COMMUNICATION MODELS IN AGRICULTURAL EXTENSION FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

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ABSTRACT

This paper reviewed suitable communication models that bring about the changes in farmers' behavior and farming practices for increase in the social economic status and livelihoods of farm families. The main focus of agricultural extension includes transferring knowledge from researchers, advising farmers on decision-making and educating farm families on how to make accurate decisions which will enable them clarify goals and stimulate desirable agricultural development. Disseminating innovations and technologies through extension education using various communication models involves agricultural and non-agricultural issues in the immediate environment and so the wellbeing of inhabitants in a particular area should be considered when using communication models. Advantages and disadvantages of these models are highlighted to show the relevance of communication models in agricultural extension and advisory services. The study highlights the implications of communication models in communicating agricultural and non-agricultural issues to farmers which is pertinent to agricultural productivity. It is recommended that competent extension agents properly trained in Information Communication Technologies (ICTs) extension approaches and the appropriate communication models educate farmers. Extension agents should also work with more contact farmers in various communities to have result oriented extension service delivery in Nigeria.

Keywords: Models, Information Communication Technologies, Agricultural Extension

INTRODUCTION

Nigeria is a populous nation in Africa and is said to have a population of 201 million people with 250 ethnic groups speaking more than 500 languages (UNdata, 2019). English is the official language of the country and the population is divided nearly in half in several ways: around 50% live in urban areas; 51.6% are Muslims and 46.9% are Christians with 59.6% literate (Central Intelligence Agency, 2019). Nigeria's land area is 911,000 square kilometers and 78% is dedicated to agriculture (including 33% permanent pasture) while 36% of the labour force works in the agriculture sector (Food and Agricultural Organization, 2019). Communication models used in educating farmers are systematic representations which helps in understanding how communication takes place (Agbamu, 2006). Models of communication helps to identify potential barriers to effective communication, elucidate the roles played by various elements involved and underscores the importance of feedback in achieving a successful communication amongst farmers, extension agents and research institutes for an increase in agricultural production in Nigeria (UNdata, 2019). Agriculture for Impact (2018) maintained that agriculture extension is the application of scientific research and knowledge through farmers to enable them practice agriculture effectively and increase yield. Extension services are classified into technology transfer, advisory service and facilitation which can only be achieved using specific communication models for various packages of technologies delivered to farmers through extension agents from research institutes (Agriculture for Impact, 2018). Kurtzo *et al.;* (2016) also asserted that communication amongst farmers, extension agents and research institutes is vital because farmers are the ones to benefit from extension education and improved technologies developed from research. Agbamu (2006) opined that the purpose of communication in

agriculture is to influence farmers by helping them understand new farming methods and communication models enable farmers and extension agents apply proven agricultural innovations at any given time especially when farming. He concludes that communication is behavior-centered or is an outward behavior that is consistent with the favourable disposition of an individual. Omotayo (2010) posited that communication among agricultural extension agents and farmers has improved with the Federal Ministry of Agriculture and Rural Development (FMARD) Training and Demonstration approach before Research Extension Farmers Input Linkage Systems (REFILS), showed that farmers did not have confidence to try results from demonstration plots on farms. But nowadays modern technologies has improved and facilitated networks among agricultural stakeholders. These networks are used to communicate to all stake holders in agriculture and they are facilitated with diverse models of communication (Sehu, 2018). Extension education is not only concerned with physical and economic achievements in agricultural production but also with the empowerment of rural inhabitants to focus on their challenges and difficulties with a positive attitude to change their perceptions towards these difficulties (Umehai *et al.;* 2023).Technology transfer in agricultural extension education involves the traditional mode of advice, knowledge and information in a linear manner while advisory services is when farmers use experts as a source of advice for specific problems which they face while facilitation is meant to help farmers define their own problems and proffer solutions to these problems on a daily basis (Agriculture for Impact, 2018). Therefore extension agents should discuss problems with rural people, help them to gain a clearer interpretation of these problems and decide how to solve them using the most efficient communication models with packages of technologies in extension service delivery. Agricultural extension communication involves a

two way process in which farmers share information or an agricultural organization delivers messages to farmers in a manner that farmers, or the agricultural organization and the farmers establish a common meaning over the shared information or messages delivered with a focus of improving farmers knowledge, attitudes, skills and aspirations (KASA) in the application of innovations received from research (Agbamu, 2006 and Umehai *et al.;* 2024). Interventions to help agricultural extension in Nigeria cater to diverse needs across the country and this is enormous not forgetting the numerous languages spoken by various tribes and individuals (Sehu, 2018). Sustainable agriculture development aims at resource improvement and preventing long-term reduction in the productivity of resources including promoting of equity from one generation to another (Okadi and Agu, 2023). Advisory experts should use efficient communication methods and staff must be ready to engage in positive discussions with research institutes to convey agricultural information to farmers so that the difficulties that arise at stations would be examined because successful communication between researchers, extension agents, and farmers is vital to achieve the goals of extension services in Nigeria (Umar *et al.;* 2024). It is vital for many farmers to be reached through the application of various communication models that aligns with the technology transferred to them. This help achieve governments sustainable agricultural development goals and objectives that is centered on food security and increased income for farmers' including the export of cash crops for foreign exchange earnings to the nation.

Overview of Communication Models

There are many communication models and they include the Schramm's model, Shannon and Weaver's model, Westley and Maclean' model, Aristotle model, Berlo's model, Gerbner's model, Hovland model, Leagan's model, Riley and Riley model, Lasswell's model, Barnlund's model and Dance's Helical model (Agbamu, 2006). Others include Stimulus - Response Model, Hypodermic Needle Model and Theories of Mass Media Effects (Adebayo and Adedoyin, 2022)**.** Communication models in agricultural extension contain the following: the speaker (extension agent), the message (agricultural technology, innovation, or practice), the channel, the listener/receiver (farmer) and the feedback (result-satisfaction or dissatisfaction) (Ogunbameru 2001 cited in Salisu *et al.;* 2019). Ogunbameru (2001) further documented four (4) major communication models: Linear or Aristotle model, the Circular model, the Process model and the Two-Step Flow model noting that the major difference between these models is feedback which does not occur in the Aristotle model (linear model).

Aristotle Communication Model

The focus is on the speaker's ability to influence the audience and get a specific response to the message. The model was originally designed for oral communication and underpins the importance of understanding the audience. Credibility, logical reasoning and emotional appeals to persuade others effectively which are all vital components of this model. The role of the speaker in convincing the targeted audience to respond as intended is vital and it can be applied in many professional scenarios (Agbamu, 2006 and Salisu *et al.;* 2019). Advantages of this model is that it appeals to the emotions of the audience, emphasizes on credibility with the audience, uses logic and evidence to support arguments and remains relevant in modern day communication. Some disadvantages of the Aristotle model includes the cultural

limitations of the model, there are no specific guidelines because it's too focused on the speaker (speaker-centric) and may neglect the active participation of the audience. It also focuses more on persuasive communication, and cannot be used in complex communication scenarios.

Berlo's Communication Model

This model looks at the emotional dimension of the message and on the SOURCE, MESSAGE, CHANNEL and RECEIVER (SMCR) to comprehend the communication process. Berlo's communication model also focuses on what influences effective communication and identifies the different components that make up the process. Olawoye and Wrigley (2014) noted varieties in culture, norms and social values which suggest that extension interventions should be tailor made for different social systems to achieve effective technology uptake and continued adoption of innovation from research institutes. In extension work a fisheries extension agent talks with a group of artisanal fisherfolks who are members of a cooperative and discuss the adoption of an outboard engine that would increase their efficiency in fish catch. (i) Source: The fisheries extension agent is the source of the message which aims to carry an idea or information to fisherfolks about gains of adopting the new technology (out board engine). (ii) Encoding: The fisheries extension agent encodes the information by imputing the thoughts and ideas of the subject-matter-specialist (SMS) into the message which can be oral, written or in visual presentation. (iii) Message: Contains all necessary details and instructions about the project. (iv) Channel: The fisheries extension agent choses the channel to convey the message, like a face-to-face meetings where method demonstration could be done. (v): Decoding: The group of artisanal fisherfolks get the message and deduce it by understanding the information given by the fisheries extension agent. (vi) Receiver: The group of artisanal fisherfolks who belong to a cooperative society are receivers of the message. They are supposed to understand what was demonstrated when the outboard engine was ignited and the routine checks done on it. (vii) Feedback: After getting the message the group of artisanal fisherfolks ask the fisheries extension agent questions, express doubts, or confirm their understanding of the method demonstration. (viii) Noise: Noise is any obstacle that may obstruct effective communication, like distraction during the meetings, language barriers, and technical glitches during the method demonstration. Adebayo and Adedoyin (2022) asserted that noise as any obstruction or distortion which interferes with a flawless communication process and it could be a sound or wrong spelling in a written or oral message. Berlo's model places emphasis on encoding and decoding so that the right message is transmitted and the vital role of feedback in communication. Advantages of Berlo's communication model includes feedback, noise, and encoding/decoding of the message. It also considers the physical and psychological context of communication and recognizes communication as a two-way process with improved clarity of the message including the concepts within the message. Disadvantages of Berlo's model is it's harder to apply and requires more study because of the individual components in the model. It may not also be applicable in mass communication or digital communication (text messages, online questionnaire, voice messages etc.).

Lasswell's Communication Model

Called "action model", depicts a framework to understand the communication process by asking: (i) Who is the source of the message? (ii) What is the content of message? (iii)

Through which medium/channel is it being transmitted? (iv) Who is targeted and how does the message effect the person? Lasswell's model can be applied like this: (i) Who: The agricultural extension agent is the speaker who initiates and communicates innovations from research institutes from the subject-matter-specialist (SMS) and he (extension agent) communicates with farmers. (ii)Says what? The message content is what the agricultural extension agent talks about which is the innovation and the benefits derived from adoption. (iii) Through which channel: An extension agent selects the best channel to get the message across to the targeted farmers (Lasswell 1948 cited in Agbamu 2006). In agricultural extension practice extension agents use different methods to channel messages for delivery to farmers. Communication methods and forms of delivery include written (bulletins, leaflets, newspapers, newsletters), audio/spoken (telephone, group discussions, farm/home visits, meetings, radio), visual (exhibits, posters, slides, result demonstration), and audio-visual (computer, video messages, television, films in cinema). We also use certain methods to channel communication according to number of individuals reached which include individual methods (farm/home visits, office calls, telephone, computer assisted instruction), group method (group discussions, result demonstration, field trips, team meeting, method demonstration), and mass method (broad cast media, print media, screen media, campaigns, farmers fair and internet). (iv)To whom: The targeted farmers in a community or village who the agricultural extension agent wishes to talk to and convince them to adopt an innovation. (v) With what effect: The success of the communication is assessed by the farmer's response and the effectiveness could be measured by the rate at which farmers adopted the innovation through the continuous application and usage of the innovation. Birukila *et al.;* (2017) discussed how the use of video messages in mobile phones and an audio-visual clip about polio vaccine safety was used to enhance the dissemination of behavioral health messages in low-literacy communities in Northern Nigeria. Saaka *et al.;* (2021) confirmed the effectiveness of video, radio and demonstration channels, for delivering behavior change interventions to the target audience. The advantages of Lassell's model of communication includes it could be applicable to mass media and interpersonal communication, it's simple to understand and helps evaluate communication processes. It is also useful in communicating with educated farmers and provides a framework for researching including understanding communication. Disadvantages of this model is it cannot account for feedback, its limited in explaining dynamics of communication in modern digital media and this model hardly consider the context and environment in which the communication takes place. Other shortcomings of Lasswell's model is it cannot capture the complexity of modern communication processes which includes disruption in connectivity by network service providers and the lack of electricity in most rural communities in Nigeria.

Shannon-Weaver Model

This is a mathematical model which dwells on the technical areas of communication and is used in mass communication (Agbamu, 2006). It has five basic components: (i) Source of information: An individual starts the communication process by sending information. In an agricultural extension organization, this might involve the extension agent organizing an advocacy campaign about an innovation. (ii) Transmitter: The transmitter encodes the message to a simple message to be conveyed through a communication channel. Digital signals including visuals could be produced for

broadcasting on numerous media platforms. (iii) Communication channel: The way through which the encoded message from the sender gets to the receiver. Examples include television, radio, social media, or other advertising platforms. (iv) Receiver: The target group who gets/receives the message. (v) Destination: The point or place the receiver interpret and decode the message. For example, the farmers forms opinions about an innovation after comprehending detailed features of the innovation. If an extension agents designs a commercial (information source) of a fertilizer with clear visuals and messages, encodes it into a digital signal (transmitter), sends it via television channels or the internet to the potential farmers who get and decode the message. The Shannon-Weaver model shows how vital comprehension is and this must be done through reliable channels for effective interpretation and successful communication process. The shortcoming of this model is that it is a linear model with no feedback and it is not a dynamic communication process. Another problem is that it is not suited for farmers with low-literacy.

Osgood-Schramm Communication Model

An interactive model that entails feedback in the communication process. In this process, the sender (the research institute through a subject-matter-specialist) delivers a message (innovation) through an extension agent to the end users or receivers (farmers). Through feedback receivers ask questions or give suggestions taking into consideration participants' backgrounds (Okwu and Obinne, 2009). For instance if an extension agent is organizing a campaign for farmers to practice a new farming method and after presentation farmers provide feedback with questions. Farmers are convinced not only by the extension agents' message but from experiences and skills acquired from trainings. The Osgood-Schramm model shows that effective communication involves active participation between all parties (subject-matter-specialist, extension agent and farmers). Feedback and understanding the context of the message is vital. This interactive process enhances the quality of communication and farmers with low educational backgrounds can benefit from this communication process through feedback.

Westley and Maclean Communication Model

This is a circular model which shows the continuous revolving nature of communication. The components in this model are the source (sender), encoder, message, decoder and receiver (Agbamu, 2006). Communication here is an ongoing process with constant feedback and interaction. An extension agent informs farmers about a new programme in which the government intends to allocate and distribute fertilizers to farmers who are members of cooperative societies directly through their handsets and mobile phones. The extension agent (source) conveys the information and encodes the key modalities of the programme into a message sent to a group of farmers (receivers) who are all members of cooperative societies through a presentation (method demonstration using their mobile phones) or a written pamphlet. As the farmers decode the message, feedback or suggestions for improvement may come from them. The extension agent takes the feedback into cognizance and reports back to the research institute through the subject-matter-specialist (SMS). The report (feedback) is further shared and analyzed with the programme research team in the research institute for discussion. The interactive process of encoding, decoding, and receiving feedback is continuous until an agreement is reached by all concerned. This interaction helps in continuous

realignment and gives room for improvement in the communication process.

Barnlund's Transactional Communication Model

This is a model that is comprehensive and interactive in approach and it depicts an interaction and exchange of messages between the sender and receiver. The model considers context, culture, and personal perceptions that influence communication *(Salisu et al.; 2019).* Barnlund's transactional model can be depicted like a meeting in which the extension agent (sender) presents an innovation to the farmers. As the extension agent conveys the proposal the farmers listen attentively and ask questions in real-time. Farmers may seek more knowledge or express personal views. There is interaction and exchange of messages between the extension agent and farmers during the meeting. Both the extension agent and farmers send and receive information simultaneously while the farmers cultural background and their individual perspectives are considered about the subject been discussed. Barnlund's model emphasizes active listening, feedback, and shared understanding amongst everyone leads to better decision-making and positive outcomes. Emeana et al.; (2020) documented the potentials in adoption of digital technology in Nigeria and maintained that through the application of digital tools extension agents are transformed intellectually to engage in bottom-up, demand-driven, pluralistic practices that harness technology generation and transfer. Aster, et al.; (2022) recommended a combination of practical demonstration and video shows/messages shared through mobile phones which would cause a positive behavioral change for farmers to adopt innovations. Olagunju et al.; (2021) contributed that the adoption of digital technologies could bring new opportunities in agricultural extension service delivery in Nigeria thus increased advocacy in ICTs application should be encouraged and supported by government.

Dance Helical Communication Model

A spiraling and dynamic communication process that evolves continuously over time. The model depicts that farmers meetings are continuously done often to talk about programme objectives, task, and schedules (Phase 1). As farmers proceed, every new meeting builds upon previous discussions, deepening their knowledge and opening their minds (Phase 2). During Phase 3 farmers implement strategies and carry out project tasks from insights learned in previous meetings. New task emerge including difficulties, prompting the farmers to adjust their approach (Phase 4). In Phase 5, farmers reflects on accomplishments looking at past interactions while identifying areas for improvement. This reflection is the main reason for realignments in communication and this predicts what takes place in future meetings and collaborations. The Dance Helical model builds strongly on continuous learning and improving on shared knowledge for effective teamwork between farmers, extension agents, subject-matter-specialist and research institutes with successful project outcomes in agricultural extension. By appreciating open conversation and individual views a clear and meaningful connection can be created in an environment where relationships and communication improves on a daily basis (Agbamu, 2006).

Stimulus-Response Model

This model explains how receivers (farmers) will react or behave when a stimulus (an extension message or technology) is introduced to them. The stimulus – response model holds every other influencer or factors constant to enable researchers understand a simple engagement process in a complex situation (Adebayo and Adedoyin, 2022). The basic idea behind the stimulus – response model is that person A communicates something to B and consequently creates X effect. Communication involves a stimulus (S) that reaches an organism (O) and that organism reacts (R). Early scholars of stimulus – response theory asserted that effect is a specific reaction to specific stimulus and that anyone can forecast the relationship between mass media message and audience reaction (Agbamu, 2006). The S – R Model and theories of communication would be explained further using the Hypodermic Needle Model, Two – Step Flow Model and Theories of Mass Media Effect.

Hypodermic Needle Model

This model asserts that media information flows directly to the masses (farmers) without any hindrance or intermediary. Messages go to an audience like a bullet and perceived media messages as medicine injected into the veins of an audience like a bullet. The audience is expected to respond in a predictable manner because the message has a positive effect on them. But when better communication research methods were used to examine the validity of this model influence many questions were raised and these queries led to a new model called the Two – Step Flow model (Agbamu, 2006).

Two – Step Flow Model

This model has been very influential and exemplifies the role of opinion leaders (contact farmers) when agricultural extension messages are entrusted to them for onward transmission to other farmers. The two – step flow model describes how meaning may change in a communication process and how noise may interfere with the understanding of the message. It also examines how a third party interpretation may influence the feedback received in a communication process (Adebayo and Adedoyin, 2022).

Innovation- Diffusion Model

Adebayo and Adedoyin (2020) contributed that the most influential model of communication in the practice of agricultural extension is the innovation diffusion model. The farmer who operates in a complex environment is the focal person in agricultural production because decision making for the farm family arises every day and from season-to-season so a mental calculation of all production processes and timelines for production is done by the farmer because decisions making usually involves choosing a course of action from a number of alternatives (Agbamu, 2006). The main aim of using a specific communication model to influence a farmer to have a positive behavioral change and adopt an innovation is time, which is an important factor in diffusion and adoption studies (Ryan and Gross 1943 cited in Rogers, 2003). Ekong (2010) affirmed that adoption process is a mental process and individuals pass from hearing about an innovation to making up his or her mind to use it while adoption is the decision to continue the full use of an innovation.

Rogers (2003) maintained that an innovation-decision process is one that an individual goes through from hearing about an innovation, to forming an opinion about the innovation, to deciding to adopt or reject, to implementation of the new idea or finally confirmation of this decision. The stages involved are:

Knowledge occurs when an individual is exposed to an innovation's existence and gains an understanding of how it functions.

Persuasion happens if an individual forms a favourable mindset or an unfavourable mindset toward innovation.

Decision is when a person does activities that lead to a choice of adopting or rejecting an innovation.

Implementation happens when a person puts a new idea into use.

Confirmation takes place if a person seeks reinforcement of earlier decisions when exposed to conflicting messages about an innovation.

Information Communication Technologies and Nigerian Farmers

Theories of Mass Media Effects talks about the social consequences of exposure to mass media. How mass media effects people are embodied in the theories of individual differences, psychodynamic persuasion, social categories, social relationships and social-cultural persuasion (Agbamu, 2006). Adebayo and Adedoyin (2022) posited that communication is more than just a physical act but is seen as a process from the perspective of the internal workings of the human mind. They further contributed that during the communication process each source - receiver undergoes internal communication on what is perceived from the original source as the meaning of the message; their peculiar interpretation of this message under the prevailing circumstances; their unique preferences and biases at that time including their analysis of a response that confers on them the best advantages during the communication scenario.

Ismail and Yusuf (2022) contributed that worldwide extension service delivery is changing rapidly because of technological advances and the level of literacy among the clientele, farmers, and extension agents. Globally agriculture uses sophisticated technologies such as robots, temperature and moisture sensors, aerial images, drones, geographical information systems (GIS), blockchain, remote sensing, cloud computing, artificial intelligence (AI)/machine learning, biotechnology, and many other emerging technologies which allows businesses to be more profitable (Gwarkila *et al.;* 2024). Different technologies for enhancing information sharing to improve agricultural productivity include the internet, automated irrigation, intelligent software analysis for pest and disease prediction, mobile applications, mobile devices, short message services, radio frequency identification technology (RFID), and unstructured supplementary service data (USSD) (Anajali *et al.;* 2024). Sennuga and Fadijii (2020) documented that the ratio of public extension agents to farmers was 1:3000 with a few extension agents delivering services to many farmers, and the World Bank recommendation is 1:500 highlighting the need for an e-extension approach. Ifejika *et al.*, (2019) defined e-extension as the use of internet technology or information communication technology to exchange information and provide services to all actors in the agricultural value chain. E - extension approaches in Nigeria include: The National Farmers Helpline Center; The Growth Enhancement Scheme (GESS)/the E-Wallet System while the Digital Green (DG) approach is done in India, Tanzania, Ethiopia, Mozambique, and Ghana (Ismail and Yusuf, 2002). All these approaches have contributed positively to the economic status of Nigerian farmers unfortunately, subsequent governments do not appropriate funds in the national budgets for the continuity of these laudable projects. This negatively affects agricultural production and discourages farmers because of rapid policy changes done by subsequent governments.

CONCLUSION

There are many communication models and apart from these communication models Information and Communication Technologies (ICTs) are now a global concept. ICTs are presently incorporated and effectively used along with different communication models to achieve result-oriented agricultural campaigns and strategies that target farmers' adoption of improved innovations in many countries including Nigeria. Various methods, campaigns, advocacies, shows, and demonstrations are used depending on the message and the target audience. Agricultural extension officers and agencies should be relevant and competent enough to transmit messages from research institutes using the most appropriate models and ICTs so that the feedback gotten from the targeted audience (farmers) would be incorporated into research for an increase in agricultural produce. The most effective models for communicating innovations in Nigeria are those models that incorporate feedback (Dance Helical, Barnlund's, Osgood-Schramm, Westley and Maclean Communication Models) due to the vast land mass and the limited number of extension agents educating farmers in the country. Camillone *et al.;* (2020) posited that agricultural extension programs should not induce dependency of farmers on experts' instructions or instructions from government agencies but rather extension programs should increase farmers' independent capacity to analyze and adapt to the ever-changing environment, market, and technological conditions which are referred to as a farmer-centric approach to agricultural extension practice. In communicating agricultural extension innovations to farmers it should be noted that mass communication channels are primarily knowledge creators, whereas interpersonal networks (opinion leaders and individuals like contact farmers) are more important in persuading individuals to adopt or reject innovations (Rogers, 2003).

RECOMMENDATION

A farmer – centric approach to agricultural extension programs should be integrated along with the most appropriate communication model using ICTs through an extension agent and contact farmer (opinion leader) for effective communication of innovations to farmers in Nigeria. Infrastructure and security must be provided for all ICT service providers and electricity companies. This would enhance communication and encourage more farmers to settle in rural areas. Competent agricultural extension agents trained in diverse communication techniques should educate and guide farmers on tested innovations for increase in productivity of agricultural produce.

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