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# Multimedia as an Instrument for Transforming Agricultural Extension: A Literature Review on Communication and Learning Effectiveness

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**Abstract**

Multimedia has become an important instrument in transforming agricultural extension by strengthening communication and learning processes among farmers. This study aims to analyze the forms and characteristics of multimedia, its contribution to communication and learning effectiveness, and the supporting and inhibiting factors influencing its implementation. This study employed a qualitative descriptive literature review approach by examining scientific publications published between 2017 and 2026. Literature was identified through academic databases using keywords related to multimedia, digital media, agricultural extension, communication, and learning. The literature was analyzed through identification, selection, thematic categorization, interpretation, and synthesis. The results show that multimedia in agricultural extension includes videos, images, infographics, animations, digital presentations, social media, smartphone applications, and online learning platforms. These media improve message clarity, attractiveness, accessibility, understanding, and interaction, while supporting learning that is more concrete, contextual, flexible, and independent. However, its effectiveness depends on content quality, digital literacy, infrastructure, internet access, user characteristics, extension workers' competencies, and institutional support. Therefore, multimedia should not be viewed merely as a tool for delivering agricultural information, but as a strategic instrument for transforming agricultural extension toward a more participatory, adaptive, and technology-oriented system.

Keywords: multimedia; agricultural extension; communication; learning; digital transformation.

## 1. Introduction

Agricultural extension plays a vital role in strengthening farmers' capacities through communication, learning, and the dissemination of agricultural information. Agricultural extension is no longer limited to face-to-face information delivery; rather, it has evolved into a participatory learning process in which farmers actively acquire, process, and apply knowledge [1]. The rapidly changing agricultural sector, advances in information technology, and the growing demand for timely and easily accessible information have created a need for the transformation of extension methods and communication media. Extension agents must therefore select and utilize appropriate communication media that are suited to the characteristics of the target audience, the extension content, and current technological developments to ensure the effective communication of agricultural information [2].

Advances in digital technology have encouraged the increasing use of multimedia as an effective tool in agricultural extension. Multimedia facilitates the delivery of information through an integrated combination of text, images, audio, video, animations, infographics, and interactive elements. These features enable extension agents to present complex agricultural information in a simpler, more engaging, and more comprehensible manner [3]. For example, demonstration videos can provide a more concrete visualization of cultivation practices, the application of

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agricultural technologies, pest management techniques, and agricultural product processing than verbal explanations alone. Furthermore, digital media facilitate the dissemination of extension information through a wide range of platforms, thereby allowing farmers to access learning materials without requiring extension agents and farmers to be physically present at the same place and time [4].

From a communication and learning perspective, the effectiveness of multimedia is determined not only by its technological capacity to deliver information but also by how its various elements are designed and integrated to facilitate message reception, comprehension, and retention. Information presented through a combination of visual and auditory elements has the potential to attract attention, enhance understanding, and support information retention among target audiences [5]. Multimedia can also promote more contextualized learning experiences by presenting content through simulations, demonstrations, illustrations, and real-world examples relevant to agricultural practices [6]. However, the use of multimedia does not automatically ensure the effectiveness of agricultural extension services. Its success is influenced by various factors, including the quality of the content, media design, users' digital literacy, audience characteristics, access to digital devices and internet connectivity, and extension agents' competence in developing and utilizing multimedia resources. Therefore, a more comprehensive understanding is needed of the extent to which multimedia contributes to communication effectiveness and learning outcomes in agricultural extension [7].

Numerous studies have investigated the use of digital media, videos, audiovisual materials, social media platforms, mobile applications, and other forms of multimedia in agricultural communication [8]–[10]. These studies highlight the potential of multimedia to broaden access to information and knowledge, increase audience engagement, and enhance learning experiences among agricultural extension participants. Nevertheless, the existing evidence remains fragmented across different types of media, audience characteristics, geographical contexts, and learning objectives. Consequently, current understanding of multimedia use in agricultural extension remains incomplete, particularly with regard to the relationship between multimedia characteristics and their effects on communication effectiveness and learning outcomes.

Against this background, this article aims to analyze the existing literature on the use of multimedia as a transformative tool in agricultural extension, with particular emphasis on its role in enhancing communication effectiveness and learning processes. Specifically, the study seeks to identify the forms and characteristics of multimedia used in agricultural extension, examine their contributions to communication effectiveness and learning outcomes, and identify the factors that facilitate or constrain their implementation. The findings are expected to provide a conceptual foundation for the development of multimedia-based agricultural extension strategies and to serve as a reference for extension agents, extension organizations, academics, and policymakers in designing agricultural communication and learning models that are more responsive to advances in digital technology. In this context, multimedia can be understood not merely as a means of delivering information, but also as a transformative instrument capable of improving the quality of communication, expanding access to learning opportunities, and strengthening the capacities of agricultural stakeholders.

## 2. Literature Review

### 2.1. Agricultural Extension

Agricultural extension is a non-formal educational process aimed at helping farmers and other agricultural stakeholders improve their knowledge, skills, attitudes, decision-making capacities, and ability to manage agricultural activities effectively. Over time, agricultural extension has evolved from a predominantly one-way process of technology transfer from extension agents to farmers into a participatory and dialogic process of communication and learning that is more responsive to the needs and characteristics of target audiences [11]. Extension plays a pivotal role in bridging scientific knowledge and farmers' local knowledge and experience, thereby enabling agricultural

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innovations to be understood, evaluated, and adapted to specific social, economic, and environmental contexts. Changes in farmer characteristics, the increasing complexity of agricultural challenges, and advances in information technology require extension systems to become more adaptive in selecting appropriate approaches, methods, and communication media [12].

## 2.2. Multimedia in Extension Services

Multimedia in agricultural extension refers to the integrated use of various media formats, such as text, images, audio, video, animations, infographics, and interactive elements, to communicate information and support learning among target audiences. Multimedia offers distinct advantages by enabling complex agricultural and technical information to be presented through demonstrations, illustrations, simulations, and videos, thereby making the content more concrete, engaging, and easier to understand [13]. Compared with the use of a single medium, the integration of multiple multimedia elements can create a more engaging communication experience and facilitate information processing through visual and auditory channels [14]. In agricultural extension, multimedia can be used both in face-to-face activities and through digital platforms, including social media, websites, mobile learning applications, and video-sharing platforms. However, the effectiveness of multimedia depends on several factors, including the quality of message design, the relevance and accuracy of the content, ease of use, the digital literacy of target audiences, the availability of technological infrastructure, and extension agents' competence in selecting, developing, and utilizing appropriate media [15].

## 2.3. Learning in Agricultural Extension

Learning in agricultural extension is a process through which farmers strengthen their capacities through experience, interaction, reflection, and the application of knowledge to address real-world agricultural challenges. As a learning-oriented process, agricultural extension recognizes farmers not merely as recipients of information but as active learners who possess valuable experience, local knowledge, and the capacity to identify and address problems related to their farming activities [18]. Learning media play an important role in creating learning experiences that are relevant, engaging, accessible, and easy to understand. Multimedia can support this process by providing learning materials in the form of video demonstrations, images, animations, simulations, infographics, and interactive content, thereby enabling farmers to understand agricultural innovations in a more concrete and practical manner and to revisit learning materials according to their individual needs. Furthermore, multimedia can facilitate self-directed learning and expand learning opportunities beyond conventional face-to-face extension activities [19].

## 3. Methodology

This study employs a literature review method using a descriptive qualitative approach [20]. This method was used to identify, analyze, and synthesize findings from previous studies on the use of multimedia in agricultural extension, with particular emphasis on the effectiveness of communication and learning. Relevant literature was identified through searches for scientific articles published between 2017 and 2026 using databases and academic search platforms such as Google Scholar, ScienceDirect, Scopus, and DOAJ. The searches were conducted using keywords such as "multimedia in agricultural extension," "digital media agricultural extension," "communication in agricultural extension," "multimedia learning," and "agricultural extension education."

Articles were selected based on the following inclusion criteria: they addressed the use of multimedia or digital media in the context of agricultural extension, communication, or learning; were published within the specified study period; and were available in full text. Subsequently, the selected articles were analyzed through several stages, including identification, selection, thematic grouping, interpretation of the findings, and synthesis. These stages were conducted to provide insights into the types of multimedia used, their benefits for communication and learning effectiveness, and the factors facilitating or constraining their implementation in agricultural extension.

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## 4. Results and Discussion

### 4.1. Forms and Characteristics of Multimedia in Agricultural Extension

The multimedia used in agricultural extension has become increasingly diverse in form, ranging from audiovisual media to interactive digital platforms. Commonly used formats include extension videos, demonstration videos, photographs and images, infographics, animations, digital presentations, social media, smartphone-based applications, and online learning platforms. Video is a particularly relevant form of multimedia for agricultural extension because it can visually demonstrate agricultural processes and stages of agricultural activities, such as cultivation techniques, the use of agricultural machinery and equipment, pest and disease control, produce processing, and farm management practices. Meanwhile, infographics and images are particularly suitable for presenting information that needs to be understood quickly, such as planting calendars, input application rates, technical procedures, and market information. Furthermore, the development of social media and digital applications has expanded the function of multimedia from a mere means of delivering information into a space for interaction, experience sharing, discussion, and learning between extension agents and farmers [21].

The primary characteristic of multimedia in agricultural extension lies in the integration of various communication elements, including visuals, audio, text, and interactivity, within a single medium. This integration enables abstract or complex agricultural messages to be presented in a more concrete and contextualized form. Video, for example, combines narration, moving images, text, and sound, allowing farmers to both see and hear explanations related to an innovation. Other important characteristics include flexibility and accessibility, as digital materials can be stored, replayed, and shared with target audiences without the need to wait for face-to-face meetings. Multimedia provides an opportunity for agricultural extension services to shift from a predominantly one-way communication model toward a more visual, flexible, participatory, and well-documented approach. However, the selection of multimedia should be adapted to farmers' characteristics, the nature of the message, extension objectives, and infrastructure conditions to ensure that the technology effectively supports the extension process [22].

### 4.2. The Contribution of Multimedia to the Effectiveness of Communication and Learning

The use of multimedia contributes to the effectiveness of extension communication, particularly by improving the clarity, attractiveness, comprehensibility, and accessibility of messages. Messages conveyed solely through verbal communication may be interpreted in different ways, particularly when the subject matter involves technical procedures that require demonstration. Multimedia can help address this issue by providing visual representations of the objects or processes being explained. Farmers not only receive explanations of how a technology is used but can also directly observe the stages of its implementation through videos, animations, or illustrations. Furthermore, digital media enable extension agents to disseminate information more rapidly and reach a broader audience. Social media and digital communication platforms also facilitate two-way communication through comments, discussions, messaging, and experience sharing. Consequently, multimedia has the potential to enhance communication effectiveness not only in terms of message delivery but also in terms of how target audiences receive and respond to information [23].

In terms of learning, multimedia contributes to creating a more concrete and engaging learning experience while also enabling learners to review the material. Farmers can revisit the content when they encounter problems in the field, allowing the learning process to continue beyond the completion of extension activities. Audiovisual materials also enable farmers to learn by observing real-world practices, thereby making the connection between knowledge and its application in farming activities easier to understand. Furthermore, multimedia accommodates diverse ways of learning by presenting information through a combination of visuals, audio, text, and demonstrations. Consequently, the use of multimedia can transform the learning process from a conventional model into one that is more contextual, self-directed, flexible, and sustainable. However, the mere availability of multimedia does not automatically

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guarantee improved learning outcomes; its effectiveness remains dependent on the quality of the content, the relevance of the material to farmers' needs, message design, levels of digital literacy, and the availability of guidance from extension agents [24].

The contribution of multimedia demonstrates that digital transformation in agricultural extension should not be viewed merely as a shift from analog to digital media, but rather as a fundamental change in how agricultural messages are produced, disseminated, received, and understood. In conventional approaches, extension agents typically serve as the primary source of information, while farmers largely act as recipients. Multimedia and digital platforms create opportunities for farmers to act as both consumers and producers of information through the documentation of practices, experience sharing, group discussions, and knowledge exchange. This transformation can strengthen a more participatory extension approach, as learning occurs not only from extension agents to farmers but also among agricultural stakeholders [25].

## 5. Conclusion

Based on the literature reviewed, multimedia plays a strategic role in transforming agricultural extension by integrating various forms of media—such as text, images, audio, video, animations, infographics, and interactive media—into communication and learning processes. The use of multimedia enhances the clarity, attractiveness, reach, comprehensibility, and flexibility of extension communication while fostering learning experiences that are more concrete, contextual, self-directed, and sustainable. This transformation facilitates a shift in information delivery from conventional to digital formats and creates opportunities for more participatory and interactive communication between extension agents and farmers. However, the effectiveness of multimedia depends on several factors, including the quality of the content, the digital competence of extension agents and farmers, the availability of technological infrastructure, internet access, the characteristics of target audiences, and institutional support. The development of multimedia in agricultural extension should be grounded in user needs and local contexts, thereby ensuring that multimedia serves not merely as a tool for information delivery but also as a strategic instrument for strengthening communication effectiveness, supporting learning, and promoting capacity building among agricultural stakeholders.

## 6. Declarations

### 5.1. Author Contributions

Conceptualization: F.A., and S.A.; Methodology: F.A.; Software: F.A.; Validation: F.A., S.A., and T.A.; Formal Analysis: F.A., and S.A.; Investigation: F.A.; Resources: F.A.; Writing Original Draft Preparation: F.A., and S.A.; Writing Review and Editing: S.A., and F.A.,; All authors have read and agreed to the published version of the manuscript.

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### 5.3. Institutional Review Board Statement

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### 5.4. Informed Consent Statement

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## 5.5. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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