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RESEARCH ARTICLE

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Innovation and the Characteristics of Board of Directors on the Performance of Islamic Banks in Indonesia

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Abstract: This study examines how board characteristics and innovation affect the performance of Islamic banks in Indonesia. It analyzes panel data from 12 banks, observed from 2010 to 2020, using secondary data and quantitative methods. The results show that a board's educational background in business negatively impacts bank performance. In contrast, both board size and innovation have positive effects. Innovation also strengthens the positive link between a board's business education and bank performance. However, it does not moderate the effect of gender diversity on performance. Instead, it moderates the negative relationship between board size and performance. While providing valuable insights, this study is limited by data availability and its focus on the Indonesian Islamic banking sector. Future research should consider additional factors and a broader context to provide a more complete understanding. This can help guide the development of strategies and policies for Islamic banks. Additionally, exploring the role of regulatory frameworks and market conditions could offer deeper insights into the dynamics of bank performance.

Keywords: characteristics of board of directors, innovation, bank performance, Islamic Bank Indonesia

1. Introduction

Indonesia, as one of the countries with the largest Muslim population in the world, has become a significant stage for the growth of the Islamic banking industry. Based on the principles of Islamic finance, the Islamic banking sector has experienced rapid growth in recent decades [1–3]. Islamic banks in Indonesia not only play a role in meeting the financial needs of Muslims but have also become a significant driver of financial inclusion across the spectrum of society. Additionally, this growth is driven by supportive government policies and public awareness of the importance of a financial system aligned with Sharia principles.

In facing increasingly fierce competition and rapid changes in the global financial industry, innovation has become vital to maintaining and enhancing the competitiveness of Islamic banks. Innovation involves the development of products and services in compliance with Sharia principles and encompasses changes in business processes, technology, and marketing strategies [4].

However, Islamic banks require proper support and guidance from the board of directors to successfully realize these innovations. The board of directors' characteristics (including educational background, experience, diversity, and size) play a crucial role in facilitating and directing practical innovation [5, 6]. Thus, a deep understanding regarding the role and attributes of the board of directors can assist Islamic banks in Indonesia in designing more effective strategies to improve their performance and sustainability.

The board of directors is an essential entity within the corporate structure of Islamic banks, responsible for strategic decision-making and operational oversight. Board characteristics and composition (including experience, industry knowledge, and diversity levels) can influence its ability to understand, support, and lead innovation efforts [7–9]. Therefore, studying the relationship between board characteristics and innovation on the performance of Islamic banks becomes relevant and essential to understand the dynamics of the Islamic banking sector. Within this framework, this research aims to explore how the board of directors' characteristics influence innovation strategies and the performance of Islamic banks in Indonesia.

The development of research themes regarding the characteristics of the board of directors and innovation on the performance of Islamic banks in Indonesia shows the importance of these factors in determining the performance of Islamic banking. Based on the research conducted, it has been found that board characteristics (such as educational background and gender) and board size significantly influence the performance of Islamic banks. For instance, research by Nainggolan et al. [10] indicates that the board of directors' characteristics impact risk-taking and the performance of Islamic banks in Indonesia and Malaysia. This research found that educational and gender diversity within the board has a significant effect on intellectual capital in Islamic banks, while board size and meeting frequency do not have a significant impact.

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This phenomenon indicates that customers' understanding and preferences for Islamic banking products are influenced by the characteristics of the board of directors and the innovation of the products offered. The urgency of this research lies in understanding the factors affecting the performance of Islamic banks to enhance the competitiveness and literacy of Islamic finance in Indonesia. Previous research has shown that board characteristics and product innovation positively impact Islamic banks' performance. However, there is a research gap in comprehensively understanding how the combination of board characteristics and product innovation influences Islamic banks' performance [11, 12].

The novelty of this research lies in a holistic approach that combines the variables of board characteristics—educational background, gender, and board size—and product innovation in analyzing the performance of Islamic banks. This research aims to provide a comprehensive understanding of the factors influencing the performance of Islamic banks and offer strategic recommendations for them to improve their performance and competitiveness.

Previous studies have also shown that product and service innovation in Islamic banks positively impacts human resource performance and customer satisfaction. For example, product innovation with multiple contracts, such as Mudharabah wal Murabahah financing, has increased customer flexibility and satisfaction [13]. Additionally, research by Cappa et al. [5] shows that banks that respond to the digital surge through open innovation, (such as mergers and acquisitions with fintech companies, experience) increased stock market performance.

Research by Corbet et al. [14] also shows that financial innovation significantly impacts bank performance in China, indicating the global relevance of these findings. On the other hand, research by Koomson [15] highlights the importance of total quality management and external factors in influencing innovation behavior and innovation performance in banks. The research results identify that knowledge application and storage through fintech innovation positively impact bank performance, as found in a study by Almuayad et al. [16] in Yemeni banks. Furthermore, research by Zulkifli et al. [17] shows that employee performance in Islamic banks in Indonesia is mediated by organizational innovation and knowledge sharing.

The writing flow of this research begins by introducing the background and urgency of the research. This is followed by a literature review that includes previous research and the identification of the research gap. Next, the research methodology is explained in detail, including research design, data collection techniques, and data analysis. The results and discussion section presents the research findings and interpretation of the results and ends with practical recommendations for Islamic banks.

2. Literature Review

Agency Theory

In the context of agency theory, the relationship between the bank owners (principals) and the bank management (agents) is the primary focus of the analysis. Agency theory posits that there is a potential for conflicts of interest between the principals and agents, making effective oversight and control by the board of directors crucial [4, 5, 7–9, 18, 19]. According to agency theory, the board of directors' characteristics significantly impact Islamic banks' performance. Educational background in business, experience, and the board composition can influence the effectiveness of oversight, decision-making, and strategy implementation of Islamic banks. For example, board members with a solid educational background in business might better understand financial and managerial aspects, which can enhance the quality of decision-making and risk management. Additionally, the size and diversity of the board can enrich the perspectives needed to tackle complex market challenges. Therefore, a better understanding of the role of board characteristics in agency theory can help Islamic bank stakeholders design more effective strategies to improve their performance and sustainability.

Characteristics of the Board of Directors

The board of directors' characteristics play a crucial role in determining Islamic banks' strategic and operational direction. Educational background, gender diversity, and board size can influence decision-making effectiveness and the bank's ability to innovate and compete in a dynamic market. Research shows that boards with a background in business economics can provide deep insights into industry challenges and opportunities, aiding in making strategic decisions that positively impact the performance of Islamic banks [6, 8, 9, 19]. Furthermore, gender representation on the board of directors enhances creativity, perspectives, and decision-making quality, ultimately driving inclusive and sustainable innovation strategies . Board size also matters as huge boards may need help to reach a consensus or make swift decisions. In contrast, more small boards might need diverse perspectives and experiences, potentially hindering innovation. Therefore, aligning the board size with the specific needs of the Islamic bank is a crucial strategy to facilitate innovation and improve the bank's performance.

Innovation

In the context of Islamic banks in Indonesia, the number of products and services offered plays a vital role in measuring the bank's level of innovation [4, 5, 13, 19, 20]. The growth in the number of products and services reflects the bank's commitment in responding to diverse and dynamic market needs, with technological advancements and changing consumer preferences, Islamic banks must continually innovate to maintain and enhance their competitiveness. Through various new products and services, Islamic banks can attract new customers, strengthen relationships with existing customers, and increase their revenue and profitability. The number of products and services of Islamic banks can be measured by observing the product portfolio offered, the range of services provided, and the frequency of new product launches. The more diverse the product portfolio and the broader the range of services, the greater the likelihood of the Islamic bank to succeed in driving innovation and providing added value to its customers. Therefore, maintaining the availability and development of innovative products and services is critical to Islamic banks' efforts to remain relevant and competitive in a constantly changing market

2.1. Hypothesis

Educational Background

Research indicates that the educational background of board members significantly impacts bank performance. For example, Quoc et al. [21] found that higher educational qualifications and diverse educational backgrounds contribute to better decision-making and enhanced performance in commercial banks in Vietnam. Similarly, Nainggolan et al. [10] showed that board members with higher educational backgrounds in Islamic banks in Indonesia and Malaysia tend to exhibit more prudent risk management and improved performance metrics. Based on these findings, the proposed hypothesis is:

H1: The board of directors' educational background positively affects Islamic banks' performance in Indonesia.

Gender

Research also suggests that gender diversity on the board of directors positively impacts bank performance. Quoc et al. [21] showed that gender diversity on boards improves the performance of commercial banks in Vietnam, Meanwhile, Nainggolan et al. [10] found that boards with female members in Islamic banks in Indonesia and Malaysia exhibit better risk management and improved performance. Based on these findings, the proposed hypothesis is:

H2: Gender diversity on the board of directors positively affects the performance of Islamic banks in Indonesia.

Board Size

Board size has also been found to impact bank performance significantly. Quoc et al. [21] discovered that larger boards are associated with more diverse viewpoints and better governance, ultimately enhancing the performance of commercial banks in Vietnam. Sueb et al. [12] also found that larger boards in Islamic banks are more effective in managing risks and improving overall performance. Based on these findings, the proposed hypothesis is:

H3: The size of the board of directors positively affects the performance of Islamic banks in Indonesia.

Innovation

Product innovation has been found to influence bank performance significantly. Zhou [22] showed that technological innovation enhances the efficiency and performance of banks. Trivedi [13] also found that banking innovations (including new revenue streams), positively impact bank performance by helping diversify income sources and improving financial stability. Additionally, Cappa et al. [5] indicated that banks responding to the digital surge through open innovation, such as mergers and acquisitions with fintech companies, experience improved stock market performance. Ashiru et al. [23] found that the adoption of financial innovations such as fintech technology and digital services improves operational efficiency and bank profitability in Nigeria. Bhattacharya et al. [19] also identified that banks adopting financial innovations (such as e-banking and digital payments experience) have significant improvements in financial performance in India. These findings support the hypothesis that product innovation can strengthen the relationship between board characteristics and bank performance. Based on these findings, the proposed hypothesis is:

H4: Product innovation positively affects the performance of Islamic banks in Indonesia.

Moderating Role of Innovation

Research also indicates that product innovation can act as a moderating variable that strengthens the relationship between board characteristics and bank performance. For instance, Cappa et al. [4, 5, 19] found that banks responding to the digital surge through open innovation (such as mergers and acquisitions with fintech companies, experience) improved stock market performance. The results show that banks investing in fintech innovation and obtaining related patents significantly improve financial performance and operational efficiency. This supports the idea that product innovation can moderate the relationship between board characteristics and bank performance. Banks adopting financial innovations such as e-banking and digital payments tend to experience significant improvements in financial performance, supporting the hypothesis that product innovation can moderate the relationship between board characteristics and bank performance. Based on these findings, the proposed hypothesis is:

H5: Product innovation moderates the relationship between board characteristics and the performance of Islamic banks in Indonesia, thereby strengthening the positive influence of board characteristics on bank performance.

3. Methodology

3.1. Research design

This study uses data from Islamic banks listed with the Financial Services Authority of Indonesia from 2010 to 2020. The primary data sources are financial and annual reports, analyzed using panel regression with secondary data from Islamic banks. The study identifies the performance of Islamic banks as the dependent variable, with return on assets (ROA) as the indicator of financial performance. The independent variables include the educational background of the board of directors in business graduates, gender diversity of the board of directors, board size, and product innovation. Additionally, the study uses control variables such as bank size, measured by the natural logarithm of total assets and bank age to account for size and age. The measurement variables are presented in Table 1.

Table 1
Measurement variables

Variable	Operational definition	Source references
Islamic Bank Performance (ROA)	Measured using ROA = net income/total asset	Nainggolan et al. [10]; Abdel-Azim and Soliman [11]
Board of Directors Education (bod_eco)	Educational background of board members in business economics	Quoc Trung [21]; Nainggolan et al. [10]; Abdel-Azim and Soliman [11]
Board of Directors Gender (bod_gndr)	Total female board members	Nainggolan et al. [10]; Agnese et al. [28]
Board Size (bod_sz)	Total number of board members	Quoc Trung [21]; Sueb et al. [12]; Abdel-Azim and Soliman [11]
Product Innovation (innov)	Number of new products launched by the Islamic bank	Zhou [22]; Trivedi [13]; Haabazoka [20]
Bank Size (Ln_aset)	Natural logarithm of total bank assets	Nainggolan et al. [10]; Sueb et al. [12]
Bank Age (age)	Number of years since the bank was established until the year of the study	Nainggolan et al. [10]; Sueb et al. [12]

Model Equations

The panel regression model used in this study to test the effect of independent and control variables on the dependent variable is as follows:

Model 1 Regression

$$\begin{aligned}\mathrm{ROA}_{it} = \beta 0 + \beta 1\,\mathrm{bod\_eco}_{it} + \beta 2\,\mathrm{bod\_gndr}_{it} + \beta 3\,\mathrm{bod\_sz}_{it} \\ + \beta 4\,\mathrm{innov}_{it} + \beta 5\,\mathrm{ln\_Aset}_{it} + \beta 6\,\mathrm{Age}_{it} + \mathrm{e}_{it}\end{aligned} \quad (1)$$

Model 2 Moderation by Innovation

$$\begin{aligned}\mathrm{ROA}_{it} = \beta 0 + \beta 1\,\mathrm{bod\_eco}_{it} + \beta 2\,\mathrm{bod\_gndr}_{it} + \beta 3\,\mathrm{bod\_sz}_{it} \\ + \beta 4\,\mathrm{innov}_{it} + \beta 5\,\mathrm{edu\_innov}_{it} + \beta 6\,\mathrm{gend\_innov}_{it} \\ + \beta 7\,\mathrm{sz\_innov}_{it} + \beta 8\,\mathrm{ln\_Aset}_{it} + \beta 9\,\mathrm{Age}_{it} + \mathrm{e}_{it}\end{aligned} \quad (2)$$

Where:
- ROA is the performance of the Islamic bank (measured by ROA or ROE)
- bod_eco is the educational background of the board of directors
- bod_gndr is the gender diversity of the board of directors
- bod_sz is the size of the board of directors
- innov is product innovation
- ln_Aset is the natural logarithm of total bank assets
- Age is the age of the bank
- $\beta 0$β0 is the constant ($\beta 1, \beta 2, \beta 3, \beta 4, \beta 5, \beta 6$β1, β2, β3, β4, β5, β6) are the regression coefficients
- i is index for cross-sectional units (banks).
- t is index for time periods (e.g., years).
- ϵ_{it}: error term.

4. Results

As shown in Table 2, descriptive statistics of the data from Islamic banks for 2010–2020 show that the ROA has an average of 0.02088 with significant variation. The educational background of directors in business (BOD_ECO) ranges from level 2 to 12, with an average of 5.630435. Gender diversity on the board (BOD_GND) has an average of 1.036232, indicating varying gender representation. The size of the board of directors (BOD_SZ) ranges from 3 to 21 members, with an average of 10.23188. The level of innovation (INNOV) ranges from 7 to 79, with an average of 33.10145. The natural logarithm of total assets (LN_ASET) ranges from 9.406812 to 17.87104, with an average of 14.5917. The age of the banks (AGE) varies from 1 to 56 years, with an average of 21.18841. This analysis provides an in-depth understanding of the characteristics of Islamic banks' board of directors, innovation, and performance over the period 2010–2020.

As shown in Table 3, the correlation matrix results show the relationships between the variables observed in this study. The correlation matrix highlights the relationships between variables related to the performance and characteristics of the board of directors of Islamic banks. The correlation between ROA and the educational background of the directors in business (BOD_ECO) shows a significant negative correlation of −0.2631. Meanwhile, the correlation between ROA and gender diversity on the board (BOD_GND) shows a positive relationship of 0.1947. The variable board size (BOD_SZ) has a significant positive correlation with innovation (INNOV) of 0.6637, indicating that the larger the board size, the higher the level of observed innovation. The correlation between innovation and the natural logarithm of total assets (LN_ASET) shows a positive relationship of 0.4466, indicating that more innovative Islamic banks tend to have larger assets. Additionally, the AGE has a significant positive correlation with LN_ASET, indicating that older banks tend to have larger total assets.

Table 2
Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
roa	138	0.020	0.0582	−0.2013	0.452
bod_eco	138	5.630	1.9745	2	12
bod_gnd	138	1.036	0.9621	0	3
bod_sz	138	10.25	3.5618	5	21
innov	138	33.101	17.599	7	79
ln_aset	138	14.591	2.124	9.406	17.871
age	138	21.188	14.985	1	56

Note: The measurement variables are presented in Table 1

As shown in Table 4, the regression results indicate that there is a significant relationship between several factors and ROA in Islamic banks. The variable representing the educational background of the board of directors in business (bod_eco) has a significant negative effect on ROA, with a coefficient of −0.0105 ($t = -2.34$), indicating that higher levels of business education among directors are associated with lower ROA. The gender diversity variable (bod_gnd) does not significantly affect ROA. However, the board size (bod_sz) has a significant positive effect on ROA, with a coefficient of 0.00269 ($t = 0.67$), suggesting that larger board sizes are associated with higher ROA. Innovation (innov) also significantly impacts ROA, with a positive coefficient of 0.00192 ($t = 2.58$), indicating that higher levels of innovation are associated with higher ROA.

Moreover, the moderation variable edu_innov significantly affects the relationship between innovation and ROA, with a positive coefficient of 0.000656 ($t = 2.88$). This indicates that the effect of innovation on ROA is stronger in Islamic banks with a higher educational background of the directors in business. However, gend_innov and size_innov do not show significant effects on this relationship, indicating that gender diversity and board size do not significantly influence the effect of innovation on ROA in this model

5. Discussion

Educational Background of the Board (bod_eco)

The regression results show that the educational background in business of the board of directors has a significant negative impact on ROA in Islamic banks. This indicates that the higher the level of business education among directors, the lower the ROA. This may be due to the focus of business education on risk analysis and conservative management, which can reduce the risk-taking necessary for increasing ROA. Research by [7, 24] also suggests that the educational characteristics of the board can influence decision-making related to bank performance. This finding aligns with the notion that high educational attainment does not necessarily translate into effective governance or enhanced performance. Pereira and Filipe [25] found that specific educational qualifications, particularly those categorized as Eduversal and EduFT, negatively affected bank financial performance, attributing this to the tendency of well-qualified board members to prioritize personal interests over the bank's financial health.

Gender Diversity on the Board (bod_gnd)

The gender diversity variable shows no significant effect on ROA, indicating that the presence of women on the board of directors does not directly affect the financial performance of Islamic banks in terms of ROA. Previous research by Hakimi et al. [8, 26, 27] also found that gender diversity on the board does not always significantly impact bank performance,

Table 3
Correlation

	roa	bod_eco	bod_gnd	bod_sz	innov	ln_aset	age	vif
roa	1							
bod_eco	−0.2631	1						1.27
bod_gnd	0.1947	−0.2542	1					1.37
bod_sz	−0.0862	0.6637	−0.1691	1				1.62
innov	−0.1776	0.4466	−0.5296	0.3248	1			1.97
ln_aset	0.0133	−0.2073	−0.2748	−0.1374	−0.1642	1		1.2
age	−0.0327	−0.152	−0.0673	−0.2836	0.1206	0.3333	1	1.21

Table 4
Regression result

	(1) roa	(2) roa
bod_eco	−0.0105**	−0.0313***
	(−2.34)	(−3.65)
bod_gnd	−0.0125	−0.0242
	(−1.43)	(−1.32)
bod_sz	0.00269	0.0141*
	(0.67)	(1.88)
innov	0.00192**	0.00111
	(2.58)	(0.63)
edu_innov		0.000656***
		(2.88)
gend_innov		0.000368
		(0.90)
size_innov		−0.000327*
		(−1.84)
ln_aset	−0.00196	−0.00401
	(−0.52)	(−1.00)
age	−0.00331	−0.00313
	(−1.35)	(−1.29)
IB (dummy)	yes	yes
Year (dummy)	yes	yes
_cons	0.103	0.143
	(1.26)	(1.55)
r2	0.230	0.291
N	138	138

Note: The results of the Hausman test showed that the number was greater than 0.05, so the random effects model was selected with robust standard errors, t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

depending on the context and culture of the organization. Further supporting the notion that gender diversity does not significantly affect bank performance, research indicated that banks led by females faced higher overall risk levels than those led by males, which could imply a detrimental effect on performance metrics. Additionally, a comprehensive analysis found an insignificant association between gender diversity and bank performance across a large sample of banks, reinforcing the argument that gender diversity alone may not be a determinant of financial success.

Board Size (bod_sz)

Board size has a significant positive impact on ROA. This indicates that the larger the board size, the higher the ROA. A larger board may offer more diverse perspectives and experiences, which can help in better decision-making and improve bank performance [28]. This finding aligns with research by Grassa et al. [9], which found that larger boards tend to be more effective in overseeing and guiding banks toward better performance. Bawaneh [29] indicates that increased board size is linked to better decision-making processes, leading to improved financial performance in banks, particularly in the context of Pakistan and India.

Innovation (innov)

Innovation has a significant positive impact on ROA, indicating that higher levels of innovation are associated with higher ROA. Innovations in products and services can improve operational efficiency and customer satisfaction, ultimately enhancing banks' financial performance. Research by Trivedi [13] and Zhou [22] also supports this finding, where technological innovations and new revenue streams positively impact bank performance.

Moderating Role of Innovation

The moderating variable edu_innov shows a significant impact on the relationship between innovation and ROA, indicating that the effect of innovation on ROA is stronger in Islamic banks with a higher educational background of the board in business. The educational background of the directors can enhance the bank's ability to implement and manage innovation effectively, thereby improving financial performance [8, 9, 30]. Conversely, the moderating variables gend_innov and size_innov do not show significant effects on the relationship between innovation and ROA, indicating that the presence of women on the board and board size do not significantly influence the effect of innovation on ROA in this model. Although gender diversity is important for various aspects of the organization, its impact on financial performance is not always significant, depending on other factors such as organizational culture and industry type. Additionally, while larger board sizes may offer more perspectives, their influence on the effectiveness of innovation depends on the ability to manage and leverage innovation effectively, which is not always directly related to board size.

6. Conclusion and Policy Recommendations

This study has revealed important findings in the relationship between board characteristics, innovation, and the performance of Islamic banks in Indonesia. Firstly, it was found that the educational background in business of the board of directors negatively affects the performance of Islamic banks. In contrast, board size and innovation positively affect the performance. Additionally, innovation was found to positively moderate the relationship between educational background and performance of Islamic banks while it did not moderate the relationship between gender diversity and performance and negatively moderated the relationship between board size and performance.

This study has several limitations. First, the data used may be limited to Islamic banks in specific regions, so the findings' generalization should be approached cautiously. Second, other variables not included in this analysis, such as market conditions or industry regulations, may affect ROA performance but were not considered in this study. Finally, this regression model does not account for potential mediating or interacting variables that could influence the relationship between independent variables and ROA.

For future research, it is recommended to expand the data scope by considering Islamic banks from various geographic regions. Further research on specific factors affecting ROA performance, such as decision-making mechanisms within the board of directors or the innovation strategies adopted by banks, could provide a better understanding of industry dynamics. Additionally, using more complex statistical models, such as path analysis or structural equation modeling, can help understand more complex relationships between the observed variables.

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Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

The data that support this work are available upon reasonable request to the corresponding author.

Author Contribution Statement

Fhatimah Nur Prawati: Conceptualization, Validation, Investigation, Writing – original draft. **Sepya Catur Wulandari:** Formal analysis. **Nur Wahyuningsih:** Resources, Project administration. **Samsul Rosadi:** Methodology, Software, Writing – review & editing. **Ade Setiawan:** Supervision, Funding acquisition. **Dewi Nurul Mardiana:** Data curation, Visualization.

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