



Strengthening Regional Food Security: A Public Administration Approach to Agricultural Education and Sustainable Community Empowerment Frameworks

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Abstrak

Ketahanan pangan menjadi salah satu tantangan global yang semakin mendesak akibat pertumbuhan penduduk, perubahan iklim, dan menurunnya produktivitas pertanian. Pendidikan pertanian memiliki peran strategis dalam meningkatkan kapasitas masyarakat untuk membangun sistem pangan yang berkelanjutan sekaligus memperkuat kesadaran lingkungan dan ketahanan sosial-ekonomi. Penelitian ini bertujuan mengembangkan kerangka pembelajaran pertanian berkelanjutan yang mampu memperkuat ketahanan pangan regional melalui pemberdayaan masyarakat. Penelitian menggunakan pendekatan studi kasus kualitatif dengan pengumpulan data melalui wawancara mendalam, observasi lapangan, diskusi kelompok terarah, dan analisis dokumen yang melibatkan petani, penyuluh pertanian, pendidik, pemerintah daerah, serta tokoh masyarakat. Hasil penelitian menunjukkan bahwa integrasi pendidikan pertanian dengan kearifan lokal, pembelajaran partisipatif, dan praktik pertanian berkelanjutan secara signifikan meningkatkan literasi pertanian, adopsi inovasi, produktivitas pangan, serta partisipasi masyarakat. Kerangka yang dikembangkan terdiri atas lima dimensi utama, yaitu literasi pertanian, pembelajaran berorientasi keberlanjutan, inovasi teknologi, kolaborasi pemangku kepentingan, dan pemberdayaan masyarakat. Kelima dimensi tersebut secara terpadu berkontribusi terhadap peningkatan ketahanan pangan rumah tangga, penguatan sistem pangan lokal, dan ketahanan sektor pertanian dalam jangka panjang. Penelitian ini menegaskan bahwa pendidikan pertanian perlu bergeser dari sekadar transfer pengetahuan menuju pembelajaran transformatif yang mendorong masyarakat menjadi pelaku utama pembangunan berkelanjutan. Kerangka yang diusulkan memberikan implikasi praktis bagi pembuat kebijakan, institusi pendidikan, dan praktisi pembangunan pedesaan dalam merancang strategi berbasis pendidikan untuk memperkuat ketahanan pangan regional sekaligus mendukung pencapaian Tujuan Pembangunan Berkelanjutan (SDGs), khususnya SDG 2 (Tanpa Kelaparan), SDG 4 (Pendidikan Berkualitas), dan SDG 11 (Kota dan Permukiman yang Berkelanjutan).

Kata kunci: pendidikan pertanian; ketahanan pangan regional; pemberdayaan masyarakat; pembelajaran berkelanjutan

Abstract

Food security has become one of the most pressing global challenges due to population growth, climate change, and declining agricultural productivity. Agricultural education plays a strategic role in enhancing community capacity to develop sustainable food systems while promoting environmental awareness and socio-economic resilience. This study aims to develop a sustainable agricultural learning framework that strengthens regional food security through community empowerment. Using a qualitative case study approach, the research collected data through in-depth interviews, field observations, focus group discussions, and document analysis involving farmers, agricultural extension officers, educators, local government representatives, and community leaders. The findings reveal that integrating agricultural education with local wisdom, participatory learning, and sustainable farming practices significantly improves agricultural knowledge, innovation adoption, food production, and community participation. The proposed framework consists of five interconnected dimensions: agricultural literacy, sustainability-oriented learning, technological innovation, stakeholder collaboration, and community empowerment. These dimensions collectively contribute to improving household food security, strengthening local food systems, and fostering long-term agricultural resilience. The study highlights that agricultural education should move beyond knowledge transfer toward transformative learning that enables communities to become active agents of sustainable development. The proposed framework provides practical implications for policymakers, educational institutions, and rural development practitioners in designing education-based strategies to achieve regional food security and support the Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 4 (Quality Education), and SDG 11 (Sustainable Cities and Communities).

Keywords: agricultural education; regional food security; community empowerment; sustainable learning

Introduction

Regional food security has become an increasingly important public policy issue as governments seek to respond to the interconnected challenges of climate change, population growth, environmental degradation, and economic uncertainty. While increasing agricultural productivity remains essential, sustainable food security requires more comprehensive governance approaches that integrate public administration, agricultural education, stakeholder collaboration, and community empowerment. From a public administration perspective, food security is not solely the responsibility of agricultural agencies but rather a multidimensional governance issue requiring coordinated action among government institutions, educational organizations, the private sector, civil society, and local communities (True, 1929).

Public administration provides the institutional framework through which food security policies are formulated, implemented, monitored, and evaluated. Effective governance ensures that agricultural development programs are aligned with local needs while promoting accountability, transparency, and citizen participation. In many developing regions, fragmented governance structures, limited institutional coordination, and inadequate policy integration often reduce the effectiveness of food security initiatives. Consequently, strengthening institutional capacity has become a strategic priority for creating resilient agricultural systems capable of responding to both short-term shocks and long-term structural changes (Dooley, 2002a).

Agricultural education represents one of the most influential policy instruments within this governance framework. Rather than functioning merely as a mechanism for transferring technical farming knowledge, contemporary agricultural education promotes lifelong learning, innovation,

leadership development, and sustainable resource management. Educational institutions, particularly universities and vocational colleges, serve as knowledge hubs that connect scientific research with practical agricultural applications. Through research, extension services, and community engagement programs, these institutions facilitate the dissemination of sustainable farming practices while encouraging farmers to adopt environmentally responsible and economically viable agricultural innovations (Dooley, 2002b).

Community empowerment complements agricultural education by transforming local residents from passive beneficiaries of government programs into active participants in rural development. Empowered communities possess greater capacity to identify local challenges, mobilize available resources, adopt technological innovations, and collaboratively develop context-specific solutions. Participatory governance mechanisms strengthen trust among stakeholders while enhancing the sustainability of agricultural development programs. In this context, agricultural extension officers, local governments, farmer organizations, educational institutions, and civil society organizations play complementary roles in facilitating collective learning and shared decision-making processes (Trauger et al., 2008).

A sustainable community empowerment framework therefore requires continuous interaction among multiple stakeholders operating within an integrated governance system. Local governments provide regulatory support and public investment; universities contribute scientific knowledge and innovation; agricultural extension services facilitate technology transfer and farmer training; private sector partners support market access and value chain development; while community organizations ensure local participation and social ownership of development

initiatives. Such collaborative governance enhances institutional resilience and strengthens regional capacity to respond to evolving food security challenges (Myers & Dyer, 2004).

Digital transformation has further expanded opportunities for strengthening agricultural governance through information and communication technologies. Digital platforms enable farmers to access climate information, market prices, precision agriculture technologies, financial services, and online training resources. Public administration must therefore incorporate digital governance strategies that improve information accessibility while reducing disparities between urban and rural communities. Integrating digital literacy into agricultural education enables farming communities to utilize technological innovations more effectively, thereby increasing productivity, reducing production risks, and improving household livelihoods (Robinson & Garton, 2008).

Sustainability remains the central principle underlying this integrated framework. Food security policies should simultaneously address economic productivity, environmental conservation, and social equity to ensure long-term resilience. Agricultural education contributes to sustainability by promoting climate-smart agriculture, efficient resource utilization, biodiversity conservation, and environmentally responsible farming practices. Community empowerment further reinforces sustainability by encouraging local ownership, strengthening social capital, and preserving indigenous agricultural knowledge that has supported rural livelihoods for generations.

From a public administration perspective, strengthening regional food security requires a transition from sector-based interventions toward integrated governance ecosystems characterized by collaboration, innovation, and evidence-based policymaking. Agricultural education

should be positioned as a strategic investment in human capital capable of enhancing adaptive capacity, technological competence, and community resilience. Simultaneously, sustainable community empowerment frameworks should emphasize participatory governance, institutional collaboration, and continuous learning as essential foundations for resilient food systems (Acker, 1999).

Ultimately, regional food security can only be achieved when governments, educational institutions, agricultural stakeholders, and local communities work collectively within a coordinated governance framework. Integrating public administration, agricultural education, and community empowerment creates an enabling environment in which knowledge, innovation, and collaboration reinforce one another. Such an approach not only strengthens food production and rural livelihoods but also contributes to sustainable regional development and supports the achievement of the Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 4 (Quality Education), SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action), and SDG 17 (Partnerships for the Goals).

These limitations indicate the need for a more comprehensive educational framework capable of integrating agricultural literacy, sustainability principles, technological innovation, stakeholder collaboration, and community empowerment into a unified learning ecosystem. Rather than viewing education solely as classroom instruction or technology transfer, contemporary agricultural education should be understood as a transformative social process that strengthens the capacity of communities to learn collectively, innovate continuously, and build resilient local food systems.

Accordingly, this study argues that strengthening regional food security requires rethinking agricultural education

as a strategic mechanism for community empowerment and sustainable development. By integrating educational innovation with participatory learning, local knowledge, and collaborative governance, agricultural education can become a powerful driver for enhancing agricultural resilience, improving farmers' livelihoods, and ensuring sustainable regional food systems in the face of future global challenges.

Result and Discussion

Agricultural Education as a Driver of Regional Food Security in Sidenreng Rappang Regency

The findings demonstrate that agricultural education plays a central role in strengthening regional food security in Sidenreng Rappang Regency (Sidrap), South Sulawesi, Indonesia. The region has long been recognized as one of Indonesia's major agricultural centers, particularly for rice production, supported by extensive irrigated agricultural land, favorable climatic conditions, and strong farming traditions. However, the sustainability of agricultural production is increasingly influenced not only by natural resources but also by the educational capacity of farming communities to adopt innovations, improve productivity, and respond to environmental challenges (Thompson & Balschweid, 1999).

The qualitative analysis revealed that education significantly influences farmers' knowledge, attitudes, and decision-making processes regarding agricultural management. Farmers with better educational backgrounds demonstrated greater confidence in adopting certified seeds, utilizing agricultural machinery, implementing sustainable farming techniques, and applying digital technologies in production and post-harvest management. These competencies directly contributed to higher productivity, better crop quality, and improved household food security (Retallick, 2010).

Field observations and interviews consistently indicated that agricultural education extends beyond formal schooling. Extension programs, farmer field schools, community training initiatives, and peer-learning activities collectively enhance farmers' competencies. Participants emphasized that continuous learning opportunities have become increasingly important in addressing rapid technological changes, climate variability, and market competition.

Consequently, agricultural education should be understood as a lifelong learning process that strengthens farmers' adaptive capacity while supporting sustainable rural development.

Agricultural Production Performance and Regional Food Security

The empirical findings confirm Sidrap's strategic contribution to regional and national food security. The regency consistently produces more than 665,000 tons of rice annually, making it one of the largest rice-producing regions in South Sulawesi. Average rice productivity reaches approximately 6.26 tons per hectare, reflecting relatively efficient farming practices supported by irrigation infrastructure and increasing technology adoption (Rudd & Hillison, 1995).

Rice production remains the dominant agricultural commodity, providing employment opportunities for thousands of rural households while ensuring stable food availability across the region. Farmers reported that productivity improvements during the last decade have resulted from multiple factors, including improved irrigation systems, certified seed distribution, mechanization, agricultural extension services, and government support programs (Garton & Chung, 1996).

Beyond crop production, Sidrap also possesses a highly developed livestock sector. The regency is widely recognized as the largest egg-producing area in Eastern

Indonesia. Poultry farming contributes substantially to regional income diversification while strengthening nutritional security through increased availability of affordable animal protein.

The coexistence of strong crop and livestock sectors creates an integrated agricultural system capable of enhancing regional resilience. Farmers increasingly combine rice cultivation with livestock production, enabling better utilization of agricultural waste, diversified income sources, and reduced economic vulnerability (Jones & Rudd, 2008).

These findings indicate that food security should not merely be evaluated through production volume but through the sustainability of integrated agricultural systems supported by continuous educational development.

Educational Level and Adoption of Agricultural Innovation

One of the strongest findings emerging from this study concerns the relationship between farmers' educational attainment and technological innovation. Interviews with agricultural extension officers consistently revealed that education significantly influences farmers' willingness to adopt modern agricultural practices.

Farmers with senior secondary education or higher generally possessed stronger analytical abilities when evaluating new technologies. They were more likely to compare production alternatives, calculate production costs, understand extension recommendations, and assess long-term economic benefits before implementing innovations.

The adoption of certified rice seeds illustrates this relationship clearly. Farmers with relatively higher educational backgrounds demonstrated better understanding of seed quality, genetic

characteristics, disease resistance, and productivity potential. Consequently, they adopted certified seed varieties earlier than farmers with lower educational attainment.

Extension officers also reported that educated farmers more frequently participated in training programs, consulted agricultural experts, and actively searched for agricultural information through digital platforms. This continuous learning behavior accelerated technology diffusion throughout farming communities.

In contrast, farmers with limited formal education tended to rely more heavily on inherited farming practices and informal knowledge networks. Although traditional knowledge remains valuable, excessive dependence on conventional methods occasionally delayed the adoption of productivity-enhancing innovations.

Nevertheless, interviews also highlighted those educational interventions can effectively reduce these disparities. Farmer field schools and community-based learning programs successfully improved technological understanding among older farmers regardless of formal educational background.

Therefore, agricultural education should not be limited to classroom instruction but should incorporate inclusive lifelong learning opportunities that accommodate farmers with diverse educational experiences.

Educational Background and the Adoption of Modern Agricultural Technologies

The findings demonstrate that farmers' educational attainment significantly influences their ability to adopt and effectively utilize modern agricultural technologies. In Sidenreng Rappang Regency, the operation of agricultural machinery—including tractors, rice transplanters, combine harvesters, and

digital post-harvest equipment—was predominantly undertaken by farmers who had completed senior secondary education or higher. This finding suggests that formal education enhances not only technical knowledge but also cognitive skills necessary for understanding and applying increasingly sophisticated agricultural innovations.

Interviews with agricultural extension officers revealed that farmers with higher educational backgrounds exhibited greater digital literacy, analytical thinking, and problem-solving abilities when using modern technologies. These farmers were more willing to participate in extension programs, technical workshops, and government-supported mechanization initiatives. Furthermore, they demonstrated greater confidence in integrating smartphones, GPS-assisted machinery, weather forecasting applications, and digital marketing platforms into their farming activities. Such competencies enabled them to optimize production planning, improve resource efficiency, and reduce operational costs.

Conversely, farmers with lower educational attainment encountered greater challenges in adopting mechanized farming systems. Elderly farmers, in particular, frequently required continuous mentoring before becoming proficient in operating modern agricultural equipment. Rather than reflecting resistance to innovation, these challenges were primarily associated with limited exposure to digital technologies and insufficient opportunities for practical training. Consequently, agricultural extension officers emphasized field-based demonstrations and hands-on learning approaches rather than conventional lecture-based instruction.

An important finding of this study is the emergence of intergenerational learning as an effective educational mechanism. Younger farmers often introduced technological innovations to older family members, while senior farmers contributed

valuable indigenous knowledge regarding soil management, irrigation systems, seasonal patterns, and local ecological conditions. This reciprocal knowledge exchange illustrates that sustainable agricultural development benefits from integrating scientific knowledge with local wisdom rather than replacing traditional practices entirely. Such collaborative learning not only accelerated technology adoption but also strengthened social cohesion and knowledge continuity within farming communities.

These findings reinforce the argument that agricultural mechanization should be accompanied by continuous educational support. Investment in agricultural machinery alone is unlikely to achieve optimal outcomes unless farmers possess adequate technical competencies and opportunities for lifelong learning. Therefore, agricultural education should be recognized as an essential component of technology diffusion and sustainable agricultural transformation.

Farmer Demographics and the Emergence of Millennial Farmers

The demographic characteristics of farmers in Sidenreng Rappang Regency indicate a gradual transformation of rural human resources. Although the majority of agricultural workers still possess elementary or junior secondary educational qualifications, this study identified an increasing participation of senior high school graduates, vocational school graduates, and university alumni entering the agricultural sector. This trend reflects changing perceptions of agriculture from a traditional occupation toward a modern, technology-driven entrepreneurial profession.

The emergence of millennial farmers represents one of the most significant developments identified in this study. Unlike previous generations, these young farmers approach agriculture from a business-oriented perspective by

integrating production management, agribusiness development, financial planning, digital marketing, and sustainable resource management. Rather than focusing solely on crop production, they increasingly emphasize value creation throughout the agricultural supply chain.

Participants reported extensive utilization of digital technologies for monitoring weather conditions, identifying crop diseases, accessing fertilizer recommendations, recording financial transactions, and tracking commodity prices. Mobile applications and online information platforms have become essential tools supporting evidence-based decision-making in daily farming activities. In addition, social media platforms facilitate peer learning by enabling farmers to exchange practical experiences, participate in online training, and access agricultural extension materials without geographical limitations.

The increasing presence of educated young farmers has also stimulated greater innovation within rural communities. Their familiarity with information technology enables faster dissemination of agricultural knowledge while encouraging broader adoption of precision agriculture and environmentally sustainable farming practices. Consequently, agriculture is gradually evolving from a labor-intensive sector toward a knowledge-intensive and innovation-driven industry.

From an educational perspective, these findings underscore the importance of strengthening agricultural curricula at secondary schools, vocational institutions, and universities to prepare future generations of technologically competent agricultural professionals. Policies supporting youth engagement in agriculture should therefore integrate entrepreneurship education, digital literacy, climate-smart agriculture, and innovation management as core learning components.

Community-Based Agricultural Education for Sustainable Development

The findings further demonstrate that effective agricultural education extends well beyond formal educational institutions. Community participation emerged as a critical determinant of successful knowledge transfer and sustainable agricultural innovation. Rather than relying exclusively on classroom instruction, farmers acquired substantial practical knowledge through collaborative learning within farmer organizations, extension activities, demonstration plots, and peer-learning networks.

Farmer groups functioned as local learning communities where members collectively discussed production challenges, evaluated farming practices, exchanged experiences, and identified appropriate technological solutions. These collaborative interactions promoted collective problem-solving while strengthening trust among community members. Agricultural extension officers served not merely as technology disseminators but as facilitators who connected scientific research with local agricultural knowledge and practical experience.

The participatory nature of agricultural learning significantly increased farmers' willingness to experiment with innovative technologies because implementation occurred collectively rather than individually. Farmers perceived collaborative experimentation as reducing production risks while enhancing confidence in adopting unfamiliar farming techniques. This finding highlights the importance of social learning in accelerating agricultural innovation diffusion.

Educational activities increasingly incorporated sustainability-related themes, including integrated pest management, efficient irrigation systems, organic

fertilizer utilization, crop diversification, biodiversity conservation, and climate adaptation strategies. Participants consistently emphasized that learning outcomes improved substantially when educational activities were conducted directly in agricultural fields through practical demonstrations. Field-based learning enabled farmers to observe technology performance under real environmental conditions while immediately evaluating production outcomes.

These findings support the concept that community-based agricultural education serves as an effective mechanism for promoting sustainable rural development. Educational programs that actively involve local communities create stronger ownership of innovations, enhance collective learning capacity, and improve long-term sustainability compared with top-down technology transfer approaches.

Development of a Sustainable Agricultural Learning Framework

The thematic analysis resulted in the development of a Sustainable Agricultural Learning Framework designed to strengthen regional food security through educational transformation and community empowerment. The framework integrates five interrelated dimensions that collectively enhance farmers' adaptive capacity within rapidly changing agricultural environments (Wolf et al., 2010).

The first dimension, Agricultural Literacy, focuses on developing farmers' fundamental understanding of crop cultivation, certified seed selection, soil fertility management, climate adaptation, integrated pest management, and regional food security. Improved agricultural literacy establishes the knowledge base required for informed decision-making and sustainable farming practices (Rudd & Hillison, 1995).

The second dimension, Sustainability-Oriented Learning, emphasizes environmentally responsible agricultural practices through efficient resource management, biodiversity conservation, renewable agricultural inputs, and climate-resilient production systems. This dimension encourages farmers to balance productivity with environmental stewardship.

The third dimension, Technological Innovation, promotes the adoption of agricultural mechanization, digital agriculture, precision farming technologies, artificial intelligence-supported decision-making, and modern post-harvest management systems. Technology is viewed not merely as production equipment but as a catalyst for improving efficiency, productivity, and competitiveness.

The fourth dimension, Stakeholder Collaboration, recognizes that sustainable agricultural education requires strong partnerships among universities, agricultural extension agencies, local governments, private industries, farmer organizations, and community institutions. Collaborative governance enhances knowledge exchange, resource mobilization, and innovation dissemination across multiple sectors (Trauger et al., 2008).

Finally, Community Empowerment represents the ultimate outcome of the framework by transforming farmers from passive recipients of agricultural technologies into active innovators capable of solving local agricultural challenges independently. Empowered communities possess greater resilience in responding to economic uncertainty, climate variability, and changing food systems.

Collectively, these five dimensions form an integrated educational ecosystem in which agricultural knowledge, technological innovation, social collaboration, and community participation reinforce one another. The proposed framework provides

a practical and theoretically grounded model for policymakers, educational institutions, and rural development practitioners seeking to strengthen regional food security through sustainable agricultural education. By integrating educational transformation with community empowerment, the framework contributes to achieving more resilient agricultural systems while supporting the Sustainable Development Goals, particularly SDG 2 (Zero Hunger), SDG 4 (Quality Education), and SDG 11 (Sustainable Cities and Communities).

The second dimension is Sustainability-Oriented Learning, emphasizing environmentally responsible farming practices, efficient resource utilization, biodiversity conservation, and climate resilience. The third dimension is Technological Innovation, encouraging farmers to adopt mechanization, digital agriculture, precision farming, and post-harvest technologies that improve productivity and market competitiveness.

The fourth dimension is Stakeholder Collaboration, integrating universities, agricultural extension agencies, local governments, private sectors, and farmer organizations into collaborative knowledge-sharing networks. Finally, the fifth dimension is Community Empowerment, which transforms farmers from passive technology recipients into active innovators capable of independently solving agricultural challenges and improving local food systems. These five dimensions collectively reinforce one another, creating an integrated educational ecosystem capable of strengthening regional food security while promoting sustainable rural development.

Implications for Regional Food Security

Overall, the findings demonstrate that regional food security depends not only on agricultural production capacity but also on

educational transformation within farming communities.

The strong relationship between educational attainment, technology adoption, certified seed utilization, mechanization, and agricultural productivity confirms that investments in agricultural education generate long-term benefits extending beyond individual farmers. Educational interventions improve knowledge, strengthen innovation capacity, increase production efficiency, and enhance resilience against environmental and economic uncertainty.

For policymakers, these findings highlight the importance of integrating agricultural education into regional development strategies through stronger collaboration among educational institutions, agricultural agencies, local governments, and farming communities. Universities can contribute by developing community-engaged agricultural curricula, conducting participatory action research, and supporting innovation transfer to rural areas. Agricultural extension services should increasingly adopt learner-centered approaches that recognize farmers as co-creators of knowledge rather than passive beneficiaries. Ultimately, strengthening agricultural education contributes not only to increased food production but also to community empowerment, environmental sustainability, rural economic resilience, and achievement of the Sustainable Development Goals. The experience of Sidenreng Rappang Regency demonstrates that sustainable agricultural learning provides a viable pathway toward strengthening regional food security while empowering rural communities to become active agents of sustainable development.

Conclusion

This study demonstrates that agricultural education is a fundamental driver of regional food security in Sidenreng Rappang Regency (Sidrap), Indonesia.

While the region possesses substantial agricultural potential, reflected in its high rice productivity and well-developed livestock sector, sustainable food security depends not only on natural resources and agricultural infrastructure but also on the educational capacity of farming communities. The findings reveal a strong relationship between farmers' educational attainment and their ability to adopt certified seeds, utilize modern agricultural machinery, implement sustainable farming practices, and integrate digital technologies into agricultural production and post-harvest management.

The study further highlights that agricultural education should be viewed as a continuous and transformative learning process rather than merely formal schooling. Community-based learning, agricultural extension services, farmer field schools, and collaborative knowledge-sharing among stakeholders significantly enhance farmers' competencies, innovation capacity, and resilience in responding to climate change, market fluctuations, and technological developments. The emergence of millennial farmers also illustrates the growing importance of integrating digital literacy, agribusiness management, and sustainable agricultural practices into rural education systems.

Based on these findings, the proposed Sustainable Agricultural Learning Framework, comprising agricultural literacy, sustainability-oriented learning, technological innovation, stakeholder collaboration, and community empowerment, provides a comprehensive model for strengthening regional food security. The framework emphasizes that education functions as a catalyst for transforming farmers from passive technology users into active innovators capable of driving sustainable agricultural development (Wolf et al., 2010).

The study contributes to the growing literature on agricultural education by demonstrating how educational

interventions can simultaneously improve agricultural productivity, strengthen rural livelihoods, and support sustainable community development. From a policy perspective, stronger collaboration among governments, universities, agricultural extension agencies, and local communities is essential for expanding inclusive agricultural education programs. Future research should employ longitudinal and comparative studies across different agricultural regions to evaluate the long-term effectiveness of the proposed framework and its contribution to achieving the Sustainable Development Goals, particularly SDG 2 (Zero Hunger), SDG 4 (Quality Education), and SDG 11 (Sustainable Cities and Communities).

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