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Empowering Millennial Farmers to Enhance the Competitiveness of Local Commodities Through Digital Technology

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ABSTRACT

The digital revolution has presented new opportunities for the agricultural sector, especially in increasing the competitiveness of local commodities amid global market trends. This study aims to analyze the role of millennial farmer empowerment in supporting the increase in the competitiveness of local commodities through the use of digital technology. Using qualitative methods based on literature studies and library research, this study examines various scientific literature and relevant policy reports related to digital transformation in the agricultural sector, the involvement of the millennial generation, and technological innovations that have an impact on the efficiency and added value of local agricultural products. The results of the study show that millennial farmers have great potential in accelerating the adoption of digital technologies such as e-commerce platforms, Internet of Things (IoT), artificial intelligence, and social media for product marketing. However, a number of challenges still hinder the optimization of their roles, including limited access to digital infrastructure, lack of training, and weak policy support. Therefore, a holistic empowerment strategy is needed, including technology-based training, entrepreneurial capacity building, and cross-sector collaboration to build an inclusive and sustainable digital agriculture ecosystem. This

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research makes an important contribution in encouraging agricultural policy reform that is more adaptive to technological developments, as well as encouraging the birth of an innovative and competitive generation of digital farmers.

1. INTRODUCTION

Demographic changes and the digital revolution have changed the landscape of the agricultural sector globally, including in Indonesia. One of the main challenges faced by this sector is the low involvement of the younger generation, especially millennial farmers, in modern and competitive agriculture (FAO, 2021). In fact, the role of the younger generation is very important in encouraging the transformation of the agricultural sector that is adaptive to digital technology and market-oriented (World Bank, 2020).

Millennial Farmers, or millennial farmers, are a group of young generations born between 1981 and 1996, who are now starting to show an important role in the agricultural sector. In contrast to previous generations of farmers, millennial farmers have characteristics that are more adaptive to technology, have a higher level of education, and are more open to innovation and cross-sector collaboration. They also tend to view agriculture not just as a traditional activity, but as a modern business opportunity that can be developed through a technology- and data-driven agribusiness approach. Therefore, the role of millennial farmers is very strategic in encouraging agricultural transformation towards smart and sustainable agriculture.

However, the participation of millennial farmers in the agricultural sector still faces a number of challenges. Many of them are reluctant to enter the world of agriculture because of the image of agriculture that is considered not economically promising, as well as limited access to land, capital, and supporting infrastructure (Syahyuti, 2019). In addition, the lack of institutional support and policies that are responsive to the needs of the younger generation is also an obstacle in encouraging farmer regeneration. In some cases, millennial farmers are more active in downstream sectors such as processing and digital marketing, but are less involved in primary production due to limited resources.

On the other hand, the potential of millennial farmers in encouraging the competitiveness of local commodities is very large if empowered appropriately. They have the ability to integrate digital technology into the agricultural value chain, from production, distribution, to marketing. The ability to utilize social media, agricultural applications, and e-commerce platforms is a distinct advantage for millennial farmers in expanding market reach and increasing product added value. Therefore, the capacity development of millennial farmers is key in building a resilient, innovative, and competitive agricultural ecosystem amid the challenges of globalization and climate change.

In the Indonesian context, the dominance of elderly farmers is an obstacle in the development of sustainable agriculture. BPS data (2022) shows that more than 60% of farmers are over 45 years old, while the participation of the younger generation is still low due to the assumption that the agricultural sector is not economically promising (Syahyuti, 2019). On the other hand, advances in digital technology have opened up opportunities to improve the efficiency of production, distribution, and marketing of local commodities

through e-commerce, the Internet of Things (IoT), and data-driven agricultural information systems (Saragih & Prasetyo, 2021; Setiawan & Yuliana, 2022).

Previous research has discussed the use of technology in the agricultural sector (Hapsari et al., 2020; Darmawan, 2019), but there are still minimal studies that focus on empowering millennial farmers in increasing the competitiveness of local commodities holistically. This gap shows the need for research that focuses on the integration of digital technology with millennial empowerment strategies in the agricultural sector (Nurhalimah & Nugroho, 2021).

The urgency of this research lies in the need to respond to changes in the global economic structure and the declining interest of the younger generation in the agricultural sector. Empowering millennial farmers is crucial in bridging the digital transformation of agriculture while maintaining the sustainability of local commodity production (Latifah, 2020). Moreover, in the era of the digital economy, farmers' ability to access technology is one of the main indicators of competitiveness (Kurniawan, 2022).

As a form of novelty, this study integrates the latest literature approach on the digital transformation of agriculture with sociological and entrepreneurial aspects of millennial farmers. The focus on empowerment has not been explicitly raised in the agribusiness literature in Indonesia.

The purpose of this study is to analyze how millennial farmer empowerment strategies can encourage increased competitiveness of local commodities through the use of digital technology. The expected benefits include contributing to the development of theories and practices in technology-based agricultural management, as well as providing policy recommendations for the government and stakeholders in building an inclusive and sustainable digital agriculture ecosystem.

2. METHODS

This study uses a qualitative approach with a literature review type of research that aims to deeply understand the phenomenon of empowering millennial farmers in increasing the competitiveness of local commodities through the use of digital technology. This method was chosen because it is relevant to explore and analyze various perspectives, theories, and previous research results related to digital transformation in the agricultural sector and the role of the millennial generation in the process (Snyder, 2019). Literature studies allow researchers to identify conceptual patterns and empirical findings that have been tested, so as to build a comprehensive synthesis of knowledge (Boell & Cecez-Kecmanovic, 2015).

The data sources in this study consist of secondary data obtained from national and international scientific journal articles, academic books, reports of official institutions (such as FAO, BPS, and the World Bank), as well as institutional publications relevant to the research topic. The data used is limited to literature published in the last five to ten years to maintain the relevance and actuality of the information. The data selection criteria were carried out purposively, namely only selecting literature that directly addresses themes such as millennial farmers, agricultural digitalization, farmer empowerment, and local commodity competitiveness.

The data collection technique is carried out through a systematic literature search and selection process using academic databases such as Google Scholar, Scopus, and

ScienceDirect. This process includes identification of key keywords, filtering by title and abstract, and evaluation of the content of the literature relevant to the focus of the research. The literature that passed the selection was then analyzed to find patterns, contradictions, and conceptual contributions to the topics discussed.

The data analysis method in this study uses thematic analysis techniques by categorizing literature findings into main themes, such as the characteristics of millennial farmers, the role of digital technology in agriculture, empowerment strategies, and increasing commodity competitiveness. This analysis is carried out in a descriptive-interpretive manner to understand the relationship between concepts and build a framework of understanding that can be used as a basis for the preparation of policy recommendations and empowerment strategies. This technique allows researchers to uncover the deeper meaning of the data studied as well as produce a synthesis of knowledge that has theoretical and practical value (Elo & Kyngäs, 2008).

4. RESULTS AND DISCUSSION

This study uses a literature study method with a qualitative approach to identify and review scientific articles relevant to the topic of empowering millennial farmers through digital technology. From dozens of articles obtained through a search process in academic databases such as Google Scholar, Scopus, and ScienceDirect, a screening was carried out based on criteria: direct relevance to the research topic, publication in the last 5–10 years, and credibility of the source. As a result, there are 10 selected articles that are analyzed in depth and are displayed in the following table.

Table 1. Findings of a Literature Study Related to Millennial Farmers, Digital Technology, and Local Commodity Competitiveness

Author & Year	Article Title	Key Results
Hapsari et al. (2020)	Agricultural Technology Innovation in Increasing Sustainable Production	Technology is able to increase the efficiency and productivity of local farmers
Saragih & Prasetyo (2021)	Farmers' Adaptation to Digital Platforms	Digitalization accelerates access to information and marketing
Setiawan & Yuliana (2022)	Digital Technology and Farmer Empowerment	Digitalization can increase the bargaining power of millennial farmers
Nurhalimah & Nugroho (2021)	Digitalization and Agribusiness Transformation in the Industrial Era 4.0	Infrastructure support and training required
Latifah (2020)	Farmer Youth Empowerment Strategy	The role of the government is important in encouraging millennial involvement

FAO (2021)	Youth in Agriculture: Challenges and Opportunities	The young generation is key in sustainable agriculture
World Bank (2020)	Transforming Agriculture for Youth Employment	Technology opens up new agribusiness job opportunities
Kurniawan (2022)	The Competitiveness of Local Agriculture in the Digital Era	Digitalization improves local supply chain efficiency
Shawn (2019)	Farmer Regeneration Crisis and Social Transformation	Incentives and education are needed so that youth are interested in farming
Afifah et al. (2023)	E-Commerce Strategy in Improving Farmers' Commodity Marketing	E-commerce expands local commodity market to the national level

The table above shows that in general, the literature reviewed shows consistency in emphasizing the importance of the role of millennials in modern agriculture, as well as the great potential of the use of digital technology in increasing the competitiveness of local commodities. Most studies underline that the main challenges lie in access to technology, digital skills training, and infrastructure and policy support from governments and other stakeholders. In this context, technology is not only seen as a means of production, but also as a medium of social and economic transformation for millennial farmers.

The findings of these selected articles form the basis for further analysis, particularly in exploring effective empowerment strategies, strengthening the institutional capacity of young farmers, and integrating digital technologies in local agricultural systems. That way, this research is expected to make a theoretical and practical contribution in encouraging a more inclusive, competitive, and sustainable transformation of the agricultural sector based on the millennial generation and digital innovation.

The results of the study of the ten selected articles show that digitalization in the agricultural sector has become a major concern in efforts to increase the competitiveness of local commodities. Digital technologies, such as e-commerce platforms, smart farming applications, and social media, have been used by farmers to expand marketing reach, increase productivity, and build a wider work network (Afifah et al., 2023; Saragih & Prasetyo, 2021). This shows that digitalization is not only changing the way farmers produce, but also the way they access markets and interact with consumers.

Furthermore, the data shows that the involvement of millennial farmers in the agricultural sector brings a new spirit in adopting technology. Millennial farmers have a high adaptability to technology and a tendency to innovate in farming practices. Studies by Setiawan & Yuliana (2022) and Hapsari et al. (2020) show that young farmers are more open to integrating modern agricultural tools as well as digital systems for agricultural product management. This is an important signal that the regeneration of farmers is not only about the number, but also the quality and mindset towards modernization.

Nevertheless, the challenge is also evident from some of the literature. One of them is limited access to technological infrastructure in rural areas. Many young farmers have not been able to utilize technology optimally due to limited internet networks, capital, and technical assistance (Latifah, 2020; Nurhalimah & Nugroho, 2021). This shows that there is a digital divide between potential and reality on the ground, which requires strategic intervention from the government and related institutions.

Support from external parties such as the government, educational institutions, and farmer organizations is also an important factor in empowering millennial farmers. Several studies emphasize the need for technology-based training, policy incentives, and mentoring programs so that young farmers are able to compete in an increasingly competitive market (Syahyuti, 2019; World Bank, 2020). The role of inclusive public policy is urgently needed so that digitalization efforts are not exclusive only to those who have access.

The next interpretation is related to the social and cultural aspects that affect the interest of the younger generation in the world of agriculture. There is still a stigma that farming is not a promising job, so an approach that can change this perception is needed. In this case, digitalization can serve as a "rebranding" of agriculture into a modern and profitable sector. This can be seen in the FAO (2021) and Kurniawan (2022) articles which emphasize the importance of building a new narrative so that agriculture becomes an attractive sector for millennials.

Overall, the literature indicates that empowering millennial farmers through digital technology not only allows increased productivity and competitiveness of local commodities, but can also create structural transformation in the agricultural sector. This empowerment must be comprehensive, covering technical, educational, financial, and policy aspects. Therefore, strategies that focus on increasing the capacity of millennial farmers and integrating technology in the agricultural system need to be developed in a sustainable and targeted manner.

Discussion

This discussion aims to delve deeper into how the role of millennial farmers in encouraging the competitiveness of local commodities can be strengthened through the use of digital technology. Based on the results of the literature study, it can be seen that the adoption of technology such as e-commerce, agricultural management applications, and digital marketing is the starting point for agricultural transformation towards a more modern and competitive direction. This is in line with the current global phenomenon where digitalization has touched almost all sectors, including agriculture as a sector that has been considered traditional.

One of the important findings of the data analyzed is that millennials have an advantage in terms of adaptation to digital technology. This generation grew up in an environment full of technological developments, so they tend to be more open to innovation and change. In the Indonesian context, facts show that more than 60% of the farmer population is dominated by the older generation, while millennials are still significantly less involved (BPS, 2023). Therefore, it is important to create an ecosystem that supports millennial participation so that farmer regeneration can run optimally.

The innovation diffusion theory from Everett Rogers (2003) can be used to explain how technology can be accepted and used by target groups. Millennial farmers in this case play a

role as a group of "early adopters" who accelerate the adoption of digital technology in the agricultural community. With their capacity to access information, young farmers can become agents of change that have a positive impact on the efficiency of production, distribution, and marketing of local commodities.

However, structural challenges are still the main obstacle in the process of digitizing agriculture. Limited access to digital infrastructure in rural areas, such as stable internet networks, the cost of technological devices, and lack of technical training, are major bottlenecks. This is corroborated by the findings of Latifah (2020) and Nurhalimah & Nugroho (2021) who stated that although young farmers have the will, limited resources often hinder them in applying technology to the maximum.

From the institutional side, the lack of an active role of local governments in encouraging digital literacy among millennial farmers is also in the spotlight. In many cases, empowerment programs are still focused on physical assistance, not yet touching on the aspect of strengthening digital capacity. In fact, empowerment theory emphasizes the importance of providing space for individuals and groups to gain control over relevant resources and information (Zimmerman, 2000).

In relation to the competitiveness of local commodities, digitalization plays a role in shortening distribution chains and expanding market access. E-commerce and digital platforms have helped farmers reach consumers directly, thereby increasing profit margins and driving distribution efficiency. The study by Afifah et al. (2023) confirms that digital technology-based marketing helps farmers reach national and even global markets. This is a great opportunity for local commodities to be known more widely with the right branding.

This transformation also opens up space for agriculture to be seen not only as a production sector, but also as part of the creative economy ecosystem. Millennial farmers not only produce, but also manage the image, narrative, and value of their agricultural products through social media and content marketing strategies. This is a form of modern agriculture that is in line with the vision of agriculture 4.0 which prioritizes the integration of data, technology, and creativity.

From the social side, empowering millennial farmers through technology can be a solution to the farmer regeneration crisis that occurs in many developing countries, including Indonesia. The perception of society that farming is a low-class job can be changed when farming is packaged in a more professional and digital form. In this case, the role of education, the young farming community, and the support of the private sector are crucial to the success of this transformation.

The author sees that synergy between technology, human resource capacity, and policy support is the main key in realizing highly competitive millennial-based agriculture. Efforts are not enough only at the level of technical training, but must also target cultural and systemic aspects. A holistic intervention model involving multi-actors is needed: governments, academia, the private sector, and the farmer community itself.

Thus, the results of this study suggest the importance of accelerating digital transformation in the agricultural sector through empowering millennial farmers. A participatory, innovative, and local needs-based approach is needed so that young farmers are not only executors, but also leaders in change. These measures will be an important foundation in strengthening the competitiveness of local commodities and creating sustainable food security in the digital era.

5. CONCLUSION

Based on the results of the literature study that has been analyzed, it can be concluded that empowering millennial farmers through the use of digital technology is one of the strategic approaches to increase the competitiveness of local commodities. The young generation who have high technology adaptation skills are an important asset in the transformation of agriculture towards a more modern, efficient, and globally connected model. Agricultural digitalization is not only able to improve production and distribution processes, but also change the perception of the farming profession to be more promising and innovative.

The findings of the study also reveal that the success of digital technology adoption is highly dependent on several key factors, including access to digital infrastructure, technology literacy, policy support, and synergy between stakeholders. There are still real challenges in addressing the digital divide, especially in rural areas, so more structured and sustainable interventions are needed. Technology-based training, the provision of internet access, and policy incentives need to be strengthened so that millennial farmers can carry out their strategic roles optimally.

For further research, it is recommended that a field-based empirical study be conducted to measure the effectiveness of the agricultural digitalization program on the performance of millennial farmers directly. The research can also examine differences in technology adoption based on region, commodity type, and socio-economic background of farmers. In addition, it is necessary to develop a specific and contextual empowerment model, adjusted to local characteristics so that it can be implemented appropriately and sustainably. Thus, the results of the research will be more applicable in supporting the development of agriculture based on the younger generation and technology.

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Hopefully this article can make a useful scientific contribution to the development of knowledge in the field of sustainable agriculture and technological innovation, as well as encourage the participation of the millennial generation in building food independence based on local commodities.

7. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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