

Islamic financial inclusion and human development nexus: Evidence from Sumatra Island, Indonesia

Ruslan Husein Marasabessy¹, Evan Hamzah Muchtar^{2*}

¹ Islamic Economy Law Study Program, Faculty of Sharia, Institut Asy-Syukriyyah, Indonesia

² Islamic Banking Study Program, Faculty of Sharia, Institut Asy-Syukriyyah, Indonesia

Abstract

Sumatra Island is one of the main targets in the development of Islamic economics and finance. This development is expected to bring significant impacts on socio-economy. Therefore, this study aims to examine the relationship between Islamic financial inclusion and human development index (HDI) in Sumatra Island, Indonesia. The study procedures were carried out using panel data on Islamic financial inclusion from 10 provinces from 2015 - 2022. Data was then analyzed using regression analysis and processed with Stata software. The results showed that there was a positive and significant relationship between financial inclusion index and HDI. To provide a broader impact on human development, it was necessary to increase Islamic financial inclusion in Sumatra Island. Therefore, bank managers must provide access to the unbanked community by opening wider and easier banking services for the unbanked. This study also provided recommendations for strategies to accelerate formal Islamic financial inclusion in Sumatra Island.

Keywords: Islamic financial inclusion, Human development, Sumatra

* Corresponding author: evan.hamzah.m@email.com

Introduction

Human development index (HDI) is one of the expected impacts of Islamic financial development, which is in line with one of Sustainable Development Goals (SDGs) (Lestari & Arumi, 2024). For developing countries, such as Indonesia, realizing one of SDGs, namely human development, is a major challenge due to low level of financial inclusion. Demircuc-Kunt et al. (2022) reported that approximately 52% adults in the country lacked access to formal financial institutions. Several studies have shown that financial inclusion is crucial to improving human development. It has also been reported to be an important factor in improving human development (Abdelghaffar et al., 2023; Omar & Inaba, 2020).

According to previous studies, several factors contribute to the low financial inclusion, including low financial literacy (Otoritas Jasa Keuangan, 2024) and rejection of the interest-based financial system for some Muslim residents (Masrizal & Trianto, 2022; Mujiatun et al., 2023; Suhartanto et al., 2020). Consequently, the development of Islamic finance has been proposed as a potential solution because it is more attractive to the unbankable and offers values of justice, free from usury and **gharar**. Financial inclusion is defined as easy access to formal financial institutions for every citizen (Sarma, 2012). In addition to Islamic banking, Islamic cooperatives also play an important role in increasing financial inclusion (Hassan, 2015). Zulkhibri (2016) stated that the risk-sharing system implemented in Islamic financial institutions is a positive influential factor.

The growth of Islamic finance in Indonesia is rapid, with various achievements and concrete actions, such as the merger of government-owned banks. Islamic banking is very important to the national economy, as it helps finance the real sector (Ramadhan et al., 2024). In addition, it is built on sharia principles, such as eliminating usury, promoting the principles of justice, and avoiding the practices of **gharar** and **maysir** (speculation). The system also encourages overcoming social inequality through wealth distribution and poverty mitigation using social finance functions (Novreska & Arundina, 2024). However, studies on the socio-economic impact of financial inclusion are still very limited, specifically on Sumatra Island. The island one of the regions where Islamic finance development is very rapid compared to the central and eastern regions of Indonesia. Despite the rapid development, socio-economic conditions, such as poverty, welfare, and education, still need improvement.

According to Otoritas Jasa Keuangan (2024), Islamic Commercial Banks have opened branches in all provinces on Sumatra Island, with 137 branches and 640 sub-branches. The amount of financing in Micro, Small, and Medium Enterprises (MSME) sector reached IDR 15.466 billion, and financing in non-MSME sector was IDR 4.606 billion. Another report revealed that the amount of third-party funds successfully collected by Islamic banks on the island reached IDR 135.981 billion. Several studies have revealed that financial inclusion contributes to HDI (Kamalu & Wan Ibrahim, 2023; Tissaoui et

al., 2024; Van et al., 2021), poverty alleviation, and economic growth (Abdelghaffar et al., 2023; Masrizal & Trianto, 2022; Novreska & Arundina, 2024; Omar & Inaba, 2020). Therefore, this study aims to examine whether Islamic financial inclusion on Sumatra Island affects socio-economic outcomes, specifically HDI.

The results are expected to contribute to the development of theory and practice in financial inclusion and HDI. To increase the depth of analysis and the model's complexity, population and education variables were included as controls. The study procedures were then carried out using static panel data from 2015 to 2022 from all provinces on Sumatra Island.

Method

This study used a quantitative method using panel data regression analysis to examine the relationship between Islamic financial inclusion and human development in Sumatra Island, Indonesia. Panel data, which combined cross-sectional and time-series data, was used to capture both spatial and temporal variations across provinces and over time.

The dataset consisted of annual data from 10 provinces in Sumatra Island over the period 2015 to 2022. The data were obtained from official sources, including Financial Services Authority (OJK) and Central Statistics Agency (BPS). The dependent variable in this study was HDI, while the main independent variable was Islamic Financial Inclusion Index (IFI). In addition, population and education were included as control variables to improve the model's robustness.

To estimate the relationship between variables, panel data regression techniques were used, such as Fixed-Effect Model (FEM) and Random-Effect Model (REM). Model selection was conducted using Hausman test, Lagrange Multiplier (LM) test, and the redundant fixed effect test to determine the most appropriate estimation model. Based on the test results, FEM was selected as the preferred model for analysis. All data processing and statistical analyses were conducted using Stata version 17.0.

Data

Secondary data were used in this study, and panel data from 10 provinces on Sumatra Island consisted of Aceh, North Sumatra, West Sumatra, Riau, Jambi, South Sumatra, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands. Annual data from 2015 to 2022 were included, obtained from several sources, including OJK and Central Statistics Agency (BPS), as shown in Table 1.

The dependent variable in the analysis is human development, as measured by HDI. The main independent variable is Islamic financial inclusion using (1) Islamic banking third-party funds, (2) the number of Islamic bank branch networks, and (3) the amount of

Islamic bank financing, which capture the penetration or accessibility, availability, and use of financial inclusion, respectively. These are the total third-party funds across all Islamic banks, third-party funds per 1,000 adult population, total Islamic bank financing per 1,000 Gross Regional Domestic Product (GRDP), and total Islamic bank branches per 100,000 adult population, adjusted for the number of Islamic bank branches.

In the following subsections, the construction of Islamic financial inclusion index was detailed based on these indicators. In addition to these main variables, control variables that were considered relevant in explaining the dependent variable were included, such as population and education.

Table 1. Variable Indicator

Variables	Variable Definition	Expectations	Source
Dependent Variable			
HDI	comparative measures of life expectancy, literacy, education and standards of living		BPS
Independent Variable			
Islamic Financial Inclusion Index	Index value resulting from sharia inclusive financial calculations	+	OJK
Population	all people who have been domiciled in the geographical area of the Republic of Indonesia for 6 months or more and/or those who have been domiciled for less than 6 months but intend to stay.	+/-	BPS
Education	The proportion of the population aged 15 years and over who has the ability to read and write Latin letters and other letters, without having to understand what they are reading/writing compared to the population aged 15 years and over.	+/-	BPS

IFI Calculations

Sarma and Pais (2008) calculated the financial inclusion index for the first time in India, focusing only on banking penetration, availability, and use of banking services. In the study, the financial inclusion index was calculated using a multidimensional method, which was very similar to UNDP method used to calculate HDI. Based on this method, the index was calculated using each dimension of financial inclusion. The index for each dimension d_i was calculated using Equation (1). A weight W_i , varying from 0 to 1 ($0 \neq W_i \neq 1$), was applied to each i -th dimension, indicating the importance of the “ i ” dimension in measuring the inclusiveness of the financial system.

$$d_i = w_i \frac{A_i - m_i}{M_i - m_i} ; i = 1, 2, 3 \dots$$

Where:

d_i = index of the i -th dimension

w_i = weight assigned to the i -th dimension ($0 \leq w_i \leq 1$)

A_i = actual value of the i -th dimension

M_i = maximum value of the i -th dimension

m_i = minimum value of the i -th dimension

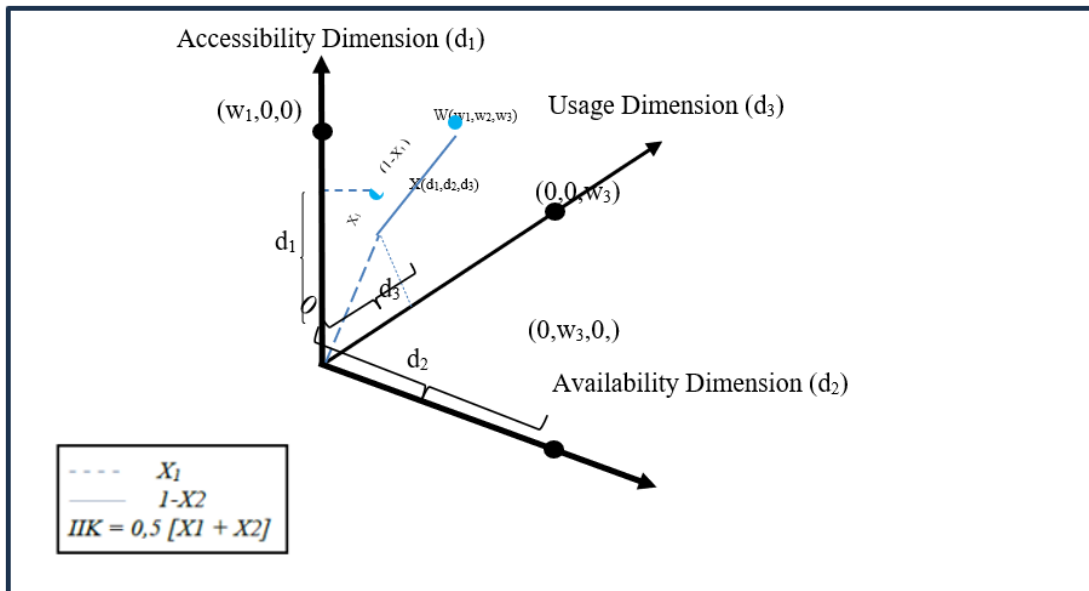


Figure 1. Illustration of Calculation of Financial Inclusion Index

Source: (Sarma & Pais, 2008)

The value of d_i for $i = 1, 2, 3$ lies in the interval $[0, w_i]$. A higher value of d_i indicates better achievement in the i -th dimension of financial inclusion. A region's level of financial inclusion is represented by the point $X=(d_1, d_2, d_3)$. In the dimensional space, point $O=(0,0,0)$ represented the lowest level of financial inclusion, while point $W=(w_1, w_2, w_3)$ represented the ideal condition, where all dimensions achieved their maximum weighted values. Therefore, the position of the point X relative to the points O and W reflected the overall level of financial inclusion in a given region.

Financial inclusion index was calculated based on the distance between the worst point and the dimension achievement ($O-X$ or X_1), as well as the distance between the ideal achievement point and the dimension achievement ($W-X$ or X_2). This was carried out with the formula:

$$x_1 = \frac{\sqrt{d_1^2 + d_2^2 + d_3^2 + d_4^2 + d_5^2}}{\sqrt{w_1^2 + w_2^2 + w_3^2 + w_4^2 + w_5^2}} \text{ and}$$

$$x_2 = 1 - \frac{\sqrt{(w_1 - d_1)^2 + (w_2 - d_2)^2 + (w_3 - d_3)^2 + (w_4 - d_4)^2 + (w_5 - d_5)^2}}{\sqrt{w_1^2 + w_2^2 + w_3^2 + w_4^2 + w_5^2}}$$

As explained earlier, the value of each dimension index d_i lies in the interval $[0, w_i]$, where higher values showed better performance in the i -th dimension. A province's level of financial inclusion was represented by the point $X=(d_1, d_2, d_3)$. In the dimensional space, point $O=(0,0,0)$ represented the worst condition, while point $W=(w_1, w_2, w_3)$ represented the ideal condition, where all dimensions achieved their maximum weighted values (Sarma, 2012). Assuming equal weights for all dimensions ($w_1 = w_2 = w_3 = 1$), the ideal point became $W=(1,1,1)$. Based on this framework, the final formula of Islamic Financial Inclusion Index (IFI) is defined as follows:

$$IFI = -\frac{1}{2} \left[\frac{\sqrt{d_1^2 + d_2^2 + d_3^2}}{\sqrt{3}} + 1 - \frac{\sqrt{(1-d_1)^2 + (2-d_2)^2 + (3-d_3)^2 + (4-d_4)^2 + (5-d_5)^2}}{\sqrt{3}} \right]$$

IFI formula is obtained by calculating the average value of X1 and X2, which represents the position between the worst point and the ideal point. The results of IFI measurement are divided into 3 categories: (i) low IFI when IFI value is less than 0.3; (ii) medium IFI when IFI value is between 0.3 and 0.6, and (iii) high IFI when IFI value is between 0.6 and 1 (Sarma, 2012). In addition, Sarma and Pais (2008) suggest that this method can be used to measure financial inclusion at different points in time and different levels of economic aggregation (village, province, state, country, and so on).

Estimating Models

In this study, panel data regression was used in Stata 17.0 for data processing. Panel data is a combination of **time series** and **cross-sectional** data. Gujarati & Porter (2009) state that several methods can be used to estimate regression models using panel data, including **pooling least squares (common effect)**, FEM, and REM. The equation for panel data regression can be described as follows:

$$Y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \quad (1)$$

Where:

Y_{it} = dependent variable for unit i at time t

α_i = intercept for unit i

β = slope coefficient

X_{it} = independent variable

ε_{it} = error term

To determine the most appropriate panel data model, several specification tests are conducted. The redundant fixed-effect test is used to select between the common-effect model and FEM. Hausman test is used to select between FEM and REM. Meanwhile, LM test is used to determine which model is preferred between the common-effect model and REM.

Following the standard empirical literature, this study estimates the impact of Islamic financial inclusion on human development. The baseline model is specified as follows:

$$HDI_{it} = \alpha_0 + \alpha_1 IFI_{it} + \sum_{k=1}^n \beta_k Control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

Where:

- HDI_{it}** = human development index for the province at the time
 IFI_{it} = Islamic Financial Inclusion Index
 $Control_{it}$ = vector of control variables (population and education)
 α_0 = constant term
 β_k = coefficient of control variables
 μ_i = unobserved province-specific effect
 λ_t = time-specific effect
 ε_{it} = error term

Province denotes cross-sectional units, while represents the time period (year). This study uses FEM based on Hausman test, showing that FEM is more appropriate than REM.

Result and Discussion

Islamic Financial Inclusion Index

Table 2 shows the Sharia financial inclusion index from 2015 to 2022, with each year showing an increase, though the increase is relatively small. Aceh Province ranked first in Sharia Financial Inclusion Index, with a score of 0.516. The second rank was occupied by Riau Islands Province with a sharia financial inclusion index in 2022 of 0.225 percent, and the third rank was occupied by Riau Province with a sharia financial inclusion index of 0.165. Meanwhile, Lampung Province had the lowest sharia financial inclusion index, namely 0.051. Riau Islands Province and Riau Province have observed a significant increase in achieving sharia financial inclusion index, with 2021 scores of 0.097 and 0.087, respectively, rising to 0.225 and 0.165 in 2022. This was inseparable from the conversion of BRK to BRK Syariah.

Table 2. Islamic Financial Inclusion Index in Sumatra Island

Province	2015	2016	2017	2018	2019	2020	2021	2022	Rank
Aceh	0.091	0.264	0.286	0.282	0.312	0.487	0.526	0.516	1
Riau Island	0.090	0.095	0.091	0.088	0.091	0.090	0.097	0.225	2
Riau	0.061	0.055	0.056	0.060	0.065	0.071	0.087	0.165	3
West Sumatra	0.089	0.085	0.082	0.080	0.085	0.089	0.099	0.107	4
Bengkulu	0.071	0.068	0.075	0.078	0.066	0.073	0.080	0.084	5
Palembang	0.053	0.048	0.052	0.057	0.061	0.065	0.069	0.075	6
North Sumatra	0.060	0.059	0.061	0.061	0.065	0.068	0.071	0.074	7
Jambi	0.055	0.045	0.046	0.052	0.052	0.057	0.060	0.065	8
Bangka Belitung	0.120	0.121	0.077	0.113	0.112	0.090	0.093	0.064	9
Lampung	0.038	0.040	0.040	0.041	0.044	0.049	0.050	0.051	10
Average	0.008	0.028	0.020	0.027	0.029	0.034	0.037	0.070	

Source: Authors' calculation (2024)

Statistic Descriptive

Table 3 presents descriptive statistics, including the mean, standard deviation, minimum, and maximum values. HDI variable has a mean of 71.196, a standard deviation of 1.917, a minimum of 66.95, and a maximum of 76.46. Meanwhile, IFI variable has a mean of 0.133, a standard deviation of 0.133, a minimum of 0.056, and a maximum of 0.707. The education variable has mean of 99.495 and standard deviation of 0.329, with minimum of 97.98 and maximum of 99.93. The population variable has a mean of 15.315, standard deviation of 0.329, minimum of 14.132, and maximum of 16.531.

Table 3. Statistic Descriptive

Variable	Obs	Mean	Std. Dev.	Min	Max
HDI	80	71.196	1.917	66.95	76.46
IFI	80	.133	.133	.056	.707
lnPopulation	80	15.315	.735	14.132	16.531
Education	80	99.495	.329	97.98	99.93

Source: Authors' calculation (2024)

Regression Analysis Results

The results of the test of the relationship between Islamic financial inclusion and HDI are shown in Table 4. The results of this study show that FEM was selected because it yielded better results compared to REM. Table 4 shows that Islamic financial inclusion positively and significantly affects human development in Sumatra Island. This indicated that the higher the level of Islamic financial inclusion, the higher the level of human development in Sumatra Island. The result supports previous results by Matekenya et al. (2021); Nanda and Kaur (2016); Novreska and Arundina (2024); Ababio et al. (2021); and Sarma and Pais (2008). For this reason, stakeholders must develop policies to

promote Islamic financial inclusion. Some strategies local governments can adopt include converting BPDs into Islamic BPDs, as has been carried out by the Aceh and Riau Provincial Governments. This shows the potential to create higher Islamic financial inclusion.

Table 4. Regression Analysis Results

Variable	Islamic Financial Inclusion and Human Development (FEM)		Islamic Financial Inclusion and Human Development (REM)	
	1(a)	1(b)	2(a)	2(b)
IFI	5.038*** (3.89)	4.610*** (5.30)	4.717*** (4.08)	3.871*** (2.82)
lnPopulation		3.619*** (3.27)		1.201** (2.00)
Education		2.675*** (7.99)		3.003*** (6.03)
C	70.527*** (410.61)	251.005*** (-7.27)	70.570*** (140.05)	-246.464 (-5.17)
Sampel Province	10	10	10	10
Observation	80	80	80	80
R-Square	0.078	0.5925		
Robust	Yes	Yes	Yes	Yes
Reduncant-fixed effect Test	Prob_F		0.000	
Hausman Test	Prob_Chi2		0.000	
LM Test	Prob_Chi2		0.000	

Source: Authors' calculation (2024)

For provinces that have converted BPD to Sharia BPD, to continue to penetrate the market by opening branch offices and cash offices down to the sub-district level. Therefore, the presence of Islamic banks at the sub-district level can increase public literacy, which enhances sharia financial inclusion. Provincial Government must also encourage the conversion of Cooperatives to Sharia Cooperatives. Hassan (2015) reported that Islamic microfinance, such as Islamic cooperatives, can increase sharia financial inclusion because of the various levels of ease in accessing it, specifically for the poor and unbankable. Abdelghaffar et al. (2023) noted that developing countries face challenges related to low economic development, including low life expectancy, poor education and health, and environmental problems. For this reason, these countries, including Indonesia, must increase access to the use of formal sharia financial services.

With greater access to higher formal finance, savings can expand, increasing access to financial services for each individual and boosting investment in education and household spending. Access to formal Islamic financial institutions must also be increased to help micro-business owners start businesses and earn income. This can

lead to poverty alleviation, reduce income inequality, and improve individuals' standard of living, thereby advancing human development. Kazemikhasragh and Pineda (2022) stated that increasing access to financial services provides them with basic tools to generate income and improve social welfare.

The development of digital financial services has become an important driver in accelerating Islamic financial inclusion, specifically in developing countries. The integration of financial technology (fintech) with Islamic financial institutions allows broader outreach to underserved and remote communities (Shaikh, 2021). Digital platforms can reduce operational costs, increase efficiency, and provide easier access to financial products such as savings, financing, and payment systems. Recent studies show that digital financial inclusion significantly improves financial access and ultimately enhances human development outcomes by facilitating inclusive economic participation (Hashemizadeh et al., 2023; Mishra et al., 2024). Therefore, the adoption of digital Islamic financial services must be prioritized to complement conventional expansion strategies.

Financial literacy plays a significant role in strengthening the effectiveness of financial inclusion in improving human development. Without adequate understanding, individuals are not able to make optimal use of available financial services. Empirical evidence suggests that higher levels of financial literacy are associated with better financial decision-making, increased savings behavior, and improved investment in education and health (Bai, 2023; Parsai & Chandok, 2025). In the context of Islamic finance, literacy also includes understanding Sharia principles, which increases trust and participation among Muslim communities. Therefore, improving financial literacy is essential to ensure that financial inclusion translates into real welfare gains.

Institutional quality and government support are also major determinants in maximizing the impact of Islamic financial inclusion on human development (Eldomiaty et al., 2020). Strong regulatory frameworks, effective supervision, and supportive public policies can enhance the stability and accessibility of financial systems. Studies show that countries with better governance and institutional quality tend to experience stronger positive effects of financial inclusion on socio-economic development (Ozili et al., 2023; Zeqiraj et al., 2022). In this regard, collaboration between the government, financial institutions, and other stakeholders is necessary to create an enabling environment that supports sustainable and inclusive development.

The results of this study also revealed a positive and significant relationship between education and human development. This study aligns with Kazemikhasragh and Pineda (2022). Abdelghaffar et al. (2023) said that a higher level of financial inclusion has an impact on increasing investment in education through increased access to financial services, specifically for women who tend to invest most of their income in education, health, and the welfare of their children. Therefore, it is important for stakeholders, especially Islamic banking and Islamic microfinance, and the government to increase

formal financial access for low-income people. With the many access points provided to the unbanked, all their transactions are carried out through banking, which reduces transaction costs and, in turn, increases their income and their welfare.

The positive relationship between education and human development can also be explained through the role of human capital accumulation. Education enhances individuals' knowledge, skills, and productivity, thereby improving their ability to access and use financial services effectively (Hajdari et al., 2023). In this context, financial inclusion not only provides access to financial products but also strengthens individuals' capacity to invest in human capital, particularly in education and health. Empirical evidence shows that financial inclusion significantly increases household investment in education, which ultimately contributes to higher human development outcomes (Ma et al., 2024).

Recent studies show that financial inclusion and human development are closely interconnected through several transmission channels, including income generation, employment opportunities, and access to basic services. For instance, Tissaoui et al. (2024) observed that financial inclusion improves human development by enhancing access to financial resources, enabling households to smooth consumption, invest in education, and improve health. This showed that financial inclusion plays a multidimensional role in supporting the components of HDI, particularly education and standard of living.

The role of financial inclusion in supporting human development is also mediated by human capital development. A study by Opoku et al. (2024) shows that human capital acts as a transmission channel through which financial inclusion affects broader development outcomes. This implies that improving access to financial services alone is not sufficient; it must be accompanied by improvements in education and human capacity to maximize its impact on development (Ababio et al., 2021). In the context of Sumatra Island, this result suggests that policies aimed at increasing Islamic financial inclusion must be integrated with education policies to achieve more optimal human development outcomes.

Financial inclusion contributes to human development by reducing poverty and inequality. Increased access to financial services enables individuals to start businesses, manage risks, and build assets, thereby improving their economic resilience and overall well-being. This is consistent with results from recent studies that emphasize the role of financial inclusion in promoting inclusive growth and achieving sustainable development goals by improving education, health, and income distribution (Mani et al., 2024).

The synergy between education and Islamic financial inclusion is crucial in accelerating human development. Policies that simultaneously promote financial access and educational improvement can generate a stronger and more sustainable impact on welfare. In this regard, expanding Islamic financial services must be accompanied by efforts to improve financial literacy and education quality, ensuring that individuals are not only financially included but also capable of using financial services productively.

Conclusion

In conclusion, the development of Islamic economics and finance aims to fulfill customer needs for financial services that align with Islamic law while simultaneously promoting real sector economic growth and enhancing human welfare. This study affirms that Islamic finance significantly increases financial inclusion among low-income and unbanked populations, particularly in Sumatra Island, where it has been shown to improve overall welfare. To strengthen this impact, stakeholders must implement appropriate policies and strategies that foster broader Islamic financial inclusion. These include efforts by Islamic Financial Institutions (IFIs) to expand access by opening sub-district branches and optimizing technology to reach underserved communities, as well as government initiatives to convert regional development banks (BPDs) into Sharia-based institutions and transform conventional cooperatives into Sharia cooperatives through various incentives and support.

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