An Exploratory Case Study of Google Meet and Zoom as Real-Time Digital Extension Tools for Aquaculture Advisory at Brazil Farm, Abuja, Nigeria

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Abstract— Limited reach and delayed responsiveness of conventional agricultural extension services may constrain fish farming productivity in Nigeria. Inadequate farm visits and delayed access to technical expertise can hinder timely problem resolution and informed decision-making. This exploratory case study examined the use of Google Meet and Zoom as real-time digital extension tools for supporting aquaculture advisory interactions at Brazil Farm, Abuja, Nigeria. A field-based case-study design was adopted, and live advisory sessions were conducted on both platforms to connect a farm manager with an aquaculture specialist located remotely. Structured observation was used to assess technical performance, interaction quality, advisory clarity, and farmer engagement during the live sessions. Both platforms enabled real-time visual assessment, interactive diagnosis, and immediate technical feedback, suggesting that synchronous video platforms may support real-time aquaculture advisory interactions in similar contexts. However, performance differences were observed. Zoom demonstrated more stable connectivity and clearer audio transmission, supporting smoother interaction during the technical discussion. Google Meet provided easier access and simpler navigation, facilitating quicker session initiation for users with limited prior experience. The observations from this exploratory case study suggest that platform functionality may be influenced by technological reliability, user familiarity, and local infrastructural conditions. Although limited to a single-case field study, the research provides empirical insight into the potential of real-time digital advisory systems to complement conventional extension approaches. Further multi-site and quantitative investigations are recommended to enhance generalizability and inform policy adoption.

Keywords— Digital extension; Aquaculture advisory; Real-time ICT; Google Meet; Zoom; Agricultural extension; Video conferencing; Fish farming; Nigeria.

I. INTRODUCTION

Agriculture remains fundamental to global food security, rural livelihoods, and economic development. However, agricultural systems face mounting pressures from rapid population growth, environmental change, and the depletion of natural resources. The global population is projected to approach 10 billion by 2050, intensifying the demand for food production while requiring greater resilience and sustainability in agricultural practices (World Bank, 2019; FAO, 2022). These pressures are particularly acute in developing countries, where smallholder farmers contribute substantially to agricultural production yet remain vulnerable to climatic variability, market fluctuations, and limited access to technical support services.

Within the agricultural sector, aquaculture, particularly fish farming, has emerged as one of the fastest-growing food-producing subsectors worldwide. Fish farming contributes significantly to food and nutrition security, income generation, and employment creation, especially in Africa and Asia (FAO, 2016; Beveridge et al., 2013). In sub-Saharan Africa, aquaculture enhances protein intake and provides livelihood opportunities along value chains encompassing production,

processing, and marketing (Brummett et al., 2008; Kassam & Dorward, 2017). In Nigeria, which grapples with persistent fish supply deficits, aquaculture has the potential to strengthen rural economies, reduce poverty, and improve household nutrition due to the growing demand for fish as an affordable source of animal protein (FAO, 2010; World Bank, 2014).

Despite its potential, fish farming in Nigeria continues to face persistent operational challenges that constrain productivity and profitability. These challenges include inadequate extension services, limited access to quality inputs such as fish seed and feed, disease outbreaks, poor water-quality management, weak market linkages, and constrained access to finance (Opara, 2008; Ogello et al., 2013; Chenyambuga et al., 2014). The limited reach of conventional agricultural extension, characterized by infrequent farm visits, high operational costs, and insufficient staffing, widens the information gap between farmers and subject-matter experts, often resulting in delayed or sub-optimal decision-making at the farm level. Access to timely, accurate, and relevant agricultural information is therefore critical for improving farm management decisions and productivity (Demiryurek et al., 2008; Das et al., 2016).

To achieve the primary goal of agricultural extension effectively, extension practitioners must be knowledgeable and skillful in communicating and disseminating information (Okunade & Oladosu, 2006). The rapid emergence and evolution of information and communication technologies (ICTs) have revolutionized information delivery across sectors, including agriculture (Alwahaishi & Snášel, 2013). In agricultural extension, ICTs have significantly transformed communication processes by facilitating faster, broader, and more interactive dissemination of information (Meera et al., 2004; Taiwo & Amoo, 2021; Nyarko & Kozari, 2021). Digital communication tools have the potential to enable extension systems to provide farmers with more timely information that may support improved production decisions and farm management practices.

In Nigeria, ICT adoption has expanded the reach of extension services by enabling communication through mobile phones, internet applications, and digital platforms, thereby mitigating some limitations of conventional extension approaches (Okeke et al., 2014). Social media and other internet-based platforms have further enhanced rapid information exchange, peer learning, and stakeholder engagement, particularly in resource-constrained rural settings (Alhassan et al., 2022). However, while digital tools have been widely used for meetings, training sessions, and coordination, especially during the COVID-19 pandemic, their structured application as real-time advisory tools in the fisheries sector remains limited.

Among emerging digital tools, synchronous video conferencing platforms such as Google Meet and Zoom present a promising but under-explored medium for real-time agricultural advisory services. Unlike asynchronous communication methods, video conferencing enables live, interactive engagement between farmers and subject-matter experts. Through real-time audio-visual interaction, experts can observe farm conditions remotely, diagnose problems instantly, and provide context-specific recommendations without physical presence. This capability is particularly valuable in aquaculture, where delays in addressing issues such as disease outbreaks or water-quality deterioration can result in rapid stock losses.

Live video-conferencing tools offer unique advantages for aquaculture advisory services because they enable visual demonstration and immediate feedback. Through real-time video interactions, extension agents can demonstrate practical techniques such as water-quality testing procedures, feeding management, disease symptom identification, pond sanitation practices, and aeration system adjustments, while farmers are able to ask questions and receive instant clarification. Davis and Sulaiman (2016) note that interactive ICT tools enhance learning outcomes in agricultural extension because they combine visual, auditory, and participatory elements that are particularly important in production systems requiring practical skill acquisition. In aquaculture, where management errors can lead to rapid stock mortality, the ability to visually assess pond conditions and provide immediate corrective guidance may significantly improve farm outcomes. Furthermore, the increasing penetration of smartphones in Nigeria has enhanced the feasibility of using live digital platforms for extension delivery. Empirical evidence indicates that farmers who utilize mobile-based advisory tools report improved access to technical information and greater confidence in adopting recommended practices (Salau & Saingbe, 2019).

Although both Google Meet and Zoom offer similar functionalities, including live video interaction, chat features, screen sharing, and session recording, they differ in interface design, connectivity stability, participant capacity, cost structure, and data requirements. These differences may influence their usability, reliability, and effectiveness in rural and peri-urban farming contexts. Despite the growing integration of ICTs in extension delivery, empirical evidence comparing the effectiveness of specific video conferencing platforms for real-time aquaculture advisory in Nigeria remains scarce. Existing studies largely focus on general ICT adoption rather than comparative evaluations of platform performance in practical farm problem-solving scenarios.

Given these realities, it is essential to assess which real-time digital platforms perform better under local infrastructural and socio-economic conditions. Comparative evaluation of platforms such as Google Meet and Zoom may provide useful insights for designing effective aquaculture advisory interventions. Nigeria's National Electronic Extension Platform (NEEP) underscores this need by promoting "interactive, cost-effective, and technology-driven" extension delivery that minimizes security risks to field agents and expands coverage to underserved farming communities (Federal Ministry of Agriculture and Rural Development [FMARD], 2023). Understanding the relative strengths and limitations of Google Meet and Zoom as real-time ICT advisory tools will provide evidence-based guidance for extension practitioners and policymakers seeking to improve aquaculture advisory services in Brazil Farm, Gosa Village, and similar communities across Nigeria.

Against this backdrop, this study conducts a comparative assessment of Google Meet and Zoom as real-time digital extension tools for addressing fish farming challenges at Brazil Farm, Gosa Village, Abuja Municipal Area, Nigeria. The study evaluates how each platform facilitates live expert–farmer interaction, enhances problem diagnosis, supports timely decision-making, and improves advisory outcomes. By systematically comparing platform performance, usability, and advisory effectiveness, this research contributes to emerging scholarship on digital extension models and provides empirical evidence to guide technology selection and policy interventions aimed at strengthening aquaculture advisory services in Nigeria and similar developing-country contexts.

1.1   Objectives of the Study:

The broad objective was to examine how Google Meet and Zoom supported real-time observation and discussion of fish farming challenges during remote advisory sessions. The specific objectives are to:

1. Evaluate the effectiveness of Google Meet and Zoom in facilitating real-time diagnosis and resolution of fish farming challenges.

2. Explore how real-time digital advisory interactions may support farmers' understanding of recommended aquaculture management practices.

3. Compare the technical performance of Google Meet and Zoom in terms of connectivity stability, audio-visual clarity, and ease of use during live advisory sessions.

4. Document farmer reflections and experiences regarding the usability of Google Meet and Zoom during the advisory sessions.

II.   RESEARCH METHODOLOGY

2.1   Research Design:

This study adopted a comparative field-based exploratory case study design to examine the use of Google Meet and Zoom as real-time digital extension tools during aquaculture advisory interactions at Brazil Farm, Abuja, Nigeria.

The research was conducted through live advisory sessions at Brazil Farm, Gosa Village, Abuja Municipal Area Council, Nigeria. The study simulated a realistic digital extension scenario in which a farm manager received remote advisory support from an aquaculture subject-matter specialist who was not physically present on the farm but was located at the University of Abuja.

Each advisory session involved:

- The farm manager and farm staff (on-site participants)

- Two researchers present at the farm (facilitators and structured observers)

- One aquaculture specialist located at the University of Abuja, Department of Fisheries

- Two supporting researchers with the remote specialist (technical support and independent observation)

These settings enabled replication of practical digital extension conditions while maintaining structured comparative observation for methodological rigor.

To enhance internal validity and minimize participant-related bias, the roles of facilitators and observers were rotated between the Google Meet and Zoom sessions. This role rotation ensured that observed differences in interaction quality,

technical performance, or user experience were attributable primarily to platform characteristics rather than individual participant influence.

Both sessions were conducted under comparable farm and network conditions to maintain procedural consistency. Each session lasted approximately 45-60 minutes, allowing sufficient time for farm assessment, problem diagnosis, and advisory discussion.

2.2   Data Collection Method:

Data were collected through structured field observation during live advisory sessions conducted via Google Meet and Zoom.

Observers (both on-site and remote) systematically recorded predefined indicators, including:

- Audio clarity

- Video quality

- Network stability and connectivity

- Ease of joining and navigating the platform

- Ease of interaction between farmer and specialist

- Responsiveness and clarity of advisory communication

- Level of farmer engagement and participation

- Occurrence and duration of technical disruptions

The use of predefined observational indicators enhanced consistency across sessions.

No structured questionnaires or formal surveys were administered, as the study focused on real-time functional performance under field conditions. However, post-session reflections and informal feedback from participants were documented to supplement observational findings.

2.3   Data Collection Procedure:

Data collection was conducted through live on-farm advisory interventions at Brazil Farm.

Step 1: Physical Farm Assessment:

The research team conducted an initial on-site assessment with the farm manager. Observations focused on pond conditions, fish health status, water quality management practices, infrastructure adequacy, and operational challenges.

Step 2: Google Meet Session:

A live advisory session was initiated using Google Meet with the remotely located aquaculture specialist. Real-time video of ponds, equipment, and farm conditions was transmitted to the specialist, who provided immediate technical feedback following visual assessment and clarifying questions. Google Meet was selected for the initial session due to the farm manager's limited familiarity with Zoom and the ease of accessing Google Meet via a shared link.

Step 3: Zoom Session:

A comparable advisory session was subsequently conducted using Zoom under similar farm and network conditions. The same categories of production challenges were discussed. Observers documented differences in technical performance, interaction dynamics, connectivity stability, and overall advisory effectiveness.

2.4   Identified Farm Challenges:

During the advisory sessions, the following key challenges were identified:

- Shortage of trained personnel and limited technical expertise

- Climate-related fluctuations affecting water quality

- Fish mortalities linked to inadequate monitoring practices

- Infrastructural limitations, including insufficient equipment

- Limited access to aquaculture health services

2.5   Expert Advisory Intervention:

During both live sessions, the aquaculture specialist provided real-time recommendations, including:

- Establishing linkages with aquaculture health professionals

- Scheduling periodic technical visits

- Implementing structured training programs for farm personnel

- Strengthening equipment maintenance and sanitation practices

- Conducting routine water-quality monitoring

- Adopting proactive fish health management strategies

The comparative evaluation focused on how effectively each platform facilitated clear communication, visual assessment, timely diagnosis, and immediate expert response.

2.6   Data Documentation and Analysis:

Observational indicators were systematically reviewed and comparatively analyzed across both platforms. The analysis focused on identifying differences in:

- Technical performance

- Quality of interaction

- Clarity and responsiveness of advisory communication

- Farmer engagement and participation

- Overall effectiveness in addressing real-time production challenges

A descriptive comparative analytical approach was employed to determine the relative suitability of Google Meet and Zoom as real-time digital extension tools under the prevailing field conditions.

III.   RESULTS AND DISCUSSION

3.1   Effectiveness in Real-Time Diagnosis and Problem Resolution:

Both Google Meet and Zoom enabled real-time visual interaction between the farm manager and the aquaculture specialist, allowing remote observation of pond conditions, feeding practices, and farm infrastructure. Through live video streaming, the specialist was able to identify observable issues such as poor water coloration, inadequate aeration practices, and irregular monitoring routines.

However, differences in technical performance influenced the efficiency of real-time diagnosis. During the observed session, Zoom appeared to provide relatively more stable connectivity and clearer audio transmission under the prevailing network conditions at the farm site. This facilitated an uninterrupted explanation of recommended corrective measures, particularly during detailed discussions of water-quality monitoring and disease-prevention protocols.

Google Meet, while accessible and easy to initiate, experienced minor audio distortions and brief connectivity lags during the session. Although these interruptions did not prevent advisory delivery, they occasionally required repetition of instructions, slightly reducing communication efficiency.

These findings align with existing research emphasizing that ICT effectiveness in extension is influenced not only by availability but also by functional reliability under field conditions (Meera et al., 2004; Taiwo & Amoo, 2021). In aquaculture, where rapid decision-making is essential to prevent stock losses, platform stability becomes a critical factor. This observation highlights the importance of technological reliability in digital extension delivery.

3.2   Influence on Understanding of Recommended Practices:

The live advisory format facilitated immediate clarification of recommended management practices, including structured water-quality monitoring and routine sanitation procedures. The ability to visually demonstrate pond conditions enhanced mutual understanding between the expert and farm personnel.

Informal reflections from the farm manager suggested increased clarity and understanding of the recommended management practices following the Zoom session, primarily due to clearer audio communication and smoother interaction flow. The reduced need for repetition allowed for more focused technical explanation.

These findings support the assertion by Davis and Sulaiman (2016) that interactive ICT tools enhance learning outcomes in agricultural extension by combining visual, auditory, and participatory elements. Real-time interaction may enhance farmers' understanding of recommended aquaculture practices and facilitate clearer communication between experts and farm personnel compared to delayed or text-based advisory methods.

3.3   Technical Performance and Usability Comparison:

Comparative assessment across predefined indicators revealed observable differences between the two platforms, as summarized in Table 1.

TABLE 1
COMPARATIVE PERFORMANCE OF GOOGLE MEET AND ZOOM DURING LIVE ADVISORY SESSIONS

Indicator	Google Meet	Zoom
Ease of joining	Easier (direct link, minimal steps)	Slightly more steps required
Connectivity stability	Minor audio distortions and brief lags	More stable, fewer disruptions
Audio-visual clarity	Adequate with occasional interruptions	Clearer audio transmission
Interaction flow	Brief interruptions requiring occasional repetition	Smoother conversational exchange
User familiarity	Higher (Google account integration)	Lower initially for this user

These findings reflect broader observations that platform performance may vary depending on bandwidth optimization and data management design (Alwahaishi & Snášel, 2013). In peri-urban Nigerian contexts where network stability is inconsistent, platform adaptability to low-bandwidth conditions becomes a decisive usability factor.

3.4   Farmer Perception and Satisfaction:

Informal post-session reflections indicated that the farm manager found both platforms useful for remote advisory support. Google Meet was perceived as easier to initiate, particularly for first-time users. However, Zoom was considered more reliable for sustained technical discussion.

The farmer noted that uninterrupted communication improved comprehension of water-quality management strategies and disease-prevention protocols. This suggests that perceived usefulness is closely linked to communication clarity and system stability.

These observations align with technology adoption research, which highlights perceived ease of use and perceived usefulness as central determinants of technology acceptance (Demiryurek et al., 2008; Nyarko & Kozari, 2021).

3.5   Comparative Effectiveness and Advisory Impact:

Overall, both platforms demonstrated potential as real-time digital extension tools in aquaculture advisory. However, comparative analysis suggests that Zoom offered relatively stronger performance in technical stability and interaction continuity under the observed field conditions.

Google Meet's simplicity and accessibility make it suitable for rapid initiation and low-barrier engagement, especially where users are less technologically experienced. Conversely, Zoom's superior interaction stability may provide advantages in scenarios requiring prolonged technical consultation.

These findings contribute to ongoing discussions on digital extension models in Nigeria, particularly within the framework of the National Electronic Extension Platform (FMARD, 2023), which advocates interactive, technology-driven advisory delivery. The observations from this exploratory case study suggest that synchronous video platforms may help reduce

geographical barriers and support real-time problem discussion between farmers and specialists. However, platform selection should consider local network infrastructure, user familiarity, cost implications, and advisory complexity.

IV.   LIMITATIONS OF THE STUDY

While this study provides insights into the comparative use of Google Meet and Zoom as real-time digital extension tools in aquaculture, several limitations should be acknowledged.

First, the study was conducted as a single-case field experiment at one fish farm in Abuja. As a result, the findings reflect the specific infrastructural, network, and managerial conditions of that farm. Variations in farm size, technological readiness, staff capacity, and regional connectivity conditions may influence platform performance differently. Therefore, the generalizability of the findings to other geographic locations or production systems remains limited.

Second, the study represents a short-term intervention focusing on immediate advisory effectiveness rather than long-term outcomes. Although both platforms facilitated real-time problem diagnosis and technical guidance, the sustained adoption of recommended practices, long-term productivity improvements, and measurable economic impacts were not systematically assessed. The absence of longitudinal monitoring limits conclusions regarding enduring behavioral or performance changes.

Third, the evaluation relied primarily on structured observation rather than quantitative performance metrics. While observational indicators such as connectivity stability, interaction flow, and user engagement provided practical insights, the study did not incorporate statistical measurement, cost–benefit analysis, or standardized usability scales. Consequently, conclusions regarding comparative efficiency are interpretive rather than statistically validated.

Fourth, the presence of researchers during the advisory sessions may have influenced participant behavior, potentially introducing observer-related bias. Although efforts were made to rotate roles and maintain consistency, the complete elimination of such effects in field experiments is difficult.

Despite these limitations, the study provides practical, field-based evidence on the feasibility of integrating synchronous video conferencing platforms into aquaculture extension systems in Nigeria. The findings offer an important exploratory foundation for larger-scale, multi-site, and longitudinal studies that can incorporate quantitative performance metrics and economic impact assessment to strengthen generalizability and policy relevance.

V.   CONCLUSION

This study comparatively assessed Google Meet and Zoom as real-time digital extension tools for addressing fish farming challenges at Brazil Farm, Abuja, Nigeria. The findings suggest that synchronous video conferencing platforms can effectively facilitate remote advisory interaction between aquaculture specialists and farm managers under real field conditions.

Both platforms enabled live visual assessment of pond conditions, interactive problem diagnosis, and immediate technical feedback, confirming the operational feasibility of integrating real-time ICT-based approaches into aquaculture extension systems. The study, therefore, contributes field-based evidence to the growing discourse on digital agricultural extension in developing-country contexts.

Comparative analysis revealed functional differences between the two platforms. Zoom demonstrated relatively stronger performance in connectivity stability and audio clarity, which enhanced continuity of interaction during extended technical discussions. In contrast, Google Meet provided easier access and simpler navigation, making it more suitable for rapid deployment and users with limited familiarity with video conferencing tools.

The findings indicate that the effectiveness of digital extension platforms depends not only on technological features but also on contextual factors such as network stability, infrastructural constraints, user familiarity, and advisory complexity. While Zoom may be preferable where stable connectivity can be reasonably maintained, Google Meet may offer advantages in resource-constrained settings where ease of access is prioritized.

As a single-case field study, these findings are context-specific and should not be generalized without further multi-site investigation. Nonetheless, the study highlights the potential of structured real-time digital advisory systems to complement conventional face-to-face extension models and strengthen responsiveness within aquaculture production systems.

VI. RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the exploratory findings of this single-case study, the following recommendations are proposed primarily to guide future research and methodological refinement in the application of digital platforms for aquaculture extension.

6.1 Need for Multi-Site Comparative Studies:

Future studies should examine the use of synchronous video conferencing platforms across multiple fish farms and geographic locations. Conducting research with larger samples will enable more robust comparison of platform performance under diverse infrastructural and production conditions and improve the generalizability of findings.

6.2 Incorporation of Quantitative Performance Metrics:

Subsequent investigations should incorporate measurable indicators such as session duration, number of technical disruptions, connectivity stability scores, and communication latency. The use of standardized quantitative metrics would strengthen the empirical assessment of digital extension platforms.

6.3 Assessment of Farmer Adoption and Behavioural Outcomes:

Longitudinal studies are needed to evaluate whether real-time digital advisory interactions influence the long-term adoption of recommended aquaculture management practices. Tracking behavioral changes, productivity improvements, and farm performance over time would provide stronger evidence of advisory impact.

6.4 Evaluation of User Experience and Technology Acceptance:

Future research should incorporate structured surveys or standardized usability scales to systematically measure farmer satisfaction, perceived usefulness, and ease of use of video conferencing platforms. Such data would complement observational findings and improve understanding of technology acceptance in rural farming contexts.

6.5 Cost-Effectiveness and Operational Feasibility Analysis:

Further studies should investigate the economic feasibility of integrating video conferencing tools into agricultural extension systems. Comparative analysis of operational costs, data consumption, and time efficiency relative to conventional farm visits would provide valuable insights for extension program design.

6.6 Exploration of Training and Digital Literacy Needs:

Additional research should assess the digital literacy levels of farmers and extension agents to determine how familiarity with communication technologies influences the effectiveness of video-based advisory interactions.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. This research was conducted independently without funding from Google, Zoom, or any commercial entity involved in video conferencing services. All assessments and conclusions are based solely on the observed performance under the specific field conditions described

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