

The Influence of Artificial Intelligence-Driven Marketing on the Competitiveness of Agricultural Products in the Digital Economy

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Abstract. The rapid development of the digital economy has transformed agricultural product marketing from conventional approaches into technology-driven strategies that emphasize data utilization and digital platforms to strengthen market competitiveness. Increasing competition in digital markets requires agricultural businesses to adopt more adaptive marketing strategies capable of responding to changing consumer preferences, expanding market reach, and improving marketing performance. In this context, Artificial Intelligence has emerged as a strategic enabler for optimizing marketing activities by supporting data-driven decision-making, enhancing promotional effectiveness, and improving communication with consumers. This study aims to analyze the role of Artificial Intelligence-driven marketing in enhancing the competitiveness of agricultural products in the digital economy. This study employed a qualitative approach using a literature review method by analyzing relevant books, scientific articles, and previous studies, with the collected data being systematically interpreted and synthesized to address the research objectives. The findings indicate that Artificial Intelligence-driven marketing contributes to improving the competitiveness of agricultural products by expanding market reach, increasing product value, strengthening consumer engagement, and enhancing overall marketing performance. The effectiveness of its implementation is supported by digital infrastructure readiness, high-quality marketing data, competent human resources, organizational support, and the integration of technology into marketing activities, although several implementation challenges remain. Therefore, strengthening adaptive marketing strategies, fostering technological innovation, encouraging stakeholder collaboration, and developing market-oriented digital marketing initiatives are essential to achieving sustainable competitiveness of agricultural products in the digital economy.

Keywords: *Artificial Intelligence, Digital Marketing, Agricultural Products, Competitiveness, Digital Economy.*

A. INTRODUCTION

The development of the digital economy has transformed the way businesses market their products, build relationships with consumers, and maintain their competitive position amidst increasingly open competition. This transformation has not only occurred in the manufacturing and service sectors but has also reached the agricultural sector, which has historically been synonymous with conventional production activities (Hokmabadi et al., 2024). The use of digital technology in marketing has opened up opportunities for agricultural products to reach a wider market without being limited by geographic location, providing farmers, farmer groups, cooperatives, and agribusinesses with greater opportunities to increase the added value of their products. Furthermore, changes in consumer behavior, which have led to an increasing reliance on digital platforms, have encouraged agricultural producers to adapt their marketing strategies to maintain their existence and increase their competitiveness in an increasingly competitive market (Choruma et al., 2024).

These changes in the business environment are occurring in tandem with increasing internet penetration, the use of mobile devices, and the growth of various e-commerce platforms that connect producers with consumers more efficiently. Marketing activities that previously relied heavily on intermediaries are now shifting toward approaches that allow producers to interact directly with buyers (Paraschiv et al., 2022). This shift provides opportunities for agricultural businesses to obtain market information more quickly, better

understand consumer needs, and respond to changes in demand in a relatively short time. However, not all agricultural businesses are able to optimally utilize these changes due to gaps in digital technology management skills, limited resources, and low data utilization as a basis for marketing decisions (Gadanakis, 2024).

At the same time, competition for agricultural products is no longer determined solely by harvest quality or production capacity. Products with relatively similar characteristics can experience varying levels of market success depending on the producer's ability to build visibility, expand promotional reach, maintain relationships with consumers, and respond quickly to changing market preferences (Shahbazi et al., 2025). This situation demonstrates that marketing success is increasingly becoming a determining factor in the competitive position of an agricultural product. Businesses that are able to identify market opportunities more accurately tend to be better able to maintain the sustainability of their businesses compared to those that still rely on traditional marketing approaches (Silvestri et al., 2023).

In recent years, developments in Artificial Intelligence (AI) have provided new alternatives for businesses to manage marketing activities in a more targeted manner. Various AI-based applications are being utilized to assist with consumer behavior analysis, promotional strategy development, digital communication management, and optimization of various online marketing channels (Zaman, 2022). This technology enables faster marketing processes, supported by analysis of much larger amounts of data compared to manual analysis capabilities. As a result, marketing decisions are no longer based solely on intuition or experience, but are increasingly influenced by information obtained through continuous data processing (Nordin & Ravald, 2023).

This change is crucial for the agricultural sector because the characteristics of agricultural products are significantly influenced by seasonal changes, production fluctuations, weather conditions, and changes in consumer consumption patterns. Information regarding market demand trends is a crucial factor in determining the success of agricultural product marketing. When producers are able to obtain this information more quickly, they have greater opportunities to adjust their sales strategies. Conversely, delays in analyzing market changes can lead to decreased competitiveness, increased distribution costs, and even losses due to products not being optimally absorbed by the market (Osman & El-Gendy, 2025).

Increasing competition is also influenced by the increasing number of agricultural products marketed through digital platforms. Local products now have to compete not only with products from their surrounding areas, but also with various products from other regions and even abroad, marketed through the same digital channels. This situation gives consumers more choices before making a purchase. Purchasing decisions are no longer solely influenced by price, but also by the quality of product information, speed of service, ease of access, consumer reviews, and the effectiveness of the producer's marketing communications. Therefore, the ability to utilize digital technology is becoming an increasingly crucial factor in determining the success of agricultural products in winning market competition (Lei et al., 2025).

Changing consumer preferences also place new pressures on agricultural producers. Consumers increasingly expect comprehensive information regarding product origin, quality, production processes, food safety, and environmental sustainability. This information must be delivered quickly, accurately, and easily accessible through various digital media. This situation has made marketing activities far more complex than before. Businesses are not only required to produce quality products but also to be able to convey relevant information to the right consumer groups at the right time (Alam et al., 2025).

Across countries, digital transformation in the agricultural sector has progressed at varying speeds. Countries with robust digital infrastructure demonstrate an increased ability of

businesses to utilize technology to support marketing activities. Conversely, developing countries still face various obstacles, ranging from limited internet access in rural areas, low digital literacy, to limited technology investment in micro and small businesses in the agricultural sector. These conditions mean that the benefits of technological developments have not been felt equally by all agribusinesses (Eduardsen et al., 2023).

Indonesia is a country with enormous agricultural potential, both in terms of commodity diversity and the number of business actors involved. However, this enormous potential has not been fully matched by marketing capabilities capable of generating high competitiveness in the digital market. Most agricultural businesses still face various challenges in utilizing technology as part of their marketing strategies. Promotional activities are often simplistic, customer data is limited, and the use of technology to understand market behavior is not yet common practice. This situation results in many agricultural products that are of good quality but do not achieve optimal market position (Witjaksono et al., 2024).

The development of AI presents an opportunity to overcome some of these limitations by increasing the efficiency of marketing processes. The use of this technology allows businesses to obtain more precise promotional strategy recommendations, determine more specific consumer targets, manage customer communications continuously, and evaluate the effectiveness of marketing activities based on real-time data. These capabilities have the potential to improve resource efficiency while increasing the chances of marketing success compared to conventional approaches (Kumar & Suthar, 2024).

Despite these growing opportunities, the implementation of AI in agricultural product marketing still shows varying levels of adoption. Some businesses have begun utilizing various AI-based applications to support digital marketing activities, while others are still in the early stages of digital transformation. These differences in adoption levels lead to variations in businesses' abilities to improve the competitiveness of their products. Companies or agribusinesses that are able to utilize technology effectively tend to gain broader market access, while businesses that have not yet adopted it face increasing challenges in maintaining market share (Giannakopoulos et al., 2024).

Furthermore, the rapid development of digital platforms means that marketing strategies that are effective in one period may not necessarily produce the same results in the next. Digital platform algorithms are constantly changing, consumer behavior is increasingly diverse, and competition between producers is intensifying. These conditions require agricultural businesses to continually adapt their marketing strategies based on more accurate and up-to-date information. The use of AI has the potential to be one approach that can facilitate this adjustment process through ongoing data analysis (Kaur et al., 2022).

Improving the competitiveness of agricultural products also has broader implications for economic growth, increasing farmer incomes, creating jobs, and strengthening the resilience of the national agricultural sector. Therefore, efforts to improve marketing effectiveness are not only related to the interests of individual business actors but also relate to broader economic development. Marketing strategies that improve market access and strengthen the position of local products will provide greater opportunities for the agricultural sector to develop sustainably in an increasingly competitive digital economy (Yogi et al., 2025).

Based on these conditions, studying the impact of Artificial Intelligence-driven marketing on the competitiveness of agricultural products is increasingly important. This study aims to analyze the impact of the application of Artificial Intelligence-driven marketing on increasing the competitiveness of agricultural products in the digital economy era, and to identify the extent to which the use of this technology can support more effective marketing strategies in facing increasingly competitive markets. Through this analysis, this study is

expected to provide an empirical basis for the development of marketing strategies that are more adaptive to changes in the digital business environment, while also enriching the literature on Artificial Intelligence-based marketing in the agricultural sector. Furthermore, the research results are expected to be a consideration for business actors, policymakers, and other stakeholders in formulating strategies that can strengthen the competitive position of agricultural products in the digital market.

B. LITERATURE REVIEW

1. Artificial Intelligence

Artificial intelligence (AI), according to John McCarthy, is a science and engineering that focuses on creating machines with intelligent capabilities, particularly through the development of computer programs or applications that can mimic human thought processes. AI is not only understood as a technology that allows computers to execute commands automatically, but also as an approach that aims to create systems capable of performing intellectual activities as humans do. In other words, AI is a step towards creating computers, robots, and applications that can work intelligently, such as recognizing information, making decisions, learning from experience, and responding to various situations more adaptively. Therefore, the development of AI is one of the important milestones in the advancement of modern technology because it allows machines to perform various functions that previously could only be done by humans (Kaushik et al., 2022).

The primary goal of AI is to produce a system that mimics human intelligence in various aspects. First, AI aims to create an expert system, a system capable of demonstrating intelligent behavior by utilizing a knowledge base and reasoning mechanisms to solve specific problems. This system is expected to learn from data or experience, provide demonstrations of processes, explain the rationale behind decisions, and provide recommendations or suggestions to users based on the context. Second, AI also aims to implement human intelligence into machines so they can understand information, think logically, learn specific patterns, and behave similarly to humans in completing various tasks. With these capabilities, AI is expected to become an effective tool in improving the efficiency, accuracy, and quality of decision-making in various fields (Sarker, 2022).

The development of AI is inseparable from the contributions of various complementary disciplines. Computer science plays a role in the development of algorithms, programming, and computing systems that form the basis for AI implementation. Biology inspires understanding of how the human nervous system and brain work, which is then adapted in the development of artificial neural networks. Psychology contributes to understanding human thought processes, learning, and decision-making, while linguistics supports the development of machines' ability to understand and produce natural language through natural language processing (Henkin et al., 2026). Furthermore, mathematics provides the theoretical foundations of logic, probability, statistics, and optimization used in various AI methods, while engineering plays a role in integrating AI technology into hardware and automated systems. One major step in AI development is creating computer systems that can think logically, learn from experience, and solve problems independently. To achieve this goal, AI utilizes various techniques to manage, organize, and represent information and knowledge so that it can be accessed, understood, and processed efficiently by users. These techniques also allow systems to be updated or modified more easily when errors are discovered or new development needs arise. Although AI capabilities continue to advance and have been applied in various situations, this technology still has limitations, so its results are not always perfect or completely accurate in all conditions.

2. Digital Economy

Since the 1990s, the term "digital economy" has been widely used, and in its early development, it was better known as the "internet economy," referring to economic activities that utilize the internet to generate economic value. This term is used to classify various economic and social activities that have emerged as a consequence of the rapid development of information and communication technology. With the increasing use of the internet in various aspects of life, the concept of the digital economy is no longer limited to activities taking place online but also encompasses the transformation of how individuals, businesses, and governments conduct economic activities using digital technology (Xia et al., 2024). The term "digital economy" was first introduced by Don Tapscott in his 1994 book, "The Digital Economy." The book explains that the digital economy is economic activity based on the use of digital technology and the internet as the primary means of creating economic value. Besides being known as the "digital economy," this concept is also often referred to as the "internet economy," "web economy," "digital-based economy," "new knowledge economy," or "new economy." These various terms essentially refer to a shift in economic paradigm characterized by the use of digital technology as a primary foundation in the production, distribution, marketing, and consumption of goods and services.

Furthermore, Don Tapscott explained that the digital economy has twelve main attributes that characterize it, namely knowledge, digitalization, virtualization, molecularization, internetworking, disintermediation, convergence, innovation, presumption, immediacy, globalization, and discordance. These twelve attributes illustrate that the digital economy does not only focus on the use of technology, but also reflects fundamental changes in economic interaction patterns, business models, and the relationship between producers and consumers. In the digital economy, information and knowledge become highly valuable resources, while innovation and connectivity are key factors in creating competitive advantage. These changes encourage the birth of various new business models that are more flexible, efficient, and able to reach a wider market compared to conventional economic models.

Furthermore, Thomas Mesenbourg identified that the concept of the digital economy consists of three main, interrelated components. The first component is e-business infrastructure, the infrastructure that serves as the foundation for implementing the digital economy, encompassing hardware, software, telecommunications networks, the internet, data centers, and various other supporting technologies that enable digital activities (Sak et al., 2025). The second component is e-business, encompassing all processes and procedures for implementing business activities that utilize computers, the internet, and digital networks to carry out company and organizational operations. At this stage, technology is used not only as a communication tool but also as an integral part of business process management, coordination, and decision-making. The third component is e-commerce, which is the electronic conduct of business transactions, from marketing and ordering to payment and delivery of products or services online. These three components demonstrate that the digital economy is not only related to online buying and selling transactions but also encompasses the entire digital ecosystem that supports modern economic activity.

Broadly speaking, the digital economy, or new economy, places greater emphasis on intangible assets, such as information, knowledge, innovation, creativity, and the use of technology, as the primary sources of economic value creation. Unlike conventional economies, which are primarily focused on the ownership of physical and material resources, the digital economy is based on the ability to develop, utilize, and exploit ideas and innovations to produce value-added products and services. Thus, the development of the digital economy has shifted the focus of economic activity from the management of material resources to the

management of information and knowledge as increasingly strategic factors of production (Corrado et al., 2022).

According to the G20, the digital economy encompasses all economic activities driven primarily by the utilization of digital information, modern information networks, and the effective use of information and communication technology to support various economic activities. This definition demonstrates that digital technology has become a key element enabling increased productivity, efficiency, innovation, and connectivity across various economic sectors. Therefore, the digital economy encompasses not only technology-based companies but also various sectors that utilize digital technology to improve service quality, expand market access, and create new, more adaptive business models (Oloyede et al., 2023).

Based on these definitions, it is clear that the key elements of the digital economy are the use of technology, digital information, and modern information networks as the primary medium for interactions and trade transactions. The concept of the digital economy continues to evolve along with technological advances and increasing internet adoption in various countries. This development has broadened the scope of the digital economy, encompassing almost all economic activities in society. Several factors accelerating the transformation from a conventional economy to a digital economy include the rapid development of information and communication technology, the increasing flow of globalization, and broader internet access, which enables people to connect without geographical boundaries. Furthermore, the main characteristics of the digital economy are marked by increased cross-border trade activity and the emergence of transaction mechanisms that can shorten or even eliminate various intermediary chains in the distribution of goods and services. This situation provides various benefits for both producers and consumers, as marketing and transaction processes can be carried out more quickly, efficiently, and at lower costs. The existence of the digital economy also allows producers to sell goods or services directly to consumers without being limited by space and time, thus significantly expanding market opportunities and facilitating public access to various products and services (Paul et al., 2024).

C. METHOD

This research uses a qualitative approach to examine the influence of Artificial Intelligence-driven marketing on the competitiveness of agricultural products in the digital economy era. This approach was chosen because it provides a comprehensive understanding of various findings published in previous research, allowing for an in-depth analysis of the relationship between the use of Artificial Intelligence in marketing activities and the increased competitiveness of agricultural products. The research focused on collecting, reviewing, and interpreting various relevant information to obtain an overview of the development of Artificial Intelligence-driven marketing implementation in supporting the competitiveness of the agricultural sector amidst the development of the digital economy. Research data was obtained through a literature review utilizing various sources relevant to the research topic, such as scientific articles, previous research results, books, proceedings, and other academic publications. All collected data was then systematically analyzed through a process of selection, grouping, interpretation, and synthesis to identify patterns, relationships, and findings related to the influence of Artificial Intelligence-driven marketing on the competitiveness of agricultural products. The results of this analysis were then used as a basis for compiling the discussion and formulating research conclusions in accordance with the stated objectives.

D. RESULT AND DISCUSSION

1. Marketing Transformation of Agricultural Products in the Digital Economy

The transformation of agricultural product marketing in the digital economy era is marked by the increasing use of digital technology in trade activities. Competition, once limited to local markets, has now expanded to broader markets, requiring businesses to adapt to the changing business environment. Marketing success is no longer solely determined by product quality, but also by the ability to utilize technology to reach consumers, effectively convey information, and build relationships with the market. Therefore, marketing has evolved from a mere sales activity to a crucial strategy for increasing added value, expanding market access, and strengthening product competitiveness.

This change is further driven by the application of Artificial Intelligence (AI) in agricultural product marketing. AI enables businesses to process consumer data, purchasing patterns, promotional responses, and changes in demand more quickly than conventional approaches. This information forms the basis for developing more targeted marketing strategies, while reducing reliance on manual processes. The impact not only increases promotional effectiveness but also strengthens the relationship between producers and consumers by delivering information more tailored to market needs.

The application of AI is also changing the way businesses set marketing priorities. While previously decisions were based largely on experience and intuition, they are now supported by data analysis that can detect changes in consumer preferences more quickly. This information can be used to determine promotional strategies, marketing communications, and sales that are more appropriate to market conditions, so that business actors are more responsive to the dynamics of the digital economy.

Furthermore, AI makes marketing a data-driven process, not simply the delivery of product information. Data from social media, e-commerce platforms, search engines, and various digital channels provides insights into consumer behavior. This information helps businesses determine promotional timing, identify potential consumer groups, and evaluate the effectiveness of marketing strategies. Thus, marketing becomes an integrated part of everything from production planning to sales evaluation.

Another change is evident in the shift from conventional marketing to data-driven marketing. Decisions previously influenced by experience and direct observation are now supported by continuous analysis of information gathered. This approach enables businesses to understand market characteristics in greater detail, allowing marketing strategies to be tailored to the needs of each consumer group.

Data-driven marketing also helps reduce uncertainty in the agricultural sector, which is affected by seasonality, weather, production, and demand fluctuations. Data analysis enables businesses to develop more adaptive marketing strategies, adjust distribution to changing demand, and minimize the risk of oversupply and price declines. Thus, the benefits not only increase promotional effectiveness but also support business management efficiency.

Data analysis is a crucial component in developing marketing strategies because it provides information on changes in consumer interests, purchasing patterns, promotional responses, and customer characteristics. This information allows for more effective allocation of marketing resources, focusing promotions on groups with higher purchasing potential. This suggests that marketing success is increasingly determined by the ability to manage information rather than simply increasing promotional intensity.

In addition to supporting strategy development, data analysis also plays a role in marketing evaluation. Businesses can identify the most effective promotional strategies, digital media, and communication methods, allowing evaluation results to serve as the basis for strategic improvements in the following period. This allows for a more sustainable and focused decision-making process.

Advances in AI also optimize digital promotions through a more personalized approach. Promotional content, delivery time, and communication media can be tailored to consumer characteristics, increasing the chances of promotional success. This approach also improves marketing budget efficiency because promotions are focused on more specific targets.

The use of AI also enhances the effectiveness of marketing communications. Interactions between producers and consumers become more responsive through the delivery of information that is fast, consistent, and tailored to their needs. Improved communication quality contributes to building consumer trust and loyalty in agricultural products.

Marketing transformation in the digital economy era shifts the decision-making process from a subjective approach to a data-driven approach. This shift enables the development of promotional strategies, the selection of marketing media, the determination of consumer targets, and the evaluation of marketing results to be carried out more systematically, accurately, and responsive to market changes.

2. The Role of Artificial Intelligence in Enhancing the Competitiveness of Agricultural Products

Increasing the competitiveness of agricultural products in the digital economy era is no longer solely determined by product quality, but also by the ability of business actors to manage marketing adaptively to market changes. Increasingly open competition demands that agricultural products be able to compete on various digital platforms with commodities from various regions and countries. In this environment, Artificial Intelligence plays a crucial role through data utilization, the development of more targeted marketing strategies, and the ability to respond quickly to changing consumer preferences. Thus, product competitiveness depends not only on production aspects but also on the ability to leverage technology to strengthen its position in the digital market.

To provide a more systematic overview of the contribution of Artificial Intelligence to increasing the competitiveness of agricultural products, the various forms of influence that have been identified in this discussion are summarized in Table 1. This summary shows that the application of Artificial Intelligence not only impacts the marketing aspect, but also contributes to strengthening the competitive position of products through various interrelated dimensions.

Table 1. Contributions of Artificial Intelligence to Agricultural Product Competitiveness

Dimension of Competitiveness	Contribution of Artificial Intelligence	Expected Marketing Outcome
Market Reach	Identifies potential customer segments and optimizes digital distribution channels	Expansion of local, national, and international markets
Product Value	Supports personalized product communication and highlights product advantages	Higher perceived product value among consumers
Product Attractiveness	Optimizes promotional content based on consumer preferences and digital behavior	Increased consumer attention and purchase intention
Customer Loyalty	Enhances customer interaction through personalized communication and timely responses	Stronger customer satisfaction and repeat purchases

Competitive Position	Provides real-time market intelligence for strategic decision-making	Stronger competitive advantage in digital markets
Marketing Productivity	Automates marketing processes and improves resource allocation	Higher efficiency and marketing performance
Sustainable Competitiveness	Continuously monitors market changes and consumer behavior	Long-term competitive resilience
Overall Marketing Performance	Integrates data analysis into strategic marketing activities	Improved effectiveness of digital marketing performance

Based on Table 1, Artificial Intelligence's contribution to the competitiveness of agricultural products encompasses various mutually supportive aspects, from expanding market reach to improving overall marketing performance. Each of these dimensions does not operate in isolation but rather forms a process that strengthens the competitive position of agricultural products in the digital economy. Therefore, the following discussion elaborates on each of these contributions in more depth.

One of the main contributions of Artificial Intelligence is expanding the market reach of agricultural products. Previously, marketing was often limited by distribution areas, marketing networks, and limited information about consumers outside the production area. Through analysis of search behavior, purchasing patterns, and consumer responses to promotions, Artificial Intelligence helps businesses identify more precise target markets, allowing products to reach new segments without relying entirely on conventional distribution expansion.

This capability also supports more effective management of various digital platforms. Businesses can tailor communication strategies to the characteristics of each medium, making information more relevant to consumers. As a result, agricultural products have a greater opportunity to be recognized in national and international markets through integrated digital marketing.

Expanding market reach also increases the added value of agricultural products. Added value stems not only from the production process but also from consumer perceptions of product quality, superiority, and characteristics. Artificial Intelligence helps determine the most relevant information for each consumer group, thus making marketing communications more effective. Furthermore, this technology supports product differentiation strategies by identifying the attributes most valued by consumers, thus giving products a more easily recognized advantage over competitors.

Artificial Intelligence also increases product appeal in the digital marketplace through more targeted promotions. Analysis of consumer behavior allows promotional materials to be tailored to the interests of each market group, thus increasing the chance of capturing consumer attention. Furthermore, evaluating consumer responses allows businesses to continuously refine promotional strategies to remain relevant to changing market preferences.

The application of Artificial Intelligence also contributes to increasing consumer loyalty. Long-term relationships can be built through rapid information delivery, consistent service, and the ability to understand consumer needs based on historical interactions. This improved experience increases consumer satisfaction and trust, encouraging repeat purchases and recommendations to other consumers. Thus, loyalty not only expands the market but also strengthens the competitive position of agricultural products.

All of these influences lead to an improved competitive position for agricultural products in the digital marketplace. Products with broad market reach, high added value, strong appeal, and consumer loyalty will be more resilient to competition. Artificial Intelligence

supports this process by providing more accurate information for decision-making, so that competitive advantage is no longer determined solely by production capacity, but also by the ability to manage information and marketing strategies.

This improved competitive position is in line with increased marketing productivity. Artificial intelligence helps automate various processes, such as consumer segmentation, promotion evaluation, and market behavior analysis, resulting in more efficient resource utilization. Furthermore, the ability to conduct continuous monitoring and evaluation allows businesses to quickly refine marketing strategies based on the results. This ongoing evaluation cycle supports increased productivity while also resulting in more accurate and sustainable decision-making.

3. Supporting Factors and Challenges in Digital Marketing Optimization

Optimizing digital marketing in the agricultural sector is influenced by various interrelated factors. The success of technology implementation depends not only on the use of Artificial Intelligence or digital tools, but also on the readiness of a supporting environment that ensures the technology is utilized effectively. Marketing transformation in the digital economy era is influenced by changes in consumer behavior, technological developments, and increasing competition, necessitating infrastructure readiness, data management, human resource competency, and the organization's ability to integrate technology into the entire marketing process. Therefore, optimizing digital marketing depends on the synergy of all supporting components, not just the technology used.

One key factor is the readiness of digital infrastructure. Adequate infrastructure enables the effective management of product information, communication with consumers, and digital transactions. In the agricultural sector, infrastructure readiness is increasingly crucial due to persistent gaps in access to internet networks, digital devices, and information systems. These limitations can hamper information delivery, slow response to market changes, and reduce the effectiveness of marketing strategies. Conversely, a strong infrastructure supports the implementation of various marketing applications, data analysis, and Artificial Intelligence services, forming the primary foundation for digital marketing transformation.

Various factors influencing the success of digital marketing optimization in the agricultural sector can be grouped into internal and external supporting factors, as well as various challenges that need to be overcome during implementation. A summary of these supporting factors and barriers is presented in Table 2 to provide a comprehensive overview of the aspects that determine the effectiveness of Artificial Intelligence utilization in digital marketing activities.

Table 2. Supporting Factors and Challenges in Digital Marketing Optimization

Aspect	Supporting Factors	Contribution to Digital Marketing Optimization	Implementation Challenges
Digital Infrastructure	Availability of digital networks, platforms, and technological facilities	Enables stable access to digital marketing channels, data systems, and Artificial Intelligence-based applications	Unequal infrastructure availability and limited digital access in certain areas
Marketing Data Management	Availability of accurate, structured,	Supports consumer analysis, market	Incomplete, inconsistent, and low-

	and updated marketing data	prediction, and data-driven marketing decisions	quality marketing data
Human Resource Competence	Digital literacy, technological skills, and analytical capabilities	Improves the ability to utilize technology and translate information into effective marketing strategies	Limited understanding of technology and differences in digital capability
Organizational Support	Commitment to technological adoption, resource allocation, and innovation-oriented culture	Encourages sustainable implementation and continuous improvement of digital marketing systems	Resistance to technological change and limited organizational readiness
Technology Integration	Integration of Artificial Intelligence with marketing activities and decision-making processes	Creates a more efficient, systematic, and interconnected marketing process	Difficulty adapting existing systems with new digital technologies
Artificial Intelligence Implementation	Utilization of AI-based analysis, automation, and personalization tools	Enhances marketing effectiveness through faster and more accurate decision-making	High investment requirements and limited technological understanding
Digital Environment Adaptation	Ability to respond to changes in consumer behavior and market conditions	Maintains marketing relevance and competitiveness in digital markets	Rapid technological changes and increasing market competition

Based on Table 2, optimizing digital marketing in the agricultural sector depends not only on the availability of Artificial Intelligence technology but also on the readiness of various supporting elements to ensure its effective use. Each factor is interconnected, so limitations in one aspect can impact the overall success of implementation.

In addition to infrastructure, the quality of marketing data is a crucial factor in supporting digital marketing optimization. Data on consumer behavior, promotional effectiveness, and changing market needs are only beneficial if managed systematically, accurately, and consistently. Data quality also determines the ability of Artificial Intelligence to produce relevant recommendations. Complete and accurate data will result in more precise analysis, while limited or inconsistent data can potentially result in decisions that are less aligned with market conditions. Therefore, data management is a strategic part of supporting digital marketing effectiveness.

Digital marketing success is also influenced by human resource competency. Mastery of technology, the ability to analyze information, and translating analytical results into marketing strategies are crucial factors in optimally utilizing Artificial Intelligence. Although technology can generate various recommendations, final decisions still depend on the ability of business actors to understand product characteristics, market conditions, and organizational goals. Differences in digital literacy levels in the agricultural sector contribute to varying degrees of successful technology implementation, making competency development a crucial need.

In addition to individual factors, organizational support also determines the success of marketing transformation. Organizations that provide resources, develop information systems, enhance human resource capacity, and encourage innovation will be better prepared for change than those that still rely on conventional work patterns. This support also ensures the sustainable use of Artificial Intelligence through system evaluation and refinement, so that the technology becomes part of a long-term strategy to increase the competitiveness of agricultural products.

The success of marketing optimization is also influenced by the ability to integrate technology into all marketing activities, from identifying market needs and developing promotional strategies, communicating with consumers, to evaluating marketing results. This integration allows every decision to be based on interconnected information, resulting in a more consistent marketing strategy. Conversely, the use of technology limited to only a portion of the process will result in less than optimal benefits for improving marketing performance.

Despite offering numerous opportunities, the implementation of Artificial Intelligence still faces several obstacles, such as limited business capabilities, the need for technology investment, organizational readiness, data quality, and difficulties integrating new systems with existing ones. These conditions indicate that the implementation of Artificial Intelligence requires simultaneous technical and managerial support to achieve optimal benefits.

The rapid changes in the digital environment also impact marketing effectiveness. The development of digital platforms, changes in consumer behavior, and increasing expectations for services require businesses to continuously adapt their marketing strategies. Artificial Intelligence helps identify these changes quickly, but its effectiveness still depends on the organization's ability to translate analytical results into appropriate actions.

Furthermore, the reduction of geographical barriers increases the intensity of competition because agricultural products from various regions can be marketed through a common platform. In this environment, businesses cannot simply rely on product quality; they must also maintain the relevance of their marketing strategies through continuous evaluation and adjustment. Therefore, adaptability to changes in the digital environment is a crucial factor in maintaining the competitiveness of agricultural products.

4. Strategic Directions for Strengthening Agricultural Product Competitiveness

Strengthening the competitiveness of agricultural products in the digital economy era depends not only on increasing production capacity but also on developing marketing strategies that can adapt to changes in the business environment. Increasingly dynamic competition due to technological developments, changing consumer preferences, and the increasing use of digital platforms requires businesses to implement flexible, information-based strategies. Therefore, strengthening competitiveness needs to be directed at developing a marketing system capable of continuous evaluation, optimally utilizing technology, and integrating market information into the decision-making process.

An adaptive marketing strategy is a crucial step in increasing the competitiveness of agricultural products. Adaptation includes not only the use of digital media but also adjustments to communications, promotions, consumer targeting, and marketing timing according to market conditions. Artificial Intelligence supports this process through data analysis that can identify changes in consumer behavior, evaluate strategy effectiveness, and provide a basis for developing more appropriate marketing approaches. Furthermore, this technology enables more specific market segmentation, making communications more relevant and increasing the chances of promotional success.

Strengthening product positioning in the digital market is also an important strategic direction. Amidst the growing number of product choices, businesses need to build a strong

identity through easily accessible information, consistent communication, and positive customer experiences. Artificial Intelligence helps analyze consumer responses, enabling businesses to understand the factors influencing market perception and sustainably strengthen product positioning. Furthermore, more targeted communication management and customer satisfaction monitoring contribute to increased trust and loyalty, strengthening product positioning amidst competition.

Another strategic direction is increasing the efficiency of marketing management. Artificial Intelligence enables the automation of various activities, such as data collection, market analysis, promotion monitoring, and performance evaluation, making the marketing process faster and more efficient. The resulting information also helps businesses allocate resources and budgets to the most effective strategies, thereby increasing marketing productivity and optimizing resource use.

Developing collaboration between stakeholders also plays a role in strengthening the competitiveness of agricultural products. Digital marketing transformation requires support from the government, educational institutions, research institutions, technology providers, the business community, and agricultural organizations. This collaboration supports increased human resource capacity, access to technology, policy development, and knowledge exchange, accelerating marketing transformation. This synergy also creates a more sustainable digital ecosystem as each party contributes according to its role in supporting innovation and increasing competitiveness.

Strengthening technology-based marketing innovation is the next strategy in facing the development of the digital economy. Artificial Intelligence enables the development of more effective marketing communications, improves the quality of interactions with consumers, and utilizes market information as a basis for strategy development. This innovation needs to be balanced with a focus on market needs through analysis of changing preferences, consumption patterns, and factors influencing purchasing decisions. In this way, businesses can develop more relevant strategies and proactively anticipate market changes before they impact competitiveness.

The implications of these various strategic directions require a shift in the perspectives of both businesses and policymakers regarding technology. For businesses, Artificial Intelligence needs to be positioned as part of a business strategy to increase competitiveness through strengthening digital competencies, utilizing information, and developing adaptive marketing systems. Meanwhile, the government plays a role in providing digital infrastructure, increasing technological literacy, strengthening regulations that support innovation, and expanding business access to digital technology so that marketing transformation can occur more equitably.

E. CONCLUSION

The transformation of agricultural product marketing in the digital economy era demonstrates that the use of Artificial Intelligence has significantly contributed to increasing product competitiveness by strengthening the effectiveness of marketing activities. The application of Artificial Intelligence drives a shift from conventional marketing approaches to more adaptive, data-driven marketing, enabling businesses to understand market characteristics, develop more appropriate promotional strategies, improve the quality of communication with consumers, and make marketing decisions based on more accurate information. This has resulted in expanded market reach, increased product added value, enhanced product appeal in the digital marketplace, increased consumer loyalty, and marketing productivity, ultimately strengthening the competitive position of agricultural products in an increasingly competitive business environment. The success of digital marketing optimization

is not only influenced by the use of Artificial Intelligence but also by the readiness of various supporting factors, such as digital infrastructure, the availability and quality of marketing data, human resource competency, organizational support, and the ability to integrate technology into all marketing activities. On the other hand, various challenges remain that need to be addressed, including differences in technological readiness, limited data quality, uneven human resource capabilities, and the rapid changes in the digital environment. Therefore, the implementation of Artificial Intelligence requires a comprehensive approach to optimize the benefits of technology sustainably to support improved marketing performance.

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