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Digital Communication for Empowering Small-Scale Livestock Farmers

Cori Qamara and I Putu Gede Didik Widiarta
Department of Animal Science, Faculty of Agriculture, Mulawarman University, Samarinda 75119, Indonesia

Corresponding Author : I Putu Gede Didik Widiarta
E-mail : didikwidiarta9@gmail.com
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ABSTRACT

BACKGROUND AND OBJECTIVES

Farmers in rural East Kalimantan face significant challenges, including limited access to information, low digital literacy, and inadequate technology infrastructure, which hinder the implementation of sustainable farming practices. Despite the increasing availability of digital communication tools and platforms, farmers in remote areas continue to struggle with utilizing technology to manage livestock operations, access markets, and enhance animal health. This study aims to examine the use of digital communication tools by small-scale livestock farmers in East Kalimantan, as well as the benefits they gain and the barriers that limit wider adoption. The objective of this research is to understand the role of digital communication in supporting sustainable livestock practices in rural communities.

METHODS

This study employs a qualitative approach, utilizing semi-structured in-depth interviews and focus group discussions (FGDs) with farmers, agricultural extension officers, and relevant stakeholders. The research was conducted in East Kalimantan Province, Indonesia, which was selected for its significant challenges, including limited access to technology and low digital literacy among farmers. Despite these challenges, East Kalimantan also holds great potential for the development of sustainable livestock farming, particularly through the use of digital communication tools. The data was analyzed thematically to identify patterns related to technology adoption, perceived benefits, barriers, and the contribution of digital tools to sustainable livestock management.

FINDINGS

The study's findings reveal that farmers utilize smartphones, mobile apps, and social media platforms to access market information, livestock health consultations, and knowledge about sustainable farming practices. The adoption of advanced technologies such as the Internet of Things (IoT) and automation systems remains limited due to high costs, limited digital skills, and weak internet infrastructure. Farmers reported benefits such as improved animal health, better decision-making, and increased efficiency in livestock management; challenges related to digital literacy and access to technology remain significant.

CONCLUSION:

Digital communication tools have significant potential to enhance sustainable livestock practices among small-scale farmers in rural areas. Several key barriers, primarily the digital literacy gap,

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infrastructure limitations, and high technology costs, need to be addressed for wider adoption. Strengthening digital training programs, improving internet connectivity in rural areas, and supporting farmer-centered technological initiatives are important steps to maximize the benefits of digital tools. This study contributes to the understanding of digital empowerment in rural livestock farming, emphasizing the need for integrated policy interventions. The limitations of this research include its focus on a single region and a relatively small sample size, indicating the need for further, broader, and comparative research.

Keywords: Communication; Digital; Literacy; Livestock; Sustainable

INTRODUCTION

The livestock sector in East Kalimantan plays a crucial role in ensuring food security and supporting the regional economy, particularly in rural areas where most farmers reside. As one of the largest provinces in Indonesia, it has abundant natural resources and vast land potential for livestock farming. This sector faces various challenges, particularly in terms of access to information and the technology required to implement sustainable livestock practices. According to data from the Central Bureau of Statistics (2023), most farmers in East Kalimantan are small- and medium-scale producers living in remote areas with limited infrastructure and minimal access to information and communication technology (ICT) (1). These limitations hinder farmers from adopting more efficient and sustainable farming practices, which ultimately affects the productivity and sustainability of the livestock sector as a whole (2).

Empowering farmers through digital communication has become a key solution to enhance productivity and improve the welfare of farmers. Technology-based communication tools, such as mobile applications and social media platforms, provide farmers with access to information on modern farming techniques, efficient feed management, and sustainable livestock processing practices (3). These technologies also serve as an efficient and low-cost extension method, which is essential given the infrastructure constraints in these areas (4). Although digital communication has proven effective in other regions of Indonesia, its adoption in East Kalimantan is still hindered by low digital literacy, limited technology infrastructure, and cultural barriers that affect the acceptance of new technologies (5).

Most farmers in East Kalimantan still rely on traditional methods that are more familiar and perceived as safe. Resistance to the use of new technologies, such as mobile applications or internet-based platforms, often arises due to the lack of adequate training and technical support (6). Traditional farming approaches also fail to encourage innovation and the use of technologies that could enhance productivity and sustainability in livestock operations (7).

Previous studies have examined the role of communication technology in empowering farmers and livestock breeders; however, most studies have been conducted in regions with more advanced digital infrastructure. In contrast, the use of digital technology in East Kalimantan is limited due to restricted internet access, low digital literacy, and a lack of training (9). The novelty of this study lies in the development of digital communication-based empowerment tailored to the conditions in East Kalimantan. The objectives of this research are: (i) to examine the impact of digital communication on farmers' knowledge and skills in efficient livestock management and

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sustainable farming practices, (ii) to identify barriers to the adoption of digital technology, (iii) to assess the effectiveness of digital platforms in improving productivity and sustainability in livestock operations, and (iv) to provide policy recommendations based on local social and cultural contexts.

RESEARCH METHOD

This study was conducted in East Kalimantan Province, Indonesia, a region characterized by a significant number of small- and medium-scale farmers and livestock breeders. East Kalimantan was selected as the research location due to its specific challenges, including limited access to technology and low levels of digital literacy among farmers and livestock breeders. Despite these challenges, the region holds considerable potential for enhancing the use of digital communication tools that support the empowerment of farmers and breeders, particularly in relation to sustainable agricultural and livestock practices. Many farmers and breeders in this region still face barriers in accessing information on modern farming techniques, making it an ideal context to examine the role of digital tools in overcoming these limitations (5).

The population of this study consists of small-scale livestock farmers in rural East Kalimantan, particularly cattle farmers directly involved in livestock operations and facing limited access to information and communication technology (ICT). The sample was selected based on the consideration that these farmers face challenges in accessing the information and technology required to improve productivity and sustainability in their operations. A purposive sampling method was used to select 150 farmers, representing those from various rural areas in East Kalimantan. The sample criteria included farmers who: (i) own cattle farms, (ii) reside in remote areas with limited infrastructure, (iii) have limited access to digital technology, and (iv) are willing to participate in the study. This method was chosen to gather in-depth and relevant information regarding the adoption of digital technology in livestock farming in East Kalimantan.

This study employs a qualitative research design, utilizing both primary and secondary data sources. Primary data was obtained through in-depth interviews and focus group discussions (FGD) with farmers, agricultural extension officers, and other relevant stakeholders in rural East Kalimantan. The primary participants in this research are farmers and livestock breeders who have used or been exposed to digital communication tools, such as mobile agriculture applications, social media platforms, and other ICT tools. Secondary data was gathered through a comprehensive literature review on digital literacy in agriculture/livestock sectors, available agricultural technologies, and previous research on farmer empowerment and sustainable agricultural practices (6).

Data collection was conducted using two main methods: semi-structured in-depth interviews and focus group discussions (FGD).

1. Semi-structured In-depth Interviews

   Interviews were conducted with farmers, livestock breeders, agricultural extension officers, and other key informants to explore their experiences with digital communication tools in agricultural and livestock operations. These interviews aimed to identify the challenges and perceived benefits associated with the adoption of digital technology and to understand how

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these tools contribute to the implementation of more sustainable agricultural and livestock practices.

2. Focus Group Discussions (FGD)

Focus group discussions were organized with groups of farmers and livestock breeders to capture collective perspectives and group dynamics regarding the use of digital tools in farming and livestock activities. This method facilitated an understanding of how farmers share information about technology and collaborate to find solutions to various challenges they face in their operations (7).

The data obtained from interviews and FGDs were analyzed using thematic analysis. The analysis process began with verbatim transcription of all interviews and discussion recordings, followed by a thorough reading to gain a comprehensive understanding of participants' experiences with digital tools. The transcriptions were then coded to identify key themes, including "adoption barriers," "benefits of digital technology," "sustainable farming practices," and "perceptions of digital training."

These codes were grouped into broader categories and linked to the research questions to identify key patterns. For instance, themes related to "technology access" and "infrastructure barriers" were compared across different groups of farmers and livestock breeders. To enhance the credibility and reliability of the findings, member checking was conducted by sharing preliminary interpretations with selected participants to ensure the analysis accurately reflected their views (7).

This study adopts a qualitative approach to gain an in-depth understanding of the role of digital communication tools in empowering farmers and livestock breeders in East Kalimantan. By examining the challenges, benefits, and opportunities arising from the use of digital technology in sustainable agricultural and livestock practices, this research aims to contribute to the development of policy frameworks and programs related to technology-based farmer empowerment in rural Indonesia.

The findings are expected to provide insights into how digital communication tools can be effectively utilized to promote sustainable agricultural and livestock practices, thereby improving the welfare of farmers and livestock breeders in East Kalimantan.

RESULTS AND DISCUSSION

Impact of Digital Communication on Farmers Knowledge and Skills

This study reveals that digital communication tools, particularly smartphones, have a significant impact on farmers' knowledge and skills in East Kalimantan. 85% of farmers (127 respondents) reported consistently using smartphones to access agricultural information, communicate with agricultural extension workers, and interact with the farming community online. The ease of access and relatively affordable prices make smartphones the most commonly used tool among farmers (8-10). These findings align with previous research showing that smartphones are the primary tool used by farmers and livestock breeders in rural Indonesia due to their ease of access (11). As shown in Table 1, smartphones are the most widely used digital tools among farmers in East Kalimantan.

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Mobile apps for livestock management were used by 70% of farmers (105 respondents), who utilized them to manage feeding schedules, monitor animal health, and maintain financial records. These mobile apps significantly contribute to operational efficiency and more accurate record-keeping, as also found in the study by Setiawan & Firmansyah (2). Referring to Table 1, 70% of farmers use mobile apps for livestock management, highlighting their importance in improving operational practices. Social media platforms, used by 65% of farmers (98 respondents), play an essential role in sharing information and marketing livestock products to a broader consumer base (12-15). This form of digitalization not only supports daily operations but also optimizes livestock business management (15-18). As illustrated in Table 1, the use of social media platforms is widespread among farmers in East Kalimantan, demonstrating their effectiveness in information sharing and product marketing.

Table 1. Adoption of Digital Tools Among Farmers in East Kalimantan

No	Digital Tool	Number of Farmers Using	Percentage of Users (%)	Purpose of Use
1	Smartphones	127	85	Accessing market information, communicating with extension workers, online interaction
2	Mobile Apps for Livestock Management	105	70	Managing feeding schedules, monitoring diseases, financial record-keeping
3	Social Media Platforms	98	65	Sharing information, marketing livestock products
4	IoT-based Devices	45	30	Automatic livestock monitoring, real-time data management
5	Automated Livestock Systems	37	25	Automated feeding, livestock health monitoring

Source: Primary data analysis (2024)

IoT-based devices and automated livestock systems have relatively low adoption rates, with 30% (45 respondents) and 25% (37 respondents) usage, respectively. The main barriers to adoption are the high cost of devices and the lack of technical knowledge regarding their use. These limitations also highlight that the use of IoT and automation systems is still hindered by cost and infrastructure issues (16-20).

Benefits of Digital Communication Tools for Sustainable Livestock Practices

Digital communication tools provide numerous benefits that support the implementation of sustainable livestock practices. As many as 75% of farmers (112 respondents) considered real-time access to market price information as the most valuable benefit. With instant access to price information, farmers can negotiate fairer prices, choose the optimal timing for sales, and reduce reliance on intermediaries. As shown in Table 2, this benefit highlights how access to market price

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information enhances farmers' ability to make informed decisions and improve their competitiveness. This finding aligns with the study, which emphasizes that better access to market price information enhances farmers' competitiveness (3).

Additionally, 68% (102 respondents) reported that digital tools enhanced their knowledge of sustainable practices, including livestock health, feed efficiency, and waste management. Referring to Table 2, this increased knowledge enables farmers to implement sustainability principles in their livestock operations. The literature also highlights the role of digital innovation in improving resource efficiency and in adopting circular economy principles (8). Moreover, 62% of farmers (93 respondents) reported improvements in livestock health management, while 60% (90 respondents) emphasized the ease of access to expert agricultural and livestock advice through various online platforms (9, 10-13). As illustrated in Table 2, these digital tools are crucial in enhancing both knowledge and health management for farmers.

Table 2. Perceived Benefits of Digital Communication Tools

No	Benefit	Number of Farmers	Percentage	Type of Benefit Experienced
1	Access to Market Price Information	112	75	Enables price negotiation, choosing optimal sale timing, reducing intermediaries
2	Increased Knowledge of Sustainable Practices	102	68	Knowledge about livestock health, feed efficiency, waste management
3	Improved Livestock Health Management	93	62	Disease management, livestock health monitoring
4	Better Access to Agricultural Advice	90	60	Access to agricultural and livestock experts via digital platforms

Source: Primary data analysis (2024)

Barriers to Digital Tool Adoption in Rural Communities

Although digital tools offer numerous benefits, their adoption remains hindered by several key barriers. As shown in Table 3, 58% (87 farmers) identified limited internet access as the most significant barrier, indicating a fundamental infrastructure gap that hampers the use of real-time data and various network-based communication tools. This barrier highlights the challenge of connectivity, particularly in rural areas, which prevents farmers from fully utilizing the potential of digital tools.

Low digital literacy was reported by 52% (78 farmers), suggesting that although devices are available, many still lack the skills to use digital tools effectively. Referring to Table 3, this issue underscores the need for digital literacy programs to help farmers maximize the use of available tools. Additionally, 45% (67 farmers) cited the high cost of advanced technologies such as IoT sensors and automation systems as a significant barrier, while 40% (60 farmers) reported

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a lack of technical support and training. As illustrated in Table 3, the high costs and lack of support further hinder the adoption of advanced technologies, which could otherwise improve productivity and sustainability in livestock management.

Table 3. Barriers to Digital Tool Adoption

No	Barrier	Number of Farmers	Percentage	Type of Barrier Faced
1	Limited Internet Access	87	58	Limited internet connectivity in rural areas
2	Low Digital Literacy	78	52	Lack of skills to operate digital tools
3	High Cost of Advanced Technology	67	45	High cost of IoT devices and automation systems
4	Lack of Technical Support and Training	60	40	No training or technical support for using digital tools

Source: Primary data analysis (2024)

These structural challenges reflect issues that consistently arise in the context of rural agriculture in Indonesia, where connectivity gaps limit the functionality of digital tools (11, 12). These barriers not only occur in the agriculture sector but also emerge in studies on sustainable consumer behavior, the adoption of green products, and digital transformation in the rural economy (20, 21). The limitation of digital literacy exacerbates the situation, as reported in various studies on ICT adoption in rural areas (10, 11). Without adequate training, even relatively accessible tools like mobile applications cannot be utilized optimally.

The financial burden associated with advanced technology further strengthens the digital divide. Although IoT devices have the potential to enhance livestock monitoring and resource efficiency, the cost of acquisition remains out of reach for many small-scale farmers. Similar findings have been reported in studies on the adoption of renewable energy, organic fertilizer production, and circular economy initiatives based on waste processing in the livestock sector (14, 16, 19). These barriers underscore the need for multidimensional interventions, including infrastructure development, digital training programs, and the establishment of financial support mechanisms, to ensure more equitable adoption of digital tools in rural farming communities.

Impact of Digital Tools on the Sustainability of Livestock Practices

This study found that farmers who regularly use digital tools experience significant improvements in livestock health and resource management. As presented in Table 4, 70% (105 farmers) reported a reduction in disease outbreaks, which was attributed to easier access to veterinary advice, faster diagnostic processes, and the implementation of preventive strategies shared through digital platforms. This reduction in disease outbreaks highlights the effectiveness of digital tools in improving animal health management.

An improvement in livestock growth rate of 65% (98 farmers) was reported, along with a similar increase in resource efficiency, particularly in optimizing feed and water consumption.

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Referring to Table 4, these findings underscore the positive impact of digital tools on livestock growth and resource use, particularly in terms of more efficient management of essential resources such as feed and water.

Table 4. Impact of Digital Tools on the Sustainability of Livestock Practices

No	Impact	Number of Farmers	Percentage	Type of Impact
1	Reduction in Disease Outbreaks	105	70	Easier access to experts, faster disease prevention
2	Increased Livestock Growth Rate	98	65	Faster growth due to more efficient feed management
3	Increased Resource Use Efficiency	98	65	Efficiency in the use of feed, water, and energy

Source: Primary data analysis (2024)

These findings are consistent with previous research, which shows that digital tools help farmers monitor livestock health more effectively and implement preventive health strategies (10, 11). By allowing farmers to track feeding behavior, water consumption, weight gain, and disease symptoms, digital applications serve as a relatively inexpensive alternative to advanced monitoring systems.

This pattern is reinforced by studies that integrate circular economy principles in livestock management, where digital monitoring enables better nutrient recycling, waste utilization, and reduction of environmental impact (14, 16, 19).

The findings also reflect the broader discourse on the transformative role of digital agriculture in building resilient and sustainable food systems. Several studies show that digital tools support improved animal welfare, reduced mortality rates, and increased productivity (11, 14, 19). Farmers in this study emphasized that access to digital learning resources enabled them to adopt various innovative practices, such as precision feeding, rotational grazing, water conservation, and organic waste recycling, which strengthen both economic and environmental sustainability.

CONCLUSION

This study reveals that digital tools, particularly smartphones and mobile-based applications, play a crucial role in enhancing livestock farming in rural areas by improving access to market price information, supporting livestock management, and improving animal health. However, the adoption of more advanced technologies, such as Internet of Things (IoT) devices and automation systems, remains limited due to high investment costs, lack of technical support, and limitations in internet connectivity quality and coverage. Despite these barriers, the use of digital tools has proven to have a positive impact on the sustainability of livestock operations, including improvements in resource management efficiency and a reduction in disease outbreaks. These findings underscore the importance of addressing digital literacy gaps and infrastructure limitations to encourage broader adoption of technology among rural farmers. Strengthening

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digital literacy and improving technology infrastructure are key steps to ensure that rural farmers can fully benefit from digital innovations, thus enhancing sustainable farming practices and overall livestock productivity.

RECOMMENDATIONS

This study makes a significant contribution to understanding the use of digital communication tools in rural livestock farming; however, several methodological limitations should be considered for future research. The limited sample size restricts the generalizability of the findings, so future research is recommended to implement a broader sample scope with a comparative approach across regions to capture the diversity of farmers' socio-economic characteristics more representatively. Additionally, given that the focus of this study remains limited to a short-term perspective, longitudinal studies are necessary to assess the long-term impacts of digital technology adoption on productivity, management efficiency, and the resilience of livestock operations. Further research is also encouraged to evaluate various digital literacy training models and community-based mentoring approaches as strategies to enhance the adoption of advanced technologies, including Internet of Things (IoT) devices and livestock automation systems. Furthermore, interdisciplinary policy studies should be conducted to formulate effective regulatory frameworks and financing schemes through collaboration among the government, private sector, and extension services, thereby strengthening rural digital infrastructure and facilitating a more inclusive technological transformation in the livestock sector.

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AUTHOR CONTRIBUTIONS

1	**Cori Qamara, S.Pt., M.Pt.**	
	Institutions	Lecturer in Animal Science Study Program, Faculty of Agriculture, Mulawarman University, Gunung Kelua Campus Jl Pasir Balengkong, Samarinda City, East Kalimantan, Indonesia.
	Contributions	Drafting publication manuscripts, conducting data analysis, data processing andprovide input in interpreting results .
	Homepage	https://sinta.kemdiktisaintek.go.id/authors/profile/6910482
2	**I Putu Gede Didik Widiarta, S.Pt., M.Pt.**	
	Institutions	Lecturer in Animal Science Study Program, Faculty of Agriculture, Mulawarman University, Gunung Kelua Campus Jl Pasir Balengkong, Samarinda City, East Kalimantan, Indonesia.
	Contributions	Coordinate the preparation of publication manuscripts, monitor the preparation of publication manuscripts, and ensure the achievement of manuscript objectives.
	Homepage	https://sinta.kemdiktisaintek.go.id/authors/profile/6903389