



Integrating Maqashid Sharia in Climate Change Management and Economic Welfare of Coffee Farmers

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ABSTRACT

Climate change has become a global phenomenon that creates ecological and economic pressures, and substantially impacts coffee's stability and productivity in Central Aceh. This study aims to examine the influence of climate change on the economic welfare level of coffee farmers in Central Aceh District. This research uses a qualitative method with a phenomenological approach. Data were collected through in-depth interviews with 30 coffee farmers in Central Aceh District, spread across Bebesen, Pegasing, and Silih Nara sub-districts. The results showed that climate change, characterised by temperature fluctuations, rainfall uncertainty, and changes in air humidity, had an impact on decreasing coffee productivity, increasing production costs, and decreasing farmers' income. In terms of *maqashid sharia*, this condition *hinders* the fulfilment of the five aspects of *hifz ad-din* (safeguarding religion), *hifz an-nafs* (safeguarding the soul), *hifz al-aql* (safeguarding the intellect), *hifz an-nasl* (safeguarding offspring), and *hifz al-mal* (safeguarding property), with the most significant impact felt on the aspect of *hifz al-mal* due to decreased income, which in turn affects the overall quality of life of farmers.

1. Introduction

Climate change has become a global issue that affects various sectors, including coffee farming in the Aceh Tengah region. The impact of climate change on coffee farming in this region is very significant, considering that Arabica coffee is a major commodity that not only plays an important role in the local economy but also in the welfare of farmers (Fardinatri et al., 2024; Syamratul et al., 2019)

In Indonesia, the impact of climate change on the coffee sector has been particularly pronounced, highlighting a number of crucial aspects that must be addressed to maintain the sustainability of the industry (Muslim et al., 2022; Trianti et al., 2023; Tsai et al., 2023). Characterised by an increase in global air temperature, climate change has a major impact on the agricultural sector, including coffee, which is a mainstay commodity in Aceh Tengah District. In Figure 1, the annual temperature anomaly in Indonesia for the period 1981-2023 shows an increasing temperature trend that directly affects crop productivity and the economic welfare of coffee farmers.

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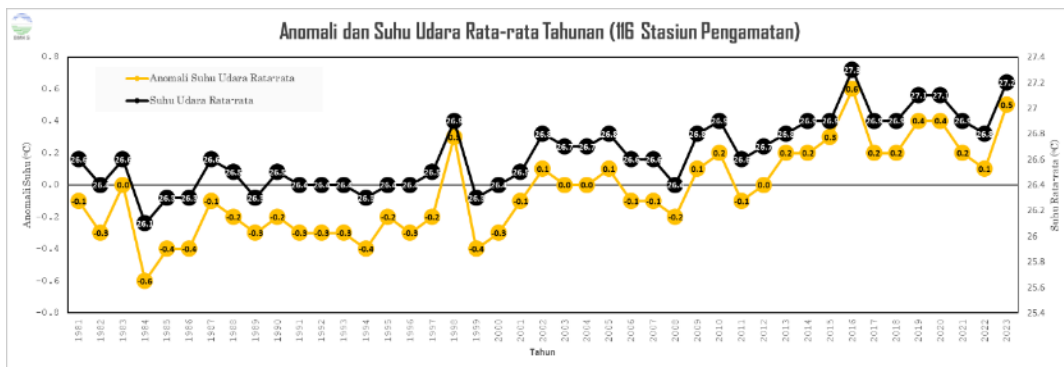


Fig. 1 Graph of Indonesia's Annual Temperature Anomalies for the Period 1981-2023
 Source: Meteorology, Climatology and Geophysics Agency (2024)

Based on the graph above, the annual air temperature anomaly shows a significant increase in temperature in Indonesia. Increasing temperatures can reduce the area suitable for coffee production and reduce coffee yields (Gay et al., 2006; Pham et al., 2019; Sujatmiko & Ihsaniyati, 2018). This also has a direct impact on the economic welfare of coffee farmers due to the decline in production and quality of coffee produced (Bracken et al., 2023; Guerrero-Carrera & Hernández-Flores, 2024; Jawo et al., 2023). In addition, rising global temperatures reduce the availability and suitability of land for Arabica coffee production by 90% by 2050 (Wijaya et al., 2024).

In addition to increasing temperatures, increasingly fluctuating rainfall patterns can have a significant effect on coffee productivity, as shown in Figure 2.

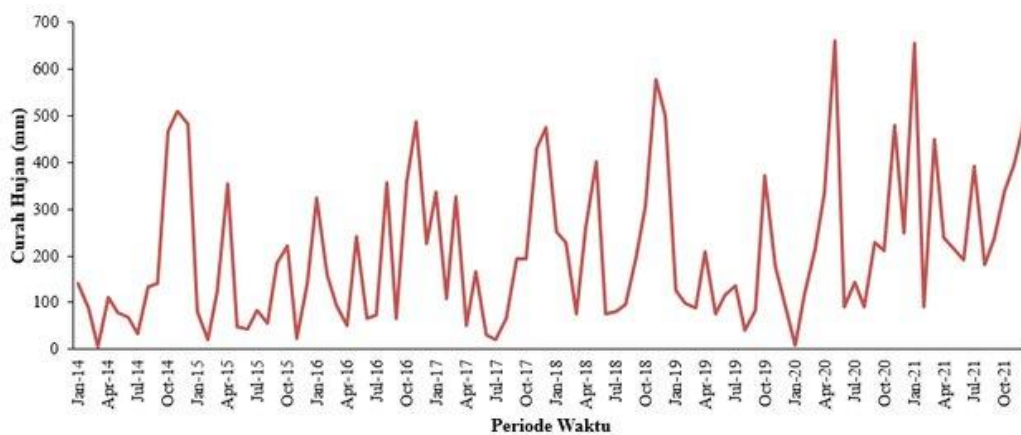


Fig. 2 Plot of Rainfall Data of Aceh Province 2014-2021
 Source: Nurhafifah et al., (2023)

High rainfall intensity can have a significant impact on coffee production (Candra & Irmeilyana, 2024). Excessive rainfall can also cause waterlogged soil conditions, inhibit root growth, reduce photosynthesis, and reduce coffee productivity (León-Burgos et al., 2022). In addition, increased rainfall due to climate change can also reduce coffee production by up to 80% (Syakir & Surmaini, 2017).

Coffee, which has become one of the leading commodities in the plantation sector in Central Aceh, based on BPS data in 2023, has an Arabica coffee plantation area of 50,034.1 thousand hectares, far greater than robusta which is only 1,114.4 thousand hectares. However, climate change

can reduce the availability and suitability of land for Arabica coffee production by 90% by 2050, which can directly threaten the sustainability of coffee production and the economic welfare of farmers (Widayat et al., 2015; Wijaya et al., 2024).

With Arabica coffee dominating the land area far more than robusta, farmers in Central Aceh are dependent on Arabica commodities, making them vulnerable to the impacts of climate change with implications for income volatility and increased risk of economic vulnerability.

The majority of coffee farmers in Central Aceh are facing major challenges due to climate change such as increased temperatures and intensified pest attacks (Anhar et al., 2020; Syamratul et al., 2019). Arabica coffee productivity in the highlands of Aceh is declining due to these factors and adaptation strategies are needed to overcome these impacts (Anhar et al., 2020; Syamratul et al., 2019). One of the proposed adaptation strategies is increased shade density and better farm management practices, such as pruning, weeding and fertiliser use (Anhar et al., 2020; Syamratul et al., 2019).

The concept of green economy that supports sustainable development is in line with maqashid sharia in protecting the soul and the environment. The implementation of a low-carbon economy and resource efficiency are part of *hifz an-nafs* (protecting the soul) and *hifz al-biah* ((Miswanto & Tasrif, 2024). protecting the environment) Then climate change due to overexploitation can threaten *hifz al-mal* (safeguarding wealth) and *hifz an-nasl* (safeguarding offspring), harming the economy of coffee farmers through decreased productivity and income instability. To maintain livelihood sustainability, agricultural adaptation strategies are needed that are aligned with the principles of justice and resource sustainability (Yusuf et al., 2023). This concept is also common in waqf activities (Syahputra et al., 2025).

Islam has a concept of *hifz al-biah* (protecting the environment) that supports sustainable resource management. This includes reducing pollution and ecosystem damage caused by irresponsible economic activities (Yusuf et al., 2023). Climate change challenges the maqashid principles of sharia by threatening human welfare and the environment. However, through the application of the concept of green economy, sustainable and protects the environment in accordance with the principles of sharia (Ayu Alifia & Fakhriah, 2024)

The decline in coffee productivity and the increasing economic vulnerability of farmers due to climate change emphasise the urgency of this research in examining the relationship between climate change and the welfare of coffee farmers in Aceh Tengah District through the maqashid sharia perspective, in order to formulate solutions based on justice and sustainability.

1.1 Climate Change and its Impact on Coffee Production

Climate change has a significant impact on coffee growth and quality. Studies show that rising temperatures, changes in rainfall and increased carbon dioxide concentrations affect the secondary metabolites and sensory attributes of coffee, which in turn affect the quality and selling price of coffee (Ahmed et al., 2021). Rising temperatures and changing rainfall patterns threaten the availability of suitable land for Arabica coffee cultivation, with predictions of a 90% decrease in land viability by 2050 (Wijaya et al., 2024).

In addition, another study showed that 66.5% of coffee farmers in Central Aceh have felt the impact of climate change, especially in the form of increased temperatures and changes in rainfall patterns (Achwan et al., 2019). Factors such as pest and disease attacks due to temperature changes have also further worsened coffee production in Central Aceh (Alfizar & Nasution, 2024)

Climate change leads to a decrease in the area of land suitable for coffee cultivation, so adaptation strategies such as agroforestry and the use of coffee varieties that are more resistant to weather changes are needed (Pham et al., 2019). (Koutouleas et al., 2022). Another study, showed

that the implementation of agroforestry systems can increase coffee's resilience to climate change and provide more stable economic benefits for farmers

1.2 Adaptation Strategies of Coffee Farmers to Climate Change

Coffee farmers in Central Aceh have implemented various adaptation strategies to cope with the impacts of climate change. Some of the commonly used strategies include planting shade trees such as lamtoro and avocado, which is done by more than 60 per cent of the farmers, and making rattan ((Achwan et al., 2019).infiltration trenches) for water conservation

In addition, research shows that agroforestry-based adaptation and increased coffee plant density at higher altitudes can increase coffee productivity in areas affected by climate change (Anhar et al., 2020).

Another study highlighted the need to increase farmers' awareness of the importance of adaptation to climate change, as many farmers still consider climate factors as a less significant threat than other aspects of production (Hasibuan et al., 2023).

1.3 Economic Welfare of Coffee Farmers

The impact of climate change on coffee farmers' welfare can be seen in terms of production and selling prices. Studies examining the economic sustainability of coffee farmers show that good irrigation systems can increase yields and profits, especially in areas that experience frequent droughts (da Silva et al., 2024). In addition, agricultural diversification and the application of sustainable agricultural techniques are important factors in improving farmers' welfare and their economic resilience to climate fluctuations (Nguyen & Drakou, 2021). Other studies have also shown that increased access to technology, markets, and training can improve coffee farmers' economic conditions in the face of climate change (Bracken et al., 2023).

Climate change not only impacts coffee production but also farmers' economic welfare. Coffee farmers in Central Aceh face challenges in the form of declining production that leads to income instability (Wijaya et al., 2024). In addition, a study on the economic resilience of coffee farmers in this region emphasised the importance of business diversification and the development of coffee-based Micro, Small and Medium Enterprises (MSMEs) as an economic solution for affected farmers (Alfiady et al., 2023).

Some studies have also suggested stronger policy interventions, including technical assistance, subsidies, and wider market access to improve the economic competitiveness of coffee farmers in Aceh Tengah (Anhar et al., 2021).

1.4 Perspective of Maqashid Sharia in Welfare

In the perspective of *Maqashid Sharia*, the economic welfare of coffee farmers can be studied through five main principles, namely: *hifz ad-din* (preserving religion), *hifz an-nafs* (preserving the soul), *hifz al-aql* (preserving the intellect), *hifz an-nasl* (preserving offspring), *hifz al-mal* (preserving property). Studies show that the application of *Maqashid Sharia* principles in agricultural economics can improve social justice and welfare of coffee farmers, especially through an economic system based on justice and sustainability (Mursid et al., 2024).

In addition, the *Maqashid Sharia-based* approach can be used in the design of Islamic economic policies to improve farmers' welfare and reduce economic inequality due to climate change impacts (Tumewang et al., 2023). This is in line with the finding that Islamic economics has great potential in building for coffee farming communities (Jawo et al., 2023).

Furthermore, research shows that sustainable climate adaptation policies based on sharia values can support the protection of wealth (*hifz al-mal*) aspect, as it helps farmers maintain their livelihoods in the face of climate change (Anhar, Rasyid, et al., 2021). In addition, it applies the principles of justice and welfare by ensuring fairer prices and more equitable distribution of profits (Alfiady et al., 2023). Another study emphasised the importance of Islamic-based education in

raising farmers' awareness of climate change as well as mitigation strategies that are in line with *Maqashid Sharia* principles (Hasibuan et al., 2023).

2. Methodology

This research uses a qualitative method with a phenomenological approach. The purpose of this approach is to explore the direct and in-depth experiences of coffee farmers in responding to the impacts of climate change on their economic welfare, and to analyse these responses within the framework of maqashid sharia.

2.1 Research Location and Invoice

The research was conducted in Aceh Tengah District, Aceh Province, which is known as one of the centres of Arabica coffee production in Indonesia. Data collection took place during the period September to November 2024.

2.2 Data Sources and Informants

The main source of data came from in-depth interviews with 30 key informants, namely coffee farmers who were purposively selected based on their exposure to climate change impacts and their involvement in the coffee farming sector. Secondary data were obtained from government documents, statistical reports, and scientific references related to climate change and Islamic economics.

To support the clarity of analysis and research structure, the following table summarises the main variables and indicators used in the research. This table aims to map the research focus systematically and become a reference in the process of collecting and analysing field data.

No.	Variables	Assessment Indicator
1	Climate Change	Average temperature change
		Changes in rainfall patterns
		Extreme weather events
		Shift in growing season
2	Farmers' Economic Welfare	Income from coffee
		Coffee plant productivity
		Diversify income sources
		Household food security
3	Maqashid Sharia	Hifz ad-din (protecting religion)
		Hifz an-nafs (protecting the soul)
		Hifz al-aql (protecting the mind)
		Hifz an-nasl (preserving offspring)
		Hifz al-mal (safeguarding property)

3. Results

3.1 Impact of Climate Change on Coffee Productivity and Quality

This study found that climate change significantly affects the economic welfare of coffee farmers in Aceh Tengah District. Based on the results of interviews, most farmers have experienced a decrease in yields of up to 30% in the last 5 years due to changes in rainfall patterns, increased average temperatures, and increased pest and disease attacks. This condition affects not only the amount of production but also the quality of coffee beans, which impacts competitiveness in the international market.

Analysis of the interview data shows that most farmers are aware of the impact of climate change on their coffee production. The main factors identified were (1) erratic rainfall causing coffee flowering failure; (2) increased temperature accelerating fruit ripening but reducing quality; and (3) increased production costs due to the need for additional irrigation and crop protection from pests.

This study corroborates previous findings showing that changes in temperature and rainfall patterns have a direct impact on Arabica coffee production (Pham et al., 2019). An annual temperature increase of 1-2°C could reduce the land suitable for Arabica coffee by 50% by 2050 (Bilen et al., 2023). The results of this study are also in line with a study by Ramadhillah & Masjud (2024) who found that climate change exacerbates pest attacks, such as the coffee fruit borer.

Coffee farmers in Aceh Tengah District are adopting various adaptation strategies, including crop diversification, use of shade trees, and better soil management. However, the main constraints they face are limited access to agricultural technology and capital (Ikhsan Fajri Zuliani & Safwandi, 2023). Therefore, stronger policy support is needed to help farmers access better resources.

The main factors contributing to these problems include erratic rainfall patterns, increased temperatures, pest and disease attacks, and increased production costs. The accumulation of these factors has led to a decline in the economic well-being of coffee farmers in the Aceh Tengah region.

3.1 The Relevance of Maqashid Sharia in the Economic Welfare of Farmers

From a *Maqashid Shariah* perspective, farmers' welfare is closely related to the principle of *hifz al-mal* (safeguarding wealth). Climate change that stresses farmers' incomes results in their reduced ability to meet basic needs and long-term investments in agriculture.

From a *Maqashid Shariah* perspective, safeguarding wealth (*hifz al-mal*) is particularly relevant in the face of climate change challenges. Income instability due to declining crop yields can prevent farmers from fulfilling their basic needs and making long-term agricultural investments.

Therefore, Islamic economic principles based on justice and collective welfare need to be applied in agricultural policies, such as Islamic financing schemes and market price protection.

As a policy implication, there is a need for synergy between the government, Islamic financial institutions, and farmer cooperatives in providing access to capital and sustainable agricultural technology. Thus, adaptation strategies based on *Maqashid Sharia* can be a solution in improving the economic welfare of coffee farmers in the midst of change challenges.

In the perspective of *hifz al-mal*, it refers to fair and sustainable economic welfare for farmers. Studies show that the implementation of sharia-based economic systems, such as Islamic microfinance and financing based on *mudharabah* and *musyarakah* contracts, can increase farmers' economic resilience to climate change risks and market price fluctuations (Muhammad Amin Pohan et al., 2024). In addition, access to Islamic finance can reduce farmers' dependence on moneylenders or conventional high-interest credit systems, which are contrary to the principles of Islamic economic justice (D. Harahap et al., 2023).

Maqashid Sharia also emphasises the importance of environmental protection (*Hifz al-Bi'ah*) as part of farmers' economic welfare. *Maqashid*-based green farming systems emphasise that farmers should avoid over-exploitation of land and natural resources to ensure long-term sustainability (N. K. Harahap et al., 2023). This study emphasises that a combination of modern agricultural technology.

4. Conclusions

This research confirms that climate change has a significant impact on the sustainability of coffee farming in Central Aceh. Factors such as erratic rainfall patterns, increased temperatures, pest and disease attacks, and increased production costs have contributed to a decline in Arabica coffee productivity and quality. These findings are reinforced by analyses showing that climate change could reduce land availability and suitability by up to 90% by 2050, directly impacting the economic well-being of coffee farmers in the region.

From a *Maqashid Shariah* perspective, especially on the principle of *hifz al-mal* (protection of wealth), these challenges threaten the economic sustainability of farmers who depend on coffee farming as their main source of livelihood. The increase in production costs due to increased irrigation needs, crop protection from pests, and crop yield uncertainty means that farmers' financial security is under serious threat. If not addressed with appropriate adaptation strategies, these impacts could worsen their economic conditions and increase poverty levels.

As an effort to implement *hifz al-mal*, policies that support the implementation of sustainable agricultural practices, strengthening farmer institutions, and wider access to climate adaptation technology are needed to maintain production stability and the welfare of coffee farmers in Central Aceh. The principle of *hifz al-mal* also requires protection for farmers through subsidy policies, sharia-based agricultural insurance schemes, and diversification of income sources to reduce dependence on a single crop.

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