



Green Banking Disclosure, Service, Bank Efficiency and Firm Value: Evidence from Indonesian Islamic Commercial Banks

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Abstract

Purpose – This study examines the effects of Green Banking Disclosure, Service Digitalization, and Bank Efficiency on the Firm Value of Islamic Commercial Banks in Indonesia during the 2020–2024 period

Methodology – This study uses a quantitative approach with panel data from seven Islamic Commercial Banks in Indonesia, yielding 35 observations over five years. Secondary data were obtained from annual and sustainability reports. Green Banking Disclosure and Service Digitalization were measured using content analysis. Panel data regression was performed using EViews 13. Based on the Chow, Hausman, and Lagrange Multiplier tests, the Random Effect Model (REM) was selected as the appropriate estimation model.

Findings – Green Banking Disclosure has a negative but insignificant effect on Firm Value. Service Digitalization has a positive and significant effect on Firm Value ($\beta = 0.578224$; $p = 0.0181$), while Bank Efficiency also has a positive and significant effect ($\beta = 0.006388$; $p = 0.0003$). Simultaneously, the three variables significantly affect Firm Value ($p = 0.000652$). The adjusted R^2 of 0.364450 indicates that the model explains 36.445% of the variation in Firm Value.

Implications– Islamic banks should strengthen service digitalization and operational efficiency while improving the substantive implementation of Green Banking beyond disclosure. Investors should consider digital capabilities and efficiency alongside sustainability and other financial fundamentals when assessing Islamic banks.

Originality– This study integrates Green Banking Disclosure, Service Digitalization, and bank efficiency into a single panel-data model to provide empirical evidence on the determinants of Firm Value in Indonesian Islamic Commercial Banks.

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1. Introduction

The banking sector plays a strategic role in driving a country's economy through its financial intermediation function. In the modern era, the banking industry is not only required to achieve optimal profitability but also to contribute to sustainable development and adapt to advances in digital technology (Saputri et al., 2024). Islamic banking, as part of Indonesia's financial system, has experienced significant growth, with total assets reaching IDR 686.73 trillion in 2023, up from IDR 608.9 trillion in 2020 (OJK, 2023).

The Indonesian government, through the Financial Services Authority (OJK), issued OJK Regulation Number 51/POJK.03/2017 concerning the Implementation of Sustainable Finance for Financial Services Institutions, Public Companies, and Issuers, requiring financial institutions to integrate environmental, social, and governance aspects into their business activities (OJK, 2017). This policy has encouraged the implementation of Green Banking in the banking sector, including Islamic banking, which is philosophically aligned with the principles of sustainability and public welfare. In addition, the COVID-19 pandemic, which began in early 2020, accelerated digital transformation in the banking sector, compelling financial institutions to accelerate the digitalization of their services to maintain operations and serve customers (Sari et al., 2025). In Islamic banking, Firm Value is an important indicator reflecting investors' perceptions of a bank's performance and prospects. High Firm Value not only benefits shareholders but also strengthens stakeholder confidence and the bank's ability to raise funds. Therefore, understanding the factors that influence Firm Value is crucial, particularly amid the dynamics of Green Banking implementation, digital transformation, and operational efficiency (Aida et al., 2024).

Although Islamic banking in Indonesia has shown positive asset growth, Firm Value performance varies significantly. Data from the Indonesia Stock Exchange (IDX) indicate that the Price-to-Book Value (PBV) of listed Islamic banks fluctuated during the 2020–2024 period. Several Islamic banks recorded PBV ratios below 1, indicating potential undervaluation, while others recorded PBV ratios above 2. This phenomenon raises questions regarding the factors underlying these differences in Firm Value (Heriyono & Aisyah, 2024). Based on OJK Islamic banking statistics, the Indonesian Islamic banking industry's total assets showed growth despite the COVID-19 pandemic. Total Islamic banking assets reached IDR 608.9 trillion in 2020, increased to IDR 640.8 trillion in 2021, IDR 682.8 trillion in 2022, and IDR 686.73 trillion in 2023. In 2024, total assets grew by 9.88% to IDR 980.30 trillion (OJK, 2025).

Green-sector financing by Islamic banks remains relatively limited. Sustainability reports from several Islamic banks indicate that financing for renewable energy, green buildings, and other sustainable projects accounts for about 2–5% of total financing. This figure remains considerably below the target stated in Indonesia's sustainable finance roadmap, which aims for sustainable financing to account for 30% of financing portfolios by 2030 (Ridwan & Harahap, 2024). In terms of digitalization, Islamic banking has seen significant adoption of digital banking services. Islamic mobile banking users increased from 8.5 million in 2020 to 17.3 million in 2023. The value of digital banking transactions also increased substantially, from IDR 1,268 trillion in 2020 to IDR 3,745 trillion in 2023, reflecting the extensive development of digital transformation within the industry (OJK, 2023). Islamic banking efficiency, as measured by the Operating Expenses to Operating Income (BOPO) ratio, has improved gradually. The average BOPO ratio in the Islamic banking industry was 87.18% in 2020, 86.44% in 2021, 85.93% in 2022, and 85.12% in 2023. The declining BOPO ratio indicates an improvement in operational efficiency, although further improvement is required to achieve an optimal efficiency level below 80% (OJK, 2023).

Green Banking refers to banking practices that incorporate environmental considerations into business and operational decisions. Green Banking Disclosure in sustainability reports can enhance bank transparency and accountability to stakeholders. When Islamic banks actively disclose their Green Banking practices, such disclosure may improve corporate reputation, attract investors interested in sustainable investment, and mitigate environmental risks that could affect long-term financial performance. Improved reputation and reduced risk may subsequently enhance investors' positive perceptions of the bank's future prospects, which can be reflected in higher Firm Value (Widiyanti et al., 2025).

Service Digitalization in banking encompasses developing digital platforms such as mobile banking and internet banking and integrating other financial technologies. Digitalization can improve operational efficiency through process automation, reduce transaction costs, expand service coverage without requiring the physical expansion of branch offices, and enhance customer satisfaction through easier access to banking services. Islamic banks that successfully undertake digital transformation tend to have broader market reach, lower operating costs, and stronger customer loyalty. These factors can contribute to higher profitability and business growth, which may ultimately increase Firm Value from the perspective of investors (Fitria, 2025).

Bank operational efficiency reflects management's ability to use resources optimally to generate income. An efficient bank can minimize operating expenses while maximizing operating income, as reflected in a lower BOPO ratio. Higher efficiency can generate larger profit margins, improve Return on Assets (ROA) and Return on Equity (ROE), and strengthen the bank's competitive position. Investors tend to assign higher valuations to efficient banks because of their stronger profitability and lower operational risk, thereby contributing to higher Firm Value (Kamarni et al., 2025).

Signaling Theory, developed by Michael Spence in 1973, explains that high-quality companies provide positive signals to the market to distinguish themselves from lower-quality companies. In this study, Green Banking Disclosure, the implementation of Service Digitalization, and high operational efficiency represent signals that Islamic banks provide to investors and other stakeholders. These signals can reduce information asymmetry between bank management and investors, enabling investors to make more informed investment decisions and ultimately affecting Firm Value (Nisa et al., 2024).

The Resource-Based View (RBV) Theory, developed by Barney in 1991, explains that a firm's competitive advantage originates from internal resources and capabilities that are valuable, rare, difficult to imitate, and well organized. In this study, Islamic banks' capabilities to implement Green Banking, use digital technology, and achieve operational efficiency constitute strategic resources and capabilities that may create competitive advantage. Such advantages enable banks to compete more effectively, improve financial performance, and ultimately enhance Firm Value (Utama & Sari, 2025).

Previous studies have extensively examined the factors influencing Firm Value in the banking sector. However, most have focused on conventional banks and employed traditional variables such as profitability, liquidity, and capital structure. Studies examining the relationship between Green Banking Disclosure and Firm Value in the context of Islamic banking remain limited, particularly in Indonesia. Several studies show that environmental sustainability disclosure can enhance Firm Value through improved reputation and social legitimacy, while others find insignificant or even negative short-term relationships due to implementation costs. Findings on the impact of digitalization on banking Firm Value also vary by context, study period, and methods used. This research gap provides an opportunity for a more comprehensive analysis by integrating Green Banking Disclosure, Service Digitalization, and Bank Efficiency into a single research framework (Waworuntu & Pratiwi, 2025).

Empirical evidence shows considerable variation among Islamic banks in Green Banking implementation, digitalization levels, and operational efficiency. Some Islamic banks actively communicate their commitment to Green Banking through sustainability reports and implement various environmentally friendly programs, while others disclose and implement far less. Digital technology strategies also vary, with larger Islamic banks generally operating more advanced digital platforms than smaller Islamic banks. In terms of efficiency, substantial differences in BOPO ratios across Islamic banks indicate variations in their ability to manage operating costs. Interestingly, banks with high levels of digitalization or extensive Green Banking Disclosure do not necessarily have the highest Firm Value, suggesting the existence of complex factors that require further investigation (Mutmainah & Apriadi, 2025).

Based on the background described above, this study is important for several reasons. First, it provides empirical evidence regarding the effectiveness of Green Banking Disclosure, Service Digitalization, and operational efficiency in enhancing the Firm Value of Islamic banks in

Indonesia. Second, the findings may provide strategic insights for Islamic bank management on allocating resources to sustainability programs, digital technology investments, and improvements in operational efficiency. Third, the results may serve as a reference for regulators, particularly OJK and Bank Indonesia, in evaluating and developing policies related to sustainable finance and the digitalization of Islamic banking. Fourth, this study provides investors with valuable information when making investment decisions on Islamic banking stocks by considering increasingly relevant non-financial factors.

2. Literature Review

2.1 Signaling Theory

Signaling theory was first introduced by Michael Spence in 1973. According to Spence, signaling theory describes how a sender conveys information to the public through signals that indicate a business's condition. Signaling theory plays a role in shaping investors' perceptions of a company, and the reactions generated by these signals can significantly influence decision-making for the future interests of the company (Spence, 1973). Such signals may include information describing management's efforts to fulfill owners' or shareholders' interests. Information received by the public is considered by shareholders and company owners as a basis for making investment decisions (Ghozali et al., 2024). Signals generate information that is processed and analyzed by parties interested in the company and may subsequently be categorized as either positive or negative signals. If the information is perceived as positive, investors are more likely to consider the company worthy of investment. Conversely, if the information is perceived as negative, it may reduce investors' intention to invest in the company (Ghozali et al., 2024).

2.2 Resource-Based View (RBV) Theory

Wernerfelt introduced the Resource-Based View (RBV) theory in 1984, and Barney further developed it in 1991. According to Barney, a company can be viewed as a collection of strategic and productive resources that are unique, rare, complex, complementary, and difficult for competitors to imitate. These resources can be utilized to sustain the company's competitive strategy. A firm's competitive advantage should therefore be based on specific resources that create barriers to imitation and reduce threats from substitute products or services (Dasuki, 2021). This perspective indicates that, to survive amid increasingly intense competition, companies must take actions that preserve and strengthen their unique competencies. Firms with distinctive technical and managerial capabilities have important resources to sustain competitive advantage. More specifically, unique advantages and superior organizational routines across one or more activities in the value chain enable firms to generate economic rents from their competitive advantage (Mulyani, 2021).

2.3 Green Banking Disclosure

Green Banking is a banking concept that applies sustainability principles by incorporating environmental considerations into business activities. According to the World Bank, Green Banking practices can enhance corporate image while reducing the negative environmental impacts of operations, supporting social responsibility and sustainability (Silva, 2019). Green Banking may be implemented through digital services such as internet banking, mobile banking, online banking, electronic banking outlets, green loans, green checking accounts, and energy-saving practices. In Indonesia, these practices are regulated under Financial Services Authority Regulation (POJK) No. 51/POJK.03/2017, which requires financial institutions to implement sustainable finance through a Sustainable Finance Action Plan and sustainability reporting (Asfahaliza & Anggraeni, 2022). This study analyzes Green Banking Disclosure based on companies' sustainability reports, using OJK Circular Letter No. 16/SEOJK.04/2021 and POJK No. 51/POJK.03/2017 concerning the Implementation of Sustainable Finance for Financial Services Institutions, Issuers, and Public Companies. To measure the extent of Green Banking implementation, each GCR disclosure item

is assigned a score of 1 if disclosed and 0 if not disclosed. The total disclosure score is then divided by the total number of predetermined indicators (Hanif et al., 2020).

$$\text{Green Banking} = \frac{\text{Disclosure Implementation Green Banking}}{\text{Total Disclosure Indicator}}$$

2.4 Service Digitalization

Service Digitalization refers to the use of digital technology in banking services to facilitate financial management. These services can be accessed through mobile applications, internet platforms, and automated systems, making transactions easier, faster, and more transparent (Moridu, 2020). Service Digitalization may influence Firm Value because it can improve operational efficiency, broaden access to services, and increase customer satisfaction. In addition, digitalization strengthens bank competitiveness and may attract investors by demonstrating the company's ability to adapt to technological developments (Lestari et al., 2021).

In Indonesia, digital banking services continue to grow as demand increases, driven by public demand for practical financial services. In Islamic banking, Service Digitalization includes ATMs, Internet Banking, Mobile Banking, SMS Banking, and Phone Banking, which enable customers to conduct transactions anytime and anywhere (Inarotul & Putri, 2022). To measure the level of Service Digitalization, each disclosed item is assigned a score of 1, while undisclosed items are assigned a score of 0. The total disclosure score is then divided by the total number of predetermined indicators (Inarotul & Putri, 2022).

$$\text{Service Digitalization} = \frac{\text{Impelementation Service Digitalization of BUS}}{\text{Total Indicator}}$$

2.5 Bank Efficiency

Bank Efficiency refers to a bank's ability to utilize resources such as labor, capital, and assets to achieve maximum output at the lowest possible cost. An efficient bank can reduce operating costs without compromising service quality or financial performance. In Islamic banking, efficiency is important for enhancing competitiveness, maintaining business sustainability, and strengthening customer confidence (Kuncoro, 2018). Bank Efficiency is commonly measured using the operating expenses-to-operating income ratio, known in Indonesia as BOPO. A lower BOPO ratio indicates a higher level of bank efficiency. Efficiency can be improved through sound asset management, effective risk management, and the utilization of digital technology (Ismail, 2018).

$$\text{BOPO} = \frac{\text{Operating Costs}}{\text{Operating Income}} \times 100\%$$

2.6 Firm Value

Firm Value reflects how investors, the market, and other stakeholders assess a business entity. This assessment represents perceptions of the company's performance, long-term prospects, and future income-generating potential. Therefore, Firm Value may be interpreted as a particular condition achieved as a result of public trust that develops through the company's operational activities over time (Agustina & Huda, 2021). The higher the Firm Value, the more positive stakeholders' perceptions of the company. Accordingly, company management should strive to optimize Firm Value as one of the company's primary objectives (Sukanti & Rahmawati, 2023).

2.7 Research Framework

A research framework is a systematic representation of the relationships among the variables examined based on theoretical foundations and previous empirical studies (Syahputri et al., 2023). The framework is used to logically explain how the independent variables, namely Green Banking Disclosure, Service Digitalization, and Bank Efficiency, are expected to influence Firm Value as the dependent variable. This study uses Signaling Theory and the Resource-Based View (RBV) as theoretical foundations to explain the relationships among the variables. The two theories serve different functions. Signaling Theory is primarily used to explain how information published by companies can shape investor and market perceptions. RBV explains how banks' internal resources and capabilities can create competitive advantage and ultimately increase Firm Value.

In the context of Green Banking Disclosure, it is important to distinguish between disclosure and the bank's actual capability to implement Green Banking practices. Green Banking Disclosure is not a strategic resource in the RBV sense; rather, it is communication or information disclosure about the bank's environmental policies, activities, and commitments to stakeholders. The relationship between Green Banking Disclosure and Firm Value is therefore more appropriately explained through Signaling Theory. The broader and higher-quality the information disclosed about Green Banking practices, the stronger the signal of the bank's commitment to sustainability, environmental risk management, and responsible governance. Such signals may strengthen reputation and investor confidence, thereby potentially increasing Firm Value (Hastuti & Aprilia, 2023).

Unlike disclosure, Service Digitalization can be understood from the RBV perspective as a manifestation of a bank's digital capabilities. Digital technology alone does not necessarily create a competitive advantage because other banks can acquire or adopt similar technologies. Competitive advantage may emerge when banks integrate technology with human resources, information systems, business processes, organizational knowledge, system security, and innovation capabilities. This combination enables banks to provide faster, easier, safer, and more customer-oriented services. The strategic value of digitalization lies not merely in the existence of digital services, but in the bank's ability to implement and manage them effectively to support competitiveness and increase Firm Value (Nugraha, 2022).

Efficiency is better understood as the outcome of a bank's ability to organize and use resources optimally. From the RBV perspective, managerial capabilities, human resource quality, technology, organizational knowledge, operational systems, and integrated business processes are resources and capabilities that can generate efficiency. When this combination of resources produces superior efficiency relative to competitors and is difficult to replicate, it may support the creation of competitive advantage. From the perspective of Signaling Theory, a strong level of efficiency also provides information to investors regarding management's ability to control costs and optimize resources, thereby contributing to positive assessments of the company (Rafif et al., 2024).

Based on the theoretical review and the relationships among the research variables, the research framework illustrates the conceptual relationships between disclosure, digitalization, and efficiency as independent variables and firm value as the dependent variable. Disclosure is viewed as an information communication mechanism that can reduce information asymmetry and enhance investor confidence. Digitalization reflects a firm's ability to implement technology, supporting innovation and improving business processes. Efficiency represents the firm's ability to manage resources and organizational capabilities to achieve optimal performance. These three variables are expected to influence firm value through distinct yet complementary mechanisms. The research framework is presented in Figure 1.

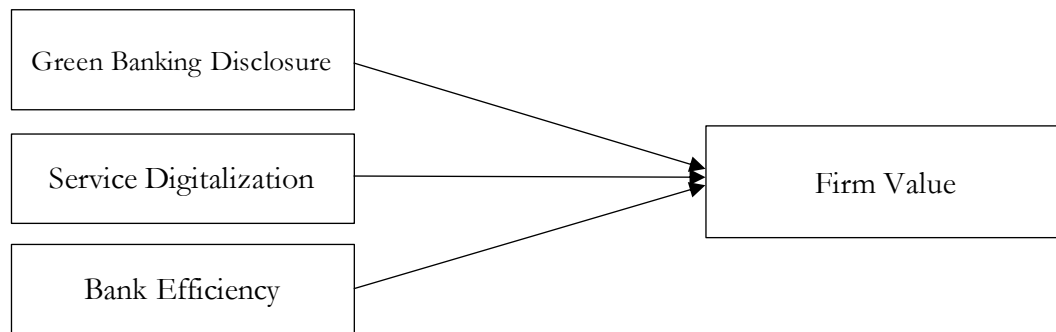


Figure 1. Research Framework

2.8 Hypotheses

2.8.1 Green Banking Disclosure and Firm Value of Islamic Banks in Indonesia

Green Banking Disclosure refers to banking practices that integrate environmental aspects into business activities to support sustainable development (Utami, 2025). From an RBV perspective, such disclosure is not a strategic resource but rather a form of corporate communication to the market. Therefore, Signaling Theory serves as the primary theoretical basis for explaining the relationship between Green Banking Disclosure and Firm Value. According to Signaling Theory, information about a bank's commitment to and implementation of Green Banking can send positive signals to investors about governance quality, environmental risk awareness, and sustainability orientation. The better the quality and breadth of disclosure, the more information investors can use to assess the company's sustainability commitment (Loissa, 2025). Winarto (2021) also found a positive relationship between Green Banking Disclosure and Firm Value in Islamic banking in Indonesia. Based on these theoretical arguments and empirical evidence, the following hypothesis is proposed:

H₁: Green Banking Disclosure has a positive effect on the Firm Value of Islamic Banks in Indonesia

2.8.2 Service Digitalization and Firm Value of Islamic Banks in Indonesia

Service Digitalization refers to the transformation of banking activities through the use of information technology to improve efficiency, convenience, and service coverage (Pratiningsih & Wardhani, 2025). From an RBV perspective, digital technology does not automatically become a source of competitive advantage because other banks may have access to and adopt the same technology. Competitive advantage is more likely to emerge when technology is combined with internal resources and capabilities, such as human resource competencies, organizational knowledge, information systems, digital security, innovation capabilities, and integrated business processes (Gisatriadi, 2022). In this study, Service Digitalization is understood as the bank's capability to implement and manage technology to provide more effective, convenient, rapid, and customer-oriented services. Such implementation capabilities may improve service quality, expand market reach, reduce transaction costs, and strengthen bank competitiveness.

From a Signaling Theory perspective, developing digital services can also signal to investors that the bank can adapt to technological developments and changing customer needs. This capability may create positive expectations regarding the bank's prospects and business sustainability. Ramadhan (2024) found that Service Digitalization is associated with improved performance and Firm Value in Islamic banking. Based on these arguments, the following hypothesis is proposed:

H₂: Service Digitalization has a positive effect on the Firm Value of Islamic Banks in Indonesia

2.8.3 Bank Efficiency and Firm Value of Islamic Banks in Indonesia

Bank Efficiency reflects the bank's ability to control operating costs in order to generate maximum income (Akbar et al., 2025). From an RBV perspective, efficiency is not directly categorized as a rare and inimitable resource; rather, it results from how the bank manages and organizes its internal resources and capabilities. These resources may include managerial competencies, human resource quality, technology, operational systems, organizational knowledge, and business processes (Rafif et al., 2024). The bank's ability to combine and organize these resources effectively can generate higher efficiency. If such capabilities have strategic value and are relatively difficult for competitors to replicate, the bank may gain a competitive advantage that supports performance and Firm Value (Siregar et al., 2023). From a Signaling Theory perspective, strong operational efficiency can also signal the quality of corporate management. Management's ability to control costs and optimize resource utilization may increase investor confidence in the bank's performance and prospects. Hastuti (2023) found that Bank Efficiency has a positive relationship with Firm Value. Based on these arguments, the following hypothesis is proposed:

H₃: Bank Efficiency has a positive effect on the Firm Value of Islamic Banks in Indonesia

3. Research Methods

3.1 Research Type and Population

This study employs a quantitative approach, specifically explanatory research. A quantitative approach was selected because the study utilizes numerical data derived from annual reports, sustainability reports, and financial statements of Sharia banks in Indonesia. This data is processed and analyzed using statistical methods to examine causal relationships between the research variables (Arislan & Mashuri Toha, 2024). This study is classified as longitudinal research because it uses data observed sequentially from 2020–2024. The study uses panel data, combining time-series and cross-sectional data. The study population consists of 19 Sharia Commercial Banks registered with the Financial Services Authority. The data is sourced from annual reports accessible via www.ojk.go.id and the official websites of the respective banks (OJK, 2023).

3.2 Sample and Data Collection Techniques

A sample is a subset of the population selected based on specific characteristics to represent the population in the study. Sample selection in this study utilizes purposive sampling, a technique where the sample is chosen based on criteria established in alignment with the research objectives (Hermawan, 2019). The sample selection criteria include: (1) Sharia Commercial Banks (BUS) registered and operational during the 2020–2024 observation period; (2) BUS that published annual reports consecutively and made them accessible throughout the 2020–2024 period; and (3) BUS that provided all data required to measure the research variables.

The study selected the sample by verifying each bank's institutional status and the availability of annual reports throughout the research period. From an initial population of 19 Sharia Commercial Banks (BUS), 12 banks were excluded from the sample: 9 failed to meet the criterion of continuous annual reporting throughout the 2020–2024 period, and 3 lacked the complete data required to measure the research variables. The lack of continuous reporting resulted from factors such as changes in institutional status, mergers, conversions, name changes, or banks commencing operations as BUS midway through the observation period. We did not include PT BRI Syariah Tbk, PT BNI Syariah, and PT Bank Syariah Mandiri as individual samples because they merged and officially consolidated into PT Bank Syariah Indonesia Tbk (BSI) in 2021. Consequently, these three banks did not maintain consistent annual reports as standalone BUS entities throughout 2024. PT Bank Syariah Indonesia Tbk was also excluded because, as a post-merger entity, it lacked a complete series of annual reports under the BSI name for the entire 2020–2024 period. We similarly excluded other banks that underwent status changes, commenced BUS operations late, or lacked a consistent, comparable data series over the five-year period.

Following the selection process, seven BUS met all criteria: PT Bank Aceh Syariah, PT BPD Riau Kepri Syariah, PT Bank Muamalat Indonesia, PT Bank Mega Syariah, PT Bank Panin Dubai Syariah Tbk, PT Bank KB Bukopin Syariah, and PT BCA Syariah. These seven banks provided annual reports throughout 2020–2024 and supplied the data needed to measure the research variables. Given the five-year observation period, the total dataset comprised 35 observations (7 banks $\times$ 5 years). To enhance transparency in the sample selection process, the selection stages are presented in Table 1.

Table 1. Sample Selection Criteria

No.	Number of Sharia Commercial Banks (BUS)	Criteria
1.	BUS registered with the OJK during the 2020–2024 period	19
2.	BUS failing to meet the criterion of continuous annual report availability during 2020–2024	(9)
3.	BUS whose annual reports lacked complete data corresponding to the research variables	(3)
4.	BUS meeting all sample criteria	7
5.	Observation period	5 years
6.	Number of observations (7 BUS $\times$ 5 years)	35

Source: OJK (2026)

Table 1 illustrates the sample selection process based on the predetermined criteria. Of the 19 Sharia Commercial Banks registered with OJK during 2020–2024, only 7 met all the requirements for inclusion in the study. These banks provided the necessary annual reports and complete data for measuring the research variables throughout the observation period. With a five-year observation period (2020 to 2024), the final sample generated 35 observations (7 banks $\times$ 5 years). The data were collected using the documentation method by examining secondary data from annual reports and financial reports published on the official OJK website and the respective banks' websites.

3.3 Variable Measurement

This study has three independent variables, Green Banking Disclosure, Service Digitalization, and Bank Efficiency, and one dependent variable, Firm Value. To ensure each variable can be measured empirically, we establish operational definitions, indicators, data sources, and measurement scales based on relevant theories and previous studies. Each variable is measured to reflect its characteristics and objectives within the banking industry. The operational definitions and measurement methods for each variable are presented in Table 2.

Table 2. Variable Measurement

Variable	Operational Definition	Indikacators	Data Source	Scale
Green Banking Disclosure	Green banking refers to banking practices that integrate environmental aspects into business activities to support sustainable development (Utami, 2025).	Carbon emissions, green rewards, green building, reuse/recycle/reduce, paperless operations, and green investment (Hanif et al., 2020)	Annual reports/ sustainability reports	Indeks
Service Digitalization	Banking service digitalization transforms banking activities through information technology to improve efficiency, convenience, and service reach (Pratiningsih & Wardhani, 2025).	Mobile banking, fintech, digital onboarding, digital products, and IT investment (Inarotul & Putri, 2022).	Annual Reports	Index

Bank Efficiency	Bank efficiency reflects a bank's ability to minimize operational costs while maximizing revenue generation (Akbar et al., 2025).	Operating expenses to operating income (BOPO)	OJK financial reports	Ratio
Firm Value	Firm value is the market value reflecting the extent to which investors trust the company's future prospects (Yanto et al., 2025).	PBV/Torbin's Q	OJK	Ratio

Table 2 presents the operational definitions and measurement methods used for each variable in this study. Green Banking Disclosure, service digitalization, and bank efficiency (Nugraha, 2022). Subsequently, panel data estimation is conducted using three commonly utilized panel data models: the common effect model, the fixed effect model, and the random effect model. The random effect model is used to determine the most appropriate model for managing the panel data. Several tests can be conducted to determine the panel data regression model to be used in this study, namely the Chow test, Hausman test, and LM test (Hutagalung & Darnius, 2022). Additionally, classical assumption tests, such as tests for normality, multicollinearity, heteroscedasticity, and autocorrelation, are conducted alongside multiple linear regression. Once the model passes the classical assumption tests, the F-test, coefficient of determination test, and t-test (partial test) are performed to test the research hypotheses regarding the partial effect of each independent variable on the dependent variable (Khasanah, 2021). The Lagrange Multiplier Test indicates that the REM is more appropriate than the CEM. The Random Effect Model (REM) was selected as the panel data regression model for this study.

4.3 Classical Assumption Tests

The following are the results of the classical assumption tests for this study, presented in Table 5.

Table 5. Classical Assumption Test Results

Test	Value	Criteria	Conclusion
Normality	0,109571	>0,05	Residuals are normally distributed
Multicollinearity	0,237215 -0,200607 0,074429	<0,80	No multicollinearity present
Autocorrelation	1,727896		No indication of autocorrelation

Source: Data processed using EViews 13 (2026)

The test results presented in Table 5 indicate that the model residuals are normally distributed, there is no high correlation among the independent variables, and the Durbin-Watson value is relatively close to 2. The model does not exhibit significant violations of the classical assumptions.

4.4 Panel Data Regression Results

The following table presents the random effects model estimation results for this study.

Table 6. Random Effect Model Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	p-Value	Note
Constant	-0,051983	0,629585	-0,082567	0,9347	Not Significant
Green Banking Disclosure	-0,837992	0,703814	-1,190644	0,2428	Not Significant
Service Digitalization	0,578224	0,231711	2,495455	0,0181	Significant
Bank Efficiency	0,006388	0,001563	4,088523	0,0003	Significant

Source: Data processed using EViews 13 (2026)

Based on Table 6, Green Banking Disclosure has a negative but insignificant effect on Firm Value. Service Digitalization and Bank Efficiency have positive and significant effects on Firm Value.

4.5 Model Suitability and Simultaneous Test

The following results of the model suitability and simultaneous test for this study are presented in Table 7.

Table 7. Simultaneous Test Results and Coefficient of Determination

Indicator	Value	Interpretation
<i>R-Squared</i>	0,420528	Model explains 42.053% of Y variation before adjustment
<i>Adj. R-Squared</i>	0,364450	Model explains 36.445% of Y variation after adjustment
<i>Prob(F-Statistic)</i>	0,000652	Model is simultaneously significant
<i>Durbin-Watson Stat</i>	1,727896	Relatively close to 2

Source: Data processed using EViews 13 (2026)

Based on Table 7, the Prob(F-statistic) value of $0.000652 < 0.05$ indicates that Green Banking Disclosure, Service Digitalization, and Bank Efficiency simultaneously have a significant effect on Firm Value. The Adjusted R-squared value of 0.364450 indicates that the three independent variables explain 36.445% of the variation in Firm Value, while 63.555% is explained by factors outside the research model.

4.5 Hypothesis Testing Results

The hypothesis-testing results for this study are presented in Table 8.

Table 8. Hypothesis Testing Results

Hypothesis	Relationship Between Variables	Coefficient	t/F-Statistic	P-Value	Note
H ₁	Green Banking Disclosure - > Firm Value	-0.837992	-1.190644	0.2428	Not significant
H ₂	Service Digitalization -> Firm Value	0.578224	2.495455	0.0181	Significant
H ₃	Bank Efficiency -> Firm Value	0.006388	4.088523	0.0003	Significant

Source: Data processed using EViews 13 (2026)

Based on Table 8, the test results indicate that H₁ is rejected, while H₂, H₃, and H₄ are accepted. Green Banking Disclosure has not been proven to have a significant effect on Firm Value. Conversely, Service Digitalization and Bank Efficiency were proven to have a positive and significant effect. Simultaneously, the three independent variables also have a significant effect on the Firm Value of Sharia Commercial Banks in Indonesia for the 2020–2024 period.

4.6 Discussion

4.6.1 The Effect of Green Banking Disclosure on the Firm Value of Islamic Banks in Indonesia

The test results show that Green Banking Disclosure has a coefficient of -0.837992 , a t -statistic of -1.190644 , and a probability value of $0.2428 > 0.05$. This indicates that Green Banking Disclosure has a negative but statistically insignificant effect on Firm Value; therefore, H_1 is rejected. The negative but insignificant coefficient cannot be interpreted as evidence that an increase in Green Banking Disclosure necessarily decreases Firm Value. Rather, it indicates insufficient statistical evidence to establish an effect of Green Banking Disclosure on Firm Value during the study period.

This finding is consistent with Tiara and Jayanti (2022) and Dewi and Putri (2024) who found that Green Banking did not have a significant effect on Firm Value. However, this result differs from Winarto (2021) who found that Green Banking Disclosure had a positive and significant effect on the Firm Value of Islamic Commercial Banks. These differences may be attributable to variations in the study period, sample characteristics, measurement indicators, and banking industry conditions during the observation period.

From the perspective of Signaling Theory, Green Banking Disclosure is expected to signal a bank's commitment to sustainability and environmental risk management. However, the findings indicate that this signal is not strong enough to affect Firm Value. Banks' disclosures may primarily reflect compliance with sustainable finance requirements and may not necessarily represent the quality or effectiveness of Green Banking implementation in generating economic benefits (Salsabila, 2026). Investors may also place greater emphasis on information more directly tied to a company's financial performance and prospects.

The economic benefits of green financing, energy efficiency, environmental risk management, and environmentally friendly activities generally require time to materialize. Therefore, the benefits of Green Banking implementation may not have been fully reflected in Firm Value during the 2020–2024 study period (Mara, 2025). The insignificant finding does not imply that Green Banking is unimportant; rather, it indicates that Green Banking Disclosure has not been statistically proven to determine Firm Value within the period and sample examined in this study. From the Resource-Based View (RBV) perspective, Green Banking Disclosure should not be positioned as a strategic resource in itself. Competitive advantage is more strongly determined by a bank's ability to integrate sustainability principles into financing activities, environmental risk management, product development, and business processes. Extensive disclosure does not necessarily increase Firm Value unless it is supported by implementation capabilities that generate economic benefits and competitive advantage (Hastuti & Aprilia, 2023).

4.6.2 The Effect of Service Digitalization on the Firm Value of Islamic Banks in Indonesia

The test results show that Service Digitalization has a coefficient of 0.578224 , a t -statistic of 2.495455 , and a probability value of $0.0181 < 0.05$. Thus, Service Digitalization has a positive and significant effect on Firm Value, and therefore H_2 is accepted. The positive coefficient indicates that, holding other variables constant, an increase in Service Digitalization is associated with an increase in Firm Value. This finding differs from Nugraha (2022) and Suseno (2025), who found that digitalization did not significantly affect Firm Value. These differences may be attributable to rapid developments in banking technology, differences in observation periods, digitalization indicators, and the level of digital service implementation across individual banks. Conversely, the findings of this study support Ramadhan (2024), who demonstrated that service digitalization influences the development of Islamic banking. From the perspective of Signaling Theory, Service Digitalization can serve as a positive signal of a bank's ability to adapt to technological developments and changes in customer behavior. The development of mobile banking, internet banking, QRIS, digital onboarding, and other technology-based services provides easier access, accelerates transactions, and improves the quality of the customer experience. The study's

significant results indicate that these capabilities may be perceived positively and are associated with higher Firm Value (Purnaman, 2026).

Digitalization also enables banks to expand their service coverage without relying entirely on physical branch networks. Although implementation requires investment in information technology, application development, cybersecurity, and system maintenance, effective technology use can enhance productivity and improve service process efficiency. Therefore, the benefits of digitalization are not limited to the availability of technology itself but also depend on the bank's ability to utilize technology to create economic value (Purnaman, 2026). From the RBV perspective, digital technology does not automatically constitute a source of competitive advantage because similar technologies can be adopted by competitors. Competitive advantage is more strongly determined by a bank's ability to integrate technology with human resources, data, system security, innovation, and business processes (Sari & Fransiska, 2023). The findings indicate that Service Digitalization was a relevant capability in supporting Firm Value creation among Islamic commercial banks during the study period.

4.6.3 The Effect of Bank Efficiency on the Firm Value of Islamic Banks in Indonesia

The test results show that Bank Efficiency has a coefficient of 0.006388, a t-statistic of 4.088523, and a probability value of $0.0003 < 0.05$. These results indicate that Bank Efficiency has a positive and significant effect on Firm Value; therefore, H_3 is accepted. The positive coefficient indicates that, holding other variables constant, an increase in Bank Efficiency is associated with an increase in Firm Value. This finding is consistent with Hastuti (2023) who found that Bank Efficiency influences Firm Value. The result shows that a bank's ability to manage its operational activities and resources efficiently is a relevant factor in forming Firm Value.

From a signaling perspective, efficiency can signal management's ability to optimize resource use and control operations. Banks that demonstrate more efficient resource management may be perceived as having stronger management quality, productivity, and prospects for future performance. This study's key findings indicate that efficiency-related information is associated with corporate valuation. Nevertheless, efficiency should be interpreted in conjunction with other indicators of financial performance and stability (Aida et al., 2024; Siregar et al., 2023). From an RBV perspective, efficiency is better viewed as an outcome of a company's ability to manage and organize its resources rather than a strategic resource in itself. Managerial capabilities, human resources, technology, and effective business processes can generate efficiency and subsequently contribute to the development of competitive advantage (Rafif et al., 2024). The findings indicate that these capabilities are meaningfully related to the Firm Value of Islamic Commercial Banks during the study period.

5. Conclusion

The results show that Green Banking Disclosure has no significant effect on Firm Value, with a coefficient of -0.837992 and a probability value of 0.2428 . In contrast, Service Digitalization has a positive and significant effect on Firm Value (coefficient = 0.578224 ; p-value = 0.0181), while Bank Efficiency also has a positive and significant effect (coefficient = 0.006388 ; p-value = 0.0003). Simultaneously, the three variables significantly affect Firm Value, as indicated by a Prob(F-statistic) of 0.000652 . The Adjusted R-squared value of 0.364450 indicates that the model explains 36.445% of the variation in Firm Value, while the remaining 63.555% is explained by other factors outside the model. These findings indicate that Service Digitalization and Bank Efficiency are more relevant in enhancing Islamic banks' Firm Value than Green Banking Disclosure during the 2020–2024 period.

This study is limited to 35 observations from seven Islamic Commercial Banks during 2020–2024. In addition, the measurement of Green Banking Disclosure and Service Digitalization is based on content analysis, which may not fully capture the quality and effectiveness of their actual implementation. The findings highlight the importance of strengthening Service Digitalization and Bank Efficiency, as both positively and significantly affect Firm Value. Meanwhile, Green Banking

implementation should focus more on substantive and measurable outcomes rather than disclosure alone. Future research should expand the sample size and observation period, use more comprehensive measurement indicators, and incorporate additional variables such as profitability, firm size, liquidity, corporate governance, and financing quality to improve the model's explanatory power regarding Firm Value.

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