

Strategic model for human resource development based on local wisdom in organic Gayo coffee cultivation in Central Aceh District, Indonesia



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ABSTRACT

Gayo coffee from Central Aceh Regency is internationally recognized for its unique taste and high quality, produced through organic cultivation rooted in local wisdom. However, the development of organic Gayo coffee faces significant challenges, particularly the low quality of farmers' human resources (HR) and the limited integration of traditional knowledge into sustainable agricultural strategies. This study analyzes the application of local wisdom in organic Gayo coffee cultivation, evaluates the quality of human resources in supporting sectoral sustainability, and proposes HR development strategies based on local values. Using a mixed-methods design with a sequential explanatory and exploratory approach, supported by SWOT and PRA analyses, data were collected from farmers, extension workers, traditional leaders, local government officials, and coffee industry actors. The findings show that despite limited education and technical skills, farmers possess strong local knowledge and cultural values that promote sustainable agriculture. The study recommends multi-level training, integration of local wisdom into extension activities, institutional capacity strengthening, and multi-stakeholder collaboration to improve human resource capacity and ensure the long-term sustainability of organic Gayo coffee cultivation.

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1. Introduction

Gayo coffee is one of the superior commodities originating from the highlands of Central Aceh, Aceh Province, which is known to have a distinctive taste and superior quality, so that it is able to build a very good reputation not only in the national market, but also in the international market as one of the best types of Arabica coffee that is in demand by coffee lovers in various parts of the world (Anhar et al., 2021; Fadli et al., 2025). The uniqueness of this coffee lies not only in its distinctive taste, which has a fragrant aroma, balanced acidity level, and a soft and complex aftertaste, but also in the organic cultivation system that has long been applied from generation to generation by local farmers in the Gayo highlands, where the planting process is carried out

without using synthetic chemicals and prioritizes the principles of environmental sustainability and local wisdom that maintains soil fertility and the sustainability of the surrounding natural ecosystem. (Fadhil et al., 2022; Solér et al., 2017).

The organic coffee farming system in Central Aceh is heavily influenced by local wisdom that has been passed down from generation to generation, where traditional practices such as natural selection of superior seeds, use of organic fertilizers from agricultural waste, and environmentally friendly pest control methods are still maintained to this day, reflecting the harmonious relationship between humans and nature and the commitment of the local community to preserving the environment while producing high-quality coffee that is recognized nationally and internationally (Arsyad, 2025).

Amidst the current of modernization and globalization, human resource (HR) management in the agricultural sector faces significant challenges, especially in efforts to maintain the sustainability of organic coffee cultivation practices based on local wisdom values (Koochafkan and Altieri, 2016). In the context of the development of modernization and the

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increasingly rapid flow of globalization, the agricultural sector, especially in the management of human resources (HR), is faced with a major challenge in maintaining the continuity of organic coffee cultivation practices based on local wisdom, because on the one hand the demands for efficiency and modern technology are increasing, while on the other hand the traditional values that are the main foundation of a sustainable agricultural system are at risk of being eroded if they are not preserved and wisely integrated into current agricultural practices (Karim et al., 2023), but agricultural modernization often ignores the values of sustainable local wisdom (Andari et al., 2023; Kurniawan et al., 2023).

The research gap lies in the limited number of studies that integrate participatory approaches into agricultural human resource development based on local wisdom, particularly in the context of Gayo coffee. Most previous research has focused more on the technical aspects of cultivation or market analysis. At the same time, few have explored how cultural values such as cooperation (gotong royong), village deliberation (musyawarah desa), and the principle of harmony with nature can be systematically adopted into farmer capacity-building strategies.

The novelty of this research lies in its approach to agricultural human resource development by integrating local wisdom from Gayo, where organic practices in Gayo coffee cultivation are enriched by cultural values such as cooperation (gotong royong), village deliberation (musyawarah desa), and the principle of harmony with nature. This strategy not only emphasizes the technical aspects of cultivation but also enhances farmers' capacity through a participatory approach based on Participatory Rural Appraisal (PRA), which actively involves local stakeholders such as traditional leaders.

According to the latest data from BPS and the Aceh Tengah Agriculture Service in 2023, the Aceh Tengah region shows enormous potential in the development of organic Gayo coffee. Currently, the area of land used for the cultivation of organic Gayo coffee reaches around 48,000 hectares, which is managed by approximately 80,000 farmers. The production level of this organic coffee is also relatively high, with an estimated harvest of around 65,000 tons each year. One of the key factors in the success of the development of organic Gayo coffee is the application of cultivation methods that refer to local wisdom, which has become an integral part of the local community's agricultural system. Based on the results of a field survey in 2025, around 72% of farmers were known to have integrated traditional principles passed down from generation to generation into their coffee cultivation practices. However, the quality of human resources is still a challenge, considering that the level of education of farmers is relatively low, with 40% only completing elementary school (SD), 30% educated up to junior high school level, 20% high school graduates, and only 10% who managed to complete education up to college level. Although organic Gayo coffee from

Central Aceh has succeeded in building an international reputation for its superior quality and the implementation of a sustainable, local wisdom-based cultivation system, human resource (HR) management in this sector still faces serious challenges. Amidst the currents of modernization and globalization, local wisdom values that are the main foundation of the sustainability of traditional agriculture are at risk of being marginalized if not adaptively integrated into modern agricultural practices. In addition, the low level of education of farmers—where most only have primary to secondary education—has the potential to hinder their ability to adopt agricultural innovations that remain in line with local sustainability principles. Therefore, efforts are needed to understand and address the gap between agricultural modernization and the preservation of local wisdom in the context of HR development, to ensure the sustainability of organic Gayo coffee cultivation in the future.

The following are three research objectives that are adjusted to the background and methods used:

1. Analyse the application of local wisdom in the organic Gayo coffee cultivation system by farmers in Central Aceh.
2. Evaluate the quality of human resources (HR) in supporting the sustainability of organic Gayo coffee cultivation amidst the challenges of modernization.
3. Formulate a strategy for developing organic Gayo coffee based on local wisdom through SWOT analysis and a participatory approach (PRA) involving various stakeholders.

2. Literature review

2.1. Gayo coffee potential

Gayo coffee is one of Indonesia's leading commodities, which has a unique taste and great potential in the global market. Fadhil et al. (2018a) highlighted the importance of formulating a strategy for developing Gayo coffee agro-industry institutions using the Interpretive Structural Modelling (ISM) approach, which emphasizes the need for coordination between actors in the value chain. Fadhil et al. (2018b) also developed a quality management system strategy using the Soft Systems Methodology (SSM) approach to ensure sustainable product quality, showing that the success of Gayo coffee development does not only depend on the production aspect, but also on the management system, institutional network, and improving quality standards in accordance with export market demand.

2.2. Sustainability and multidimensionality of coffee agribusiness

Sia et al. (2025) in their research assessed the sustainability of Arabica coffee agribusiness in

Toraja using a multidimensional approach. The results show that social, environmental, and economic aspects must be considered in a balanced manner to maintain the existence of coffee agribusiness amidst the challenges of climate change and the global market. In addition, research by [Ibnu \(2020\)](#) strengthens the importance of the capacity to implement coffee standards in Indonesia in order to realize more sustainable coffee production. The success of Gayo coffee as a sustainable value chain model is also supported by the findings of [Hernandez-Aguilera et al. \(2018\)](#) which shows that consistent product quality can foster long-term relationships between farmers and international buyers, forming what is known as the relationship coffee model.

2.3. Agricultural human resources and coffee competitiveness

The quality of human resources (HR) is a key factor in developing the agricultural sector, including coffee. Research by [Pandey et al. \(2025\)](#) and [Farida \(2023\)](#) showed that innovations in HR management, such as Sustainable Development Goals (SDGs)-based training and technology adoption, have a significant impact on increasing farmer productivity. This is also reflected in the research of [Aghaee Malekabadi et al. \(2024\)](#), who designed a sustainable human resource development model in the agricultural extension sector in Iran, emphasizing the importance of strengthening sustainable education. For Gayo coffee farmers, strengthening human resource capacity is key to maintaining the quality of the harvest, increasing the efficiency of farming efforts, and expanding market access.

2.4. Education, training, and transformation of coffee farmers

Various other studies also support the importance of training and education in the transformation of smallholder farmers, including coffee farmers. Their systematic review showed that training, innovation, and adoption of new technologies contributed significantly to improving economic outcomes and food security of farmers in Africa. This is reinforced by the findings of [Mgendi et al. \(2021\)](#), which stated that training programs must be integrated with technological and institutional support to truly impact productivity. Thus, to encourage the strengthening of the coffee sector, such as Gayo coffee, a comprehensive approach is needed in human resource development, starting from increasing agricultural literacy, technical training, to utilizing digital technology to expand access to information and markets.

3. Research methods

This study uses a mixed-methods approach with sequential explanatory and exploratory strategies,

which begins with the collection and analysis of quantitative data, then continues with qualitative data to deepen understanding of the initial findings ([Akimowicz et al., 2018](#)). Quantitative data were collected through a structured survey using a questionnaire distributed to Gayo coffee farmers in Central Aceh to measure aspects of human resource quality, the level of adoption of local wisdom in organic cultivation, and the challenges they face in sustainable agricultural practices. The sample was selected using purposive sampling by considering the active involvement of farmers in organic coffee cultivation practices.

The next stage was to collect qualitative data through in-depth interviews and focus group discussions (FGD) with key stakeholders, such as agricultural extension workers, traditional leaders, local government representatives, and coffee industry players. This study applied a more structured purposive sampling technique, with selection criteria based on active involvement in organic coffee cultivation, participation in farmer groups, and a minimum of five years' experience in applying local wisdom principles. We selected 120 respondents from the total population of organic coffee farmers in Central Aceh to represent the diversity of practices and levels of understanding of traditional values ([Pereira et al., 2021](#)). The Participatory Rural Appraisal (PRA) approach was used to explore local perceptions and traditional practices that are still relevant in the development of agricultural human resources. In addition, a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis was conducted to formulate strategies for developing agricultural human resources based on local wisdom. Data triangulation was used to ensure the validity of the findings. By directly linking the results of the analysis to SWOT and PRA factors, this study not only produces data-driven strategies but also ensures the social and cultural relevance of the Gayo coffee human resource development model. This approach strengthens the methodological foundation of the study as a basis for contextual and sustainable policy interventions. The results of this combination of approaches are expected to enable to formulation of a contextual, participatory, and sustainable Gayo coffee human resource development strategy model.

4. Research results

SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis is a very important tool in strategic planning and implementation of sustainable Gayo coffee development in Central Aceh Regency. This approach provides a systematic framework for understanding and responding to various factors that influence the success of the local wisdom-based coffee farming sector. By identifying strengths, weaknesses, opportunities, and threats, SWOT analysis can help formulate strategies that are targeted, data-based, and adaptive to market and environmental dynamics. This comprehensive

approach allows Gayo coffee development to contribute to increasing the economic resilience of farmers, reducing poverty in rural areas, and maintaining environmental sustainability through environmentally friendly cultivation practices.

To strengthen economic resilience and reduce poverty, strategies can be designed by recognizing the region's superior potential, such as the internationally recognized taste quality of Gayo coffee, as well as identifying weaknesses such as limited access to agricultural technology and training for farmers (Flint, 2010). In addition, SWOT analysis allows the development of adaptive strategies that can respond to challenges such as climate change, global market price fluctuations, and shifts in consumer preferences, thereby supporting the long-term sustainability of the Gayo coffee sector.

Based on the results of a survey of 120 organic coffee farmers in Central Aceh Regency, it was found that most farmers (around 70%) still have elementary to secondary education. Only 10% have higher education. In terms of technical skills, around 62% of farmers do not yet comprehensively understand the principles of modern organic farming, including certification, integrated pest control, and post-harvest management. However, most farmers (around 85%) still carry out traditional cultivation practices rooted in local wisdom, such as natural fertilization using compost and season-based crop rotation. A quantitative

summary of these strengths, weaknesses, opportunities, and threats is presented in Table 1.

In-depth interviews with agricultural extension workers and traditional leaders showed that limited access to training, a lack of field facilitators, and a lack of technological support are the main obstacles in increasing human resource capacity. However, the community has strong socio-cultural potential through the values of cooperation and the principle of "balance with nature," which are still embedded in daily agricultural practices.

The results of the analysis show that local wisdom plays an important role in shaping the work attitude and resilience of farmers. Customary practices such as village deliberations, collective work, and hereditary knowledge about weather, local varieties, and water conservation have formed a sustainable and community-based agricultural system. As many as 78% of farmers stated that they believe more in ancestral practices than modern approaches that are not yet fully understood.

In focus group discussions (FGD) through the PRA approach, it was found that farmers were very open to training that integrated traditional values into new technologies. With a participatory approach, they were willing to accept innovations if delivered by facilitators who understand local culture. This shows that HR development strategies must be culture-based, contextual, and involve the role of traditional leaders as agents of change.

Table 1: Quantitative SWOT matrix

| SWOT factors | Weighted score | Rating score (1–5) | Weight x rating |
|--|----------------|--------------------|-----------------|
| Strengths (S) | | | |
| 1. High local knowledge | 0.20 | 4 | 0.80 |
| 2. Mutual cooperation spirit | 0.15 | 5 | 0.75 |
| 3. Commitment to organic farming | 0.10 | 4 | 0.40 |
| 4. Gayo coffee's global image | 0.10 | 5 | 0.50 |
| Total score S | | | 2.45 |
| Weaknesses (W) | | | |
| 1. Limited formal education | 0.15 | 2 | 0.30 |
| 2. Low farmer regeneration | 0.10 | 2 | 0.20 |
| 3. Lack of technology training | 0.10 | 2 | 0.20 |
| 4. Low documentation of local wisdom | 0.10 | 2 | 0.20 |
| Total Score W | | | 0.90 |
| Opportunities (O) | | | |
| 1. Global demand for organic coffee | 0.20 | 5 | 1.00 |
| 2. NGO/green market support | 0.15 | 4 | 0.60 |
| 3. Educational agrotourism potential | 0.10 | 4 | 0.40 |
| 4. Support for agricultural digitalization | 0.10 | 3 | 0.30 |
| Total score O | | | 2.30 |
| Threats (T) | | | |
| 1. Modernization that erodes local values | 0.15 | 3 | 0.45 |
| 2. Dependence on global markets | 0.10 | 3 | 0.30 |
| 3. Climate change | 0.10 | 3 | 0.30 |
| 4. Lack of regulatory support | 0.10 | 3 | 0.30 |
| Total Score T | | | 1.35 |

4.1. SWOT analysis

In facing the challenges of modernization and global market dynamics, the sustainability of organic Gayo coffee cultivation is highly dependent on the capacity and quality of the human resources (HR) involved. To understand the strategic position and potential for HR development in this sector, a comprehensive analysis approach is needed. One of the effective tools used is the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis.

1. Strengths

- **Local Skills and Knowledge:** Gayo coffee farmers have generations of experience in cultivating and processing distinctive, high-quality coffee.
- **Strong Cultural Identity:** Gayo coffee has become part of the community's identity, so there is a high commitment and enthusiasm to maintain quality.
- **Solid Farming Community:** There are cooperatives and farmer groups that support collaboration and knowledge transfer between farmers.

- International Recognition: Gayo coffee's human resources have produced products that are known in the global market, reflecting their quality and capabilities.
- Adaptive to organic farming systems: Many Gayo farmers have implemented environmentally friendly farming methods.

2. Weaknesses

- Low Access to Formal Education and Modern Technology: Many farmers still rely on conventional methods and are less exposed to agricultural technology innovations.
- Limited Continuous Training: The lack of technical and managerial training hinders the development of sustainable human resource capacity.
- Limitations in Foreign Languages and Digital Marketing: Communication barriers in reaching international markets directly.
- Lack of regeneration of young farmers: Young people tend to be less interested in the agricultural sector, threatening the sustainability of the workforce.

3. Opportunities

- Government and International Institution Support: Availability of training programs, technical assistance, and access to financing for coffee farmers.
- Growth of the Global Specialty Coffee Market: Demand for quality coffee, such as Gayo, continues to increase, opening new market opportunities.
- Development of Coffee-Based Tourism (Coffee Tourism): Can be a means of education and direct promotion of Gayo coffee.
- Digital Transformation and E-commerce: Opportunities to utilize digital platforms to expand marketing and promotion networks.

4. Threats

- Climate Change: Affects coffee planting patterns and production, requiring adaptation that not all human resources are ready to face.

- Competition from Other Coffee Production Areas: Competition in quality and price from coffee from other regions, both domestically and abroad.
- World Market Price Fluctuations: Dependence on the global market makes farmers' incomes unstable.
- Urbanization and Land Conversion: Reduce the number of human resources remaining in the coffee sector and narrow the cultivation area.

4.2. TOWS matrix

By utilizing the potential of human resources (HR) involved in Gayo coffee cultivation, the implementation of local wisdom-based development strategies is a strategic step to increase the economic resilience of farmers and reduce poverty levels in Central Aceh Regency. HR who has hereditary knowledge, experience, and direct involvement in the coffee production process are the main strengths that can be optimized. In this context, TOWS analysis is very important to assess how HR strengths and weaknesses interact with external opportunities and threats faced by the Gayo coffee sector. This essay describes the TOWS analysis for the development of Gayo coffee HR and develops strategies, especially based on the Strengths-Opportunities (SO) approach, to encourage more adaptive, innovative, and sustainable human resource management. Table 2 presents the TOWS matrix for human resources in the Gayo coffee sector in Central Aceh.

These SO (strengths–opportunities) strategies utilize the internal strengths of Gayo coffee human resources to capture existing external opportunities. With local knowledge and skills that have been passed down from generation to generation, Gayo coffee farmers can be encouraged to take part in training developed based on local wisdom and global standards. In addition, farmer involvement in agrotourism and coffee promotion activities can open new markets and increase added value. The use of digital technology and e-commerce platforms is also an important step to expand marketing networks, introduce Gayo coffee to a wider market, and attract the interest of the younger generation in this sector.

Table 2: TOWS matrix – Gayo coffee human resources in central Aceh

| | Opportunities | Threats |
|------------|---|---|
| Strengths | Strategy SO (strengths – opportunities) Developing local wisdom-based HR training for global market expansion. | Strategy ST (strengths – threats) Strengthening farmer cooperatives to face price fluctuations and global competition. |
| | Increasing farmer involvement in agrotourism and public training. Utilizing digital technology and e-commerce for marketing and promotion of Gayo coffee. | Increasing local innovation in facing climate change. Strengthening Gayo coffee branding as a superior regional product. |
| | Strategy WO (weaknesses – opportunities) Collaborating with external parties (NGOs, universities) to increase human resource capacity. | Strategy WT (weaknesses – threats) Conduct adaptive training on the impacts of climate change. Build partnership networks for distribution and price stability. Design regional policies that support the regeneration of human resources in coffee farming. |
| Weaknesses | Attracting the interest of the younger generation through agricultural digitalization and business training. Establishing a coffee business incubator for farmer regeneration. | |

The ST (strengths–threats) strategy aims to use existing strengths to face and reduce the impact of external threats. Solid and experienced coffee farmer cooperatives can be utilized to strengthen their bargaining position and anticipate fluctuations in

global market prices. In addition, local wisdom and organic farming capabilities can be used as a basis for formulating sustainable agricultural innovations to face the challenges of climate change. Strengthening the image of Gayo coffee as a certified

specialty coffee is also a shield against competition with coffee products from other regions.

The Weaknesses–Opportunities strategy focuses on utilizing opportunities to overcome weaknesses in Gayo coffee's human resources. One effective step is to collaborate with universities, NGOs, and training institutions to increase the capacity of farmers in terms of knowledge, management, and the use of modern agricultural technology. Digital-based approaches, such as smart farming or digital marketing, can also be used to attract the interest of the younger generation to participate in the coffee business. In addition, the establishment of a coffee business incubator at the local level can accelerate farmer regeneration and create young entrepreneurs in the coffee agribusiness sector.

The Weaknesses–Threats strategy is defensive, focusing on reducing internal weaknesses while avoiding or reducing the impact of external threats. Therefore, adaptive training for farmers related to climate change is crucial to maintain production. Establishing distribution networks and partnerships with various parties can help stabilize the supply chain and coffee-selling prices. Furthermore, regional policies are needed that support the regeneration of young farmers, for example, with incentives for education, training, and financing for coffee-based businesses.

4.3. Evaluation of human resources quality in supporting the sustainability of organic Gayo coffee cultivation amidst the challenges of modernization

Organic Gayo coffee cultivation in Central Aceh has great potential as a national and even international leading commodity. However, its success and sustainability are highly dependent on the quality of human resources involved in the entire value chain – from cultivation to marketing. Evaluation of the quality of human resources includes aspects of knowledge, skills, attitudes, and the ability to adapt to the dynamics of the times.

Most Gayo coffee farmers still rely on hereditary experience in cultivation practices. Knowledge of formal organic cultivation techniques, including integrated pest control, natural fertilizer management, and hygienic and environmentally friendly post-harvest, still needs to be improved. Some farmers have received training, but the coverage is not yet even and sustainable. Modern challenges such as climate change and global market competition require farmers to understand international organic standards and environmentally friendly agricultural technologies.

Many Gayo coffee farmers show a high level of enthusiasm in maintaining the organic coffee heritage. However, attitudes to innovation and the use of technology are still mixed. Some farmer groups are open to digital innovations, such as the use of weather applications and automatic irrigation systems. However, many are still hesitant and

reluctant to change traditional patterns. This is an obstacle to increasing productivity and efficiency.

Challenges such as urbanization, migration of young people to non-agricultural sectors, and digitalization affect the sustainability of Gayo coffee human resources. Farmer regeneration is a crucial issue because most farmers are currently over 45 years old. The low interest of the younger generation in agriculture is due to the perception that farming is not economically promising. In fact, modernization can be an opportunity if combined with entrepreneurship training, the use of technology, and digital promotion of coffee products.

Coffee farmer cooperatives in Central Aceh have begun to play a role in strengthening human resource capacity, for example, through organic certification training and farm business management. However, challenges in organizational governance, transparency, and limited financial resources are still obstacles to increasing capacity collectively.

The application of local wisdom in the organic Gayo coffee cultivation system in Central Aceh has an important role in maintaining the sustainability of environmentally friendly agriculture and based on the cultural values of the local community. The results of the SWOT analysis show that traditional practices that have been passed down from generation to generation are the main strength in supporting organic farming. Values such as cooperation, collective awareness in preserving nature, and natural land conservation methods such as planting shade trees and terracing show that Gayo farmers have developed a farming system that is in line with the principles of ecology and sustainability.

However, there are still some weaknesses that need attention. One of them is the lack of systematic documentation of local knowledge, which causes the potential loss of cultural values when the younger generation is no longer interested in continuing their work as farmers (Wu and Sardo, 2009). In addition, the lack of integration between local wisdom and modern scientific approaches, as well as minimal policy support from local governments, are also obstacles to the development of sustainable cultivation systems more broadly.

On the other hand, the opportunities that are open are quite large, especially with the increasing market demand for ethical and sustainable organic coffee products. The green lifestyle trend and global consumer desire for products derived from agricultural practices that respect nature are a great opportunity to promote Gayo coffee based on local wisdom (Kurnia et al., 2022). In fact, the potential for developing cultural agrotourism and agricultural ecotourism can encourage the preservation of local traditions while improving the welfare of farming communities. However, farmers are also faced with several external threats, such as the flow of modernization that prioritizes the use of chemicals and instant farming systems, as well as the challenges of climate change and market price uncertainty. If not anticipated properly, this

condition can erode local values that have been the main strength in organic Gayo coffee cultivation.

The government plays a strategic role in developing agricultural human resources (HR) based on local wisdom in the cultivation of organic Gayo coffee in Central Aceh, not only as a policymaker but also as a facilitator, mentor, and connector between farmers, educational institutions, and coffee industry stakeholders. Through affirmative regulations, the government can protect traditional practices such as *gotong royong* (cooperation) and *musyawarah desa* (village deliberation) to ensure their preservation amid modernization. In addition, the government should provide technical and managerial training that integrates agricultural technology with local values through participatory approaches like Participatory Rural Appraisal (PRA), and offer incentives such as financing, microcredit, and training scholarships to encourage youth involvement in farming. Strengthening farmer institutions, such as cooperatives and farmer groups, through governance support and market access is also essential to enhance farmers' bargaining power in the global market. Furthermore, the government can promote Gayo coffee as a regional flagship product through organic certification, trade diplomacy, and the development of culture-based agro-tourism, thereby positioning Gayo coffee not only as an economic commodity but also as a symbol of sustainability and cultural heritage recognized worldwide.

Thus, a holistic strategy is needed to protect and develop the local wisdom of Gayo farmers. Strengthening human resource capacity, documenting traditional practices, integrating environmentally friendly technology, and policies to protect local wisdom are the main keys to maintaining the sustainability of organic Gayo coffee cultivation amidst the challenges of ever-growing modernization. Thus, a holistic strategy is needed to protect and develop the local wisdom of Gayo farmers. Strengthening human resource capacity, documenting traditional practices, integrating environmentally friendly technology, and policies to protect local wisdom are the main keys to maintaining the sustainability of organic Gayo coffee cultivation amidst the challenges of ever-growing modernization.

5. Conclusion

Through SWOT analysis and a participatory approach based on Participatory Rural Appraisal (PRA), it was found that the strategy for developing organic Gayo coffee must be directed at increasing the capacity of farmers' human resources through integrated training, strengthening local wisdom-based extension, and increasing the active role of various stakeholders, including traditional leaders, local governments, extension workers, and coffee industry players. Multi-party collaboration is an important key to encouraging the integration of traditional knowledge with modern innovation, so

that the organic coffee farming system based on local wisdom remains relevant, sustainable, and able to compete in national and international markets. Based on the results of research conducted using a mixed methods approach, it can be concluded that the organic Gayo coffee cultivation system in Central Aceh is still very thick with the application of local wisdom values that have been passed down from generation to generation. Traditional practices such as the use of natural organic fertilizers, biological pest control, and conventional selection of superior seeds show that farmers still maintain a harmonious relationship between humans and nature in the cultivation process. However, the quality of farmers' human resources (HR) is still a crucial challenge in maintaining the sustainability of this system. The low level of formal education of most farmers causes limitations in accessing information, modern agricultural technology, and adaptation to climate change and global market dynamics. This has an impact on the effectiveness of managing organic coffee farming.

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Compliance with ethical standards

Ethical considerations

This study followed established ethical standards for research involving human participants. All participants were informed about the study's purpose and procedures, and informed consent was obtained prior to data collection. Participation was voluntary, with the right to withdraw at any time. Anonymity and confidentiality were maintained, no personal identifiers were collected, and the data were used solely for academic research purposes.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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