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Innovative Management in Agricultural Human Resource Development Based on Adaptive Management in Gowa Regency: Promoting Agricultural Downstream Development

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Abstract

The objective of this study is to analyze innovative management based on adaptive management to strengthen agricultural human resource capacity, enhance farmers' capacity for downstream processing and value addition, and promote farmers' economic self-reliance in Gowa Regency. This study employed a qualitative research method using a case study approach. Data were collected through interviews, observations, and documentation, and analyzed using NVivo 12 Plus through transcription, coding, and thematic categorization. The findings indicate that innovative management based on adaptive management plays an important role in strengthening agricultural human resource capacity through five key strategies: competency development and mentoring, technology adoption and innovation, production and risk management, network development and market orientation, and monitoring, evaluation, and adaptive learning. This approach enables farmers to adapt to changes in technology, environmental conditions, risks, and market dynamics while enhancing their capacity for processing, packaging, marketing, and value creation. However, its effectiveness remains constrained by limited technical and managerial capacity, restricted access to capital and technology, price fluctuations, weak inter-actor coordination, and inadequate continuous monitoring and evaluation. Therefore, adaptive management should be developed as a collaborative governance mechanism that integrates human resource capacity, technology, institutions, financing, markets, and continuous learning to support agricultural downstream development and farmers' economic self-reliance.

Keywords: *Innovative Management; Adaptive Management; Product Downstreaming; Agricultural Downstream Development; Farmers*

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PENDAHULUAN

The background of this study arises from the challenges of agricultural human resource (HR) development in Gowa Regency, which continues to face limitations in technical skills, innovation, and the capacity for agricultural product downstreaming (Tajuddin, 2024). The agricultural sector serves as the backbone of the local economy; however, the productivity and value-added of agricultural products remain low due to weak innovative management practices and limited human resource capacity (Arsyad et al., 2021). Enhancing farmers' competencies, technological mastery

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(Ouassanouan et al., 2022), and capabilities in managing downstream value chains is essential for promoting productivity (Marrero et al., 2022), economic value creation (Waha et al., 2018), and sustainable local self-reliance (Tscharntke et al., 2012). Therefore, this study aims to explore an innovative management model based on *adaptive management* that can strengthen agricultural human resource capacity while simultaneously promoting the downstream development of agricultural products in Gowa Regency.

Several studies have demonstrated that improving agricultural human resource competencies through training (Lal et al., 2002), mentoring (Ketterings, 2014), and technology transfer significantly enhances productivity and innovation in the agricultural sector (Farrié et al., 2015). Other studies emphasize the importance of *adaptive management* in agricultural resource management (Thomann et al., 2020), where flexibility and the ability to adapt to environmental changes (Ayambire & Pittman, 2021), market dynamics (Wang et al., 2022), and policy developments are critical factors for program success (J. Chen et al., 2023). Additional literature highlights the role of cross-sector collaboration, including government agencies, research institutions, and the private sector, in supporting agricultural downstream development and increasing product value addition (Bhattacharya & Mondal, 2025).

Previous research has also revealed that the development of innovative management can enhance farmers' capabilities in production planning (Sun et al., 2023), risk management (Hryvkivska et al., 2024), and the implementation of efficient modern agricultural practices (Iftikhar et al., 2025). However, studies that specifically integrate *adaptive management* with human resource capacity building and agricultural downstream development remain limited (Kone et al., 2017), highlighting the need for a systematic investigation to develop an innovative management model that is both relevant and applicable (Reznik et al., 2026). Other studies also emphasize the importance of data-driven evaluation and field-based practices to tailor interventions to local conditions. An *adaptive management* approach enables continuous adjustments to training strategies, technological innovations, and product downstreaming processes in response to market dynamics and farmers' needs, thereby fostering sustainability and local economic self-reliance (C. Chen et al., 2024).

The problem-solving approach adopted in this study is based on an *adaptive management* framework that integrates agricultural human resource capacity development, the implementation of downstream agricultural practices, and innovative management strategies. This approach emphasizes intensive training, mentoring, and technical assistance for farmers, as well as the provision of modules and guidelines based on best practices. It also incorporates data-driven monitoring and evaluation to ensure that interventions are aligned with local conditions, farmers' needs, and market dynamics. Accordingly, this study is expected to generate an innovative management model that is responsive, sustainable, and replicable across various agricultural regions.

Although several studies have discussed agricultural human resource development and agricultural downstreaming, the **state of the art** of this research

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indicates that the systematic integration of *adaptive management* into agricultural human resource capacity strengthening remains limited.

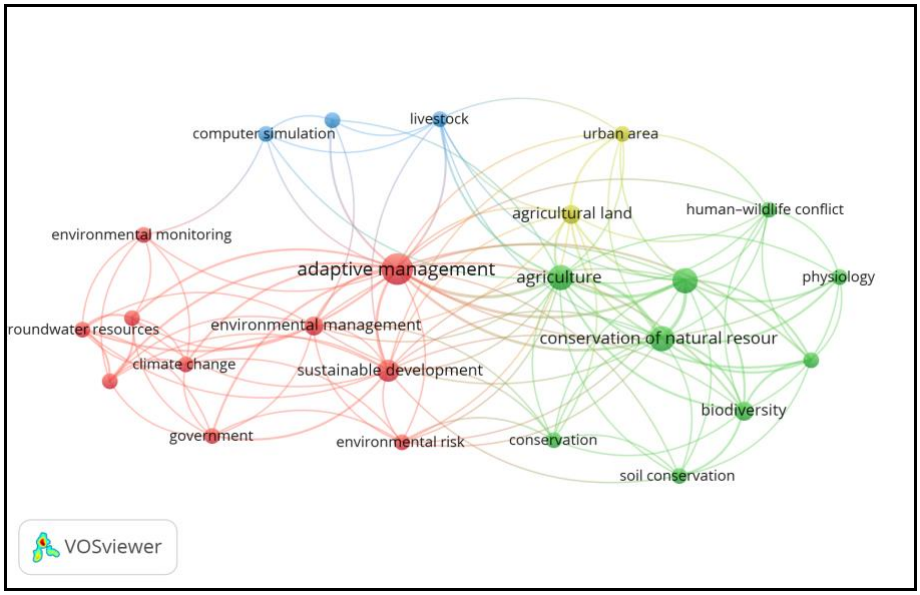


Figure 1. Research Gap and Novelty

The novelty of this study lies in the implementation of an innovative management model that simultaneously integrates training, mentoring, and product downstream development, supported by data-driven monitoring and adaptive adjustments to local conditions. This approach offers an innovative solution capable of sustainably improving productivity, value creation, and farmers' self-reliance. The research questions addressed in this study are: (a) What forms and strategies of innovative management based on adaptive management can enhance agricultural human resource capacity in Gowa Regency? (b) To what extent does the implementation of adaptive management influence farmers' capabilities in agricultural product downstream development and value addition? and (c) What supporting and inhibiting factors affect the effectiveness of implementing this innovative management model? The urgency of this study lies in the need to strengthen agricultural human resource capacity as a key driver of local economic development and agricultural sector self-sufficiency.

This study aims to comprehensively analyze the implementation of an innovative management model based on adaptive management for agricultural human resource development in Gowa Regency, particularly in enhancing technical competencies, innovation capacity, technological proficiency, and farmers' ability to manage production processes through to agricultural product downstream development. Furthermore, the study seeks to examine the extent to which the adaptive management approach can strengthen farmers' capacity to increase product value through training strategies, mentoring, technical assistance, technology adoption, and value chain management tailored to local needs and market dynamics. The study also aims to identify the supporting and constraining factors affecting the

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implementation of innovative management, including aspects related to human resource capacity, technology, institutional arrangements, market access, policy support, and collaboration among government agencies, farmers, research institutions, and the private sector. Ultimately, this research is expected to produce an innovative management model that is adaptive, responsive, practical, and sustainable in strengthening agricultural human resources, improving productivity and product economic value, and promoting farmers' economic self-reliance in Gowa Regency.

METHODOLOGY

This study employed a qualitative research design using a case study approach in Gowa Regency. Data collection techniques included in-depth interviews with farmers, farmer group administrators, agricultural extension officers, and officials from the agricultural department; participant observation of training activities and agricultural product downstreaming initiatives; documentation of activity reports, training modules, and mentoring records; as well as *Focus Group Discussions* (FGDs) involving farmers, extension officers, and relevant stakeholders. This approach enabled a contextual understanding of actual practices and conditions in the field.

Key informants consisted of farmers, farmer group administrators, agricultural extension officers, and officials from the agricultural department. The documentation collected included training modules, activity reports, evaluation records, and recordings of FGDs and interviews. Data were analyzed using NVivo 12 Plus through several stages, namely transcription, initial coding, category development, analysis of relationships among categories, and thematic synthesis. Validation was conducted through source triangulation to ensure the credibility and consistency of the findings.

Informants were selected purposively based on their involvement, experience, and knowledge regarding agricultural human resource capacity development, the implementation of *adaptive management*, and the process of agricultural product downstreaming in Gowa Regency. Semi-structured interviews were conducted to enable the researcher to explore informants' experiences in depth while providing opportunities for the emergence of new information related to training strategies, mentoring, innovation implementation, adaptation to change, and agricultural value-added development. Observations were undertaken to identify actual practices occurring in the field, particularly regarding the application of training outcomes, interactions between farmers and extension officers, technology utilization, and the management and development of agricultural products.

The analytical process was conducted iteratively by linking empirical data with the concepts of *adaptive management* and innovative management. Findings from interviews, observations, FGDs, and documentation were compared to identify both

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consistent patterns and differences in perspectives among informants. The analysis then focused on the development of major themes, including competency enhancement, mentoring, innovation and technology, production management, market orientation, and adaptive monitoring and learning. The final stage involved interpreting the relationships among these themes to formulate an innovative management model based on *adaptive management* that is contextual and relevant to the needs of agricultural human resource development and agricultural downstreaming in Gowa Regency.

RESULT AND DISCUSSION

Innovative Management Strategies Based on Adaptive Management for Strengthening Agricultural Human Resource Capacity

Strengthening agricultural human resource capacity in Gowa Regency requires management strategies that are not only oriented toward enhancing technical skills but are also capable of adapting farmer development programs to technological changes, market demands, environmental conditions, and policy dynamics. The *adaptive management* approach is particularly relevant because it enables training, mentoring, innovation, and evaluation processes to be implemented flexibly in accordance with farmers' needs and field-based experiences. Based on the results of the study, these strategies can be mapped into several key aspects as follows.

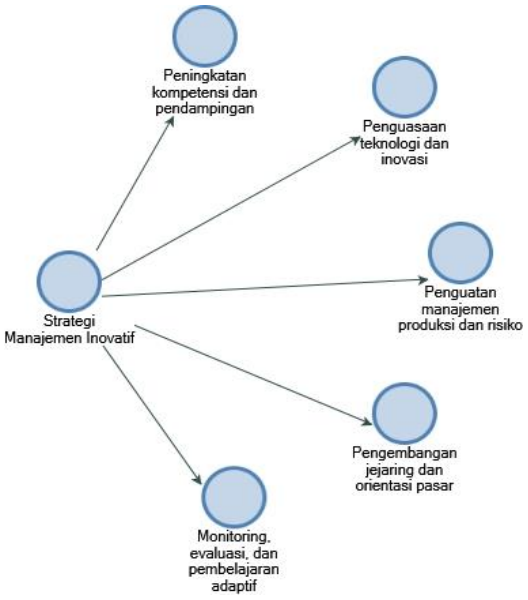


Figure 2. Innovative Management Strategies Based on Adaptive Management for Strengthening Agricultural Human Resource Capacity in Gowa Regency

The innovative management strategy based on *adaptive management* demonstrates that strengthening agricultural human resources cannot be achieved through a single form of intervention but requires an integrated and sustainable approach. Five key strategies were identified, namely competency enhancement and mentoring, technology mastery and innovation, strengthening

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production and risk management, network development and market orientation, as well as monitoring, evaluation, and adaptive learning. These five strategies are interrelated because improvements in farmers' skills need to be supported by technology, managerial capabilities, market access, and learning mechanisms that enable strategies to be continuously adjusted to changes in agricultural conditions.

The first strategy, competency enhancement and mentoring, serves as the primary foundation for strengthening agricultural human resource capacity. Technical training provides farmers with fundamental knowledge and skills, while mentoring and assistance enable such knowledge to be translated into actual practice. This approach is essential because farmers' capabilities are determined not only by the knowledge acquired through training but also by their ability to apply, evaluate, and improve practices based on field experiences. The principles of *adaptive management* are reflected in the adjustment of training materials and methods according to farmers' needs, experiences, and challenges.

The second strategy, technology mastery and innovation, indicates that human resource development should focus on farmers' ability to respond to advancements in agricultural technology. The use of production technologies, information technologies, and digital marketing tools can help farmers improve efficiency, access market information, and expand their consumer reach. However, technology adoption cannot be implemented uniformly because the capabilities, infrastructure availability, and needs of farmer groups vary considerably. Therefore, an adaptive approach is required to ensure that introduced technologies are compatible with local conditions and can be utilized sustainably.

Furthermore, strengthening production and risk management highlights a shift in farmers' roles from production operators to agricultural business managers. The ability to develop production plans, manage inputs, calculate costs, and identify risks is increasingly important in addressing uncertainties related to production and markets. Weather fluctuations, price volatility, input constraints, and policy changes can all affect the success of agricultural enterprises. From an *adaptive management* perspective, production strategies should not be treated as fixed decisions but rather as approaches that require continuous evaluation and adjustment in response to changing circumstances.

The fourth strategy, network development and market orientation, demonstrates that strengthening agricultural human resources also requires institutional support and relationships with actors beyond farmer groups. Collaboration among farmers, government agencies, research institutions, agricultural extension officers, private-sector organizations, and market actors can provide access to knowledge, technology, financing, and marketing opportunities. Such networks also enhance farmers' capacity to understand market requirements and align production with demand. Consequently, *adaptive management* operates not

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only at the individual farmer level but also through institutional capacities to build relationships and respond to changes in the external environment.

The fifth strategy, monitoring, evaluation, and adaptive learning, functions as the mechanism linking all previous strategies. Monitoring enables program implementers to assess the progress of farmers' capacity development and program effectiveness, while evaluation provides a basis for determining which aspects should be maintained, improved, or modified. This process creates a *learning-by-doing*pattern in which implementation experiences become a source of learning for improving future interventions. Therefore, program success is measured not only by the achievement of initial targets but also by the program's capacity to learn from implementation outcomes and continuously adapt its strategies.

These five strategies further demonstrate that *adaptive management* possesses a cyclical character. Competency enhancement generates new capabilities, which encourage the adoption of technology and innovation. These capabilities are subsequently reinforced through production and risk management as well as market networking. The results of implementation are then monitored and evaluated to generate new insights that can be used to refine training, technological applications, and production strategies. This cycle enables human resource development to remain dynamic, extending beyond training activities to become a continuous process of learning and innovation.

Overall, the findings of this study indicate that innovative management based on *adaptive management* can be understood as an approach to human resource development that integrates competencies, technology, management, networking, and continuous learning. The primary advantage of this approach lies in its ability to tailor interventions to farmers' needs and changes in the agricultural environment, ensuring that capacity development remains neither uniform nor static. The integrated implementation of these five strategies can strengthen farmers' capabilities in managing production, addressing risks, utilizing innovations, responding to market opportunities, and ultimately enhancing their capacity for agricultural downstream development and value creation.

Implementation of Adaptive Management in Agricultural Downstream Development and Value Addition

The implementation of *adaptive management* in agricultural product downstream development in Gowa Regency demonstrates that enhancing farmers' capacity should not stop at the ability to produce primary commodities. Instead, it should be directed toward strengthening their capabilities in processing, packaging, marketing, and developing products according to market needs. This approach enables farmers to adjust downstream development processes based on production conditions, raw material availability, changing consumer demand, market prices, and available technological capacities. Consequently, *adaptive management* provides a

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framework that enables gradual and responsive value-added development based on local conditions.

The influence of *adaptive management* is evident in changes in farmers' perspectives regarding agricultural outputs. Agricultural products are no longer viewed solely as commodities to be sold in fresh or raw forms but increasingly as resources that can be processed into products with higher economic value. This process includes simple processing activities, packaging improvements, product diversification, and the development of marketing strategies. Such capabilities indicate that downstream development is not merely a technical process of agricultural processing but also a process of strengthening farmers' managerial and entrepreneurial capacities.

In the context of Gowa Regency, the ability to engage in downstream development is strongly influenced by farmers' capacity to recognize market opportunities. *Adaptive management* enables production and processing strategies to be adjusted according to shifts in consumer demand. When demand for a particular product increases, farmers can modify production volumes and processing methods accordingly. Conversely, when prices or demand decline, strategies can be redirected toward product diversification or changes in marketing channels. This pattern illustrates that adaptability is a critical factor in reducing farmers' dependence on the sale of primary products, which generally provide limited value addition.

The application of an adaptive approach also strengthens farmers' ability to innovate. Innovation does not necessarily require sophisticated technologies; it can be achieved through modifications in processing techniques, packaging designs, product quality, product sizes, diversification of processed products, and marketing methods. The gradual nature of innovation allows farmers to learn from both experience and market responses. Consequently, failures or limitations associated with a particular product do not necessarily signify the end of the downstreaming process but can instead serve as valuable information for product improvement in subsequent stages.

Another important aspect is continuous mentoring and learning. Farmers' downstreaming capabilities require support from agricultural extension officers, farmer groups, local governments, and other actors possessing expertise in processing and marketing technologies. Through mentoring activities, farmers can acquire knowledge related to production standards, packaging, quality assurance, business record-keeping, and marketing strategies. From the perspective of *adaptive management*, mentoring should not be implemented uniformly but should be tailored to the capacities and needs of each farmer group, thereby making the capacity-building process more contextual and effective.

The implementation of *adaptive management* also influences farmers' ability to develop longer agricultural value chains. Farmers who possess processing and marketing capabilities have greater opportunities to capture a larger share of

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economic value than those who only sell raw agricultural products. However, increasing value addition depends not only on processing capabilities but also on access to markets, supporting materials, technology, financing, and distribution networks. Therefore, downstream development should be viewed as an institutional process involving multiple stakeholders rather than as the sole responsibility of individual farmers.

From a sustainability perspective, the *adaptive management* approach enables downstream development processes to be continuously evaluated based on outcomes and changing local conditions. Monitoring of production costs, product quality, consumer acceptance, sales volume, and profitability can be used to determine whether a strategy should be continued, improved, or replaced. This mechanism creates a learning cycle that strengthens farmers' capacity to make decisions based on experience and information. Thus, *adaptive management*contributes not only to short-term value addition but also to the development of farmers' long-term capacity to manage and expand their enterprises independently.

Overall, the implementation of *adaptive management* in Gowa Regency can be considered influential in strengthening farmers' capacity to move from primary production toward processing and value creation, particularly through improvements in adaptability, innovation, learning, market orientation, and business management. However, these impacts will be optimized only when supported by access to technology, continuous mentoring, strong farmer-group institutions, access to financing, processing infrastructure, and adequate marketing networks. Therefore, *adaptive management* should not be viewed merely as a program management method but also as a learning mechanism that enables farmers in Gowa Regency to gradually enhance their downstreaming capacity, strengthen their position within agricultural value chains, and sustainably increase the economic value of agricultural products.

Supporting and Inhibiting Factors in the Implementation of Innovative Management Based on Adaptive Management

The implementation of innovative management based on *adaptive management* in strengthening agricultural human resources and promoting agricultural downstream development in Gowa Regency is influenced by both farmers' internal conditions and external factors related to institutions, technology, markets, and policies. Supporting factors create opportunities for farmers to adapt, innovate, and develop product value addition, whereas inhibiting factors may limit farmers' ability to sustainably apply new knowledge, technologies, and strategies.

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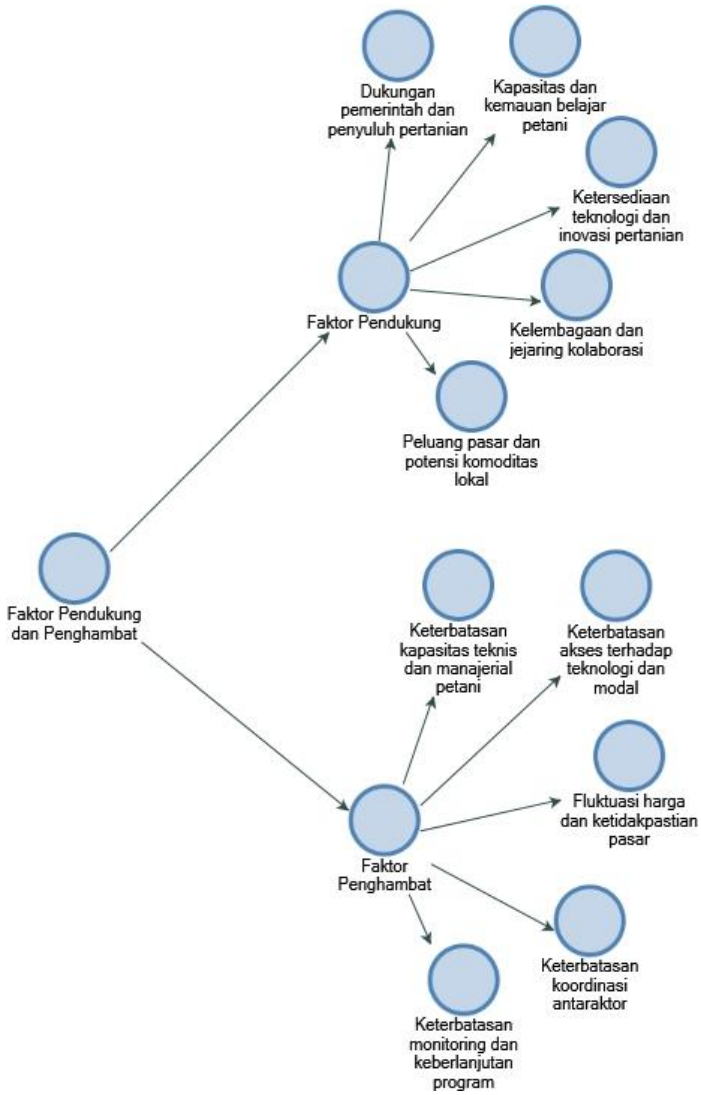


Figure 3. Supporting and Inhibiting Factors in the Implementation of Innovative Management Based on Adaptive Management in Gowa Regency

Based on these findings, the implementation of innovative management based on *adaptive management* in Gowa Regency is influenced by the interaction among farmers' capacities, institutional support, access to technology, market conditions, and program sustainability. Supporting factors indicate that the agricultural human resource development ecosystem already possesses several important assets; however, inhibiting factors reveal that these assets have not yet been fully integrated into an adaptive innovation system. Therefore, the primary challenge lies not merely in the availability of programs but in the ability to integrate various resources in a manner that generates sustainable capacity development and value creation.

Government support and agricultural extension services constitute the most fundamental supporting factors, as government institutions hold strategic roles in providing policies, programs, facilities, and technical assistance. In the context of Gowa Regency, agricultural extension officers serve as a bridge between technical knowledge and farmers' actual needs. However, the effectiveness of such support

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depends heavily on the mentoring approach employed. The *adaptive management* approach requires extension activities to go beyond simple information transfer and evolve into processes of dialogue, experimentation, evaluation, and adjustment based on farmers' experiences. Consequently, program success is determined more by extension officers' ability to understand farmers' specific challenges than merely by the number of training sessions conducted.

Farmers' capacity and willingness to learn represent internal factors that determine the sustainability of innovation. Farmers who are willing to experiment with technology, evaluate production outcomes, and make changes based on experience possess stronger adaptive capacities in responding to environmental and market changes. This is particularly important because *adaptive management* fundamentally places learning at the core of management processes. However, willingness to learn must be supported by opportunities for experimentation and adequate mentoring. Without such support, innovation risks remaining at the knowledge stage and may fail to develop into actual changes in production practices and downstream development activities.

Technology and agricultural innovation also occupy a strategic position, as they can expand farmers' capabilities beyond production toward business management and marketing. Production technologies can enhance efficiency, while information technologies and digital marketing facilitate access to price information, consumers, and markets. Nevertheless, technology does not automatically generate innovation if it is incompatible with users' capacities and local conditions. Therefore, the principle of adaptation must be applied in technology selection by considering farmers' capabilities, costs, infrastructure availability, and economic benefits. An approach that focuses excessively on technology introduction without considering user readiness may instead result in dependency or low adoption rates.

Institutional arrangements and collaborative networks are additional supporting factors that expand individual farmers' capacities. Farmer groups, cooperatives, government agencies, universities, research institutions, and private-sector organizations can provide resources that individual farmers may not be able to access independently, including knowledge, technology, financing, processing facilities, and market access. In the context of downstream development, these networks become increasingly important because value addition requires strong linkages among production, processing, distribution, and marketing activities. Therefore, *adaptive management* should be understood as an institutional process that enables various actors to share information, learn collectively, and adjust interventions in response to changing needs within the agricultural sector.

On the other hand, limitations in technical and managerial capacities, as well as restricted access to technology and capital, constitute structural barriers that may reduce the effectiveness of innovation initiatives. Farmers' production capabilities are not necessarily accompanied by competencies in financial record-keeping,

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business planning, product development, packaging, and marketing. This situation becomes more complex when farmers are required to bear investment costs associated with technology adoption and processing activities. As a consequence, farmers tend to adopt safer strategies, namely selling products in their primary form despite generating lower value addition. This finding suggests that agricultural human resource development should be accompanied by improved access to capital, technology, and supporting infrastructure.

Price fluctuations, market uncertainty, and weak coordination among stakeholders further increase the risks associated with innovation implementation. When commodity prices change rapidly or market access remains uncertain, farmers have fewer incentives to invest in downstream development processes that require additional time and resources. At the same time, inadequate coordination may result in training programs, technological assistance, mentoring activities, and marketing interventions operating independently from one another. This situation highlights a gap between program design and the actual needs of the agricultural system as a whole. From an *adaptive management* perspective, information regarding market changes should serve as the basis for adjusting production programs, technology adoption, training activities, and downstream development strategies in an integrated manner.

The final barrier is the weakness of monitoring, evaluation, and program sustainability mechanisms, which constitutes a significant concern because *adaptive management* relies on continuous learning cycles. Programs should not be assessed solely based on the number of training participants or the quantity of assistance provided but should also be evaluated in terms of improvements in skills, innovation adoption rates, productivity growth, downstreaming capabilities, market access, and changes in the economic value received by farmers. If evaluation is conducted only at the end of a program, opportunities for corrective action during implementation become limited. Therefore, strengthening *adaptive management* in Gowa Regency should focus on developing systems that continuously integrate training, practice, monitoring, evaluation, learning, and policy adjustment. Substantively, these findings indicate that the greatest challenge is not the lack of innovation itself but rather the creation of an ecosystem capable of enabling innovation to be learned, adapted, implemented, and sustained by farmers over time.

CONCLUSION

The findings of this study demonstrate that innovative management based on *adaptive management* represents an important approach for strengthening agricultural human resource capacity in Gowa Regency. Farmer development cannot be achieved solely through one-way technical training but requires continuous processes of learning, mentoring, innovation, evaluation, and adaptation. Five principal strategies were identified: competency enhancement and mentoring,

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technology mastery and innovation, strengthening production and risk management, network development and market orientation, and monitoring, evaluation, and adaptive learning. These strategies form an interconnected cycle that enables farmers to adjust production practices in response to technological developments, environmental conditions, business risks, and market demands. The implementation of this approach also encourages a shift in farmers' orientation from merely producing primary commodities to managing agricultural enterprises capable of processing, packaging, diversifying, marketing, and creating value-added products. Consequently, *adaptive management* contributes to enhancing adaptive capacity, innovation, entrepreneurial orientation, and farmers' ability to move toward agricultural downstream development.

However, the study also found that the effectiveness of *adaptive management* is strongly influenced by the strength of the supporting ecosystem and the ability to overcome various structural constraints. Government support and agricultural extension services, farmers' willingness to learn, access to technology, farmer-group institutions, collaborative networks, and market opportunities constitute important assets for successful innovation and downstream development. Conversely, limitations in technical and managerial capacities, restricted access to capital and technology, price volatility, market uncertainty, weak stakeholder coordination, and insufficiently sustainable monitoring and evaluation systems remain major challenges. These findings emphasize that the challenge of agricultural human resource development in Gowa Regency does not primarily stem from a lack of programs or innovations, but rather from the incomplete integration of capacity building, technology, financing, institutions, markets, and policy learning. Therefore, *adaptive management* should be further developed as a governance mechanism that enables governments, extension officers, farmers, universities, private-sector organizations, and market actors to learn collectively, evaluate outcomes, and continuously adjust interventions, thereby ensuring the sustainable development of agricultural human resources and agricultural downstreaming activities.

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