



DIGITAL MARKETING AND MECHANIZED AGRICULTURE FOR SMALLHOLDER FARMERS IN SUB-SAHARAN AFRICA: BOOSTING ADOPTION AND SUSTAINABILITY

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Abstract

Smallholder farmers are central to food production in developing economies but face persistent challenges such as low productivity, poor market access, and limited adoption of mechanized agriculture. These issues are exacerbated by financial constraints, fragmented landholdings, and inadequate digital literacy. While digital marketing holds promise for enhancing agricultural outcomes, its potential to promote mechanized farming amongst smallholder farmers remains underexplored. Using a literature-based research design, this study investigates how digital marketing can drive the adoption of mechanized agriculture among smallholder farmers. The research assesses digital marketing usage, identifies barriers and opportunities, evaluates strategy effectiveness, and examines the combined impact on productivity, income, and sustainability. Findings reveal that platforms like Facebook, WhatsApp, and mobile apps are helping farmers access information, machinery services, and digital training. However, the digital divide, cost barriers, and infrastructural limitations continue to hinder broader adoption. The study recommends government investment in rural digital infrastructure, public-private partnerships for tool development, affordable financing, and farmer-focused training. It also calls for data protection frameworks and inclusive policies. Integrating digital marketing with mechanized agriculture can transform smallholder farming, improve livelihoods, and promote sustainable agricultural development.

Keywords: Smallholder Farmers, Digital Marketing, Mechanized Agriculture, Agricultural Sustainability, Rural Development.

Introduction

Smallholder farmers form a critical backbone of both global and regional food security, particularly in regions like Africa, where they are responsible for a substantial portion of agricultural output (Moss 2024). Their contributions extend beyond mere production, playing a vital role in home consumption, providing employment opportunities, and alleviating poverty within developing economies. Despite their significance, these farmers persistently grapple with challenges such as low productivity, restricted access to markets, and heightened vulnerability to the adverse impacts of climate change. Recognizing the imperative for sustainable intensification in smallholder agriculture has grown, driven by the interconnected goals of achieving food security, fostering economic advancement, and ensuring

environmental conservation (Mdoda et al. 2022). A significant challenge faced by smallholder farmers is the limited adoption of mechanized agriculture. This is often attributed to a confluence of factors, including the prohibitive costs associated with machinery, inadequate access to credit and financing, the constraints of small landholdings, and a deficiency in the necessary technical knowledge and skills (Dhillon & Moncur 2023). Consequently, the levels of mechanization in many African nations remain considerably low, hindering their agricultural potential. Simultaneously, achieving sustainability in smallholder farming is an ongoing challenge, compounded by issues such as declining soil fertility, restricted use of essential external inputs, and the escalating risks posed by climate change. Compounding these issues is the persistent gap in effective communication and the dissemination of crucial information regarding modern agricultural practices and available technologies to these smallholder farmers (Adamu & Kawugani 2025).

In this context, digital marketing emerges as a potentially transformative force. Digital tools, encompassing websites, e-commerce platforms, social media channels, mobile applications, and email marketing, possess the capacity to revolutionize access to information, streamline intricate supply chains, and establish direct connections between agricultural producers and their consumers (Ebarefimia et al. 2024). The increasing rates of mobile phone ownership and expanding internet access across numerous developing regions offer a promising pathway for meaningful digital engagement with these farmers. Furthermore, digital platforms also known as e-commerce have demonstrated their ability to enhance market access for farmers, leading to the realization of fairer prices for their produce and a reduction in the significant issue of post-harvest losses. It enables farmers to sell their products and services to consumers and businesses more efficiently. This approach, which includes online marketplaces and digital channels, aims to improve agricultural supply chain management; expand farmers' customer base; and provide consumers with easy access to fresh, locally sourced agricultural products (Morepje et al. 2024).

This research endeavors to explore the nexus between digital marketing and mechanized agriculture in the context of smallholder farmers. The primary objectives of this research are multifaceted. Firstly, it aims to assess the current extent of digital marketing adoption among smallholder farmers and to understand its influence on their awareness of the benefits and availability of mechanized agriculture. Secondly, it seeks to identify the principal challenges and promising opportunities associated with the strategic use of digital marketing to actively promote the adoption of mechanized agriculture for these farmers. Thirdly, the research will evaluate the effectiveness of specific digital marketing strategies in encouraging the uptake of sustainable mechanized farming practices that are both productive and environmentally responsible. Fourthly, it intends to determine the overall impact of the combined implementation of digital marketing and mechanized agriculture on the critical aspects of productivity, income generation, and the long-term sustainability of smallholder farm operations. The research will culminate in the proposition of actionable policy recommendations and the identification of key elements for an enabling environment that can effectively foster the broader adoption of these integrated approaches.

Methodology

This study adopts a literature-based research design. The choice of this approach was informed by the aim of the research, which is to critically examine the role of digital marketing in promoting the adoption and sustainability of mechanized agriculture among smallholder farmers. Given the broad and evolving nature of the subject, reliance was placed on secondary data obtained from published books, peer-reviewed journal articles, reports of international development organizations, and credible online sources that address the intersection of digital marketing, mechanization, and smallholder farming. The study did not involve primary fieldwork or survey-based data collection. While this limits the scope of empirical validation, it allows for a wide-ranging synthesis of insights from different contexts, making the results useful for academic discussions and policy directions.

Literature Review

The agricultural sector is undergoing a significant transformation, with digital marketing playing an increasingly prominent role. Various online channels and technologies, including websites, e-commerce platforms, social media, mobile applications, SMS messaging, and interactive voice response (IVR) systems, are being utilized across the agricultural landscape. Research indicates that digital marketing has the potential to significantly impact agricultural product sales, enhance market access for farmers, and improve the efficiency of supply chains, particularly for smallholder farmers in Africa and other developing regions (Ebarefimia et al. 2024). Digital platforms are proving instrumental in providing farmers with access to real-time market price information, establishing direct sales channels, and fostering connections with potential buyers, thereby reducing information asymmetry and empowering farmers in the marketplace (Morepje et al. 2024). Studies have also highlighted the influence of mobile phone and radio usage on market participation and the accessibility of crucial agricultural information among smallholder farmers, demonstrating the power of even basic digital tools (Fabregas & Kremer 2024). Social media platforms such as Facebook, WhatsApp, and YouTube are increasingly being utilized as tools for information exchange, social networking, and market access for farmers in various countries, including developing regions. According to Rela et al. (Rela et al. 2025), research done by Anwarudin et al. and Hamzani shows that farmers actively use Facebook and Facebook groups to seek farming advice, share experiences, and access informal training materials. This platform is particularly relevant in areas with limited access to formal extension services, as it provides fast, flexible, and inexpensive information. While the potential of digital marketing to transform agricultural markets for smallholder farmers is evident, its effectiveness is significantly shaped by factors such as the level of digital literacy within the farming communities and the availability of robust digital infrastructure (Abdulai 2022). However, research findings on the direct impact of digital marketing on sales have been varied, suggesting that contextual factors and the specific implementation strategies play a crucial role in determining the outcomes.

Mechanized agriculture presents a significant opportunity to improve the productivity and overall efficiency of smallholder farming operations. The adoption of appropriate machinery can lead to increased yields, enhanced farm returns, and greater cropping intensity, while simultaneously reducing the physical demands of labor and improving the timeliness of essential agricultural tasks (Mdoda et al.

2022). Despite these considerable benefits, the widespread adoption of mechanized agriculture among smallholder farmers is often impeded by a range of barriers. These include the high costs associated with purchasing and maintaining agricultural machinery, limited access to affordable credit and financing options, the constraints imposed by small and fragmented landholdings, inadequate rural infrastructure, and a general lack of technical expertise and know-how among farmers. Recognizing these challenges, the importance of developing and promoting appropriate mechanization technologies that are specifically tailored to the needs and scales of small-scale farming in developing countries has been increasingly emphasized (Adamu & Kawugani 2025). In this context, agricultural mechanization services (AMS) and machinery renting models have emerged as viable solutions to improve access for smallholder farmers, allowing them to leverage the benefits of mechanization without the significant capital investment required for ownership (Okoro 2024). Sustainability in the context of smallholder farming is a complex and multifaceted goal, encompassing not only economic viability and environmental stewardship but also crucial aspects of social equity and well-being. Mechanized agriculture, when implemented thoughtfully and with consideration for environmental impacts, has the potential to significantly contribute to sustainability through more efficient utilization of resources, reduction in soil degradation, and the facilitation of climate-smart agricultural practices (Bathaei & Streimikrene 2023).

Digital marketing can play a vital role in promoting the adoption of sustainable agricultural practices among smallholder farmers and in connecting them with markets that increasingly demand sustainably produced food. While both digital marketing and mechanized agriculture have been explored in the context of smallholder farmers, the existing body of research on their combined application and synergistic effects remains relatively limited. This gap highlights a critical area for further investigation, specifically focusing on how tailored digital marketing strategies can effectively target and promote the adoption of mechanized agriculture among smallholder farmers, and how this integration can lead to greater positive impacts on both agricultural productivity and long-term sustainability. Understanding the potential synergies between these two domains is essential for unlocking more effective pathways to agricultural transformation for smallholder communities.

Challenges in the Adoption and Sustainability Nexus

The effective integration of digital marketing and mechanized agriculture to benefit smallholder farmers faces several significant challenges. One of the most prominent is the digital divide, which encompasses disparities in access to essential digital infrastructure, particularly reliable internet connectivity and consistent electricity supply, especially in remote rural areas where many smallholder farmers reside (Ebarefimia et al. 2024). This divide is further exacerbated by the often limited digital literacy and skills among these farmers, which hinders their ability to effectively utilize digital marketing tools and access the wealth of information available online (Dhillon & Mocur 2023). The affordability of necessary digital devices, such as smartphones, and the ongoing cost of internet services and digital platforms also present considerable barriers for smallholder farmers operating on limited financial resources (Enfuse 2024). Moreover, existing gender disparities in access to and the utilization of digital technologies further compound these challenges, often leaving female farmers at a disadvantage (Fischer 2018).

Financial and economic constraints constitute another major challenge. The high costs associated with purchasing and maintaining agricultural machinery often render it unaffordable for many smallholder farmers. Furthermore, access to crucial credit and financing options, which could facilitate the acquisition of both machinery and the adoption of digital marketing initiatives, remains limited for this segment of the agricultural population (Dhillon & Moncur 2023). A critical factor influencing technology adoption is also the farmers' perception of the potential return on investment (ROI) for both digital marketing strategies and mechanized agriculture technologies. Many smallholder farmers, operating with limited income and often exhibiting risk-averse behavior, require clear evidence and assurance of tangible economic benefits before committing to new approaches (Adamu & Kawugani 2025).

Infrastructure and logistical barriers in rural areas also pose significant challenges. Unreliable electricity supply can disrupt the operation and maintenance of machinery and hinder the consistent use of digital technologies (Ebarefimia et al. 2024). Inadequate transportation networks can further complicate the delivery of agricultural machinery, essential spare parts, and access to markets, thereby undermining the potential advantages of mechanization (Dhillon & Moncur 2023). The limited availability of spare parts and qualified repair services for agricultural machinery in rural areas further discourages investment in and adoption of these technologies (Adamu & Kawugani 2025).

Socio-cultural and behavioral factors exert a considerable influence on the adoption of new agricultural practices and technologies. Farmers' inherent resistance to change and skepticism towards innovations, often rooted in past unsuccessful experiences or a general lack of trust in new methods, can act as a significant barrier (Dhillon & Moncur 2023). Strong cultural preferences for traditional farming practices, coupled with limited awareness of the specific benefits offered by both mechanization and digital marketing, can further slow-down the adoption process. Conversely, the influence of established social networks and peer groups can play a crucial role in shaping technology adoption decisions, as farmers often look to the experiences and opinions of their trusted peers (Abdulai 2022).

It is important to acknowledge the potential sustainability trade-offs associated with agricultural mechanization. If not implemented with careful consideration, increased mechanization can lead to negative environmental impacts such as soil compaction, increased greenhouse gas emissions, and the potential for chemical pollution from overuse of fertilizers and pesticides (Mdoda et al. 2022).

Digital Marketing Strategies for Boosting Adoption of Mechanized Agriculture

Digital marketing offers a powerful suite of strategies that can be leveraged to overcome many of the challenges hindering the adoption of mechanized agriculture among smallholder farmers. Information dissemination and awareness campaigns can be significantly enhanced through the use of social media platforms such as Facebook, WhatsApp, YouTube, Twitter, and Instagram, which provide avenues for reaching target audiences with engaging and educational content highlighting the benefits of mechanized agriculture (Ebarefimia et al. 2024). Targeted mobile applications and SMS campaigns can also be developed to directly provide farmers with crucial information regarding the advantages, availability, and proper utilization of mechanized equipment. Creating visually appealing and informative video content and infographics that clearly demonstrate the advantages of mechanized farming over traditional methods can also be highly effective. For farmers with limited literacy, interactive voice response (IVR)

systems present a valuable tool for delivering essential agricultural information in an accessible audio format (Kamur et al. 2024).

Building trust and leveraging peer influence are critical for encouraging technology adoption. Digital platforms can facilitate the creation of online farmer forums and communities where farmers can connect, share their experiences, and offer peer-to-peer support related to mechanized agriculture. Actively encouraging experienced farmers who have already successfully adopted mechanization to share their personal testimonials and success stories through various digital channels can be a powerful motivator for others. Furthermore, engaging trusted agricultural influencers and knowledgeable extension agents to promote the benefits of mechanization on these digital platforms can lend credibility and reach to adoption campaigns (Chacko n.d.).

Digital marketing can also play a key role in facilitating access to machinery and essential services. Developing specialized digital platforms and user-friendly mobile applications that directly connect farmers with available agricultural machinery rental services and individual equipment owners can significantly lower the financial barriers to mechanization (Burger 2019). Creating online marketplaces where farmers can buy and sell used agricultural equipment that is suitable for the scale and needs of smallholder farming can also enhance affordability and access. Additionally, providing digital tools that enable farmers to collectively organize and pool their resources to access mechanization services can make adoption more feasible for smaller operations (Nottmeyer 2025).

Targeted digital extension services can play a crucial role in supporting the adoption of mechanized agriculture. Delivering tailored advice and practical support on specific mechanized farming practices through mobile applications, SMS messaging, and interactive online platforms can overcome the limitations of traditional, in-person extension services. Providing farmers with readily accessible expert knowledge and information on best practices in mechanized agriculture through digital channels can also enhance their understanding and confidence in adopting these new methods. Furthermore, offering digital training modules and easily understandable resources on the safe and effective operation and routine maintenance of various types of agricultural machinery can address a critical knowledge gap and promote sustainable use (Farmonaut n.d.).

Enhancing Sustainability through Digital Marketing and Mechanized Agriculture

The integration of digital marketing and mechanized agriculture holds significant promise for enhancing the sustainability of smallholder farming practices. Precision agriculture, a key element of sustainable intensification, can be effectively promoted through digital marketing strategies. These strategies can highlight how precision farming techniques, such as GPS guidance for machinery, variable rate technology for input application, and remote monitoring of crops and soil conditions, can be seamlessly integrated with mechanized equipment. Digital platforms can also be used to provide farmers with valuable data-driven insights on how to optimize their resource use, including water, fertilizers, and pesticides, when utilizing mechanized equipment, leading to both economic and environmental benefits (Enfuse 2024).

Digital marketing can also play a crucial role in promoting sustainable mechanization practices. Information on conservation agriculture practices, such as minimum tillage, crop rotation, and

maintaining permanent soil cover, along with the specific types of machinery that are best suited for these practices (like no-till planters and direct seeders), can be effectively disseminated through digital platforms (Abdul Rahman et al. 2024). The significant benefits of sustainable mechanization for enhancing soil health, conserving precious water resources, and building resilience to the impacts of climate change can be effectively showcased to farmers through various digital channels (Olusola 2025). Digital platforms can empower farmers to engage in data-driven decision making for enhanced sustainability. These platforms can facilitate the collection and analysis of crucial data related to resource utilization, prevailing environmental conditions, and overall farm performance, which can then be used to inform and refine sustainable farming practices that are enabled by mechanization (Farmonaut n.d.). By providing farmers with valuable feedback and tailored recommendations for improving their sustainability practices based on the analysis of this collected data, digital tools can contribute to more environmentally sound and economically viable farming systems (Enfuse 2024).

Case Studies and Examples

Numerous initiatives across Africa and other developing regions demonstrate the successful application of digital marketing to promote agricultural technology adoption. Platforms like Hello Tractor in Nigeria, Kenya, and Tanzania, often described as the "Uber for tractors," connect smallholder farmers with tractor owners, enabling them to rent machinery services through a mobile app and a network of booking agents (GSMA n.d.). TracTrac Plus is a web and mobile app by TracTrac Mechanization Services Limited that helps smallholder farmers hire, lease, or own tractors bridging the gap in access to mechanization services. FarmCrowdy in Nigeria utilizes a digital platform to connect smallholder farmers with investors, providing them with financing and access to markets (Giwa 2023). DigiFarm in Kenya acts as a one-stop shop, allowing farmers to access low-cost seeds and fertilizers, loans, insurance providers, and bulk purchasers through their mobile phones. These examples showcase the power of digital platforms in addressing key challenges faced by smallholder farmers (MercyCorps 2021).

Mechanized agriculture has also shown a significant positive impact on the productivity and sustainability of smallholder farms in various contexts. Studies from China and India have demonstrated that the adoption of mechanized farming practices leads to increased crop yields and improved efficiency (Jena & Tanti 2023). In Africa, initiatives like the Farm Mechanization and Conservation Agriculture for Sustainable Intensification (FACASI) project have helped farmers access and utilize two-wheel tractors, resulting in reduced labor requirements and increased productivity (Meadu 2020). Furthermore, the use of power tillers in Nigeria has been shown to significantly increase rice yields compared to traditional hand cultivation methods (Falaye et al. 2012). These case studies highlight the tangible benefits of mechanization for smallholder farmers.

Policy Recommendations and Enabling Environment

Fostering the adoption of digital marketing and mechanized agriculture for smallholder farmers requires a concerted effort involving various stakeholders, with governments playing a pivotal role. Government initiatives and support are crucial for creating an enabling environment. This includes significant investment in developing robust rural digital infrastructure, ensuring reliable internet connectivity,

expanding mobile network coverage, and establishing technology hubs that can serve as centers for digital literacy training and agricultural innovation. Governments need to implement well-defined policies and regulations that actively promote digital agriculture, streamline processes for technology adoption, and create a supportive ecosystem for innovation in the sector. Providing direct financial assistance to smallholder farmers, through subsidies, grants, or low-interest loans, specifically targeted towards the purchase or rental of appropriate agricultural equipment and the adoption of digital marketing tools, can help overcome critical affordability barriers. Furthermore, supporting the establishment and growth of agricultural mechanization service centers and actively promoting equipment sharing initiatives can significantly improve access for farmers who cannot afford individual ownership.

Public-private partnerships (PPPs) offer a powerful mechanism for accelerating progress. Encouraging and facilitating collaborations between government agencies, private sector companies specializing in agricultural technology and digital solutions, non-governmental organizations (NGOs) with expertise in rural development, and financial institutions are essential for developing and effectively implementing comprehensive digital and mechanization initiatives. Fostering specific partnerships aimed at strengthening the capacity of local entrepreneurs and technicians in the critical areas of maintenance and repair of agricultural machinery is also vital for the long-term sustainability of mechanization efforts.

Investing in capacity building and training programs is paramount for ensuring the successful adoption and effective utilization of both digital marketing tools and mechanized agriculture practices. Comprehensive training programs are needed to enhance the overall digital literacy and skills of farmers, agricultural extension workers, and other key stakeholders in the agricultural sector. Developing targeted educational guidelines and relevant training curricula that are specifically designed to enhance farmers' digital literacy, taking into account their existing knowledge and needs, is crucial. Additionally, providing thorough and practical training on the proper operation and routine maintenance of various types of agricultural machinery is essential for ensuring their efficient and sustainable use.

Finally, as digital technologies become increasingly integrated into the agricultural sector, it is imperative to proactively address regulatory and ethical considerations. This includes establishing clear frameworks and protocols to safeguard data privacy and ensure the security of information collected through digital agriculture platforms. Policies should be put in place to clearly define data ownership and ensure data sovereignty for the farmers who are the primary producers of this information. Furthermore, it is essential to actively address the potential for the "digital divide" to inadvertently exacerbate existing inequalities between large-scale and smallholder farms, ensuring that the benefits of digital transformation are inclusive and equitably distributed.

Measuring Impact and Key Performance Indicators (KPIs)

To effectively evaluate the success of integrating digital marketing with mechanized agriculture for smallholder farmers, it is crucial to develop and track relevant Key Performance Indicators (KPIs). These metrics should assess both the adoption rates and the resulting impact on farm productivity, income, and sustainability.

To measure the adoption of mechanized agriculture influenced by digital marketing, several KPIs can be tracked. This includes the number of farmers who actively access information about mechanized

agriculture through various digital platforms, providing an indication of the reach and engagement of digital marketing efforts. The rate of increase in inquiries or direct requests for mechanization services (such as rentals or purchases) that can be attributed to digital marketing campaigns can also serve as a valuable metric. Ultimately, the conversion rates of specific digital marketing campaigns into the actual adoption of mechanized farming practices on the ground will be a key indicator of their effectiveness.

Evaluating the broader impact on farm productivity, income, and sustainability requires a more comprehensive set of KPIs, categorized by the three dimensions of sustainability: environmental, economic, and social. In terms of productivity, key indicators include a measurable increase in crop yields per unit of land, a significant reduction in post-harvest losses due to improved harvesting and processing technologies, and a potential increase in the total area of land that farmers are able to cultivate effectively. From an economic perspective, the primary KPIs will be a demonstrable increase in the overall farm income and profitability for smallholder farmers and a reduction in their overall labor costs due to the efficiency gains from mechanization. Environmental sustainability can be assessed through indicators such as a decrease in water usage per unit of output, improvement in key soil health indicators like organic matter content, overall fertility, and reduced rates of soil erosion, and a measurable reduction in greenhouse gas emissions from agricultural activities. Social sustainability can also be gauged by improvements in food security at both the household and broader community levels, an overall enhancement in the livelihoods and quality of life experienced by farmers, and the creation of new employment opportunities within rural communities.

A robust framework for monitoring and evaluating the effectiveness of these integrated digital marketing and mechanization strategies should be developed. This framework should begin with a clear logic model that outlines the inputs, activities, outputs, intended short-term outcomes, and long-term impacts of the integrated approach. A mixed-methods approach, combining quantitative data on the aforementioned adoption rates, productivity metrics, income levels, and sustainability indicators with rich qualitative data gathered from farmer surveys, in-depth interviews, and focus group discussions, will provide a comprehensive understanding of the program's effects. Establishing detailed baseline data prior to the implementation of any interventions and then consistently tracking changes in these indicators over time will be essential for accurately assessing the overall impact and effectiveness of the integrated digital marketing and mechanization strategies.

Conclusion

This research has explored the significant potential of integrating digital marketing strategies with the adoption of mechanized agriculture to transform the livelihoods and sustainability of smallholder farmers, particularly within the African context. The analysis reveals that while smallholder farmers face substantial challenges in accessing both digital technologies and modern agricultural equipment due to factors such as the digital divide, financial constraints, and infrastructural limitations, a strategic combination of these two domains offers promising pathways forward. Digital marketing can effectively disseminate crucial information, build trust, facilitate access to machinery and services, improve market linkages, and deliver targeted extension support, thereby addressing key barriers to the adoption of mechanized farming practices. Furthermore, the integration of these approaches can significantly

enhance the sustainability of smallholder agriculture through the promotion of precision farming, conservation agriculture techniques, improved market access for sustainably produced goods, and the empowerment of farmers with data-driven decision-making tools.

Recommendations

1. Establish Community-Based Digital Hubs: Setting up rural digital hubs or “farmer technology centers” equipped with internet access, demonstration plots, and ICT tools would allow farmers to practically engage with digital platforms before adopting them individually. These hubs could serve as knowledge-sharing and peer-learning points to boost trust in mechanized agriculture and digital marketing.
2. Incorporate Behavioral Insights into Adoption Strategies: Beyond technical training, programs should consider the behavioral and cultural factors that affect farmers’ decision-making. By applying behavioral economics approaches (e.g., nudges, social proof, or farmer role models), adoption rates for digital tools and mechanization services can be significantly increased.
3. Develop Local Language Digital Content: Most digital agricultural platforms use English or urban-centric communication styles. Creating localized content in indigenous languages, with culturally relevant illustrations and audio-visual aids, will improve inclusivity and make digital marketing messages more accessible to smallholder farmers in rural communities.
4. Introduce Farmer-Led Data Cooperatives: Smallholder farmers should be encouraged to form cooperatives that own and manage their agricultural data. By pooling data on production, machinery use, and market access, farmers can strengthen bargaining power, reduce exploitation, and negotiate better terms with service providers and agritech firms.

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