demand and mobile-accessible audio medium, align well with this model by promoting awareness, persuasion and ultimately decision-making among farmers (3).

Podcasts have revolutionized information sharing across sectors-from business to public health-and are now making inroads in agriculture. Unlike traditional radio programs, which follow fixed schedules, podcasts offer on-demand content that can be streamed or downloaded and listen while working in the field or traveling to markets (4). This allows farmers to engage in "just-in-time" learning, which is especially vital in times of crop failure or pest outbreaks. From a uses and gratifications theory perspective, podcasts fulfil informational and entertainment needs, empowering farmers to actively select content relevant to their local context and needs (5).

Moreover, podcasts overcome literacy barriers, making them more inclusive than written materials (6). They are also cost-effective, eliminating the need for physical infrastructure or recurring staff costs. Content can be easily produced in regional languages, enhancing relatability and local relevance (2). This accessibility aligns with protection motivation theory, where risk awareness (e.g. pest outbreaks) combined with access to self-efficacy tools (e.g., expert advice in podcasts) enhances motivation to adopt protective behaviours (7).

The origins of podcasting trace back to the early 2000s, with journalist Ben Hammersley coining the term "podcast" in 2004 by combining “iPod” and “broadcast” (8). Yet, its foundation lies in the broader evolution of audio media, starting with KDKA radio in the 1920s, followed by FM innovations in the 1930s and portable audio players like the Walkman in 1979 (9). Today, podcasts are among the fastest-growing digital media formats, available on platforms like Spotify, Apple podcasts, YouTube and Google podcasts (10). Their rise is driven by increased smartphone penetration and affordable internet access, especially in developing countries such as Brazil, South Korea and India (11).

The versatility of podcast formats further enhances their utility in agriculture. Some provide expert explanations on farming techniques, climate-resilient practices and market updates (4). Others are interview-based, featuring policymakers, progressive farmers and agronomists who offer valuable insights (5). Storytelling-based podcasts foster peer learning and emotional engagement, while news-focused content updates farmers on market prices and government schemes (8).

Crucially, podcasts bridge the knowledge gap by disseminating research-backed practices and real-world solutions even to isolated communities (5). Their audio-based format enables easy assimilation of information, regardless of literacy level (2). Economically, they are more sustainable than conventional models of extension, enabling mass outreach with minimal recurring investment (5). Podcasts also promote farmer-to-farmer learning, as interviews with successful practitioners make information relatable and trusted (12).

Returning to our Tamil Nadu farmer, a well-curated podcast could mean the difference between repeating outdated pest control practices and applying scientifically supported, effective solutions. In an era of increasing digital connectivity and localized content creation, podcasts hold transformative potential for agricultural extension by ensuring that crucial information reaches the farmers who need it most, in the language and format they understand best, this study seeks to investigate how podcasts can revolutionise the dissemination of agricultural knowledge and empower farmers:

- To explore the potential of podcast as a tool for transferring agricultural technologies to farmers.
- To analyze the role of podcasts on key extension functions.
- To identify the constraints faced by farmers in utilizing podcasts as an effective medium for agriculture.

Review of literature

Podcasts are a game-changing medium for sharing knowledge, especially in the fields of education and professional development. They offer a versatile and interesting platform that facilitates formal and informal education in a variety of subjects, such as skill development, digital literacy and agricultural extension. Podcasts are a useful tool for agricultural extension because they allow for the sharing of knowledge within an organisation, enabling both vertical and horizontal information flow that supports timely decision-making and farmer empowerment (10).

Their research highlights how podcasts facilitate the easy exchange of information between interested parties, increasing the availability of pertinent agricultural insights. Similarly, learner-generated podcasts strengthen digital literacy and collaborative knowledge-building, which supports their potential in farmer-to-farmer learning (11). Podcasts can facilitate peer-based knowledge exchange in a more dynamic and participatory way by enabling farmers to produce and distribute content.

Podcasts are especially well-suited for rural education since they promote engagement and break down conventional barriers to support constructivist learning (12). This is consistent with, which highlights the potential of podcasts in agricultural education by showing how combining them with ethnoscience-based learning enhances knowledge retention and teamwork (13). Further supporting their function in knowledge expansion, also claims that podcasts provide a forum for expert engagement, professional growth and co-constructive reflection (14).

The interactive and multimedia-rich features of Web 2.0 tools are also advantageous to podcasts. These technologies improve virtual learning environments and collaboration, offering flexibility for "anytime, anywhere" learning (15). In agricultural extension, where farmers require on-demand access to knowledge without interfering with their daily routines, this is extremely helpful. The impact of interpolated questions in podcasts and discovered that adding interactive components greatly enhanced listeners' retention of information (16). According to their research, structured podcast formats have the potential to improve learning outcomes and serve as a useful instrument for knowledge transfer between farmers. Additionally, podcasts improve communication, especially when they are created with interactive and socially relevant content, which supports their use in agricultural education (17).

Podcasts enable users to co-create and share knowledge, which is a crucial component of farmer education and extension services and examined them as collaborative knowledge-building tools (18). Podcasts enable self-directed knowledge acquisition and retention, promoting informal learning and making them an invaluable tool for lifelong learning (19). Podcasts improve motivation and engagement in addition to aiding in learning. Podcasts retain information and discovered that, although they don't perform noticeably better than traditional lectures, they make review materials more accessible, which strengthens learning objectives (20). In a similar vein, podcasts enhance student involvement and cater to various learning preferences, making them an invaluable supplement to project-based learning (21).

Podcast-based learning also improves critical thinking and digital literacy. The ways in which podcasts, blogs and social media help students develop their media literacy and creativity (22). Their results support the use of podcasts as a tactical teaching aid. Furthermore, the value of podcasts in

professional education, pointing out that they can offer asynchronous and on-demand learning opportunities, especially in specialised fields like medical education (23).

Action research design

The action research design used in this study integrated planning, action, observation and reflection to simultaneously address problems and develop solutions. The study was conducted in key agricultural blocks in and around Coimbatore, including PN Palayam and Thondamuthur, where podcast videos were produced and Perur, where farmers' awareness of the produced content was assessed.

Selection of respondents

The integration of action research and *ex post facto* design in this study is deliberate and complementary. Action research supports active engagement with farmers to introduce and assess podcast-based extension tools through participatory methods. In contrast, the *ex post facto* design allows for the retrospective comparison of outcomes between two naturally formed groups-podcast users and non-users without researcher intervention.

A total of 60 farmers were purposively selected and categorized into two groups based on prior exposure to agricultural podcasts. This grouping enables the measurement of knowledge differences and behavioural outcomes (*ex post facto*), while also facilitating participatory feedback and learning cycles (action research). Together, these approaches provide a holistic view of both the process and impact of podcast-based agricultural extension

Podcast content creators

The use of snowball and purposive sampling was intentional to ensure the inclusion of experienced and information-rich farmers who could contribute meaningful content to the podcasts. While these non-probability sampling techniques are efficient for identifying niche or hard-to-reach participants, we acknowledge that they may introduce selection bias and limit the generalizability of the findings to the broader farming population.

To mitigate these limitations, we ensured diversity within the sample by including farmers from varied backgrounds, such as natural farming practitioners and conventional pesticide users, different geographical areas and with varying farm sizes. Additionally, the focus of this component was not to generalize outcomes, but to capture authentic, practical insights and lived experiences that could be shared through podcasts to benefit a wider audience. For broader validation, future studies could employ stratified random sampling across larger populations.

Podcast awareness respondents

A total of 30 respondents were selected for the podcast awareness component to ensure a focused, in-depth exploration of farmers' awareness, accessibility and perception of podcast-based extension services. The sample size was determined based on the exploratory nature of this phase, where the goal was to gain qualitative insights rather than statistical generalization.

This number was also practical given time and resource constraints and sufficient to reach data saturation, where additional responses no longer yielded new themes or information. The sample allowed for meaningful interaction with farmers while maintaining feasibility for detailed data collection and analysis.

- To assess their awareness and perception of the shared knowledge, farmers in this group watched the podcast videos.
- The purposive sampling technique was used to select them, guaranteeing that the participants were pertinent and able to offer insightful commentary on the podcasts.

To gather a range of viewpoints on agricultural practices, respondents were chosen according to predetermined criteria. The study concentrated on two groups of farmers: those who actively use chemical pesticides in their farming operations and those who use more contemporary, environment friendly or technologically advanced farming techniques. Of the 60 respondents, 30 farmers were chosen for data collection and analysis and another 30 farmers were chosen for podcast video documentation. The snowball sampling technique was used to find participants for the qualitative analysis of the podcast documentation. Purposive random sampling, on the other hand, ensured representativeness and relevance in the quantitative data collection and analysis process.

The study included the creation of a YouTube podcast channel called "உழவர்களின் உலகம்" (translated as "The World of Farmers") to share information and record the results. Through video interviews, this platform provided a means of disseminating farmer perspectives and experiences. A total of 30 videos of interactions with farmers were posted to the channel, documenting their distinct viewpoints on innovations, difficulties and agricultural practices. The platform's objectives were to improve farmer-to-farmer education and establish a practical knowledge base that was open to a larger audience. An organised and tested interview schedule was used to collect data through in -person interviews and field visits, ensuring comprehensive information from respondents. The interview schedule was pre-tested with a small group of farmers and reviewed by subject matter experts to ensure clarity, relevance and reliability. Feedback from the pilot was incorporated to refine the questions. The study employed an *ex post facto* research design, which is appropriate for examining variables influencing the adoption of creative farming techniques, as it allows analysis of cause-and-effect relationships without direct manipulation of variables, aligning well with the research objectives.

Creating awareness

In the study, the farmer producer organisation (FPO) of the Thondamuthur block was crucial. With a membership of 1200 farmers, this FPO is regarded by its members as a high-performing organisation. Its selection was heavily impacted by its efficacy and favourable farmer perception. The FPO also shared the podcast channel with its members through WhatsApp groups, which helped to spread the word about the study. This strategy made sure that the information reached a large and varied group of farmers, encouraging the sharing of knowledge and gathering of feedback.

The data was analysed using the proper statistical tools, which made it possible to identify important trends, obstacles and opportunities. Meaningful conclusions regarding the adoption of innovative farming practices were drawn from the findings. Critical insights into the factors influencing farmers'

decisions and their overall experiences with agricultural innovations were obtained from the FPO's active participation and the contrasting adoption patterns in the Thondamuthur and Periyanaickenpalayam blocks.

Garrett's ranking framework

To investigate how podcasts affect important agricultural extension tasks, Garrett's ranking method was used to determine and rank the barriers farmers encounter when trying to use podcasts as a productive way to share agricultural knowledge. This approach made it possible to systematically assess the difficulties faced by farmers and their relative significance. Based on their observations and experiences, farmers were asked to rank the identified constraints. The following formula was used to convert these ranks into scores:

$$\text{Percent position} = [100 \times (Rij - 0.5) / Nj]$$

Where, Rij denotes the rank assigned to the i^{th} factor by the j^{th} respondent, Nj represents the total number of factors ranked by the j^{th} respondent.

Garrett's ranking table was used to convert the percent positions obtained from this formula into scores. After that, the mean score was determined by adding the scores for each component. Farmers' use of podcasts as a medium for agricultural extension was found to be most significantly hampered by factors with the highest mean scores. This method aided in identifying obstacles like restricted internet access, unfamiliarity with digital tools, difficulty accessing pertinent content and language barriers. The study's methodical analysis of these limitations revealed ways to better customise podcasts to farmers' requirements and preferences. Garrett's ranking technique, which was used in this study, provided a quantitative framework for understanding how well podcasts work to raise awareness, change attitudes, improve knowledge, encourage symbolic adoption and encourage the actual adoption of agricultural innovations. As a cutting-edge tool for agricultural extension, the results should aid in the creation of strategies that improve podcasts' impact and accessibility.

Using NVivo 12 Plus software, qualitative data analysis was conducted on farmers' recommendations about podcast use. Open-ended responses were coded and a word cloud was generated to visually represent the most frequent terms and themes. Although the primary method was thematic analysis, themes were developed through systematic coding of responses to identify key patterns and insights, enhancing the clarity and depth of the qualitative findings (24).

Results and Discussion

The potential of podcast

The podcast channel "உழவர்களின் உலகம்" (Farmers' World), is a digital platform for sharing agricultural knowledge, presenting real-life experiences and bridging the information gap between traditional and innovative farming practices (Fig. 1). A total of 30 videos posted, this channel offers farmers easily accessible, knowledgeable content on a variety of subjects, including drone technology, disease management, weedicide-controlled technology and organic farming.

Fig. 2 showed the analytics of YouTube podcast channel show a very promising trend in the use of digital media for the dissemination of agricultural knowledge. Farmers and agricultural stakeholders are clearly actively interacting with the content, as evidenced by the 1642 views, which shows the increasing popularity of podcast-based learning. The 34-hour watch duration shows that viewers are not just clicking on the videos but also devoting a considerable amount of time to learning the content, thereby confirming the capacity of this medium to transmit knowledge. A total of 52 new subscribers has joined the channel, demonstrating the possibility of creating a devoted following that appreciates podcasts as a means of lifelong learning.

The consistent increase in viewership indicates that your material is connecting with the intended audience and encouraging a creative method of knowledge exchange between farmers. This offers a chance to plan additional content

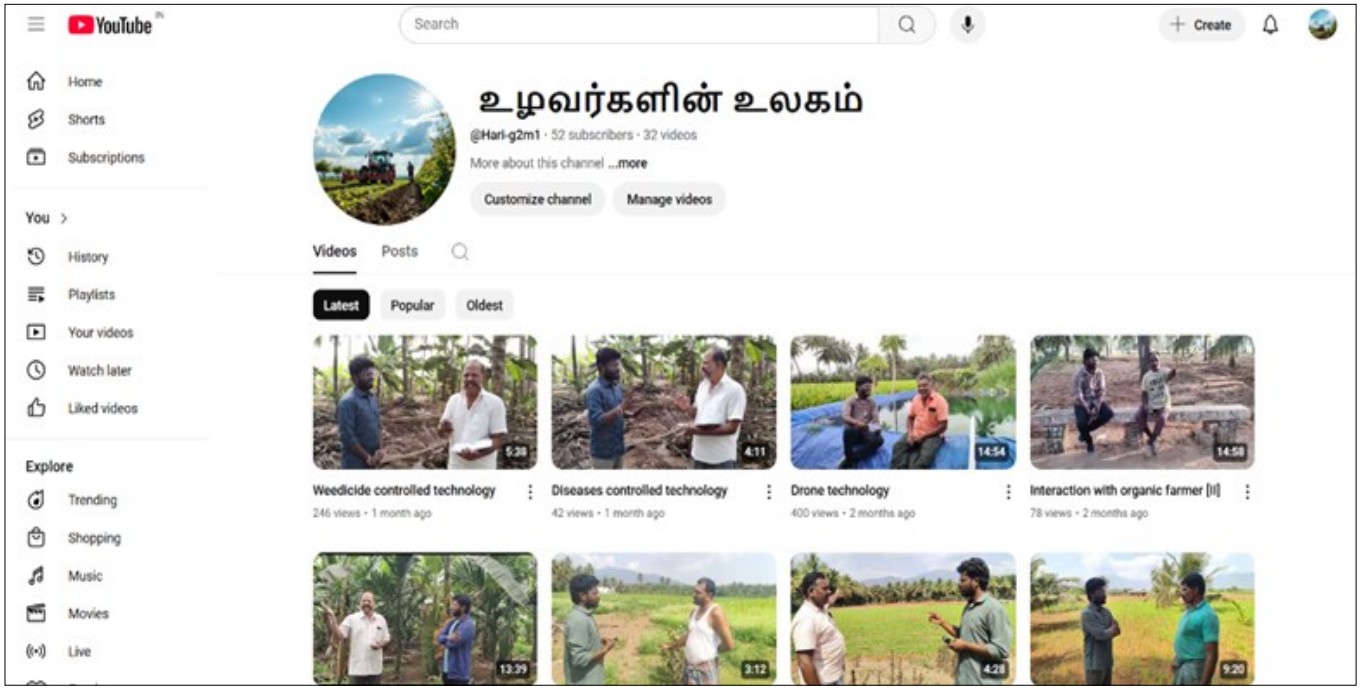

Fig. 1. Podcast channel for the study.

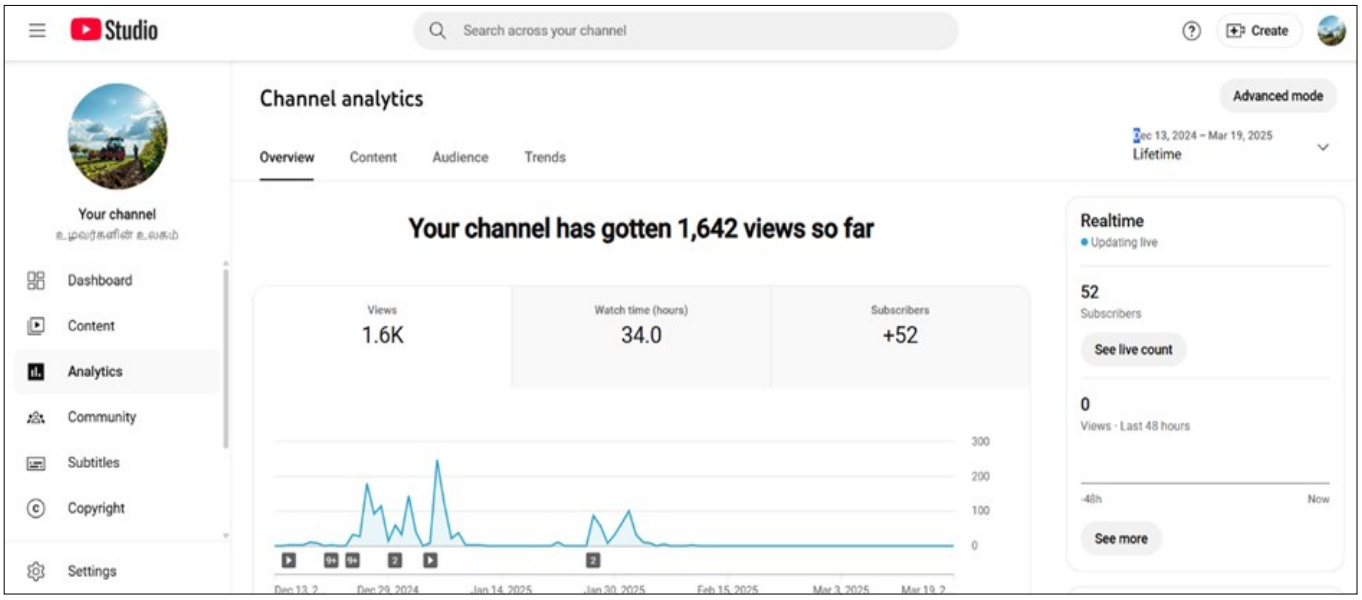

Fig. 2. Total views of the channel.

promotion, possibly making use of farmer networks and social media to increase reach. The channel's general response confirms that podcasts are a powerful, adaptable and easily accessible tool for agricultural extension that fills knowledge gaps and equips farmers with solutions supported by science. The potential for this channel to transform digital agricultural education and set the standard for future technology-driven extension programs lies in its sustained efforts to diversify its content, engage its audience and hold interactive discussions.

The most interesting podcast videos on the channel are highlighted, which offers important information about the content preferences of farmers (Fig. 3). With the highest number of views, the "drone technology" video demonstrates a keen interest in cutting-edge agricultural innovations and precision farming methods and "weedicide-controlled technology" comes next, addressing farmers' demand for efficient weed control methods. It appears that many farmers are keen to learn from practical experiences in sustainable farming, as evidenced by the popularity of the "interaction with organic farmer" videos. The "seven days seven vegetable concept" video, which demonstrated the potential of organised farming methods, also garnered attention. A total of 52 subscribers, 34 hours of viewing time and 1642 views overall, the channel shows an increasing influence in disseminating agricultural knowledge. The content is reaching a relevant audience, encouraging knowledge-sharing and hands-on learning among farmers, as evidenced by the 26648 impressions and 5.4 % click-through rate.

Role of podcasts on key extension functions

An in-depth understanding of how well podcasts influence farmer behaviour and knowledge is provided by the examination of their function in important agricultural extension functions, as shown in Table 1. With a Garrett mean score of 71.6, the highest-ranked function improving knowledge indicates that podcasts have been the most successful in providing farmers with pertinent information. This illustrates how effectively audio-based content can convey timely, relevant and topic-specific agricultural knowledge in an approachable way. From a researcher's perspective, this result shows how podcasts can be used as a low-cost, scalable tool to help rural populations fill in information gaps, particularly in places with limited access to traditional extension services.

The role of raising awareness comes in second, with a Garrett mean score of 67.66. This implies that podcasts are essential for introducing farmers to new methods, tools and government initiatives. By allowing for repeated exposure to the

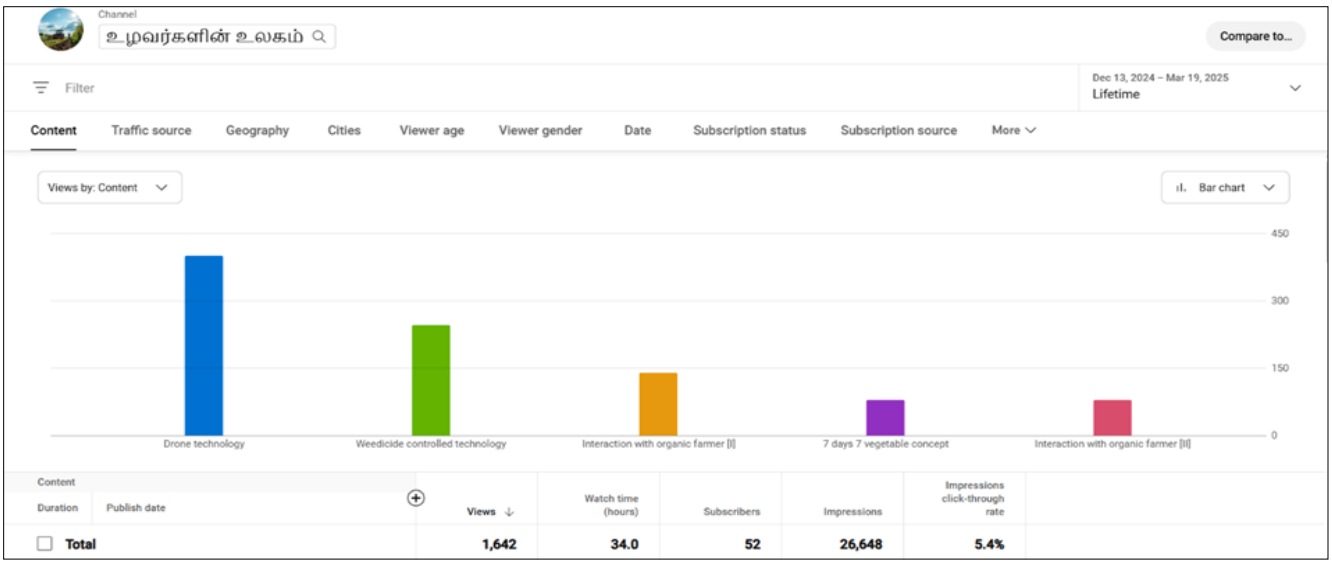

Fig. 3. Highlights the top five most-watched podcast videos.

Table 1. Reflets the role of podcasts on key extension functions.

Role of podcasts	Total score	Garrett mean score	Rank
Enhancing knowledge	2150	71.60	I
Creating awareness	2030	67.66	II
Shaping attitudes	1970	65.60	III
Fostering symbolic adoption	1530	51.00	IV
Promoting actual adoption	1205	40.10	V

material, the auditory format helps farmers learn about innovations that they might not have otherwise encountered. In remote or marginalised communities where face-to-face extension is sporadic or non-existent, the impact on raising awareness is especially noteworthy.

With a Garrett mean score of 65.6, attitudes shaping ranks as the third most influential role in Table 2. This suggests that podcasts have an impact on farmers' attitudes and perspectives regarding contemporary farming methods in addition to providing them with information. By highlighting the perceived advantages and applicability of the information presented, podcasts that feature expert voices, success stories and peer experiences help to promote positive attitude change. As a researcher, this suggests that podcasts are useful not only as a means of communication but also as a means of influencing attitudes that can help people become more behaviourally prepared.

Table 2. Constraints faced by the farmers in utilizing podcast.

Constraint	Total score	Garrett mean score	Rank
Lack of awareness about podcasts as an information source	2091	69.7	I
Inconsistent or unreliable internet connectivity	2075	69.1	II
Lack of trust in the credibility of podcast information	2015	67.1	IV
Limited access to smartphones or digital devices	2051	68.3	III
Language barriers in podcast content	1959	65.3	V
Low digital literacy among farmers	1774	59.1	VI
Lack of time due to agricultural and household responsibilities	1693	56.4	VII
Difficulty in finding specific or relevant podcast episodes	1604	53.4	IX
Limited integration of podcasts into the existing extension framework	1562	52	X
Low motivation to adopt new information-sharing technologies	1654	55.1	VIII

Symbolic and actual adoption were measured using a Garrett ranking method, with symbolic adoption reflecting farmers' consideration or intent to adopt new practices without full implementation (Garrett mean score: 51.0). Symbolic adoption captures early interest and attitude change, often preceding actual behavioral change. This study found that while podcasts foster symbolic adoption by raising awareness and intent, additional support such as peer interactions or demonstrations is needed to translate this into actual adoption, meaning the full practical application of new practices.

Finally, encouraging actual adoption has the lowest Garrett mean score (40.1), indicating that although podcasts are useful for raising awareness and knowledge, they might not be enough to encourage complete behavioural adoption on their own. Whether or not farmers adopt the practices that podcasts introduce is probably influenced by elements like follow-up support, technical assistance and resource accessibility. This restriction thus emphasises how crucial it is to incorporate podcasts with more comprehensive extension tactics, such as field trips, on-farm trials and group-based learning exercises.

Constraints faced by the farmers in utilizing podcast

Table 2 indicates the constraints' ranking according to Garrett mean scores. It provides important information on the obstacles that prevent farmers from making the most of podcasts as a tool for agricultural extension. Having a Garrett mean score of 69.7, the most significant limitation is the lack of knowledge regarding podcasts as a source of information. The fact that many farmers are either ignorant of the podcast concept or their potential as a dependable learning tool underscores a serious communication gap. This necessitates, from the perspective of a researcher, a focused awareness campaign and outreach at the grassroots level to introduce farmers to podcast-based learning through interactive extension activities and demonstrations.

Inconsistent or unreliable internet connectivity (Garrett mean score 69.1) is the second main limitation and it reflects the infrastructure issues that are common in many rural areas. Accessing digital content is still severely hampered by unreliable internet, even with the increasing use of mobile networks. The third-ranked problem, restricted access to smartphones or other digital devices (Garrett mean score 68.3), which highlights the technological and economic divide in rural areas, is closely related to this restriction. In order to ensure greater accessibility, these two limitations highlight the necessity of offline podcast solutions like preloaded devices, community listening centres or integration into regional radio shows.

Lack of confidence in the reliability of podcast information (Garrett mean score 67.1), which ranks fourth, highlights an important psychological and social component. Trust is a key factor in the adoption of knowledge in traditional agricultural settings. Farmers frequently turn to tried-and-true sources like knowledgeable peers or local extension agents. Podcast content may not be easily embraced if it is thought to be generic or remote. This research implies that the effectiveness of the tool could be greatly increased by including reliable voices in the creation of podcast content, such as prosperous farmers, subject-matter experts and local extension agents.

Language barriers are another significant obstacle; they rank fifth in podcast content (Garrett mean score 65.3). This limitation highlights how crucial linguistic inclusivity. Local dialects and straightforward, relatable presentation are essential for the success of podcast-based communication. The content's practical usefulness may be limited if it is not properly localised, as it may not connect with its target audience.

Farmers' low digital literacy ranked sixth (Garrett mean score 59.1), is another significant issue. This illustrates how many farmers struggle to use podcast platforms, mobile apps or even simple smartphone functions. Through practical instruction or supervised group sessions led by extension agents, it reaffirms the necessity of capacity-building initiatives that can acquaint farmers with digital tools.

Next, with a Garrett mean score of 56.4, is a lack of time as a result of household and agricultural obligations. This restriction

demonstrates the real-world limitations in farmers' daily schedules that prevent them from making time for new learning resources. It highlights how crucial it is to create podcast content that is succinct, time-efficient and flexible enough to fit farmers' schedules possibly in the form of brief episodes that can be listened to while travelling or relaxing. A lack of perceived benefit or resistance to change is reflected in the eighth-ranked constraint, low motivation to adopt new information-sharing technologies (Garrett mean score 55.1). Peer pressure, success stories and interactive examples of the practical applications of these tools can frequently help break down this psychological barrier. Greater adoption may result from showcasing the podcasts' ability to enhance agricultural practices and yields.

The last two limitations, the inability to locate particular or pertinent podcast episodes (Garrett mean score 53.4) and the restricted incorporation of podcasts into the current extension framework (Gerrett mean score 52.0), point to deficiencies in institutional support and content organisation. Farmers might have trouble navigating disorganised or poorly categorised content, which suggests that user-friendly interfaces and thematic categorisation are necessary. Furthermore, the lack of formal extension system integration indicates that podcasts are frequently viewed as stand-alone resources rather than as supplementary elements of the larger agricultural knowledge delivery system. With assistance from field-level officers and institutions, podcasts should be integrated into the current extension framework to optimise their impact.

Suggestions from farmers for utilizing podcast

The NVIvo software was used to create the word cloud, which includes insightful recommendations from farmers on how to best utilise podcast-based learning for agricultural extension Fig. 4. This graphic illustrates the strategic components necessary to make podcasts a successful extension tool in addition to the practical requirements of the farming community. The most frequently used terms, like "trusted" and "awareness," imply that increasing awareness and establishing credibility are prerequisites for podcast adoption. Farmers advise promoting podcasts through reputable and well-established channels, such as extension agents, agricultural specialists and other farmers who have successfully incorporated innovations. More farmers will interact with the medium if credible voices are incorporated into podcast episodes, as this will greatly increase the content's perceived dependability.

Fig. 4. Indicates the suggestions from farmers for utilizing podcast using NVIvo software.

The recommendation for raising "awareness" emphasises the necessity of focused marketing initiatives to explain the idea and advantages of podcasts to rural audiences. This could be accomplished through community gatherings, awareness campaigns at the village level and demonstration events where podcasts are presented utilising basic technology. Moreover, the use of the terms "training" and "workers" implies that farmers think training programs are essential for extension staff as well as users. These courses could prepare extension agents to assist in the field and facilitate the process while also teaching farmers how to use, access and benefit from podcast platforms. This dual strategy would guarantee that podcasts are viewed as a component of a larger extension strategy rather than as stand-alone tools.

Another important suggestion that is clear from the terms "languages" and "multilingual" is language inclusivity. Farmers stress how crucial it is to deliver podcast content in local dialects in order to respect linguistic diversity and make sure that messages are heard by even the most isolated and marginalised communities. Words like "concise," "easy" and "features" also convey the farmers' desire for content that is concise, easy to understand and user-friendly. Researchers and content creators ought to think about structuring episodes in a way that is succinct, topic-specific and straightforward. The time limits and differing literacy levels that are frequently present in rural communities would be accommodated by this design.

Words like "affordable," "preloaded" and "podcast" suggest that farmers' recommendations focused on economic and technological access. These phrases suggest that podcast distribution needs to consider the digital and financial constraints faced by many farmers. Podcasts can be distributed through preloaded memory cards, inexpensive radio-compatible devices or communal listening systems in areas with poor internet connectivity. Adding podcasts to already-existing community resource centres or making them accessible offline could contribute to the democratisation of access to digital extension content.

Farmers are requesting relatable, useful and interesting content, as indicated by the terms "demonstrations," "stories" and "experts." They appreciate first-hand accounts of success, information supported by experts and audio examples of best practices. Knowledge retention and motivation can be significantly increased by organising podcast episodes around thematic subjects or seasonal difficulties that farmers face and then adding storytelling components to support these themes. A preference for structured content libraries where episodes can be accessed according to crop type, farming difficulty or region-specific issues is also indicated by the reference to "categorisation." More relevant and individualised listening experiences would be possible as a result.

Conclusion

This study demonstrates that podcast-based agricultural education effectively enhances farmer-to-farmer learning, particularly in knowledge sharing and the adoption of innovations. The findings indicate that farmers have become more aware of and hold positive attitudes toward new agricultural practices. However, questions remain regarding the scalability of podcast interventions across diverse agro-ecological zones and their ability to sustain long-term behavioural change. To support the development of a comprehensive digital learning ecosystem, policymakers and extension officers should consider integrating podcasts with other ICT tools to broaden reach and effectiveness. Emphasizing mobile accessibility, creating multilingual content and promoting farmer-led participatory podcast development can further boost engagement and information retention. For researchers, future studies should focus on designing rigorous longitudinal evaluations to assess the sustainability, economic benefits and overall impact of podcast-based interventions on farming communities. This will provide stronger evidence to guide scalable and cost-effective agricultural extension strategies.

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Authors' contributions

CFC carried out the survey, analysed the data and drafted the manuscript. HN assisted in data collection and analysis as part of the research study. KC contributed by developing ideas, reviewing the manuscript and assisting with procuring research grants. TSP helped in summarizing and revising the manuscript. MS also contributed to summarizing the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used QuillBot for paraphrasing and language correction in order to improve the clarity and readability of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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