Agricultural extension: is it still relevant?

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Abstract The rapid development of Artificial Intelligence (AI) and automation systems in the digital world challenges agricultural extension. This study investigates the contemporary significance of diverse and productive agriculture, specifically focusing on agricultural extension. This study investigates the implementation of agricultural extension services in Indonesia's automation, digital, and adapting environments through a comprehensive review of existing literature. Studies have indicated that agricultural extension plays a crucial role in mitigating climate change. This study assesses the effectiveness of agricultural extension services in different environments in Indonesia through qualitative research methods. Information was gathered by conducting interviews, surveys, and field observations. The results demonstrate the indispensability of agricultural extension in all types of environments, particularly in addressing climate change. It has been ascertained that each environment necessitates distinct educational approaches. Digital environments prioritise acquiring technical knowledge, automation environments necessitate education in sustainable agricultural practices, and adapting environments prioritise integrating field experience and local knowledge. This study provides an extensive review of the functions of agricultural extension. It demonstrates that agricultural extension can combat climate change. Furthermore, it underscores the importance of employing educational methods and approaches tailored to the specific environment, as this will influence the development of agricultural extension education.

Keywords: communication pedagogy; developmental communication; digital agricultural services

INTRODUCTION

Amidst the current era of rapid technological advancement, with Artificial Intelligence (AI) leading the way in innovation, it is often overlooked that agriculture remains of utmost importance (Bannerjee et al., 2018; S. Y. Liu, 2020; R. Sharma, 2021; S. Sharma et al., 2023). Artificial intelligence significantly impacts businesses, economics, and civilizations (Amaliyah & Jatmika, 2023; Jiang et al., 2022; Pallathadka et al., 2023; Susilo, 2023). However, agriculture continues to be the fundamental pillar of civilization, as it sustains life and provides essential resources for human existence (Hassan et al., 2010; Pathmudi et al., 2023; Rumble & Irani, 2016; S. Sharma et al., 2023). While there have been significant advancements in AI, it is important to recognise and emphasise agriculture's crucial role in ensuring food security, promoting environmental sustainability, achieving economic prosperity, and maintaining social stability (De Leon et al., 2021; Susilo et al., 2022).

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Agriculture is the main foundation of food security. Notwithstanding the progress made in artificial intelligence and other technological fields, agriculture remains the predominant means of providing sustenance for the growing global population (Pathmudi et al., 2023; Rumble & Irani, 2016). By 2050, the global population is expected to exceed nine billion, leading to an increase in food consumption (Teneva et al., 2023). Artificial intelligence (AI) can be instrumental in enhancing agricultural practices, boosting crop productivity, minimising wastage, and addressing the impacts of climate change. Artificial intelligence (AI) technologies, such as precision farming, automated monitoring systems, and predictive analytics, enable farmers to make decisions based on data, enhance production, and ensure a reliable food supply for the expanding population (Gardezi et al., 2023; Rattan, 2023; Srivastava et al., 2023).

In addition, agriculture is closely linked to environmental sustainability, a pressing concern given the current challenges of climate change and ecological degradation (De Leon et al., 2021; Füssel & Klein, 2006; Kundzewicz et al., 2018; Pacoma, 2019; Susilo et al., 2021, 2022). Intensive industrial agriculture techniques have resulted in common consequences such as soil erosion, water pollution, deforestation, and biodiversity loss (Gardezi et al., 2023; Rattan, 2023). Artificial intelligence (AI) has the potential to transform agriculture into a more sustainable and eco-friendly industry (Rattan, 2023; Srivastava et al., 2023). Artificial intelligence algorithms can analyse extensive datasets to enhance the utilisation of resources, decrease the usage of chemicals, promote regenerative agricultural methods, and minimise the negative effects on the environment (S. Y. Liu, 2020; R. Sharma, 2021). Farmers can enhance crop production efficiency and safeguard natural resources and ecosystems for future generations by employing AI-driven solutions. Moreover, agriculture is crucial in fostering economic growth and well-being, particularly in rural regions where farming communities often face poverty and inequity. By harnessing AI technology, farmers can enhance their competitiveness, expand their market reach, diversify their sources of income, and create employment opportunities within the Agri-tech sector (Gardezi et al., 2023; Srivastava et al., 2023). Artificial intelligence (AI) driven solutions, such as intelligent irrigation systems, self-governing machinery, and tools for optimising supply chains, can revolutionise agricultural value chains by enhancing productivity, reducing expenses, and boosting profitability for farmers and agribusinesses. Investing in agricultural modernisation using AI benefits rural economies and contributes to overall economic development and resilience.

Agricultural extension is crucial in the contemporary agricultural industry, acting as a conduit between research and application by spreading essential information and advancements to farmers and rural communities (M. K. Hossain & Kabir, 2001; Martínez-Domínguez & Mora-Rivera, 2020; Thompson, 2007). Agricultural extension is about transferring agricultural knowledge and promoting sustainable practices, adapting to climate change, and enhancing livelihoods. In the face of twenty-first century challenges such as climate change, food security, and the integration of digital technologies, the importance of agricultural extension officers in the agricultural sector is growing (Klien, 2020; Onitsuka et al., 2018). These professionals play a vital role in driving change and innovation in rural areas, making their contributions essential in developing communication studies (Fahmi & Mendrofa, 2023; Joshi et al., 2023; Yanti et al., 2023).

Development communication is a field that prioritises communication to advance social development (Odoom et al., 2021). It specifically aims to empower communities by sharing knowledge and encouraging their involvement in development initiatives (Gessese, 2020). Agricultural extension officers exemplify the principles of development communication. They serve as intermediaries who utilise communication strategies to educate and involve farmers and rural communities in embracing contemporary agricultural techniques, sustainable practices, and technological advancements. These officers contribute to the development of rural areas by enhancing agricultural productivity and promoting environmental sustainability. Their role emphasises the convergence of agricultural extension and development communication, emphasising the significance of efficient communication strategies in attaining agricultural and rural development.

Moreover, incorporating digital technologies in agricultural extension has created new opportunities for development communication. Agricultural extension officers currently employ digital platforms and tools to expand their reach to a broader audience, deliver timely and pertinent information, and enable interactive learning (Atalla et al., 2023; Dharmaraj &

Vijayanand, 2018). The digital transformation has increased the scope of agricultural extension services and emphasised the necessity for officers to possess communication skills that go beyond conventional methods. The changing agricultural extension landscape, marked by the integration of digital technologies, highlights the mutually beneficial connection between agricultural extension and development communication studies (Hassan et al., 2010; Pathmudi et al., 2023; Rumble & Irani, 2016; S. Sharma et al., 2023). The future of agricultural extension in promoting rural and agricultural development depends increasingly on innovative communication strategies and digital solutions.

Agriculture is not only economically significant, but it is also closely intertwined with social stability and the overall welfare of human beings. Rural communities that heavily depend on agriculture may face socioeconomic challenges such as poverty, food insecurity, and limited access to essential services (C. Liu et al., 2020; Rizou et al., 2020; Warshawsky, 2016). The government and organisations can enhance the capabilities of these individuals, improve their quality of life, and foster equitable economic expansion by harnessing AI for agricultural advancement (Fahmi & Mendrofa, 2023; Yanti et al., 2023). Artificial intelligence (AI) can be used to enhance agricultural extension services, market information systems, and financial inclusion efforts. This can assist smallholder farmers in overcoming challenges, taking advantage of opportunities, and participating more efficiently in the global economy. Moreover, through the facilitation of equitable technological and informational access, AI has the potential to diminish disparities and enhance social unity within rural communities (Dharmaraj & Vijayanand, 2018). In addition, agriculture serves to conserve cultural heritage and ancestral knowledge, showcasing the wide range and abundance of human civilization. Agriculture has historically been associated with cultural customs, ceremonies, and individual identities, exerting an impact on the geographical features and means of subsistence of populations worldwide. Amidst the era of artificial intelligence (AI), it is crucial to preserve and advance traditional farming knowledge, not only for the sake of cultural conservation but also to foster agricultural innovation. By integrating indigenous knowledge with AI-powered technology, we can develop solutions that are tailored to specific contexts, honour local traditions, adjust to dynamic circumstances, and advance sustainable agricultural practices rooted in centuries of wisdom and expertise.

Notwithstanding substantial advancements in AI and technology, agriculture continues to be crucial for the sustenance, prosperity, and welfare of humanity. In navigating the challenges of the twenty-first century, we must recognise agriculture's fundamental significance and prioritise it in conjunction with advancements driven by artificial intelligence. By harnessing AI's transformative potential, we can enhance agricultural productivity, ensure sustainability, and promote inclusivity (Gardezi et al., 2023; Rattan, 2023; Srivastava et al., 2023). This will lead to a future where food security is assured, ecosystems are safeguarded, economies thrive, and communities prosper. To ensure a resilient and prosperous Earth for future generations, it is imperative that we fully acknowledge and adopt the interdependence of agriculture and artificial intelligence (AI).

Although agricultural extension officers play a crucial role in connecting agricultural research with its practical implementation, there is a significant challenge in maximising their effectiveness in the ever-changing field of agriculture and rural development (Dharmaraj & Vijayanand, 2018; Gardezi et al., 2023; Pathmudi et al., 2023; Rattan, 2023; Srivastava et al., 2023). The main research issue arises from the evolving agricultural practices, the emergence of digital technologies, and the urgent requirement to tackle climate change. These factors collectively necessitate a reassessment of conventional extension methodologies and communication strategies. Given the crucial role of these officers in implementing development communication principles in rural communities, it is imperative to examine how their roles and strategies can be modified or improved to address the current needs of these communities effectively. This study seeks to fill this void by investigating novel strategies in development communication that can enhance the efficacy of agricultural extension officers in advocating for sustainable agricultural practices, improving food security, and fostering socio-economic progress in rural areas in the face of these difficulties.

METHODOLOGY
This study utilised a qualitative research design to investigate the changing role of agricultural extension officers in the context of development communication (Yanti et al., 2023). The study

examines explicitly their strategies, challenges, and effects on rural development. The qualitative approach is selected due to its ability to offer thorough comprehension and profound insights into intricate social phenomena, which is crucial for effectively addressing the research problem (Denzin & Lincoln, 2011).

Data was gathered via semi-structured interviews and focus group discussions. Semi-structured interviews were conducted with agricultural extension officers, policymakers, and experts in development communication. These interviews aimed to gather diverse viewpoints on the efficacy of existing communication strategists, the incorporation of digital technologies, and the difficulties encountered in adjusting to swiftly evolving agricultural environments. Focus group discussions were arranged with farmers participating in agricultural extension services. These discussions aimed to collect shared knowledge and understanding about how extension officers communicate and the strategies they use, including how they are received, how effective they are perceived to be, and any areas where improvements can be made.

The selection of participants (See Table 1) for both the semi-structured interviews and focus group discussions will be done using purposive sampling. This sampling strategy guarantees the incorporation of individuals who possess first-hand experience or specialised knowledge pertaining to agricultural extension and development communication, thus enhancing the study with a wide range of well-informed perspectives.

Table 1. Informant Background

No	Informant Code	Age (years old)	Occupation
1	A	38	Agricultural Extension Officer in West Java
2	B	33	Agricultural Extension Officer in West Java
3	C	50	Farmer
4	D	51	Farmer
5	E	42	Farmer

Source: Author Data Processed (2023)

Multiple strategies have been implemented to ensure the credibility of the study. To address individual bias, researcher triangulation was employed by engaging multiple researchers in data collection and analysis. Furthermore, a process called participant validation, or member checking, was implemented to ensure the accuracy and alignment of the interpreted data with the participants' own experiences. This involved sharing the findings with the participants and seeking their verification and confirmation. Reliability was achieved by providing comprehensive documentation of the research process, including the creation of interview and discussion guides, as well as the procedures for data collection and analysis. The comprehensive documentation enables the study to be reproduced and the results to be confirmed.

The data collected from interviews and focus group discussions was analysed using thematic analysis. This approach entails systematically encoding the data through the process of induction, wherein patterns are identified and subsequently organised into themes that arise directly from the data (Yin, 2009). The analysis concentrated on clarifying the roles, strategies, challenges, and impacts of agricultural extension officers as perceived by both themselves and the farmers they assist.

This study seeks to gain a detailed understanding of the role of agricultural extension officers in the context of development communication and their influence on rural development by using a qualitative research approach. The results were anticipated to provide valuable knowledge regarding efficient communication tactics and incorporating digital technologies in agricultural extension. The study will augment the existing knowledge on development communication and provide insights for policy and practice, ultimately improving the efficacy of agricultural extension services in promoting sustainable rural development.

RESULTS AND DISCUSSION
Digital Economy and Farming

The digital economy has become a major catalyst for global prosperity and innovation in this era of rapid technological advancement (Luo et al., 2023; Piscicelli, 2023; Susilo & Dizon, 2023; Susilo & K. Santos, 2023). The agriculture and digital economy sectors, traditionally considered distinct, are now converging to create new opportunities and transform the entire food

production, distribution, and consumption process. The impact of agriculture on the digital economy extends well beyond the physical fields, encompassing a range of technologies and methods that enhance productivity, environmental friendliness, and connectivity. Agriculture plays a crucial role in the digital economy through the adoption of precision farming methods. Precision farming employs advanced technologies such as GPS, drones, sensors, and data analytics to optimise agricultural practices. Farmers can optimise crop yields by precisely managing inputs such as water, fertilisers, and pesticides while simultaneously minimising waste and mitigating environmental impact. Efficiency directly leads to economic benefits by reducing manufacturing expenses and enhancing profitability. Examine the utilisation of drones in the field of precision agriculture. Equipped with advanced cameras and sensors, drones can capture highly detailed images of fields. This enables farmers to monitor the health of their plants, identify insect infestations, and analyse agricultural yields with exceptional accuracy. By analysing this data in real-time, farmers can enhance resource allocation and production efficiency. This not only enhances the economic feasibility of agricultural activities, but it also contributes to environmental sustainability by reducing input wastage and mitigating the risk of contamination. Agriculture plays a substantial role in generating data that fuels the digital economy. Massive amounts of data are collected throughout the agricultural value chain using IoT devices and sensors integrated into farm equipment, soil probes, and livestock. Properly analysing and utilising this data can provide valuable information on weather patterns, soil quality, crop productivity, market trends, and customer preferences. By harnessing the power of big data analytics and artificial intelligence, participants in the agricultural industry can enhance production, streamline supply chain operations, and provide customised products that meet evolving customer demands. The advancement of intelligent agricultural systems is an exemplification of agriculture's data contribution to the digital economy. These integrated systems utilise data analytics and machine learning algorithms to give farmers practical insights and decision-making abilities.

The significance of agricultural extension in stimulating the digital economy within the agriculture sector cannot be exaggerated. Agricultural extension officers play a crucial role in bridging the gap between research and practical implementation by introducing and facilitating the adoption of digital technologies within farming communities.

"Incorporating digital tools and platforms into farming practices is crucial for improving agricultural productivity, efficiency, and sustainability. By utilising digital platforms, farmers can obtain up-to-date information on market trends, weather forecasts, and optimal techniques for crop management". (Informant A, 10 September 2023)

This access to knowledge greatly enhances their ability to make well-informed decisions. Extension services have a crucial role in ensuring that the advantages of the digital economy are accessible to rural areas. The role of an agricultural extension officer like Informant A is fully integrated into cultivating digitisation among farmers. They achieved this by promoting digital literacy and offering training on the use of these technologies. As a result, they created an environment that encourages innovation and growth at the grassroots level.

Furthermore, agricultural extension plays a crucial role in promoting the use of precision agriculture technologies, thus stimulating the growth of the digital economy. This technology induction is supported by the Informant E statement.

"These technologies, such as drone surveillance for crop monitoring and smart irrigation systems, allow farmers to maximise the use of resources like water, fertilisers, and pesticides, reducing costs and minimising environmental harm". (Informant E, 10 September 2023)

In this context, extension officers have the responsibility of explaining these technologies for the farming community, highlighting their advantages, and facilitating their incorporation into everyday farming practices. This enhances farm productivity and sustainability and establishes agriculture as a feasible and appealing sector for young entrepreneurs and technologically adept individuals like Informant E mentioned. Agricultural extension services play a crucial role in fostering a more inclusive digital economy in agriculture, where innovations drive economic opportunities and improve competitiveness at both local and global levels.

Moreover, the digitalisation process enabled by agricultural extension plays a significant role in the advancement of rural digital ecosystems. Extension services facilitate the integration of rural economies into the wider digital economy by linking farmers with digital marketplaces, financial services, and online learning resources.

Informants C and D mentioned the agricultural extension officer who visited their village and inducted the marketplace, like Tokopedia and Shopee. They acquired knowledge on digital literacy regarding how to market their day-old chicken faster through digitisation and mobile internet.

This integration creates opportunities for rural entrepreneurs and agribusinesses to expand and enhance rural economies by adding value and diversifying their products and services. Furthermore, the data produced by digital farming methods provide valuable insights for policy formulation and further advancements in agricultural technologies and practices. Agricultural extension services serve as catalysts for the adoption of digital technologies in farming and play a crucial role in integrating agriculture into the digital economy. They promote socioeconomic development and resilience in rural communities.

Indonesian Agriculture Extension Officer: A Future Career?
Agriculture is critical to Indonesia's economy, providing major employment, food security, and rural development opportunities (Najib & Kiminami, 2011). However, the industry confronts various hurdles, including climate change consequences, poor infrastructure, and restricted access to modern farming practices. Amidst these obstacles, agriculture extension is a critical route for empowering farmers, increasing production, and promoting sustainable agricultural practices. Agriculture extension in Indonesia has evolved from conventional extension services to integrated, technology-driven methods. Historically, extension services were concerned with teaching fundamental farming practices and inputs. Recognising the need for a more comprehensive approach, the Indonesian government, in conjunction with many stakeholders, has increased efforts to modernise agricultural extension (Ibrahim et al., 2020).

The future prospects of Indonesian agricultural extension officers are critical due to the rapid advancement of technology and the growing focus on sustainable agriculture. This dilemma is rising due to the declining rate of agricultural school graduates who continue to work on farms (Ngadi et al., 2023). They choose to go to fancy banks or industries instead of advocating and cultivating digital farms for Indonesian Farmers.

"Indonesia's progress in the agricultural sector highlights the increasing importance of extension officers in spreading innovative practices and technologies to farmers. This field's evolution poses challenges and opportunities for individuals contemplating a career in it. Smart farming, which involves incorporating digital technologies into agriculture, requires extension officers to have a strong foundation in agricultural sciences as well as digital literacy and the capacity to adapt to and utilise new technologies. This dual requirement greatly expands the range of responsibilities and enhances their worth within the agricultural ecosystem". (Informant B)

The optimistic voice from Informant B, meanwhile criticised by Informant A during the FGD. Although agricultural extension officers are crucial in connecting research with the farming community, there is a noticeable feeling of pessimism regarding the future of this profession in Indonesia. The scepticism primarily arises due to obstacles such as inadequate financial resources, restricted availability of cutting-edge technologies, and insufficient opportunities for professional growth, all of which collectively impede the effectiveness and attractiveness of the profession. In addition, the increasing urbanisation and appeal of city living have caused a decrease in the younger generation's interest in agricultural professions, intensifying concerns about the long-term viability of this crucial industry. In addition to the occasional negative societal perception and underestimation of agricultural work, these factors create a difficult environment for individuals contemplating or pursuing a career as an agricultural extension officer in Indonesia. This situation poses a threat to the prospects of this crucial profession in its role of supporting the country's agricultural development and food security.

Furthermore, the worldwide effort to promote sustainable agriculture highlights the significance of extension officers in advocating for practices that achieve a harmonious balance between productivity and environmental conservation. Indonesian agricultural extension officers

are responsible for promoting and instructing on sustainable farming methods, including integrated pest management and efficient water resource utilisation. The transition towards sustainability not only affects the agricultural practices being advocated, but also requires a more profound comprehension of ecological principles and climate-smart agriculture. The career trajectory of extension officers is transforming to incorporate a greater focus on sustainability, rendering it a potentially gratifying domain for individuals who are fervent about positively impacting environmental preservation and ensuring food security (De Leon et al., 2021; Susilo et al., 2022).

The growing acknowledgment of the agricultural sector's importance in the Indonesian economy highlights the potential for career advancement and progress in agricultural extension. The government's emphasis on improving agricultural productivity and competitiveness necessitates the crucial involvement of extension officers in the dissemination of knowledge and technology to achieve these goals. This generates a need for proficient and extensively trained extension officers, creating possibilities for career advancement and expertise in fields such as agrotechnology, agronomy, and agricultural economics. The future profession of an agricultural extension officer in Indonesia offers a wide range of roles and responsibilities, as well as the chance for ongoing learning and making a significant impact.

Nevertheless, to fully achieve the potential of the agricultural extension field, it is imperative to make a focused endeavour to improve the perception and appeal of this career path. This entails enhancing the training and professional development options for extension officers, as well as ensuring that these positions are esteemed and appropriately remunerated. The digital transformation and the shift towards sustainable agriculture offer a distinct chance to redefine the role of agricultural extension officers, making it a more dynamic and attractive career option for future generations. In Indonesia's agricultural landscape, extension officers will play a crucial role in shaping the future. This career path offers both challenges and rewards, with the opportunity to make a substantial impact on the country's development.

The curriculum in Developmental Communication schools and Agricultural Studies needs to adjust to the changing landscape shaped by digital integration and the urgent need for sustainable agriculture. This adaptation necessitates a comprehensive and multidisciplinary approach to education, guaranteeing that students possess the knowledge and abilities essential to effectively navigate and influence the future of agriculture and rural development.

First and foremost, it is crucial to include digital literacy and technological proficiency as fundamental skills. It is recommended that courses on digital tools for agricultural management, such as Geographic Information Systems (GIS), remote sensing, and mobile applications for farm management, be incorporated into the curriculum. This incorporation not only equips students to utilise technology in agricultural methods but also empowers them to facilitate the transfer and acceptance of technology among farming communities. Incorporating programming and data analytics into the curriculum can allow students to create and personalise digital solutions specifically designed for local agricultural problems.

The curriculum should prioritise sustainable agricultural practices and the principles of environmental stewardship. One can attain this by enrolling in courses encompassing subjects like agroecology, integrated pest management, soil health, water conservation techniques, and climate-smart agriculture. These courses should offer theoretical knowledge and practical skills through hands-on learning experiences, such as internships and field projects with local communities, NGOs, and government agencies. By engaging in practical activities, students can implement sustainable agricultural methods in actual situations and gain a comprehensive understanding of the intricate relationship between agriculture and environmental and social factors.

Moreover, the curriculum should cultivate the ability to analyse and evaluate information, find solutions to complex problems, and communicate effectively. This will empower graduates to connect scientific research, technological advancements, and the agricultural community. By including courses on communication strategies, community engagement, and extension methodologies, students can improve their skills in effectively sharing knowledge and promoting participatory development processes. Developing strong soft skills, such as leadership, teamwork, and empathy, is essential in order to collaborate with diverse stakeholders in the agricultural industry effectively.

Subsequently, the curriculum should be adaptable and responsive, incorporating current research and emerging trends in agriculture and development communication. Regularly reviewing and adapting course content, as well as forming partnerships with industry and research institutions, is necessary to ensure that students are exposed to the latest practices and technologies. By modifying the curriculum in these manners, Developmental Communication schools and Agricultural Studies can equip a fresh cohort of professionals who are well-prepared to tackle the challenges and seize the opportunities presented by the digital and sustainable agricultural revolution.

The changing responsibilities of agricultural extension officers in Indonesia, considering the technological advancements and a move towards sustainable agriculture, have important theoretical implications in the field of agricultural extension and development communication. Incorporating digital technologies into agricultural practices highlights the necessity for an updated theoretical framework encompassing the intricacies of digital literacy, technology adoption, and the socio-economic factors that influence these processes in rural communities. This integration presents a new perspective on the traditional diffusion of innovation theory, proposing a more detailed comprehension of how innovations are communicated and embraced in the agricultural industry. A comprehensive approach is required, considering not only the technological aspects but also the human and social dimensions of technology transfer and adoption. The requirement for agricultural extension officers to have a combination of technical agricultural expertise and digital skills emphasises the convergence of agricultural science, information technology, and social sciences, thus broadening the theoretical foundations of the agricultural extension field.

Furthermore, the growing focus on sustainable agricultural practices highlights the theoretical implications of environmental stewardship, climate change adaptation, and sustainable development in the agricultural extension field. It requires a reassessment of current theories on modifying behaviour and embracing sustainable practices, incorporating knowledge from environmental psychology, sociology, and education (Atalla et al., 2023; Dharmaraj & Vijayanand, 2018; M. A. Hossain et al., 2023; S. Y. Liu, 2020; Ngadi et al., 2023; Odoom et al., 2021; Yanti et al., 2023). This shift necessitates that extension officers not only transmit knowledge but also employ participatory and dialogic communication strategies that promote a more profound comprehension and dedication to sustainable practices among farmers. The significance of extension services in promoting sustainability is underscored by the relevance of theories pertaining to social capital and community-based resource management (Zhang, 2022). The establishment of robust and cohesive communities becomes imperative in order to facilitate collective efforts towards achieving sustainable agriculture. Therefore, the evolving agricultural extension practices in Indonesia and similar settings highlight the necessity for an interdisciplinary theoretical framework that aligns with the agricultural industry's current challenges and goals.

CONCLUSION

The changing role of agricultural extension officers in Indonesia signifies a crucial moment for the agricultural sector, characterised by the growing incorporation of digital technologies and the necessity for sustainable practices. This paper has emphasised the need for a substantial overhaul in the educational curriculum for Developmental Communication Schools and Agricultural Studies in order to adjust to these changes. To adequately prepare future professionals for the changing landscape, the educational system should incorporate digital literacy, technological proficiency, and sustainable agricultural practices into the curriculum. Additionally, it should prioritise the development of critical soft skills. This adaptation is not simply a scholarly endeavour, but a crucial transformation to guarantee the agricultural industry stays dynamic, sustainable, and able to confront food security demands, environmental preservation, and economic progress in the digital era.

Subsequent investigation stemming from this study could delve into the precise ramifications of curriculum modifications on the efficacy of agricultural extension services in advancing digital and sustainable agricultural practices. Examining the extended consequences of incorporating digital tools and sustainable methods on farm efficiency, ecological well-being, and rural livelihoods could yield valuable observations. Furthermore, conducting comparative studies across various regions or countries could provide insights into the variability of the

success of these educational interventions and the contextual factors that influence their effectiveness. This future research would not only augment the existing knowledge on agricultural extension and education but also provide practical guidance for policymakers, educators, and practitioners who are working towards improving the resilience and sustainability of the agricultural sector in response to swift technological and environmental transformations.

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