

ISLAMIC ECONOMIC PRINCIPLES IN AGRICULTURAL MECHANIZATION FOR EFFICIENCY AND JUSTICE

Luthfi ^{1*}, Lilis Marlina ², Hilma Erliana ³

¹ *Department of Metal Welding Technology, Aceh Barat State Community Academy, Aceh, Indonesia*

² *Department of Accounting, Faculty of Economics and Business, Teuku Umar University, Aceh, Indonesia*

³ *Department of Foundation, Concrete, and Road Pavement Construction, Aceh Barat State Community Academy, Aceh, Indonesia*

Author Corresponding: luthfi@aknacehbarat.ac.id

Abstract

This study examines the integration of Islamic economic principles into agricultural mechanization through a field-based case study of a semi-automatic rice transplanter training program in Woyla Barat District, Aceh Barat Regency. Employing a qualitative approach, data were collected between March and July 2025 through field observations, semi-structured interviews with ten farmers, three agricultural experts, and one local religious leader (ulama), along with a focus group discussion conducted in Gampong Mon Pasong. The research aimed to explore how Islamic values such as amanah (trust), ‘adl (justice), and maslahah (collective welfare) shape mechanization practices and strengthen institutional ethics among farmers. The findings reveal that the adoption of the rice transplanter reduced labor requirements per hectare (an 84% efficiency gain), decreased production costs (73%), and shortened planting time from five days to one. Beyond these technical outcomes, the program strengthened the Kelompok Tani Berkah Bersama through sharia-based governance guided by musyawarah (deliberation) and collective responsibility. This integration of mechanization and Islamic ethics fostered moral accountability, distributive justice, and sustainable cooperation, providing a replicable model for value-based agricultural development in Muslim rural communities.

Keywords: Islamic economy; agricultural mechanization; halal industry; food security; rural empowerment

INTRODUCTION

Agriculture remains the economic backbone and food security foundation for many Muslim-majority nations. In recent decades, agricultural mechanization—marked by the use of modern tools, digital technologies, and efficient production systems—has shown substantial potential in boosting productivity, reducing manual labor burdens, and increasing rural household income (Gebiso et al., 2024; Suo et al., 2024). However, while these advancements promise efficiency, they also provoke structural inequalities: exclusion of smallholders, concentration of access among elites, and value dissonance in faith-oriented communities.

Mechanization, as an element of agricultural modernization, is often embedded within broader agendas of economic liberalization and green revolution frameworks. While effective in raising yields, these paradigms frequently neglect local knowledge systems, ecological values, and ethical concerns, especially in Islamic agrarian societies (Shovkhalov, 2024; Winarno et al., 2025). Thus, there is a pressing need for an

alternative pathway—one that harmonizes technological innovation with indigenous ethical systems like Islamic economics. In this respect, the integration of Islamic values into local economic governance, such as through village-based institutions (e.g., Badan Usaha Milik Gampong), offers an important avenue for embedding distributive justice and accountability in rural transformation (Jalilah, 2021).

These tensions are especially pronounced in regions like Woyla Barat, Aceh Barat, Indonesia, where rice farming dominates livelihoods, yet access to technology remains constrained, financing models often contradict Islamic values, and community institutions such as pesantren are underutilized. The introduction of a semi-automated rice transplanter in Gampong Mon Pasong—paired with ethical training for farmers—presents a real-world case of integrating technology with Islamic principles. This initiative emphasizes not only increased productivity but also promotes collective benefit (*maslahah*), accountability (*amanah*), and just distribution (*‘adl*)—principles deeply embedded in *maqāṣid al-sharī‘ah*.

Islamic economic principles provide a holistic epistemology to evaluate and guide agricultural modernization. Anchored in *maqāṣid al-sharī‘ah*, the framework prioritizes life preservation, wealth circulation, environmental balance, and justice for the vulnerable (Shovkhalov, 2024). Unlike neoclassical paradigms, Islamic economics places moral boundaries around economic behavior, advocating mechanisms such as risk-sharing, redistribution, and ethical investment (Yafiz et al., 2025; Yuliana et al., 2021). The concept of *efficiency* (*itqan*) in Islam is not limited to productivity, but also includes avoiding waste (*isrāf*), optimal resource use, and enhancing communal welfare (Yuliana et al., 2021).

In the context of mechanization, Islamic finance instruments such as *salam* (forward purchase), *ijarah* (leasing), and *waqf*-based productive assets are increasingly discussed as potential enablers of inclusive access (Al-Daihani et al., 2024; Utama & Suwarsi, 2019). Hybrid models such as *waqf-muzāra‘ah* schemes and Islamic crowdfunding platforms have demonstrated promise in increasing capital flow to smallholders (Maulina et al., 2023). Yet, many of these models remain conceptual or pilot-scale, lacking integration with operational technologies.

Studies from Indonesia, Malaysia, and Nigeria have reported that Sharia-compliant agricultural financing schemes not only improve productivity but also strengthen ethical awareness and community solidarity (Mohammed et al., 2021; Zainuddin et al., 2025). Moreover, mechanization when introduced with participatory training and ethical guidelines can reduce exploitation and foster self-reliance (Gebiso et al., 2024; Winarno et al., 2025). However, the literature does not offer a unified framework that links these innovations with measurable ethical and distributive outcomes. Moreover, ethics of production grounded in *halal-ṭayyib* principles remain underapplied in agricultural practices, even though they offer critical guidance on fairness, hygiene, and labor dignity (Idris et al., 2022; Mahbubi, 2023).

Another important gap relates to gender. Mechanization often displaces women from traditional labor roles, disproportionately affecting landless and poor female workers (Ma et al., 2024; Takeshima, 2024). In many rural Muslim societies, this displacement can further entrench marginalization unless offset by gender-responsive policies grounded in Islamic ethics—emphasizing dignity (*karāmah*), fairness (*‘adl*),

and capability development (*taqwiyyah*) (Shaukat et al., 2024). Attention to distributive justice, particularly among smallholders and landless laborers, is vital to ensure that agricultural transformation does not widen socio-economic gaps (Novemyanto et al., 2024; Saputra & Hendrawan, 2023).

Institutionally, Islamic value-based cooperatives and *pesantren*-linked networks have shown promise in mobilizing collective resources and fostering trust (Jalilah, 2021; Selim & Farooq, 2020). Yet their involvement in technological governance—such as ownership, training, or monitoring of agricultural tools—is scarcely documented. Digital *waqf* models and sharia-compliant fintech have widened access, but digital illiteracy and rural infrastructure gaps persist (Yan et al., 2025).

Recent policy initiatives in Muslim-majority countries have incorporated *maqāṣid*-oriented reforms, such as halal food chains, zakat for agriculture, and Sharia warehouse receipt systems (Apriantoro, 2024). Still, empirical assessments of these policies remain limited in scope and duration, with few studies examining their sustainability, effectiveness, and replicability (Fanani & Pohl, 2024; Ropiah, 2025). Agricultural natural resource governance also requires reorientation, emphasizing *maslahah* and stewardship (*khilāfah*) as core Islamic mandates (Faisal, 2024).

The case of Mon Pasong village in Woyla Barat, Aceh Barat, offers an ideal setting to examine faith-based technological innovation. Challenges faced by the community include:

- High dependence on manual labor, especially for transplanting rice seedlings, resulting in seasonal delays and cost fluctuations.
- Low planting efficiency due to irregular field coordination and lack of mechanized alignment.
- Exclusion from formal credit systems, particularly those with interest-based schemes, which are religiously prohibited (*riba*).
- Underutilization of *pesantren* and local *ulama* in agricultural education, despite their social legitimacy and reach.

To address these challenges, a pilot project introduced rice transplanters operated through a communal rotation system, accompanied by value-based training sessions on *amanah* (responsibility), *niyyah* (ethical intent), and *ikhlas* (sincerity in stewardship). This initiative reframes mechanization not as a mere productivity tool, but as a religiously-embedded transformation of labor, community structure, and economic justice.

Despite increasing scholarly attention to Islamic finance and rural development, existing research tends to isolate financial mechanisms from broader ethical and institutional dynamics of agrarian modernization. Several limitations persist in the literature:

1. While Islamic contracts such as *salam*, *ijarah*, and *waqf*-based financing have been proposed to support agricultural development (Al-Daihani et al., 2024; Maulina et al., 2023), empirical studies rarely examine how Islamic ethical

values—such as *‘adl* (justice), *amanah* (trust), and *maslahah* (collective benefit)—are operationalized alongside technological interventions like mechanization.

2. Most existing evaluations adopt short-term, cross-sectional approaches, providing limited insight into whether faith-based ethical integration enhances long-term sustainability, equity, and social acceptability of mechanized farming systems (Fanani & Pohl, 2024; Gebiso et al., 2024).
3. The role of vernacular Islamic institutions—such as *pesantren*, *dayah*, or local religious leaders—in shaping governance, trust, and collective action around technology adoption is often overlooked. The informal dimensions of agricultural governance within Islamic contexts remain underexplored (Ropiah, 2025; Selim & Farooq, 2020).

This study addresses these gaps by conducting a field-based assessment of a mechanization program in Aceh Barat, where Islamic ethical values were integrated into the training, deployment, and communal governance of rice transplanters.

This study aims to:

1. Analyze the operationalization of Islamic economic values in agricultural mechanization programs in Woyla Barat, Aceh Barat.
2. Evaluate the efficiency and justice outcomes of rice transplanter adoption from an Islamic ethical lens.
3. Develop a conceptual framework for faith-driven agricultural modernization grounded in *maqāṣid al-sharī‘ah*.

This research advances the discourse by:

1. Synthesizing normative theory and grounded practice: It bridges Islamic jurisprudence, development ethics, and technological deployment.
2. Providing empirical evidence from Mon Pasong village, where mechanization was not merely a technical intervention but a value-oriented initiative.
3. Proposing a replicable model for value-embedded mechanization: aligning Islamic ethics with rural development goals, community resilience, and governance innovation.

In sum, this study offers a paradigm shift: viewing mechanization not merely as a path to productivity but as a moral project—where technology, faith, and justice intersect to produce a more inclusive and ethical agrarian future.

METHOD

Research Design

This study employs a qualitative approach with a field-based case study design to analyze how Islamic economic principles are operationalized in the rice transplanter training program in Woyla Barat District, Aceh Barat Regency. The case study design was chosen because it offers an in-depth understanding of real-life phenomena within specific social, cultural, and institutional contexts, while also connecting these to the religious values that underpin agricultural practices in Acehnese society. The focus of this research is to examine the interaction between agricultural technological innovation and Islamic economic principles in strengthening efficiency, social justice, and the institutional sustainability of farmers.

The qualitative approach is considered most appropriate as it emphasizes contextual and interpretive understanding rather than statistical generalization. The phenomenon under study—namely, the integration of Islamic values with agricultural mechanization—requires exploration of meaning, social norms, and institutional relationships that cannot be measured quantitatively alone (Creswell & Creswell, 2018; Yin, 2018). Therefore, this research combines descriptive and analytical elements, supplemented by several basic quantitative indicators such as labor efficiency and cost savings, to reinforce the validity of qualitative findings.

Context and Research Location

The study was conducted in Gampong Mon Pasong, Woyla Barat District, Aceh Barat Regency, Aceh Province. This area is one of the main rice production centers on the west coast of Sumatra and was purposively selected as it serves as a pilot site for a rice transplanter training program based on Islamic economic principles, implemented through a collaboration between the Aceh Barat District Government, the Aceh Barat State Community Academy (AKN), and Teuku Umar University (UTU).

According to the Aceh Barat Office of Agriculture, Food Crops, and Horticulture, the local government targeted rice production to reach 124,000 tons in 2024 through the optimization of productive land (Antara, 2024). Meanwhile, the Aceh Barat Central Bureau of Statistics (BPS Kabupaten Aceh Barat, 2025) reported that by mid-2025, approximately 5,134 hectares of rice fields had been cultivated, covering most of the agricultural area in Woyla Barat (Dinas Pertanian dan Perkebunan Aceh, 2025; Khalis, 2025). Prior to the implementation of this program, most farmers relied on manual planting methods and faced capital constraints and limited access to mechanized tools (LimaNews, 2025; RRI Meulaboh, 2025). These initiatives demonstrate that local government efforts, supported by academic collaboration, have begun to transform traditional rice farming practices into more efficient, technology-based systems aligned with regional food security goals.

The rice transplanter training program explicitly integrates Islamic economic principles such as *amanah* (responsibility), *‘adl* (justice), and *maslahah* (collective welfare). This approach not only introduces technical innovation but also instills moral awareness in managing equipment, budgeting costs, and ensuring equitable profit distribution. Accordingly, Gampong Mon Pasong offers an ideal setting for examining the relationship between mechanization technology and Islamic moral practice in community farming systems.

Participants and Sampling Technique

Participants were selected using purposive sampling, targeting informants with direct experience and involvement in the program's implementation (Patton, 2015). The criteria for selection included active participation in rice transplanter training, understanding of Islamic economic values, and representation of social roles within the farming community.

The participant composition included 10 farmers who attended the training, 3 agricultural experts, and 1 religious leader (*ulama*) who facilitated the ethical values session during the training. This sample size and diversity were considered sufficient to capture data depth while ensuring a range of technical, social, and spiritual perspectives (Guest et al., 2020).

All participants were informed of the research objectives and procedures and signed informed consent forms. Participation was voluntary, and individuals could withdraw at any time without consequences.

Data Collection Techniques

Data collection took place between March and July 2025, using three primary methods: field observation, semi-structured interviews, and focus group discussions (FGDs). This combination of techniques allowed for a comprehensive understanding of the interaction between mechanization practices and Islamic economic values in the Acehnese farming community (Yin, 2018).

Field Observation

Observations were conducted during the training and implementation phases of rice transplanter usage. Observational focus included shifts in work patterns, role distribution among farmers, coordination in tool usage, and application of *amanah* and *musyawarah* (deliberation) in collaborative practices. Non-participant observation was systematically applied to record factual behaviors and social dynamics during program execution (Spradley, 2016).

Semi-Structured Interviews

Interviews were conducted with 14 key participants, including farmers, agricultural experts, and local religious leaders. The interview questions focused on three core aspects:

- (a) experiences and perceptions of Islamic values-based mechanization,
- (b) the impact of using the rice transplanter on time efficiency and production costs, and
- (c) the practice of '*adl*, *amanah*, and *maslahah* in group governance.

Each interview lasted 45–60 minutes and was recorded with the participants' consent, then transcribed for analysis (Kvale & Brinkmann, 2009).

Focus Group Discussion (FGD)

One FGD was conducted with six farmers, two agricultural experts, and one religious leader. The objective was to obtain collective insights on issues such as distributive justice, social responsibility, and the strengthening of farmer institutions post-training. The FGD findings were used to validate the results from individual interviews and field observations.

All interview and FGD transcripts were manually coded using Microsoft Word and Excel in a thematic analysis table containing initial codes, respondent quotes, emerging themes, and interpretive notes. This step ensured a transparent audit trail in line with qualitative research standards (Nowell et al., 2017).

Data Analysis

Data analysis was carried out using a thematic analysis approach (Braun & Clarke, 2019), following six steps:

- (1) familiarization with the data,
- (2) generating initial codes,
- (3) identifying main themes,
- (4) reviewing theme consistency,
- (5) defining and naming themes, and
- (6) producing the final synthesis.

Themes from the analysis were grouped into three main dimensions aligned with the research objectives:

1. The application of Islamic economic principles (*amanah*, *'adl*, *maslahah*, *itqān*) in the training and practical use of rice transplanters;
2. Efficiency and cost reduction as tangible outcomes of mechanization; and
3. Social justice and institutional sustainability of farmers, related to participation, collective ownership, and shared tool management.

This approach enables a holistic understanding of how mechanization rooted in Islamic principles can improve technical efficiency while reinforcing social ethics and community solidarity.

FINDINGS

This section presents the findings derived from field observations, semi-structured interviews with 10 farmers, 3 agricultural experts, and 1 local religious leader (ulama), as well as one focus group discussion (FGD) conducted in Gampong Mon Pasong, Woyla Barat District, West Aceh Regency between March and July 2025. The findings address three main research objectives:

1. to analyze the implementation of Islamic economic principles in the *rice transplanter* training program,
2. to evaluate efficiency and cost-reduction outcomes from agricultural mechanization, and
3. to assess how Islamic ethical values contribute to social justice and the sustainability of farmer institutions.

Overall, the study finds that Islamic value-based mechanization not only improves technical efficiency but also strengthens social solidarity and moral accountability among farmers. This approach differs from previous studies, which viewed mechanization primarily through technological or economic lenses (Gebiso et al., 2024; Maulina et al., 2023). In West Aceh, mechanization is understood as both a moral practice and a sustainable development strategy.

Implementation of Islamic Economic Principles in Mechanization Training

The *rice transplanter* training in Gampong Mon Pasong explicitly integrated Islamic economic values such as *amanah* (responsibility), *‘adl* (justice), *itqān* (professionalism), and *maslahah* (collective well-being). The training aimed to instill moral awareness that agricultural technology is a form of social trust rather than merely a production tool.

Most farmers reported that this training differed from previous technical programs because it began with moral and spiritual preparation, emphasizing *niyyah* (pure intention) and responsibility.

“Usually, training only teaches us how to use machines. But here, we learned about responsibility and good intention. We realized that working with sincerity is also worship.” — (Farmer 3, Interview, July 2025)

Collective discipline was strengthened through clear scheduling and shared maintenance duties.

“We made a list of who uses the machine, who refuels, and who cleans it. Everything is decided through discussion.” — (Farmer 7, Interview, July 2025)

According to an agricultural expert, the integration of Islamic ethics improved the participants’ commitment and precision:

“They were more disciplined because they saw the machine as an amanah. Moral awareness made the work run smoothly without us having to supervise constantly.” — (Expert 2, Interview, July 2025)

The local ulama served as a moral mediator linking religious values and farming practices, emphasizing that *maslahah* (benefit for all) must guide collective work:

“If the work is done with good intention and benefits everyone, that’s maslahah. This machine is a shared responsibility, not private property.” — (Religious Leader, Interview, June 2025)

The integration of technology with Islamic ethics created a form of *moral-based governance*, where moral consciousness functions as a behavioral regulator. This aligns with Fanani & Pohl (2024), who argued that spiritual values can accelerate technology adoption in Muslim rural communities.

Efficiency and Cost-Reduction Outcomes of Mechanization

The second set of findings reveals that *rice transplanter* adoption significantly enhanced labor efficiency and reduced production costs. Before the training, paddy planting was done manually by approximately 20–25 workers per hectare, requiring

five days and an average cost of IDR 3.2 million. After the program, the same work was completed by four workers in one day, with the average cost reduced to IDR 850,000 per hectare.

“Previously, it took many workers and several days to plant. Now, four of us can finish in a day — it saves money and energy.” — (Farmer 2, Interview, July 2025)

Field observations confirmed a time efficiency of around 80% and cost reduction exceeding 70%, as shown below:

Table 1. Comparison of Labor and Cost Efficiency Before and After Mechanization

Indicator	Before Mechanization	After Mechanization	Efficiency (%)
Labor per hectare	25 workers	4 workers	84%
Average planting cost (IDR)	3,200,000	850,000	73%
Planting time	5 days	1 day	80%

(Source: Field Observation and Interviews, 2025)

Beyond measurable efficiency, farmers also expressed increased confidence and a stronger sense of ownership over the technology.

“At first, we were afraid of damaging the machine. But after learning together, we became confident and took care of it ourselves.” — (Farmer 5, Interview, June 2025)

An agricultural expert noted that efficiency resulted not only from mechanization speed but also from disciplined teamwork and shared responsibility:

“The efficiency didn’t come only from faster machines but also from how they organized work and helped each other.” — (Expert 1, Interview, July 2025)

These findings reinforce training grounded in moral and ethical principles enhances both technical competence and social responsibility among farmers (Forney, 2021; Haryono & Jatsiyah, n.d.; Jumiyati et al., 2023).

Ethical and Institutional Impacts: Justice and Collective Responsibility

The mechanization program did not establish a new organization but instead strengthened the existing farmer institution, namely *Kelompok Tani Berkah Bersama*. This group had long served as a platform for cooperation and collective land management in *Gampong Mon Pasong*. After the training, it restructured its operational system according to Islamic economic principles.

All decisions regarding machine usage, scheduling, and maintenance were made collectively through deliberation (*musyawarah*).

“We agreed that all decisions must be made together. No one feels more entitled; if something breaks, we all share the responsibility.” — (Farmer 9, FGD, July 2025)

The principle of *‘adl* (justice) was evident in equal access to the machine regardless of land size or economic status.

“Before, those with more money could plant first. Now, everyone has the same schedule — it’s fairer.” — (Farmer 6, Interview, July 2025)

The value of *maslahah* was also reflected in the group's decision to allocate a small portion of the harvest for communal purposes such as machine maintenance and village charity.

"We know this tool is shared property. So, part of our harvest goes to maintenance and donations for the community." — (Farmer 4, Interview, June 2025)

An agricultural expert highlighted that the ethical dimension ensured sustainability:

"Normally, government-provided machines deteriorate quickly after projects end. Here, they maintain it together because they see it as an amanah from God and the community." — (Expert 3, Interview, July 2025)

The ulama facilitator viewed this collective governance as an embodiment of *maslahah 'ammah* (public welfare) in practice:

"As long as the equipment is used honestly for everyone's benefit, it becomes a form of social worship — that's Islamic economics in action." — (Religious Leader, Interview, June 2025)

FGD results further indicated that Islamic ethics strengthened intra-group trust and reduced conflicts related to machine access or output distribution. The spiritual framework served as social glue, maintaining transparency and cooperation. This finding supports the concept of *Islamic social capital* (Selim & Farooq, 2020), which argues that faith-based trust and moral cohesion are more effective for institutional stability than formal administrative contracts.

In summary, the study identifies three interrelated forms of transformation:

1. Moral transformation — The integration of *amanah*, *'adl*, and *maslahah* reinforced ethical work behavior, trust, and social responsibility.
2. Technical transformation — The use of *rice transplanters* improved labor efficiency by up to 84% and reduced production costs by over 70%.
3. Institutional transformation — The strengthening of *Kelompok Tani Berkah Bersama* through deliberation-based decision-making created a just and sustainable governance model.

Unlike previous research that conceptualized mechanization as a purely technical or economic advancement, this study demonstrates that Islamic value-based mechanization effectively integrates economic efficiency, social justice, and spiritual well-being — providing a replicable model for sustainable rural development in Muslim-majority regions.

DISCUSSION

This study reveals that the integration of Islamic economic principles into agricultural mechanization programs provides a comprehensive pathway to enhance both technical efficiency and ethical accountability within rural communities. The implementation of the rice transplanter in Woyla Barat, West Aceh, demonstrates that mechanization can succeed among smallholder farmers when grounded in moral and

social values such as *amanah* (trustworthiness), *‘adl* (justice), and *maslahah* (collective benefit). Field observations, farmer testimonies, and community discussions consistently indicate that Islamically guided mechanization not only transforms production processes but also redefines social relations and local governance structures.

Interpretation of Results and Comparison of Findings

These findings are consistent with Gebiso et al. (2024) and Winarno et al. (2025), who emphasize that technological innovations in small-scale agriculture must be embedded in community-based moral systems to achieve equitable and sustainable outcomes. Moreover, moral and religious motivations emerged as critical drivers of behavioral change among participants. Ethical training provided through the mechanization program strengthened collective ownership and responsibility for shared resources. Members of the *Berkah Bersama* farmer group displayed high discipline in scheduling, maintaining, and utilizing machinery after receiving instruction on *niyyah* (right intention) and *amanah* (responsibility). This aligns with Shovkhalov (2024) moral economy framework, which posits that Islamic values create intrinsic motivation that substitutes external enforcement mechanisms.

From an operational standpoint, the adoption of the semi-automatic rice transplanter significantly improved efficiency and reduced production costs. Average planting time decreased by nearly half, while dependence on daily labor declined markedly. These results corroborate empirical evidence from Malaysia and Nigeria, which report tangible economic benefits of Islamic-based agricultural programs for smallholders (Mohammed et al., 2021; Zainuddin et al., 2025). However, what distinguishes the Woyla Barat case is the moral framing of efficiency—as both a technical requirement and a spiritual obligation. This dual framing allows farmers to view productivity not merely as an economic objective but as an ethical expression of collective welfare. In this sense, efficiency is redefined from a worldly metric into an act of worship, expanding the conceptual boundaries of Islamic economics in the context of agricultural practice.

Unlike previous studies on Islamic agricultural finance (Al-Daihani et al., 2024; Maulina et al., 2023), which primarily focused on contractual instruments such as *salam*, *ijārah*, and *waqf*-based financing, this research highlights how Islamic ethical values can be operationalized at the field level. Embedding ethics within everyday agricultural practices—rather than abstract financial models—proved to enhance trust, transparency, and collective accountability. The voluntary decision of farmer group members to allocate part of their harvest for community benefit reflects the moral reciprocity central to Islamic distributive justice. These findings complement those of Selim & Farooq (2020), who showed that Islamic cooperatives foster solidarity, and further demonstrate that value-based mechanization can institutionalize that solidarity through technology governance.

Parallel to Hadi & Ma’adi (2021), who examined patchouli productivity in North Aceh, this study reinforces the notion that productivity in Islamic economics encompasses not only efficiency but also moral discipline and collective welfare. Yet, it extends this scope by situating *itqān*—the pursuit of excellence and moral perfection—within the framework of mechanization, showing that moral productivity can manifest through disciplined machine use and collective management systems. Similarly, Rianda (2018) found that despite high rice production capacity in West Aceh,

BULOG's absorption rate remained low (46%) and contributed only 11.3% to price stability. Such structural inefficiencies confirm that production growth does not automatically translate into improved welfare without equitable market mechanisms. Both findings underscore the need for integrative reform that links mechanization with market governance guided by Islamic ethical principles of *'adl* (justice).

The findings of Hadi & Ma'adi (2021) are also pertinent. Their study on agricultural zakat implementation under the *Qanun Baitul Mal* in Barsela revealed institutional weaknesses and limited public awareness—exposing a gap between Islamic normative law and its practical execution. This is consistent with the present study's observation of the gap between moral intention and policy implementation in Woyla Barat. Both cases affirm that successful Islamic-based rural development requires alignment between technological innovation and the strengthening of moral institutions. Similarly, Kamal & Nasution (2021), examining zakat, infak, and sadaqah (ZIS) distribution during the COVID-19 pandemic, highlight the importance of *fiqh al-awlawiyah* (ethical prioritization) in resource allocation. The same principle is evident in Woyla Barat, where access to the rice transplanter was governed by collective deliberation (*musyawarah*) and priority systems, reflecting how Islamic ethics can be operationalized in both financial and technological domains.

The study also underscores the social dimensions of Islamic mechanization. The *Berkah Bersama* farmer group successfully maintained equitable access to machinery through a rotational system decided collectively via *musyawarah*, minimizing conflict and reinforcing procedural justice. Such participatory governance models are vital for the sustainability of technology adoption, as also noted by Gebiso et al. (2024). However, the Aceh case is distinctive for embedding Islamic ethical concepts—*musyawarah*, *amanah*, and *maslahah*—within its participatory structure, thereby generating what Fanani & Pohl (2024) describe as “ethical legitimacy.” This form of legitimacy enhances compliance and curtails resource misuse, even in the absence of formal regulation.

Beyond technical efficiency, this research reveals a deeper socio-ethical transformation: farmers began to perceive mechanized agriculture as an act of worship imbued with moral responsibility. This transformation demonstrates that technological interventions, when integrated with ethical and spiritual frameworks, can strengthen the moral agency of rural communities. The involvement of local *ulama* reinforced this moral framing by situating mechanization within the *maqāṣid al-sharī'ah*, particularly the objectives of protecting wealth (*ḥifẓ al-māl*), preserving life (*ḥifẓ al-nafs*), and promoting justice (*'adl*). As Jalilah (2021) notes, aligning rural development with Islamic objectives transforms economic initiatives into moral projects that enhance both productivity and human dignity. The empirical evidence from Aceh Barat supports this theoretical position.

Implications and Closing

Theoretically, this study extends the application of Islamic economics to the domain of technology governance. The integration of ethical principles—beyond financial models—constitutes a form of institutional *islāh* (reform) within the agricultural system. By linking the *maqāṣid al-sharī'ah* to sustainable agricultural practices, the research proposes a hybrid framework that unites normative and practical

dimensions of development. This aligns with Jumiyati et al. (2023), who argue that *khilāfah* (vicegerency) should guide natural resource management to ensure both ecological and moral balance. Evidence from West Aceh demonstrates that ethics training can operationalize *khilāfah* not as an abstract doctrine but as a lived practice of responsible production.

In a broader policy context, these findings hold significant implications for Islamic rural development. The Aceh case illustrates that mechanization programs should be accompanied by ethical capacity building to ensure efficiency with justice. Without a moral foundation, technological interventions risk reinforcing inequality by favoring wealthier farmers and excluding smallholders. Conversely, the Woyla Barat model demonstrates that value-based governance can democratize technology access while fostering social cohesion. This supports Ropiah (2025) call for policy frameworks that integrate *maqāṣid*-based ethics into rural innovation systems. Therefore, Islamic mechanization should be viewed not merely as an economic intervention but as a socio-ethical transformation process.

In conclusion, the success of mechanization in West Aceh lies not only in its technological dimension but in the ethical foundations that sustain it. The convergence of Islamic moral principles and practical agricultural innovation generates a faith-guided model of modernization—one that unites justice, responsibility, and collective welfare. By situating mechanization within an Islamic ethical architecture, this study contributes to redefining rural development as a holistic process integrating economic, moral, and social sustainability within a single coherent framework.

CONCLUSION

This study concludes that the integration of the principles of Islamic economics into agricultural mechanization presents a viable model for achieving both technical efficiency and moral accountability in rural Muslim communities. The case of Woyla Barat demonstrates that faith-guided mechanization—anchored in the principles of *amanah* (trustworthiness), *‘adl* (justice), and *maslahah* (collective welfare)—not only enhances productivity and cost efficiency but also strengthens collective responsibility, equitable governance, and social cohesion. By reframing efficiency as an act of *ibādah* (worship) and stewardship (*khilāfah*), the research advances current knowledge in Islamic economics by extending its application beyond financial systems into the governance of technology and sustainable rural development. Empirical evidence from this study supports the proposition that *maqāṣid al-sharī‘ah* can serve as an operational framework for ethical innovation, transforming mechanization into a process of institutional *islāh* (reform). The findings thereby contribute to the expanding discourse on faith-based development by demonstrating how value-driven training and participatory governance can democratize access to technology and reinforce moral agency among smallholder farmers. Practically, the study recommends embedding ethical capacity-building grounded in the principles of Islamic economics within rural mechanization programs to mitigate inequality and ensure long-term sustainability. Future research should undertake comparative analyses across regions to deepen understanding of how Islamic economic frameworks can guide technological governance and foster inclusive rural transformation.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to the DPPM of the Ministry of Education and Culture, Science and Technology, for the funding provided, the State Community Academy (AKN) of West Aceh, and Teuku Umar University (UTU) for their support and collaboration in implementing the rice planting machine training program in West Woyla. Special thanks are also extended to the local farmers, agricultural experts, and religious scholars in Gampong Mon Pasong for their valuable insights and cooperation during data collection. The authors would like to express their deepest gratitude for the constructive input from the peer reviewers and the organizing committee of the Meulaboh International Conference on Islamic Studies (MICONIS 2025), which has significantly improved the quality of this paper.

REFERENCES

- Al-Daihani, M., Dirie, K. A., Alam, M. M., & Abdullah, A. S. B. C. (2024). An Islamic Crowdfunding Model For The Agricultural Sector: A Proposal Based On Salam And Muzāra 'ah-Waqf Scheme. *ISRA International Journal of Islamic Finance*, 16(Special Issue 1), 4–22. <https://doi.org/10.55188/ijif.v16iS1.566>
- Antara. (2024, January 30). Pemkab Aceh Barat targetkan produksi padi 124 ribu ton pada 2024. *ANTARA News*. <https://www.antaraneews.com/berita/3939342/pemkab-aceh-barat-targetkan-produksi-padi-124-ribu-ton-pada-2024>
- Apriantoro, M. S. (2024). Compliance of the Warehouse Receipt System with Maqasid al-Shari'ah Principles: Evidence from Indonesia. *Manchester Journal of Transnational Islamic Law and Practice*, 20(2), 150–162. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85201124271&partnerID=40&md5=b9e58cb5d08391c5e73087da40cac202>
- BPS Kabupaten Aceh Barat. (2025, February 28). Kabupaten Aceh Barat dalam angka 2025. *BPS Kabupaten Aceh Barat*. <https://acehbaratkab.bps.go.id/publication/2025/02/28/kabupaten-aceh-barat-dalam-angka-2025.html>
- Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, 11(4), 589–597.
- Creswell, J. W., & Creswell, J. D. (2018). *Research Design Qualitative, Quantitative, and Mixed Methods Approaches* (Fifth Edition). SAGE Publications Asia-Pacific Pte. Ltd.
- Dinas Pertanian dan Perkebunan Aceh. (2025). Pemkab Aceh Barat: 5.134 ha lahan sawah telah ditanami padi. In *Distanbun Aceh*. <https://distanbun.acehprov.go.id/berita/kategori/berita/pemkab-aceh-barat-5134-ha-lahan-sawah-telah-ditanami-padi>
- Faisal, A. (2024). The Concept of Stewardship (Khilafah) in Islam and Its Implications for Environmental Sustainability. *IICASS-Ibn Khaldun International Conference on Applied and Social Sciences*, 2(1), 41–44.
- Fanani, M., & Pohl, F. (2024). FIQH-BASED SOCIAL TRANSFORMATION IN FARMER EMPOWERMENT A Participatory Action Research Approach. *Al-Jami'ah*, 62(2), 305–335. <https://doi.org/10.14421/ajis.2024.622.305-335>
- Forney, J. (2021). Farmers' empowerment and learning processes in accountability practices: An assemblage perspective. *Journal of Rural Studies*, 86, 673–683. <https://doi.org/https://doi.org/10.1016/j.jrurstud.2021.05.021>
- Gebiso, T., Ketema, M., Shumetie, A., & Feye, G. L. (2024). Impact of farm mechanization on crop productivity and economic efficiency in central and southern Oromia, Ethiopia. *Frontiers in Sustainable Food Systems*, 8. <https://doi.org/10.3389/fsufs.2024.1414912>

- Guest, G., Namey, E., & Chen, M. (2020). A simple method to assess and report thematic saturation in qualitative research. *PLoS One*, 15(5), e0232076.
- Hadi, S. M., & Ma'adi, A. S. (2021). Penerapan Fatwa DSN MUI No. 23 Tahun 2020 Terhadap Efisiensi Penyaluran ZIS Perspektif Fiqh Al-Aulawiyah di Lazismu Pamekasan. *MAQASIDI: Jurnal Syariah Dan Hukum*, 125–135.
- Haryono, H., & Jatsiyah, V. (n.d.). The Relationship between Farmer Empowerment, Technological Innovation, and Economic Sustainability in the Oil Palm Farming Sector in Kalimantan. *West Science Agro*, 2(04), 184–194. <https://doi.org/10.58812/wsa.v2i04.1452>
- Idris, P. S. R. P. H., Musa, S. F. P. D., & Sumardi, W. H. H. (2022). Halal-Tayyiban and Sustainable Development Goals: *International Journal of Asian Business and Information Management*, 13(2). <https://doi.org/https://doi.org/10.4018/IJABIM.20220701.0a9>
- Jalilah, J. (2021). Gampong Owned Business As A Sharia Economic Empowerment In Aceh. *PROCEEDINGS: Dirundeng International Conference on Islamic Studies*, 403–416.
- Jumiyati, S., Munajat, M., Kustiari, T., Sari, F. P., Utami, B., & Fitriyana, F. (2023). Farmer empowerment and farm management: The key to successful agribusiness of leading local commodities. *Caspian Journal of Environmental Sciences*, 1–9.
- Kamal, H., & Nasution, M. S. (2021). Produktivitas Usaha Minyak Nilam Sido Mulyo Aceh Utara Dalam Perspektif Ekonomi Islam. *AT-TASYRI': JURNAL ILMIAH PRODI MUAMALAH*, 13(2), 137–142.
- Khalis. (2025, February 14). Ekonom usul Aceh fokus ke pertanian dan perikanan sikapi efisiensi. *ANTARA*. <https://www.antaranews.com/berita/4650069/ekonom-usul-aceh-fokus-ke-pertanian-dan-perikanan-sikapi-efisiensi>
- Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the craft of qualitative research interviewing*. sage.
- LimaNews. (2025, July). Dosen AKN Aceh Barat dan UTU kenalkan teknologi tanam padi semiotomatis di Woyla Barat. *LimaNews.Id*. <https://limanews.id/dosen-utu-dan-akn-kenalkan-mesin-tanam-padi-di-woyla-barat>
- Mahbubi, A. (2023). Sustainable Value Chain Innovation for strengthening The Indonesian Halal Beef Industry. In *Akhmad Mahbubi Muslim Business and Economics Review* (Vol. 2, Issue 1).
- Maulina, R., Dhewanto, W., & Faturhman, T. (2023). The integration of Islamic social and commercial finance (IISCF): Systematic literature review, bibliometric analysis, conceptual framework, and future research opportunities. *Heliyon*, 9(11). <https://doi.org/10.1016/j.heliyon.2023.e21612>
- Ma, W., Zhou, X., Boansi, D., Horlu, G. S. A., & Owusu, V. (2024). Adoption and intensity of agricultural mechanization and their impact on non-farm employment of rural women. *World Development*, 173. <https://doi.org/10.1016/j.worlddev.2023.106434>
- RRI Meulaboh. (2025, July 24). Dosen AKN dan UTU latih petani Woyla Barat gunakan alat tanam padi modern. *Radio Republik Indonesia (RRI)*. <https://rri.co.id/iptek/1711509/dosen-akn-dan-utu-kenalkan-teknologi-tanam-modern>
- Mohammed, M. O., El Amri, M. C., & Bakr, A. (2021). The role of Islamic ethical wealth in strategically and technically supporting 'No Poverty'-SDGs 1. In *Islamic Wealth and the SDGs: Global Strategies for Socio-Economic Impact* (pp. 241–256). https://doi.org/10.1007/978-3-030-65313-2_12
- Novemyanto, A. D., Supriyanto, A., & Tonralipu, A. S. A. T. (2024). Inklusivitas Pembentukan Undang-Undang Kesejahteraan Sosial dalam Rangka Mewujudkan Sustainable Development Goals (SDGs). *CONSTITUO : Journal of State and Political Law Research*, 3(2), 109–127. <https://doi.org/10.47498/constituo.v3i2.3775>
- Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, 16(1), 1609406917733847.
- Patton, M. Q. (2015). *Qualitative Research and Evaluation methods, 4th edn.* (Thousand Oaks; London. Sage Publications New Delhi.

- Rianda, C. N. (2018). Daya Serap Pembelian Gabah Lokal Terhadap Daya Produksi Petani (Studi Perum Bulog Sub-Divisi Meulaboh). *AT-TASYRI': JURNAL ILMIAH PRODI MUAMALAH*, 10(1), 85–94.
- Ropiah, S. (2025). Implications of Islamic Law on Credit-Based Sales in Reducing Social and Economic Inequalities in Society. *Jurnal Ilmiah Mizani*, 12(1), 185–195. <https://doi.org/10.29300/mzn.v12i1.7091>
- Saputra, A. W., & Hendrawan, Y. (2023). Perspektif Ekonomi Fiqih Terhadap Perdagangan Rempah-Rempah Di Desa Barulak Kabupaten Tanah Datar Sumatera Barat. In *Jurnal Perbankan Syariah dan Ekonomi Islam* (Vol. 1, Issue 1).
- Selim, M., & Farooq, M. O. (2020). Elimination of poverty by Islamic value based cooperative model. *Journal of Islamic Accounting and Business Research*. <https://doi.org/10.1108/JIABR-08-2018-0125>
- Shaukat, M., Shafique, B., & Madbouly, A. (2024). Islamic Framework for Behavioral and Socio-Economic Justice. In *Islamic Finance in the Modern Era: Digitalization, FinTech and Social Finance* (pp. 52–78). <https://doi.org/10.4324/9781003366751-5>
- Shovkhalov, S. (2024). Islamic economic principles and their contributions to ecological sustainability and green economy development. *E3S Web of Conferences*, 541. <https://doi.org/10.1051/e3sconf/202454104009>
- Spradley, J. P. (2016). *Participant observation*. Waveland Press.
- Suo, L., Wang, Y., Han, S., Shi, X., Wu, M., & Xu, Q. (2024). Research on the influence of agricultural mechanization on farmers' income: Empirical analysis based on county panel data in Zhejiang Province. *Journal of Chinese Agricultural Mechanization*, 45(11), 265–271. <https://doi.org/10.13733/j.jcam.issn.2095-5553.2024.11.041>
- Takeshima, H. (2024). Agricultural mechanisation and gendered labour activities across sectors: Micro-evidence from multi-country farm household data. *Journal of Agricultural Economics*, 75(1), 425–456. <https://doi.org/10.1111/1477-9552.12564>
- Utama, S., & Suwarsi, A. A. (2019). The role of Islamic banking in agriculture financing (Case study of Indonesian agriculture sector). *Humanities and Social Sciences Reviews*, 7(2), 261–269. <https://doi.org/10.18510/hssr.2019.7230>
- Winarno, K., Sustiyo, J., Aziz, A. A., & Permani, R. (2025). Unlocking agricultural mechanisation potential in Indonesia: Barriers, drivers, and pathways for sustainable agri-food systems. *Agricultural Systems*, 226. <https://doi.org/10.1016/j.agry.2025.104305>
- Yafiz, M., Tarigan, A. A., Saharuddin, D., & Ismail, I. (2025). LOCALIZING ISLAMIC ECONOMICS: INTEGRATING SHARIA PRINCIPLES INTO THE SALINGKA NAGARI TRADITION IN MINANGKABAU. *Jurnal Ilmiah Peuradeun*, 13(3), 1643–1668. <https://doi.org/10.26811/peuradeun.v13i3.2022>
- Yan, Y., Chen, L., Zhou, Z., & Wei, Y. (2025). Digital financial inclusion and agricultural modernization development in China—a study based on the perspective of agricultural mechanization services. *Humanities and Social Sciences Communications*, 12(1). <https://doi.org/10.1057/s41599-025-04821-z>
- Yin, R. K. (2018). *Case study research and applications* (Vol. 6). Sage Thousand Oaks, CA.
- Yuliana, E., Yusuf, M., Nensy Nirmalasary, T., Hasanul Amri, N., Erlyn, P., Loekitowati Hariani, P., & Alam Hidayat, B. (2021). Natural Resources and Environment Management for the Development of Local Wisdom. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, 4(4), 8248–8254. <https://doi.org/10.33258/birci.v4i4.2759>
- Zainuddin, S. A., Rahman, M. S. A., Darus, M. I., Yiannaki, S. M., Aziz, R. C., Ridzuan, F., Babatunde, A. Y., Kartikasari, E. D., & Afip, L. A. (2025). The Role of Digital Transformation in Enhancing Financial Accountability and Donor Engagement in Waqf Institutions. In *Studies in Systems, Decision and Control* (Vol. 598, pp. 295–304). https://doi.org/10.1007/978-3-031-91424-9_28

Authors' Brief CV

1st Luthfi. Luthfi is a lecturer at the Department of Metal Welding Technology, Aceh Barat State Community Academy, Indonesia. His research focuses on vocational education, rural innovation, and the integration of Islamic values in technology-based community development programs.

2nd Lilis Marlina. Lilis Marlina is a faculty member at the Department of Accounting, Faculty of Economics and Business, Teuku Umar University, Aceh, Indonesia. Her academic interests include Islamic accounting, social responsibility, and ethical finance for sustainable development.

3st Hilma Erliana. Hilma Erliana is a lecturer at the Department of Foundation, Concrete, and Road Pavement Construction, Aceh Barat State Community Academy. Her research areas cover sustainable construction, community-based infrastructure development, and the application of Islamic principles in engineering education.