“IT investment and Islamic banking performance in Indonesia: Do Sukuk issuance and Sariah governance matter?”

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ARTICLE INFO	Jaenal Effendi, Abdul Qoyum, Leo Indra Wardhana and Hassanudin Mohd Thas Thaker (2023). IT investment and Islamic banking performance in Indonesia: Do Sukuk issuance and Sariah governance matter?. *Banks and Bank Systems*, *18*(2), 75-87. doi:10.21511/bbs.18(2).2023.07
DOI	http://dx.doi.org/10.21511/bbs.18(2).2023.07
RELEASED ON	Monday, 22 May 2023
RECEIVED ON	Friday, 13 January 2023
ACCEPTED ON	Thursday, 20 April 2023

JOURNAL	"Banks and Bank Systems"
ISSN PRINT	1816-7403
ISSN ONLINE	1991-7074
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
62	1	8

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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IT INVESTMENT AND ISLAMIC BANKING PERFORMANCE IN INDONESIA: DO SUKUK ISSUANCE AND SARIAH GOVERNANCE MATTER?

Abstract

IT investment and financial performance are crucial issues for the Islamic banking industry. An Islamic banking (IB) that is established in a technologically advanced setting, employs mostly young and tech-savvy employees, and adheres to Islamic principles in all aspects of its activities, needs to invest in IT. This investment in information technology is essential if they are to remain competitive and achieve solid financial performance. This study aims to investigate the effect of IT investment on Islamic banking performance in Indonesia. The study used data of 14 Islamic banks in Indonesia, from 2012 to 2021. By employing panel regression analysis, the study revealed that IT investment has a significant impact on Islamic banking performance, indicated by ATM and Expenses for Human Resources (BG), which has the coefficient 1.75e-07 (Alpha 0.060) and 4.73e-14 (Alpha 1%), respectively. The study also documented a significant relationship between IT investment and IB performance, caused by Sukuk issuance and the Shariah supervisory board. Sukuk issuance has a negative impact on banking performance in relation to IT investment, while shariah governance (board of directors and shariah supervisory board) has a positive impact. Hence, it is also important for an Islamic banking to minimize the use of Sukuk, which until now was still categorized as debt, and to maximize the role of good governance to back up IT spending.

Keywords information technology investment, Islamic banking performance, Sukuk issuance, Shariah governance

JEL Classification G11, G21

Received on: 13th of January, 2023
Accepted on: 20th of April, 2023
Published on: 22nd of May, 2023

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Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

Technology is a key factor in business success in this era, especially for the Islamic banking sector, which was established in an era of technological innovation. According to some empirical findings, there are some arguments concerning the significance of technology investment for banking performance, as indicated by a higher rate of return (Hoque & Liu, 2021; Salvatore, 2005). In addition, the financial performance will affect the growth of Islamic banking, which can measure the position of banking in the whole economic system (Saeed et al., 2020). In addition, from the perspective of an investor, Islamic banking growth indicates that a company has a profitable investment. The existence of investment opportunities can provide a positive signal to a company's growth, which affects the sustainability of the company in the future (Hoque & Liu, 2021). The growth of an Islamic bank is a key point for success in the future, in which one of the important factors for banking growth performance is technological innovation.

There are some previous studies that have discussed the impact of IT investment on performance. According to a study by Ozili (2018), technology innovation directly affects the competitiveness level of a bank. IT investment will also have a positive impact by decreasing the cost for banking (Beccalli, 2007; Türkmen & Değerli, 2015), and transforming bank operations via fast accessibility for the customer (Abubakar et al., 2019). IT investments are also expected to have a positive impact on the financial inclusion by boasting financial services users, improve the quality of digital finance providers, and also support the governments programs (Ozili, 2018).

In addition, another economic theory suggests that innovation and technological change is very important, since it can boost the economic growth and improve firm performance (Romer, 2022; Aghion & Howitt, 2007). This effect is because technological advances can enable firms to introduce new firms' products and also improve the firm's services. As a result, the firm will gain a competitive advantage and access a wider market share (Aral & Weill, 2007; Bresnahan et al., 2002). The results of another study also indicate that IT has contributed immensely to the growth of the banking industry (Idowu et al., 2002). Thus, the key for a country's development is subject to innovation enhancement, especially in economic transformation and development in developing economies (Brown & Petersen, 2009). Generally speaking, banks always stimulate factors for modern economies and financial systems, therefore one way to enhance the vitality of the banks is via innovation and efficiency. However, there is another study (Beccalli, 2007) that shows the negative impact of investment in IT on the efficiency of banking.

Islamic banking in Indonesia is the most important financial sector that significantly contributes to the development of the economy by providing financing schemes to the society based on Islamic principles. An Islamic bank was established in the technological era, thus, digitalization for the Islamic banking industry is one of the interesting issues. For Islamic banks, IT investment can improve their performance, both fundamental and market (Takeda et al., 2021).

Therefore, the impact of IT investments on Islamic banking performance has still become a critical financial issue. As is known, investment in IT, of course, is costly for the Islamic banking, especially as a new and young industry. Hence, Islamic banks should have correct decisions, especially by analyzing the effect of IT investment on Islamic Bank Performance. Furthermore, another evidence provided by some previous studies, such as those conducted by the Council of Economic Advisers (Herren, 2001), and McKinsey Global Institute (2001), confirmed that there is no direct link between IT investment and bank productivity, or this is well known as the productivity paradox.

Although there are some previous studies on the impact of IT investment on banking performance, to the best of the author's knowledge, there are no previous studies focused on Islamic banks. Most of them mainly concentrated on bank innovations like corporate governance (Al Dalayeen, 2017), bank supervision and management (Chortareas & Mavrodimitrakis, 2016; Pasiouras et al., 2009), and improving financing models (Inman & Nikolova, 2017). Therefore, this study will discuss the impact of IT investment on Islamic banking performance using the example of Indonesia. The study focuses on Indonesia due to several reasons. First, Islamic banking in Indonesia is one of the biggest markets in the world. Although in terms of IB share it is still 7%, the development trend of IB is very good. Second, Indonesia as the biggest Muslim population in the world has very huge potential, thus investment in IT is intended to improve performance. Third, the Internet penetration in Indonesia is also a very impressive progress, thus, it will help form the success of IT investment. In addition, this study tests how strongly Sukuk Issuance (as the shariah source of the fund) and Sharia governance affect IT investments, and Sukuk issuance on Islamic banking performance.

http://dx.doi.org/10.21511/bbs.18(2).2023.07

1. LITERATURE REVIEW AND HYPOTHESIS

1.1. Islamic label and IT investment: productivity paradox

The main objective of Islamic banking is to realize *maqasid al-shari'a*. According to Abozaid and Dusuki (2007), *maqasid al-shari'a* is the very objective or the rationale behind the sharia ruling for a specific regulation, including in economic activity. According to Islamic scholars, the main objective of sharia is to safeguard and preserves public interests (*maslahah*) in all aspects of life. Some examples of *maqasid al-shari'a* is charity, in which the main objective of a charity contract in shariah is to enhance social cohesion by helping each other, especially for the poor (Kamali, 1999). Therefore, from the Islamic banking perspective, the objective of the firm is not only to maximize financial performance (return, risk, liquidity) and sustainabilty, but also cover the fulfilment of the shariah value and *maqhasid shari'a* (see Figure 1).

Theoretically, the general objective of sharia is the attainment of *maslahah*. *Maslahah* is an Arabic word that means welfare, benefit, or interest. It has been applied in Islamic legal theory to promote public benefit and prevent social evil. *Maslahah* is defined as *seeking benefit and repelling harm* (Abozaid & Dusuki, 2007). Benefits sought include shaping human needs, eradicating poverty, and addressing socioeconomic challenges or promoting sustainability (Figure 1).

Currently, the main challenge for Islamic banks is how they can invest in technology, as the result, this will improve IB performance. Nevertheless, the Productivity paradox said that there is an absence of a positive impact of IT on productivity (as originally identified by Solow (1957)). The bigger challenge, of course, is faced by Islamic banking in Indonesia, which is known as the new industry, the rise of the productivity paradox issue is more critical. Even the use of Sukuk (shariah compliance financing) and Shariah governance do not predict a significant impact of boosting the effectiveness of IT investment on Islamic banking performance.

1.2. Previous studies

There are some previous studies on the impact of investment technology on bank performance. Some previous studies revealed a positive effect of IT investment on bank performance (Hoque & Liu, 2021; Salvatore, 2005; Ozili, 2018; Abubakar et al., 2019; Romer, 2022; Aghion & Howitt, 2007). While the others documented insignificant impact of IT investment on bank performance (Beccalli, 2007). Roy and Thangaraj (2020) examined the relationship between IT investment and profitability using panel data. The study revealed that a private bank in India is more aggressive in investing in IT compared to a public bank. Accordingly, the paper is in line with the previous study by Ozili (2018) that argues that technology will promote a competitive landscape by reducing cost, providing a fast accessible banking system (Adrian & Liang, 2014; Meena & Parimalarani, 2020), decreasing the employee cost (Beccalli, 2007; Türkmen & Değerli, 2015). According to Beccalli (2007) and Ho and Mallick (2010), in the context of the global banking system, several studies discussed the profitability paradox in a different setup. The empirical results show

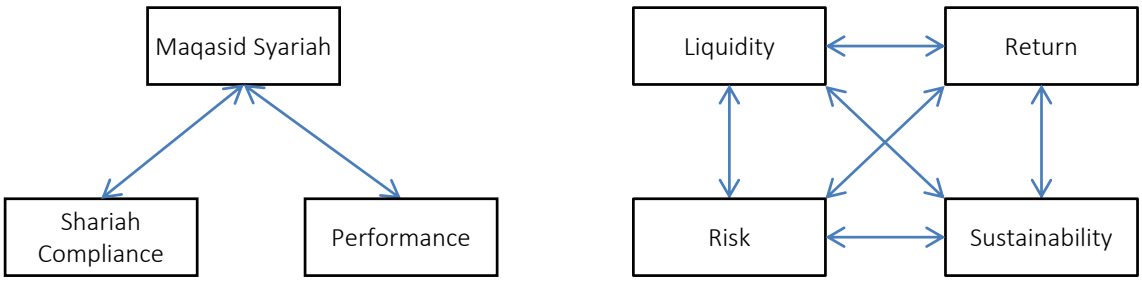

Figure 1. Firm's objective from the Islamic perspective

that there is still an inconsistent and mixed result on the hypothesis about how technology can improve a bank's profitability or embrace weak or non-existent links.

On the other hand, Saphyra et al. (2021) find that many investors are interested in investing in financial technology, thus, this affects the availability of credit for people. Because through this innovation, it can be possible to improve the quality, effectiveness, and efficiency of the business model related to financial services. The same finding on the positive effect of IT investment was also documented by Casolaro and Gobbi (2007), whose study of 600 Italian banks revealed that both profit and cost frontier shifts are significantly correlated with IT investment. Banks that implement capital-intensive IT are also more efficient. Financial technology (Fintech) is making a positive contribution to the whole financial system by reducing costs, providing higher-quality services, and increasing customer satisfaction. Hence, new studies play an essential role in improving Fintech investments (Kou et al., 2021). Leckey et al. (2011) conducted a study in Ghana and investigated the relationship between IT investment and banking performance. They found that banks at high levels of investments in IT increased return on assets (ROA) and return on equity (ROE). The same result was also documented by Hung and Luo (2016).

The purpose of this paper is to examine whether IT investment has an impact on Islamic bank performance. Thus, following the majority of views in the literature, the following hypothesis is put forward:

H1: IT investment has a positive effect on Islamic banking performance.

2. RESEARCH METHODS

2.1. Data and sample

The study was conducted in Indonesia from 2012 to 2021 with the participation of all Islamic commercial banks. The data were obtained from 14 official websites of Islamic commercial banks in Indonesia.

Table 1. Sample used in the study

No.	Islamic Commercial Bank	Total Data	Data Source
1	PT. BPD NTB Syariah	100	Annual Report
2	PT. Bank Aceh Syariah	100	Annual Report
3	PT. Bank Aladin Syariah	70	Annual Report
4	PT. Bank BCA Syariah	100	Annual Report
5	PT. Bank BNI Syariah	90	Annual Report
6	PT. Bank BRI Syariah	90	Annual Report
7	PT. Bank Jabar Banten Syariah	80	Annual Report
8	PT. Bank Mega Syariah	70	Annual Report
9	PT. Bank Muamalat Indonesia	80	Annual Report
10	PT. Bank Panin Dubai Syariah	100	Annual Report
11	PT. Bank Syariah Bukopin	100	Annual Report
12	PT. Bank Syariah Mandiri	90	Annual Report
13	PT. BTPN Syariah	80	Annual Report
14	PT. Bank Victoria Syariah	100	Annual Report
Total Data		1,250	

2.2. Empirical models

The methodology in this study consists of two main steps. First, a panel regression was used to determine whether IT investment has an impact on Islamic bank performance. The study uses some variables as a proxy for IT investment, namely, the Number of ATMs, Total Investment in Software, and Human resource expenses. Second, the study also adopts a statistical approach by including Islamic criteria such as Sukuk issuance and Shariah Governance (Belkhir et al., 2016; Naseem et al., 2017), to determine which of them have a moderate impact on the performance of Islamic banking (Abdallah & Bahloul, 2021). To test the hypothesis, the equations by Hayat and Kabir Hassan (2017) were adopted as follows:

$$ROA_{it} = \beta_0 + \beta_1 ITinvest_{it} + \varepsilon_{it}, \quad (1)$$

$$ROA_{it} = \beta_0 + \beta_1 ATM_{it} + \\ + \beta_2 Soft_{it} + \beta_3 BG_{it} + \varepsilon_{it}, \quad (2)$$

$$ROA_{it} = \beta_0 + \beta_1 ATM_{it} + \beta_2 Soft_{it} + \\ + \beta_3 BG_{it} + \sum_{d}^{3} \delta_d Sukuk_j + \sum_{s=1}^{3} \theta_s Z_{it} + \varepsilon_{it}. \quad (3)$$

The dependent variables (ROA_{it}) are for IB performance based on accounting measurement. Dummy Sukuk is 1 for IB with sukuk issuance,

http://dx.doi.org/10.21511/bbs.18(2).2023.07

and 0 otherwise. *ITinvest* is for total IT Investment that consists of the number of ATMs (*ATM*), total investment in Software (*Soft*), and Human Resources Expenses (*BG*), and ε_{it} is the error term.

Table 2. Definitions of variables

Variable	Definition and Measurement
Dependent variable	
ROA	Return of Assets (in IDR)
Independent variables	
ATM	Number of ATM Machines (in terms of number)
Soft	Total Investment for Software (in IDR)
BG	HR Expenses (in IDR)
Moderating variable	
Sukuk	1 for IB with Sukuk Issuance, 0 otherwise (Dummy variable)
Shariah Governances	
BOD	Number of Board of Directors (in terms of number)
Audit Committee	Total Number of Audit Committees (in terms of number)
SSB	Total Number of Shariah Supervisory Boards (in terms of number)

3. RESULTS AND DISCUSSION

Table 3 reports the descriptive statistics for the variable of 14 Islamic banks in Indonesia for the period 2012–2021. During the last 10 years, the average ROA of Islamic banks in Indonesia is around 0.7%. This rate of performance is quite competitive, which indicates every 1,000 assets will create a net income of around 7. This will attract an investor to invest in an Islamic bank, since, according to Hoque and Liu (2021), financial performance as the firm objective is usually indicated by a higher return. Thus, with a higher return, the firm objective can be realized (Salvatore, 2005).

The IT Investment proxied by ATM, Soft, and BG indicated that an Islamic bank in Indonesia pays great attention to investing in IT. As for ATM, for example, an Indonesian Islamic bank has an average of 14,885 ATMs. An interesting finding was also documented by Software Investment where an Islamic Bank allocated a maximum of 1.7% of equity for IT development. This fact indicated that Islamic banks already have good awareness of digitalization in response to the trend in society. Table 3 shows that not all Islamic banks are interested is sukuk as financing resources. It can be seen from the average of Sukuk that around 0.224, or below 0.5, means that Sukuk was not the main financial instrument applied by an Islamic bank. This supports the finding from Guizani (2020) that sukuk is the last alternative to the financial deficit of Islamic-compliant firms.

Table 3. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	125	.0074954	.0333955	–.1688571	.1080234
ATM	125	14,885.09	47,569.75	0	287,113
Sof	140	.0010391	.0028806	0	.0176283
BG	125	287e+9	311e+9	685e+6	1,230e+9
Sukuk	125	.224	.4185998	0	1
BOD	125	4.248	1,059.945	2	7
AC	125	3.808	1,311.832	2	8
SSB	125	2.216	.4680777	1	3

Notes: ROA: Return on Assets; *ATM*: number of ATM machines owned by an Islamic Bank; *Soft*: Investment of an Islamic bank in Software; *BG:* Total expenses of an Islamic bank for Human Resources; *Sukuk*: Sukuk Issuance of an Islamic bank, 1 for issuance, and 1 for otherwise; *BOD*: Board of Directors; *AC*: Audit Committee; *SSB*: Shariah Supervisory Board.

Table 4 contains a correlation matrix of the variables used in this study. The table shows that all

Table 4. Correlation matrix

Variable	ROA	ATM	Sof	BG	Sukuk	BOD	AC	SSB
ROA	1.0000	–	–	–	–	–	–	–
ATM	0.0405	1.0000	–	–	–	–	–	–
Sof	0.2087	–0.0843	1.0000	–	–	–	–	–
BG	0.2989	–0.1646	0.1968	1.0000	–	–	–	–
Sukuk	0.0067	0.5197**	–0.1838	0.4013	1.0000	–	–	–
BOD	0.1420	0.4837*	–0.0268	0.3544	0.6008**	1.0000	–	–
AC	0.1026	0.4513*	0.0530	0.1579	0.3139	0.4405*	1.0000	–
SSB	0.0626	0.4374*	–0.1555	0.0333	0.4096*	0.4438*	0.3308	1.0000

Note: ROA: Return on Assets; *ATM*: number of ATM machines owned by an Islamic Bank; *Soft*: Investment of an Islamic bank in Software; *BG*: Total expenses of an Islamic bank for Human Resources; *Sukuk*: Sukuk Issuance of an Islamic bank, 1 for issuance, and 1 for otherwise; *BOD*: Board of Directors; *AC*: Audit Committee; *SSB*: Shariah Supervisory Board. *T*-statistics in parentheses. *, **, and *** mean significance at 10%, 5%, and 1%, respectively.

three aspects of Shariah governance are highly correlated with sukuk issuance. The highest correlation is between Sukuk Issuance and BOD (0.6008), Sukuk Issuance and SSB (0.4096). This correlation indicates that a higher number of Shariah Governances will tend to promote Islamic banking to issue Sukuk, which is well known as an Islamic instrument for financing banking deficits.

In addition, *ATM* as one of the proxies for IT investment also has a positive correlation with the Sukuk Issuance and Shariah Governance variable. This can be seen from Table 4 in the correlation between *ATM* and *Sukuk*, which is 0.5197, *ATM* and *BOD* is 0.483, *ATM* and *AC* is 0.451, and *ATM* and *SSB* is 0.4374. The higher correlation between Sukuk and IT investment indicates that Islamic banks that issued sukuk will tend to have higher IT investments. It supports the Islamic finance principle whereby sukuk is issued based on the project. Moreover, better Shariah governance will also improve the better awareness for the bank to invest in IT. This finding supports the argument of Unal and Aysan (2022) who state that fintech has a deep relationship with the primary doctrines of Islam and Islamic finance, which supports fintech investment by Islamic financial institutions. The main reasons are transparency, social benefit-focused investment, protecting the wealth of the people and the environment, protecting the human factor, and minimizing the friction in terms of money, labor and time are some of the common goals for both fintech and Islamic finance.

Table 5, which describes the regression result between IT investment and Islamic bank performance, revealed that IT investment has a positive effect on Islamic bank performance. It is indicated by an ATM machine and Expenses for Human Resources (BG), which has coefficient 1.75e-07 (Alpha 0.060) and 4.73e-14 (Alpha 1%), respectively. This results of the two proxies of IT investment differ from Software Investment, which documented insignificant results for IB performance. This finding is very interesting, which evidenced that investing in IT for an Islamic Bank can improve the performance of the Islamic Bank. This finding supports the logic of Islamic banks, since infant industries still need fast development, especially to improve their service for customers. This finding is supported by another regression result as stated in the Table A1 dan Table A2 by focusing in Software investment and BG in which documented that IT investment has significance impact on Islamic bank performance. Hence, IT plays a significant role in this matter, in which with IT investment, the Islamic banking service will increase, hence customer loyalty also increased. As a result, better banking performance will be raised (Romer, 2022; Aghion & Howitt, 2007). This finding contradicts the theory of the Productivity Paradox, which assumes IT investment has no significant effect on performance (Beccalli, 2007). In addition, this study also supports some previous studies (Aral & Weill, 2007; Bresnahan et al., 2002).

Table 5. Regression results

Variables	Coef.	Std. err.	t	P > t	[95% Conf.	Interval]
ATM	1.75e–07*	9.22e–08	1.90	0.060	–7.20e–09	3.58e–07
Sof	1.068.475	1.016.547	1.05	0.295	–.944743	3.081.693
BG	4.73e-14***	1.28e-14	3.69	0.000	2.19e-14	7.26e–14
Sukuk	–.026535**	.0106744	–2.49	0.014	–.0476751	–.005395
BOD	.0013801***	.0037895	0.36	0.716	–.0061249	.008885
AC	–.0006582***	.0025728	–0.26	0.799	–.0057534	.0044371
SSB	.0056366***	.0071701	0.79	0.433	–.0085635	.0198366
_cons	–.0198259	.0187945	–1.05	0.294	–.0570473	.0173956
Numb obs	–	125	–	–	–	–
Prob > F	–	0.0025	–	–	–	–
R-squared	–	0.1682	–	–	–	–
Adj R-squared	–	0.1184	–	–	–	–

Note: ATM: number of ATM machines owned by an Islamic Bank; *Soft*: Investment of an Islamic bank in Software; *BG*: Total expenses of an Islamic bank for Human Resources; *Sukuk*: Sukuk Issuance of an Islamic bank, 1 for issuance, and 1 for otherwise; *BOD*: Board of Directors; *AC*: Audit Committee; *SSB*: Shariah Supervisory Board. *T*-statistics in parentheses. *, **, and *** mean significance at 10%, 5%, and 1%, respectively.

http://dx.doi.org/10.21511/bbs.18(2).2023.07

In addition, the positive impact of IT investment on Banking Performance will increase the revenue of Islamic banks by reducing its cost (Roy & Thangaraj, 2020), improving financial inclusion (Ozili, 2018), creating more loyal customers and investors (Adrian & Liang, 2014; Roy & Thangaraj 2020), and thus returns of Islamic bank will increase (Saphyra et al., 2021; Casolaro & Gobbi, 2007; Leckey et al., 2011). Therefore, Islamic banks as one of the new industries in finance that have had promising growth during the last three decades must give greater attention to IT investment. This is due to the fact that people, especially millennials, are very familiar with IT, supported by good internet access as well as many application providers, so digital finance is a relevant platform. Their satisfaction is largely determined by good service quality in the online service.

The productivity paradox as mentioned by Beccalli (2007) is not evidenced in this study. This may have a relationship with the different eras. Currently, Islamic banks exist in our digital era. Thus, this study suggests that in the future, investment in IT will be of great importance in improving the efficiency of the Islamic bank. Islamic banking as a new industry can focus on investing in Information technology, since currently there are many young generations with good IT literacy and wide internet access.

This finding shows that IT investment has a positive impact on Islamic banking performance. However, the findings, as described in Table 5, do not indicate which of the Islamic value principle in finance has a significant impact on IB performance. Hence, this study regresses Sukuk Issuance and Shariah Governance to check whether Islamic finance practice has an impact on IT investment or not, especially in case of Sukuk Issuance. The study regresses it to test whether this variable can moderate IT Investment and IB performance. Table 5 evidenced that sukuk has a negative effect on Islamic bank performance, indicated with the coefficient at –.026535. Sukuk is known as one of the main alternatives to finance the company deficit and is based on Islamic principles, i.e. Ijarah contract, or Murabahah contract, in Indonesia. The main difference between Sukuk and Bond is that in Sukuk the issuance must be based on the specific project and have underlying assets. Sukuk is not like debt in form, but still like debt in substance. This study also finds that shariah governance has a positive effect on Islamic banking performance in terms of IT investment. It is indicated with the coefficient of *BOD* and *SSB* at .0013801 and .0056366, respectively.

These results are quite acceptable if one compares them with previous research, in which an Islamic firm uses Sukuk as the last alternative to finance the firm. As Sukuks are considered hybrid contract securities that have the features of stocks and bonds. It is the same with a bond: sukuk has a maturity date, and some of these securities are usually of fixed revenue and a final payment at the maturity date (Unal & Aysan, 2022; Oluoha et al., 2021). On the other hand, although Sukuks are indicative of some sort of partnership and ownership of the holder in respect of the asset, they lack the right of voting and interfere in underlying assets. These Islamic instruments involve a high information cost. Due to their specific structuring, Sukuks are especially exposed to moral hazard and adverse selection problems. In addition, Table 5 revealed that shariah governance has no significant impact on Islamic banking performance. BOD, AC, and SSB have little effects on improving the performance of Islamic banking in Indonesia.

An interesting finding was also documented in this study regarding the relationship between IT investment and IB performance. Table 6 shows that SSB as part of the shariah governance reduced the effect of the use of IT investment on IB performance. The rest of the Shariah governance, i.e. BOD and AC, have no significant impact on the relationship between IT investment and IB performance. The negative impact of SSB indicated that the relationship between IT investment and IB performance decreased with the higher SSB member. This finding indicated that the big size of SSB is less effective in developing consensus, reducing agency costs, improving communication, and having good control; this statement supports previous studies such as Ben Abdallah and Bahloul (2021), Naseem et al. (2017), Sakti (2022), and Musdalifa et al. (2022). Overall, from the statistical testing, this study revealed that IT investment has a positive effect on Islamic banking performance.

Table 6. Moderated regression analysis results

Variables	–1	–2	–3	–4	–5	–6	–7	–8
	ROA	ROA	ROA	ROA	ROA	ROA	ROA	ROA
ATM	0.000000200	0.00000124***	-0.000000294	-0.000000354	0.000000209	0.000000311	0.000000245	0.00000322*
	(1.39)	(3.12)	(-1.01)	(-1.14)	(0.77)	(1.15)	(0.30)	(1.82)
Sof	2.271	2.256	2.267	2.195	2.270	2.211	2.270	2.223
	(0.68)	(0.69)	(0.68)	(0.67)	(0.69)	(0.68)	(0.68)	(0.68)
BG	3.41e-15	–2.36e-15	3.50e-15	–3.34e-15	2.22e-15	–5.29e-15	3.36e-15	–4.70e-15
	(0.29)	(–0.16)	(0.30)	(–0.23)	(0.18)	(–0.35)	(0.28)	(–0.31)
Sukuk	0.00136	0.00604	0.00200	0.00534	0.000227	0.00291	0.000474	–0.00165
	(0.30)	(0.83)	(0.41)	(0.72)	(0.06)	(0.43)	(0.11)	(–0.21)
BOD	–0.00314	–0.00126	–0.00356	–0.00172	–0.00325	–0.00126	–0.00315	–0.00149
	(–0.92)	(–0.41)	(–0.96)	(–0.49)	(–0.93)	(–0.40)	(–0.91)	(–0.46)
AC	–0.00335	–0.000948	–0.00328	–0.00123	–0.00222	0.000183	–0.00330	–0.000374
	(–1.55)	(–0.40)	(–1.51)	(–0.51)	(–0.94)	(0.07)	(–1.47)	(–0.14)
SSB	0.00537**	0.00856	0.00556**	0.00922*	0.00513*	0.00879*	0.00545**	0.00978*
	(2.02)	(1.64)	(2.03)	(1.66)	(1.96)	(1.68)	(1.99)	(1.81)
c.ATM#c.Su~k	–0.000000304*	–0.00000135***	–	–	–	–	–	–
	(–1.79)	(–3.25)	–	–	–	–	–	–
c.ATM#c.BOD	–	–	2.67e–08	3.54e–08	–	–	–	–
	–	–	(0.78)	(0.98)	–	–	–	–
c.ATM#c.AC	–	–	–	–	–3.72e–08	–4.88e–08	–	–
	–	–	–	–	(–1.07)	(–1.47)	–	–
c.ATM#c.SSB	–	–	–	–	–	–	–0.000000117	–0.00000112*
	–	–	–	–	–	–	(–0.42)	(–1.85)
_cons	0.0424***	0.0316**	0.0436***	0.0305*	0.0381***	0.0232	0.0421***	0.0272*
	(2.94)	(2.03)	(2.95)	(1.92)	(2.73)	(1.37)	(2.93)	(1.76)
N	125	125	125	125	125	125	125	125

CONCLUSION

This study aims to analyze the effect of IT investment on Islamic banking performance in Indonesia. The result is very crucial for improving the quality of Islamic banks, which face many challenges, especially in terms of technological development, different types of customers, most of which are the young generation, and shariah issues. Hence, IT investment will ensure Islamic bank competitiveness compared to conventional counterparts. Nevertheless, IT investment is not simple, since the cost of IT investment is quite high, while its effect on the performance may be still questionable.

Based on the statistical analysis, the study finds several interesting results. First, IT investment has a good correlation with Shariah governance. This means that shariah governance tends to have higher investments in IT. This indicates that an Islamic bank has good awareness of investment. It is logical, since the establishment of an Islamic bank is in the modern time with the massive growth of IT and the young generation. Therefore, by investing in IT, Islamic banks can compete with other banks. Second, this study also documented interesting findings that contradict the Productivity paradox, which assumes there is no clear effect of IT investment on firm performance. The empirical testing shows that IT investment applied by Islamic banks has a positive impact on Islamic bank performance in Indonesia. Third, the study also evidenced the relationship between Sukuk issuance and Shariah Governance with IT investment and IB performance.

The study revealed that Sukuk issuance has a negative effect, by reducing the impact level of IT investment on Islamic banking performance. The different result was documented by BOD and SSB. This finding suggests that the higher Sukuk issuance will make a firm more prudent in investing in IT. In addition, a higher number of BOD and SSB may create an effective decision. While the sukuk that a

http://dx.doi.org/10.21511/bbs.18(2).2023.07

firm may issue is not intended for IT, it is more oriented toward a real IB business. The higher risk faced by a firm due to the financial risk when IB issued Sukuk makes Islamic bank more prudent in deciding on IT projects.

This finding suggests that Islamic banking in Indonesia should improve IT by investing more funds. The better IT will improve the service quality for the customer, especially the millennial generation with better technology literacy and internet access. This study also suggests that future research to expand the data to incorporate other bank branches comprehensively and even rural banks can enhance the results and improve its potential generalization. Comparison of conventional and Islamic banks could be another area for future research.

AUTHOR CONTRIBUTIONS

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http://dx.doi.org/10.21511/bbs.18(2).2023.07

APPENDIX A

Table A1. Regression Result for software investment

Variables	–1	–2	–3	–4	–5	–6	–7	–8
	ROA	ROA	ROA	ROA	ROA	ROA	ROA	ROA
ATM	–9.04e-08	–6.54e-08	–9.27e-08	–8.48e-08	–0.000000103	–0.000000101	–9.87e-08	–8.18e-08
	(–0.99)	(–0.80)	(–0.99)	(–0.88)	(–1.03)	(–0.97)	(–1.00)	(–0.90)
Sof	2.281	2.212	9.173	7.502	–0.881	–1.954	5.483	21.43
	(0.69)	(0.68)	(0.91)	(0.70)	(–0.17)	(–0.34)	(0.26)	(0.84)
BG	3.62e-15	–4.21e-15	7.12e-15	9.09e-16	3.52e-15	–2.82e-15	3.55e-15	–3.88e-15
	(0.31)	(–0.29)	(0.57)	(0.06)	(0.30)	(–0.20)	(0.30)	(–0.26)
Sukuk	0.00128	0.00386	–0.000222	0.00326	0.00119	0.00385	0.00119	0.00387
	(0.28)	(0.55)	(–0.05)	(0.46)	(0.26)	(0.55)	(0.26)	(0.55)
BOD	–0.00322	–0.00143	–0.00225	–0.000611	–0.00299	–0.00109	–0.00312	–0.00127
	(–0.92)	(–0.44)	(–0.67)	(–0.20)	(–0.86)	(–0.35)	(–0.90)	(–0.40)
AC	–0.00314	–0.000765	–0.00339	–0.00149	–0.00376	–0.00198	–0.00331	–0.00105
	(–1.45)	(–0.31)	(–1.58)	(–0.63)	(–1.65)	(–0.86)	(–1.52)	(–0.43)
SSB	0.00537**	0.00957*	0.00480*	0.00811	0.00542**	0.00891*	0.00544*	0.00972
	(2.01)	(1.70)	(1.83)	(1.60)	(2.06)	(1.71)	(1.94)	(1.62)
c.Sof#c.Su~k	–6.615	–18.88	–	–	–	–	–	–
	(–0.62)	(–1.37)	–	–	–	–	–	–
c.Sof#c.BOD	–	–	–1.996	–1.530	–	–	–	–
	–	–	(–0.81)	(–0.58)	–	–	–	–
c.Sof#c.AC	–	–	–	–	0.833	1.110	–	–
	–	–	–	–	(0.53)	(0.72)	–	–
c.Sof#c.SSB	–	–	–	–	–	–	–1.604	–9.599
	–	–	–	–	–	–	(–0.16)	(–0.76)
_cons	0.0417***	0.0264	0.0401***	0.0298*	0.0434***	0.0314**	0.0421***	0.0274
	(2.94)	(1.60)	(2.82)	(1.92)	(3.08)	(2.04)	(2.97)	(1.64)
N	125	125	125	125	125	125	125	125

Note: T-statistics in parentheses. *, **, and *** mean significance at 10%, 5%, and 1%, respectively.

Table A2. Regression Result for total expenses for human resources (BG)

Variables	–1	–2	–3	–4	–5	–6	–7	–8
	ROA	ROA	ROA	ROA	ROA	ROA	ROA	ROA
ATM	–0.000000102	–9.42e-08	–8.06e-08	–8.81e-08	–7.41e-08	–0.000000104	–0.000000104	–0.000000102
	(–1.02)	(–0.93)	(–0.79)	(–0.84)	(–0.81)	(–0.93)	(–1.04)	(–0.98)
Sof	2.299	2.217	2.302	2.262	2.315	2.213	2.217	2.152
	(0.69)	(0.67)	(0.72)	(0.70)	(0.70)	(0.67)	(0.66)	(0.65)
BG	1.07e-16	6.61e-15	–9.18e-14	–5.94e-14	–1.57e-14	2.86e-15	2.91e-14	3.41e-14
	(0.00)	(0.23)	(–1.63)	(–1.03)	(–0.67)	(0.11)	(0.84)	(0.91)
Sukuk	–0.00262	0.0140	–0.000497	0.00266	0.000454	0.00467	0.000364	0.00354
	(–0.24)	(0.83)	(–0.12)	(0.36)	(0.10)	(0.62)	(0.08)	(0.50)
BOD	–0.00313	–0.000962	–0.00875	–0.00468	–0.00319	–0.00107	–0.00333	–0.00145
	(–0.92)	(–0.31)	(–1.41)	(–0.82)	(–0.94)	(–0.35)	(–0.94)	(–0.45)
AC	–0.00339	–0.00110	–0.00347	–0.00163	–0.00522	–0.000779	–0.00309	–0.000837
	(–1.58)	(–0.48)	(–1.63)	(–0.69)	(–1.33)	(–0.16)	(–1.36)	(–0.34)
SSB	0.00547**	0.00807	0.00660**	0.00921*	0.00465	0.00891	0.00932*	0.0143**
	(2.01)	(1.42)	(1.99)	(1.70)	(1.61)	(1.60)	(1.86)	(1.99)
c.BG#c.Sukuk	6.67e–15	–1.61e–14	–	–	–	–	–	–
	(0.30)	(–0.54)	–	–	–	–	–	–
c.BG#c.BOD	–	–	1.83e–14*	1.10e–14	–	–	–	–
	–	–	(1.83)	(1.14)	–	–	–	–
c.BG#c.AC	–	–	–	–	4.66e–15	–1.30e–15		
	–	–	–	–	(0.88)	(–0.20)		
c.BG#c.SSB	–	–	–	–	–	–	–1.02e–14	–1.46e–14
	–	–	–	–	–	–	(–0.96)	(–1.21)
_cons	0.0429***	0.0292*	0.0671***	0.0457**	0.0530**	0.0270	0.0327**	0.0161
	(3.02)	(1.86)	(2.75)	(2.09)	(2.46)	(1.03)	(2.06)	(0.88)
N	125	125	125	125	125	125	125	125

Note: T-statistics in parentheses. *, **, and *** mean significance at 10%, 5%, and 1%, respectively.