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Strategy for Strengthening Human Resource Management in Addressing Agricultural Entrepreneurship Challenges to Achieve Sustainable Food Security

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A B S T R A C T

This study examines strategic approaches to strengthening human resource management in addressing the challenges faced by agricultural entrepreneurs to support sustainable food security. The research focuses on identifying competency gaps, organizational learning patterns, performance systems, motivation mechanisms, and digital adoption within agricultural enterprises. A mixed method approach was employed, combining structured questionnaires and semi-structured interviews with agricultural entrepreneurs, extension agents, and institutional stakeholders. Quantitative data were analyzed using descriptive and inferential techniques, while qualitative data were examined through thematic analysis to identify recurring patterns and contextual insights. The findings reveal that core competencies, particularly managerial and digital skills, remain limited and unevenly distributed. Organizational learning processes are largely informal, leading to inconsistent knowledge transfer and weak innovation capacity. Performance management is underdeveloped, with minimal use of structured indicators or incentive based motivation systems. Digital adoption is hindered by limited infrastructure, low literacy, and financial constraints, resulting in slow technological transformation. The study concludes that strengthening human resource management through structured training, integrated learning systems, performance frameworks, and digital capacity building is essential for enhancing entrepreneurial resilience and supporting sustainable food systems. These findings provide a strategic foundation for policymakers, training institutions, and agricultural organizations to design targeted interventions that strengthen agricultural entrepreneurship and contribute to long term food security.

KATA KUNCI

Manajemen Sumber Daya Manusia, Kewirausahaan Pertanian, Adopsi Digital, Pembelajaran Organisasi, Ketahanan Pangan

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A B S T R A K

Penelitian ini bertujuan untuk mengidentifikasi dan menganalisis strategi penguatan manajemen sumber daya manusia dalam menghadapi berbagai tantangan kewirausahaan pertanian guna mendukung ketahanan pangan berkelanjutan. Ruang lingkup penelitian mencakup pengukuran tingkat kompetensi pelaku usaha, pola pembelajaran organisasi, sistem kinerja, mekanisme motivasi, serta tingkat adopsi digital dalam kegiatan agribisnis. Pendekatan campuran digunakan melalui penyebaran kuesioner terstruktur dan wawancara semi terstruktur kepada para wirausahawan pertanian, penyuluh, dan pemangku kepentingan institusional. Data kuantitatif dianalisis menggunakan teknik deskriptif dan inferensial, sedangkan data kualitatif dianalisis secara tematik untuk menemukan pola dan konteks yang relevan. Hasil penelitian menunjukkan bahwa kompetensi inti, terutama dalam aspek manajerial dan literasi digital, masih terbatas dan tidak merata. Pembelajaran organisasi berlangsung secara informal sehingga menyebabkan transfer pengetahuan yang tidak konsisten dan kemampuan inovasi yang rendah. Sistem kinerja belum terstruktur, dengan minimnya indikator evaluasi dan mekanisme insentif yang mendorong motivasi. Tingkat adopsi digital terhambat oleh keterbatasan infrastruktur, rendahnya literasi teknologi, dan kendala biaya, sehingga memperlambat transformasi agribisnis. Penelitian ini menyimpulkan bahwa penguatan manajemen sumber daya manusia melalui pelatihan terstruktur, integrasi sistem pembelajaran, kerangka kinerja, serta peningkatan kapasitas digital sangat diperlukan untuk memperkuat ketahanan wirausaha pertanian dan mendukung sistem pangan berkelanjutan. Temuan ini memberikan dasar strategis bagi perancang kebijakan, lembaga pelatihan, dan organisasi pertanian dalam mengembangkan intervensi yang lebih tepat sasaran.

1. Introduction

Agricultural entrepreneurship has become a critical pillar in achieving sustainable food security [1], particularly in developing countries that continue to face challenges in modernizing the agricultural sector [2]. The transition toward a more adaptive and productive food system requires human resources with strong capacities, adequate managerial skills, and a readiness to innovate [3]. Field conditions show that many agricultural entrepreneurs still struggle with limited managerial literacy, inadequate access to technology, and weak abilities to manage production and market risks [4]. These issues highlight the strategic importance of strengthening human resource management as a foundation for advancing agricultural entrepreneurship [5].

The development of agricultural entrepreneurship increasingly emphasizes competencies that extend beyond technical farming skills [6]. Modern agricultural enterprises require leadership capabilities, sound decision making, creativity, and the ability to apply digital technologies [7]. In this context, human resource management functions as the driving force in building individual and organizational capacities [8]. Effective training programs, continuous mentoring, and supportive working environments are essential elements that enhance productivity and entrepreneurial success [9]. At the same time, the integration of digital tools into production, marketing, and distribution processes demands more advanced competencies [10], enabling agricultural actors to compete within dynamic agri food value chains [11].

The urgency of this study arises from the persistent gap between the potential of the agricultural sector and the suboptimal capacity of human resources within it [12]. Although the number of agricultural entrepreneurs is increasing, strategies for managing and developing human resources have not been systematically structured or aligned with sustainability oriented objectives [13]. Various empowerment programs have been introduced, yet many fail to deliver long term impact due to the absence of comprehensive managerial approaches [14]. This condition demonstrates the need for further exploration of human resource management strategies that directly address the real challenges faced by agricultural entrepreneurs [15].

Based on these realities, the purpose of this study is to examine strategies for strengthening human resource management in addressing agricultural entrepreneurship challenges to achieve sustainable food security [16]. The central question guiding this research is: What human resource management strategies are most effective in enhancing the capacity of agricultural entrepreneurs to support sustainable food systems, The findings are expected to contribute to theoretical development, strengthen policy design, and provide practical recommendations for stakeholders, training institutions, and agricultural entrepreneurs seeking to improve resilience, innovation, and long term sustainability in the agricultural sector [17].

Existing research on agricultural entrepreneurship generally focuses on technical productivity, digital adoption, and market access, yet the strategic role of human resource management remains insufficiently explored. Most capacity building initiatives in agriculture are fragmented, short term, and disconnected from integrated HRM functions such as competency development, organizational learning, motivation systems, performance evaluation, and innovation culture. Moreover, studies rarely examine how HRM strategies can directly strengthen entrepreneurial resilience or support long term sustainability within food systems. This lack of a comprehensive HRM based framework creates an important gap in understanding how human resource management can be positioned as a central mechanism for developing competitive and sustainable agricultural entrepreneurs.

The novelty of this study lies in its development of an integrated strategic model that positions human resource management as the core driver of agricultural entrepreneurship aimed at achieving sustainable food security . This research introduces a unified framework that links HRM practices such as competency enhancement, learning culture, performance systems, and innovation readiness with the broader sustainability goals of modern food systems. It also incorporates the dimension of digital transformation into HRM strategy, offering a new perspective on how structured HRM interventions can improve decision making, increase adaptive capacity, and strengthen value chain competitiveness among agricultural entrepreneurs. This holistic approach distinguishes the study from previous works that treated HR development as isolated and non systemic.

2. Research Method

The research method provides the fundamental framework that guides the process of data collection, analysis, and interpretation in this study. A clear methodological description is essential to ensure transparency, accuracy, and reproducibility of the research findings. This section outlines the procedures used to examine strategies for strengthening human resource management in addressing agricultural entrepreneurship challenges. The methodological explanation includes the design of the study, the characteristics of the research subjects or data sources, and the analytical techniques applied. Each stage of the process is described with sufficient detail regarding size, scope, and procedures, allowing other researchers to replicate the study under similar conditions. New or modified analytical approaches are elaborated

comprehensively, while established techniques are presented concisely according to standard guidelines. This framework ensures that the research maintains scientific rigor and produces valid, reliable insights aligned with the objectives of the study.

2.1. Research Design

This study employs a descriptive analytical research design aimed at identifying and interpreting strategic components of human resource management within the context of agricultural entrepreneurship. The design integrates qualitative and quantitative perspectives to obtain a comprehensive understanding of HRM challenges and opportunities across different agricultural environments. The qualitative component focuses on exploring contextual insights related to capacity development, innovation behavior, and managerial practices among agricultural actors. Meanwhile, the quantitative component provides measurable evidence regarding the relationships between HRM strategies and indicators of entrepreneurial performance and sustainability. The combination of these approaches enables the study to investigate both conceptual patterns and practical implications. The design also allows flexibility in interpreting diverse sources of information, ensuring that the findings remain relevant to varying agricultural settings. This methodological structure ensures that the research captures the complexity of HRM processes and their influence on sustainable food systems.

2.2. Population and Sampling

The population of this study consists of agricultural entrepreneurs, farmer groups, extension agents, and organizational stakeholders involved in human resource development within the agricultural sector. A purposive sampling technique is used to ensure the selection of participants who possess relevant experience and knowledge related to HRM practices, training activities, and entrepreneurial challenges. This sampling method allows the research to gather in depth insights from individuals considered to have strategic roles in shaping human resource capacities. The sample size is adjusted based on data saturation for the qualitative component and statistical adequacy for the quantitative component. By combining these criteria, the sample reflects both representativeness and depth of understanding. The sampling framework also accommodates regional variations, enabling the study to capture diverse perspectives influenced by local agricultural ecosystems, market conditions, and institutional support systems.

2.3. Data Collection Techniques

Data collection relies on a combination of structured questionnaires, semi structured interviews, and document analysis to obtain comprehensive information on HRM strategies and entrepreneurial practices. Structured questionnaires are distributed to measure specific indicators such as competency levels, performance systems, innovation readiness, and digital adoption. Semi structured interviews are conducted with key stakeholders to explore deeper insights into challenges, needs, and contextual barriers affecting human resource development in agriculture. These interview sessions encourage respondents to elaborate on personal experiences and organizational practices that may not be captured through quantitative instruments. Additionally, document analysis is performed on policy frameworks, training modules, and institutional guidelines to complement primary data. The triangulation of these three techniques enhances the reliability and validity of the findings, ensuring that the collected data reflects both empirical patterns and practical realities.

2.4. Data Analysis Procedures

The study applies a mixed method analysis combining descriptive statistics, thematic analysis, and interpretative evaluation. Quantitative data obtained from questionnaires are analyzed using descriptive and inferential statistics to identify trends, relationships, and significant variables influencing HRM effectiveness. These analytical steps allow the study to evaluate competency gaps, adoption of HR practices, and entrepreneurial outcomes. For qualitative data, thematic analysis is employed to categorize narratives based on recurring patterns such as leadership behavior, learning culture, motivation systems, and innovation barriers. The integration of quantitative and qualitative results follows a convergence model, where findings from both methods are compared and interpreted collectively. This approach ensures that numerical data and contextual insights support each other, enabling a comprehensive assessment of HRM strategies. The analytical framework strengthens the credibility of the research by presenting multi dimensional interpretations.

2.5. Research Validity and Reliability

To ensure the rigor of the study, several validity and reliability measures are implemented across the research stages. In the quantitative component, instrument reliability is tested using internal consistency and pilot assessments to confirm clarity and stability of responses. Validity procedures include expert judgment and construct verification to ensure that questionnaire items accurately represent the variables being measured. In the qualitative component, credibility is maintained through triangulation of data sources, member checking, and detailed documentation of interview processes. Transferability is supported by providing clear descriptions of the research context, allowing other researchers to apply the approach in similar settings. Dependability and confirmability are ensured through systematic coding procedures and transparent analytical trails. By integrating these strategies, the

study upholds methodological rigor and strengthens confidence in the accuracy and consistency of its findings.

3. Result and Discussion

This section presents the findings of the study in a structured and logical sequence to illustrate the patterns, observations, and data derived from the research process. The results are arranged to form a coherent narrative that highlights essential facts without interpretation, ensuring that the presentation remains objective and free from analytical bias. Tables and figures are included only when necessary to support clarity, and repetition of identical information across text and visuals is avoided. Subtitles are used to organize the results according to key themes identified during data analysis, enabling readers to follow the progression of the study's evidential outcomes.

The discussion further elaborates on the meaning of these results by interpreting their implications, identifying relationships among variables, and drawing generalizations aligned with the objectives of the study. This section addresses the research questions by connecting empirical findings with conceptual understanding, ultimately revealing how human resource management strategies influence agricultural entrepreneurship and sustainable food security. Any ambiguous or inconsistent findings are presented transparently and examined objectively to maintain scientific rigor. Through this integrated structure, the results and discussion collectively provide a comprehensive explanation of the study's contributions.

3.1. Competency Levels and HR Readiness

The results show that the overall competency level of agricultural entrepreneurs remains relatively moderate, indicating gaps in managerial, digital, and innovation related skills. Respondents demonstrated strength in basic agricultural knowledge and operational skills but exhibited weaknesses in decision making, strategic planning, and risk management. Many participants reported limited exposure to capacity-building programs, particularly those focusing on entrepreneurship, organizational leadership, and sustainable production practices. These findings illustrate that human resource readiness is still heavily oriented toward traditional farming approaches rather than the demands of modern agribusiness ecosystems, which require broader knowledge and adaptive capabilities.

The analysis also reveals variations in competency levels based on age, experience, and involvement in institutional networks. Younger entrepreneurs showed higher digital literacy and openness to innovation, while older farmers possessed deeper experiential knowledge but showed reluctance toward new technologies. The readiness of human resources was further influenced by the presence or absence of supporting institutions such as extension services, cooperatives, and training centers. Areas with active institutional support produced entrepreneurs with more balanced competencies, particularly in financial literacy, farm planning, and market access. These relationships highlight the importance of structured human resource development in shaping entrepreneurial quality.

The discussion indicates that competency gaps directly affect the capacity of agricultural entrepreneurs to innovate, manage risks, and adopt sustainability driven practices. Strengthening HRM strategies becomes essential for addressing these gaps through targeted training, mentorship models, competency mapping, and continuous learning systems. The results emphasize that improving human resource readiness is not merely a technical process but requires a holistic approach integrating behavioral, managerial, and technological dimensions. This alignment is crucial for enabling entrepreneurs to contribute effectively to sustainable food security.

Table 1. Competency Levels and HR Readiness

Competency Aspect	Current Condition	Identified Gap	Implication
Managerial Skills	Moderate	Limited strategic decision making	Weak entrepreneurship readiness
Digital Literacy	Low Moderate	Limited use of digital tools	Slow adoption of innovation
Innovation Capacity	Low	Risk aversion and low experimentation	Reduced competitiveness
Leadership Ability	Moderate	Lack of formal training	Limited organizational direction
Market Knowledge	Moderate	Insufficient market analysis skills	Vulnerable to price fluctuations

Table 1 illustrates the current competency conditions of agricultural entrepreneurs across key aspects of human resource readiness, including managerial skills, digital literacy, innovation capacity, leadership abilities, and market knowledge. The findings indicate that most competencies remain at a moderate level, especially in areas related to strategic decision making and technology utilization. Managerial abilities tend to focus on operational tasks rather than long term planning, while digital literacy remains low to moderate, reflecting limited integration of digital tools in production management, market information access, and organizational decision making processes.

The gaps identified in each competency area reveal the underlying factors contributing to the weak competitive position of agricultural entrepreneurs. Limited exposure to training programs, insufficient technological familiarity, and a tendency toward risk aversion restrict innovation capacity. Leadership skills

are also underdeveloped, making it difficult for entrepreneurs to guide teams or farmer groups toward collective goals. Additionally, inadequate market analysis skills prevent entrepreneurs from anticipating price dynamics, consumer preferences, and supply chain demands. These weaknesses collectively hinder the transition from traditional farming practices to more competitive and sustainable agricultural business models.

The implications of these findings highlight the need for a structured human resource management strategy that prioritizes core competency development. Enhancing digital literacy, strengthening leadership capabilities, fostering innovation oriented behavior, and providing continuous managerial training are essential steps to improve HR readiness. A well designed HRM approach will enable agricultural entrepreneurs to increase productivity, manage risks more effectively, and engage more meaningfully in sustainable food system development. Strengthening human resource capacity represents a critical foundation for advancing agricultural entrepreneurship and supporting long term food security.

3.2. Organizational Learning and Knowledge Sharing

The findings show that organizational learning within agricultural groups remains informal and irregular, relying heavily on peer interactions and sporadic extension activities. Knowledge sharing tends to occur reactively, often triggered by urgent production problems or market uncertainties rather than structured learning initiatives. Most respondents indicated that they seldom participate in scheduled learning forums, primarily due to limited access, time constraints, and lack of facilitative leadership within their organizations. This pattern reflects the absence of systematic mechanisms to strengthen collective learning and innovation capabilities across agricultural communities.

Further analysis shows that regions with strong institutional ties, such as partnerships with universities, cooperatives, or NGOs, demonstrate better learning dynamics. In these contexts, knowledge flows more consistently through training, field demonstrations, digital platforms, and collaborative projects. Respondents from these regions also expressed higher confidence in experimenting with new technologies and techniques. The presence of learning systems proved to influence entrepreneurial behavior, encouraging problem solving, innovation, and proactive adaptation to environmental challenges. These differences highlight the critical role of organizational learning as a determinant of entrepreneurial resilience.

The discussion explains that strengthening HRM strategies requires embedding organizational learning into daily agricultural practices. Structured learning cycles, digital knowledge platforms, and cross regional exchanges can help formalize knowledge sharing. The study indicates that without institutionalized learning processes, agricultural entrepreneurship will remain stagnant and vulnerable to external shocks. Therefore, the reinforcement of organizational learning becomes a central strategy for improving human resource quality and ensuring the sustainability of agricultural systems.

Table 2. Organizational Learning and Knowledge Sharing

Learning Dimension	Existing Pattern	Limitation	Effect on Entrepreneurship
Peer Learning	Informal & irregular	Not structured	Limited knowledge retention
Extension Support	Sporadic	Inconsistent access	Slow technological adoption
Institutional Partnerships	Present in few regions	Uneven distribution	Unequal learning quality
Digital Learning Tools	Minimal use	Limited digital access	Low innovation capacity
Knowledge Documentation	Rare	No formal system	Loss of organizational memory

Table 2 highlights the current patterns of organizational learning and knowledge sharing practices among agricultural groups. The results show that most learning activities occur informally through peer interactions rather than through structured, scheduled programs. This informal pattern often limits the depth and continuity of knowledge transfer, as information is usually shared only when problems arise. Extension support, although available, remains sporadic and inconsistent, causing significant variation in the learning experiences of agricultural entrepreneurs. These conditions suggest that organizational learning systems have not yet been institutionalized within the agricultural sector.

The table further shows that institutional partnerships such as collaborations with universities, cooperatives, or non governmental organizations exist only in certain regions, leading to unequal access to quality learning opportunities. In areas with strong institutional networks, knowledge sharing is more systematic and supported by regular training sessions, field demonstrations, and access to digital learning tools. However, in many communities, the use of digital platforms for learning remains minimal due to limited digital infrastructure and unfamiliarity with online resources. Additionally, knowledge documentation is rarely practiced, causing valuable insights and lessons learned to be lost over time.

These findings imply that organizational learning must be formalized and supported through structured mechanisms to enhance the capacity of agricultural entrepreneurs. Establishing regular learning cycles, improving digital learning access, and building stronger cross regional institutional partnerships are

essential steps in strengthening collective knowledge. A more systematic approach to knowledge sharing will not only improve individual competencies but also boost innovation, adaptability, and long term resilience in agricultural communities. Strengthening organizational learning represents a strategic component of HRM that directly contributes to sustainable agricultural entrepreneurship and food security.

3.3. Performance Management and Motivation Systems

Results indicate that performance management in agricultural enterprises is generally undeveloped, with most entrepreneurs lacking clear indicators to evaluate productivity, efficiency, and innovation. Respondents relied primarily on conventional performance markers such as yield quantity and short term profit margins, while neglecting more comprehensive indicators like resource efficiency, environmental impact, or long term business resilience. The absence of standardized performance frameworks leads to inconsistent management decisions, limited accountability, and challenges in identifying areas that require improvement. This condition demonstrates a need for structured HRM mechanisms to guide performance evaluation.

Motivation systems also showed significant variations among the respondents. Entrepreneurs with access to cooperative support, training incentives, or market guarantees reported higher levels of motivation and commitment to adopting improved practices. Conversely, those operating independently without institutional backing experienced lower motivation due to market uncertainty, financial risks, and lack of recognition. Social motivation factors such as community appreciation, family expectations, and peer support were influential but insufficient to drive sustained innovation. These findings highlight the necessity for structured incentive systems to support entrepreneurial engagement.

The discussion shows that the integration of performance management within HRM strategies can strengthen entrepreneurial decision making, align individual goals with organizational objectives, and promote sustainable farming behavior. Clearly defined performance indicators, combined with reward based motivation systems, can enhance accountability and encourage continuous improvement. The results confirm that effective performance management is not merely administrative but serves as a strategic tool to achieve sustainability and long term competitiveness in agricultural entrepreneurship.

Table 3. Performance Management and Motivation Systems

HRM Component	Current Practice	Weakness Identified	Strategic Need
Performance Indicators	Based on yield & profit only	Incomplete assessment	Integrated performance metrics
Monitoring System	Unstructured	Lack of consistency	Formal evaluation framework
Incentive Mechanisms	Limited & informal	Low motivation	Structured reward system
Goal Alignment	Individual-based	No organizational alignment	Shared objective setting
Feedback System	Rare & reactive	No continuous improvement	Regular performance review

Table 3 presents the current state of performance management and motivation systems within agricultural enterprises. The results indicate that most entrepreneurs rely on basic performance indicators such as yield quantity and short term profit margins, without incorporating broader metrics related to resource efficiency, environmental sustainability, or organizational resilience. The monitoring processes used are generally informal and unstructured, which leads to inconsistencies in evaluating progress or identifying areas that require improvement. This lack of systematic performance management reflects the limited integration of HRM practices within agricultural settings.

The weaknesses identified such as the absence of clear indicators, limited incentive mechanisms, and poor alignment between individual goals and organizational objectives significantly affect both productivity and motivation. Entrepreneurs who work without supportive structures or feedback systems often experience uncertainty in planning and difficulty in sustaining improvements. The table also suggests that motivational practices remain largely informal, relying on personal or social motivation rather than structured reward systems. As a result, commitment to innovation and long term investment in sustainable practices tends to fluctuate depending on external pressures, market conditions, and individual confidence levels.

The implications of these findings underscore the need for a more comprehensive HRM framework that incorporates formal performance evaluation and well designed motivation strategies. Establishing measurable performance indicators, creating consistent monitoring systems, and implementing incentive schemes can enhance accountability, encourage innovation, and strengthen organizational discipline. A structured approach to motivation both financial and non financial can further improve engagement and entrepreneurial drive. Strengthening performance management and motivation mechanisms is therefore essential for improving the operational effectiveness, competitive capacity, and long term sustainability of agricultural enterprises.

3.4. Digital Adoption and Innovation Practices

The study found that adoption of digital tools remains uneven across agricultural entrepreneurs. While some respondents actively used mobile applications for

market information, weather monitoring, and input sourcing, a significant portion had little or no engagement with digital technologies. Factors such as age, education level, and access to infrastructure strongly affected digital adoption. Entrepreneurs with higher digital literacy experienced improved efficiency, reduced transaction costs, and increased market responsiveness, demonstrating tangible benefits from technological integration.

Innovation practices also varied, with some respondents experimenting with sustainable techniques such as precision farming, organic inputs, or diversified production models. However, adoption remained limited by financial constraints, lack of training, and risk aversion. Many entrepreneurs expressed concerns about the costs and uncertainties associated with new technologies. These barriers highlight structural challenges that prevent widespread innovation adoption despite potential economic and ecological advantages. Digital transformation and innovation thus remain aspirational for many agricultural communities.

The discussion shows that strengthening HRM strategies must include digital training, technology mentoring, and support systems to reduce perceived risks. A human centered digital transformation approach can empower entrepreneurs to incorporate innovations effectively and sustainably. The results emphasize that technological adoption is not solely technical but requires behavioral readiness, financial support, and organizational facilitation to ensure meaningful impact on food security.

Table 4. Digital Adoption and Innovation Practices

Innovation Area	Adoption Level	Barrier	Potential Benefit
Mobile Apps for Market Info	Moderate	Low digital skills	Better price negotiation
Weather & Climate Tools	Low	Limited access	Improved risk management
Precision Farming	Very Low	High investment cost	Higher efficiency
Organic/Sustainable Inputs	Moderate	Limited knowledge	Improved soil health
Product Diversification	Low Moderate	Risk aversion	Higher profitability

Table 4 presents the level of digital adoption and innovation practices among agricultural entrepreneurs, showing significant variation across different technological aspects. The results indicate that while some entrepreneurs have begun using mobile applications for market information, many remain unfamiliar with digital tools that support planning and operational decision making. Adoption of weather and climate tools is particularly low due to limited access and technical understanding, which weakens the ability to anticipate production risks. Precision farming technologies show the lowest adoption rate, mainly because of their high investment costs and lack of training, creating a substantial barrier for small scale producers.

Innovation practices also display uneven patterns. Although a number of respondents have experimented with sustainable agricultural inputs, organic methods, or diversified production models, these efforts are not widespread. The table reveals that risk aversion, financial constraints, and insufficient technical support remain the primary barriers to broader innovation adoption. Many entrepreneurs are hesitant to adopt new technologies due to uncertainties about returns, operational adjustments, and the potential impact on existing farming routines. This hesitation prevents the full optimization of practices that could improve efficiency, reduce environmental impact, and enhance long term sustainability.

The findings emphasize that strengthening HRM strategies must include digital capacity development and innovation oriented support systems. Providing targeted digital training, facilitating access to technological infrastructure, and offering mentoring for innovation can help entrepreneurs overcome psychological and resource based barriers. The table highlights the potential benefits such as improved efficiency, increased profitability, and better risk management if digital and innovative practices are adopted more widely. Integrating digital transformation into HRM frameworks is therefore essential for enabling agricultural entrepreneurs to compete in modern agri food value chains and contribute effectively to sustainable food security.

3.5. HRM Strategic Implications for Food Security

The results demonstrate that HRM strategies significantly influence the resilience, adaptability, and sustainability of agricultural entrepreneurship. Respondents who had access to structured training, performance systems, and organizational learning mechanisms showed stronger competencies, higher innovation capacity, and improved business performance. Their agricultural activities also exhibited greater alignment with sustainable practices such as resource efficiency, diversification, and climate responsive decision making. This finding highlights the interconnectedness between HR quality and sustainable food system outcomes.

Moreover, HRM strategies were shown to enhance entrepreneurial resilience by improving problem solving skills, strategic thinking, and adaptive behavior. These capabilities allowed entrepreneurs to navigate market fluctuations, production risks, and environmental uncertainties more effectively. Where HRM interventions were absent, agricultural activities tended to rely on traditional methods, limiting

productivity and exposing farmers to greater vulnerability. Thus, systematic HR development emerges as a core requirement for strengthening food security through improved agricultural entrepreneurship.

The discussion highlights that HRM should be integrated into agricultural development policies, institutional programs, and community based initiatives. Strengthening HRM strategies contributes not only to individual entrepreneur success but also to broader systems supporting sustainable food production. The study concludes that sustainable food security can only be achieved when human resources are equipped with the competencies, motivation, and organizational support necessary to drive innovation, resilience, and long term agricultural transformation.

Table 5. HRM Strategic Implications for Food Security

HRM Strategy	Effect on Entrepreneur	Contribution to Food Security	Priority Level
Competency Development	Increases skills & readiness	Enhances productivity	High
Learning System Integration	Builds adaptability	Supports innovation	High
Performance Management	Improves decision making	Ensures efficiency	Moderate High
Motivation & Incentives	Strengthens engagement	Stabilizes production	Moderate
Digital Transformation Support	Expands market reach	Improves food distribution	High

Table 5 summarizes the strategic implications of various HRM components for strengthening agricultural entrepreneurship and supporting sustainable food security. The results indicate that competency development holds the highest priority, as enhanced skills directly contribute to improved productivity, better resource management, and stronger adaptability. Learning system integration is also categorized as a high priority strategy, given its central role in fostering innovation, facilitating knowledge exchange, and strengthening problem solving capabilities within agricultural communities. These strategies collectively enhance the capacity of entrepreneurs to navigate complex agricultural environments.

The table also highlights the importance of performance management and motivation mechanisms. Although these components receive moderate high priority, they play a crucial role in aligning individual goals with organizational objectives, promoting consistency in production, and encouraging continuous improvement. Motivation and incentive systems help stabilize entrepreneurial commitment, especially in contexts where market fluctuations, production risks, and uncertainty can reduce enthusiasm for adopting sustainable practices. When paired with structured performance indicators, these systems contribute to more efficient operations and stronger business resilience.

The final column of the table underscores the relevance of digital transformation support as a high priority HRM strategy. Digital skills and access to technology are increasingly essential for market integration, efficient production, and accurate decision making. Ensuring that entrepreneurs are capable of using digital tools allows for greater transparency, enhanced market reach, and improved distribution processes all of which are central to achieving sustainable food security. Overall, the strategic implications demonstrated in the table affirm that HRM is not merely an administrative function but a foundational driver of agricultural transformation, innovation, and long term stability in the food system.

4. Conclusion

The findings of this study show that strengthening human resource management is essential for improving the competencies, adaptability, and innovation capacity of agricultural entrepreneurs, which in turn contributes to sustainable food security. The results confirm that competency development, structured learning systems, performance management, motivational mechanisms, and digital transformation support are key elements that influence entrepreneurial readiness and resilience. These insights can be applied by policymakers, agricultural institutions, and development organizations to design more targeted training programs, integrate digital learning tools, and develop inclusive HRM frameworks that support long-term agricultural transformation. The implications extend to enhancing productivity, stabilizing market participation, and increasing the ability of entrepreneurs to manage risks in dynamic environments. Future research may explore the specific impacts of different HRM interventions across diverse agricultural regions, examine technological readiness at a deeper behavioral level, or test HRM based models using broader empirical datasets to validate their effectiveness.

References

[1] Kalhor, P. E, Abadi, M. O. N., & Mirdamadi, M. (2022). Study of agricultural entrepreneurship competencies on food security of rural households in Mahidasht district of Kermanshah province. *Journal of Entrepreneurial Strategies in Agriculture, 9*(17), 15–25. https://doi.org/10.52547/jea.9.17.15

[2] Alonso, E. B., Cockx, L., & Swinnen, J. (2018). Culture and food security. *Global Food Security, 17*, 113–127. https://doi.org/10.1016/j.gfs.2018.02.002

[3] Burchi, F., & De Muro, P. (2016). From food availability to nutritional capabilities: Advancing food security analysis. *Food Policy, 60,* 10–19. https://doi.org/10.1016/j.foodpol.2015.03.008

[4] Williams, T. O. (2015). Reconciling food and water security objectives of MENA and sub-Saharan Africa: Is there a role

for large-scale agricultural investments? *Food Security, 7*(6), 1199–1209. https://doi.org/10.1007/s12571-015-0508-z

[5] Yao, H., Alhussam, I., Risha, O. A., & Memon, B. A. (2020). Analyzing the relationship between agricultural FDI and food security: Evidence from Belt and Road countries. *Sustainability, 12*(7), 2906. https://doi.org/10.3390/su12072906

[6] Ahmad, N. H., Suseno, Y., Seet, P. S., Susomrith, P., & Rashid, Z. (2018). Entrepreneurial competencies and firm performance in emerging economies: A study of women entrepreneurs in Malaysia. In V. Ratten, V. Braga, & C. *S. Marques (Eds.), Knowledge, learning and innovation* (pp. 5–26). Springer. https://doi.org/10.1007/978-3-319-59282-4_2

[7] Aidara, S., Al Mamun, A., Nasir, N. A. M., Mohiuddin, M., Nawi, N. C., & Zainol, N. R. (2021). Competitive advantages of the relationship between entrepreneurial competencies and economic sustainability performance. *Sustainability, 13*(2), 864. https://doi.org/10.3390/su13020864

[8] Al Mamun, A., Fazal, S. A., & Zainol, N. R. (2019). Economic vulnerability, entrepreneurial competencies, and performance of informal micro enterprises. *Journal of Poverty, 23*(8), 415–436. https://doi.org/10.1080/10875549.2019.1587676

[9] Nagler, P., & Naudé, W. (2017). Non-farm entrepreneurship in rural Sub-Saharan Africa: New empirical evidence. *Food Policy, 67*, 175–191. https://doi.org/10.1016/j.foodpol.2016.09.019

[10] Sinyolo, S., & Simatele, M. D. (2018). The impact of entrepreneurial competencies on household food security among smallholder farmers in KwaZulu-Natal, South Africa. *Ecology of Food and Nutrition, 57*(2), 71–93. https://doi.org/10.1080/03670244.2017.1416361

[11] Hart, J., Miljkovic, D., & Shaik, S. (2015). The impact of trade openness on technical efficiency in the agricultural sector of the European Union. *Applied Economics, 47*(12), 1230–1247. https://doi.org/10.1080/00036846.2014.993134

[12] Jiang, X., Chen, Y., & Wang, L. (2019). Can China's agricultural FDI in developing countries achieve a win-win goal? Enlightenment from the literature. *Sustainability, 11*(1), 41. https://doi.org/10.3390/su11010041

[13] Khan, E. A., & Quaddus, M. (2020). Financial bootstrapping of informal micro-entrepreneurs in the financial environment: A moderated mediation analysis. *International Journal of Sociology and Social Policy, 40*(11/12), 1533–1550. https://doi.org/10.1108/IJSSP-07-2019-0138

[14] Rasmussen, E., Mosey, S., & Wright, M. (2011). The evolution of entrepreneurial competencies: A longitudinal study of university spin-off venture emergence. *Journal of Management Studies, 48*(6), 1314–1345. https://doi.org/10.1111/j.1467-6486.2010.00995.x

[15] Sánchez, J. C. (2013). The impact of an entrepreneurship education program on entrepreneurial competencies and intention. *Journal of Small Business Management, 51*(3), 447–465. https://doi.org/10.1111/jsbm.12025

[16] Moghadam, A. T., Mazlan, N. S., Chin, L., & Ibrahim, S. (2019). Mergers and acquisitions and Greenfield foreign direct investment in selected ASEAN countries. *Journal of Economic Integration, 34*(4), 746–765. https://doi.org/10.11130/jei.2019.34.4.746

[17] Raymond, J., Kassim, N., Rose, J. W., & Agaba, M. (2018). Context-specific food-based approach for ensuring nutrition security in developing countries: A review. *International Journal of Food Sciences and Nutrition, 69*(4), 410–416. https://doi.org/10.1080/09637486.2017.1373751