

The Impact Of Blockchain Technology To The Bank's Efficiency And Profitability In Indonesia

Agus Saur Utomo¹, Mahendra Galih Prasaja², Nayla Fahiya Rahmawati³

^{1,2,3}Fakultas Ekonomi, Universitas Muhammadiyah Purworejo

Email: agussaur@umpwr.ac.id

Abstract

Received: 28 April 2024

Revised: 9 Juni 2024

Accepted: 30 Juni 2024

This research empirically examines the impact of blockchain adoption to the bank's profitability and efficiency in Indonesia. Descriptive statistic and paired sample t-test are employed to analyses the data. The sample of this study is Bank Permata, a pioneer bank in Indonesia that adopted blockchain technology. Bank Permata have a conventional service as well as syariah service unit. Secondary data was taken from bank's financial report as long as 2019-2023. Efficiency is proxied by BOPO ratio while profitability is proxied by ROA, ROE, GPM, OPM and NPM ratios. The study found that blockchain technology doesn't have significant impact to the bank efficiency, however the level of bank efficiency is increasing after implementing blockchain. Bank profitability is partly affected by adoption of blockchain technology. GPM, OPM and NPM are significantly different after implementing the blockchain however ROA and ROE are not significantly different. Nevertheless, there are increasing ROA and ROE ratio after blockchain adoption.

Keyword: *Blockchain, Efficiency, Profitability*

INTRODUCTION

Currently, financial technology (Fintech) become a key of banking innovations. This technology changes the business model from initially having to meet in person and bring a certain amount of cash to pay, to being able to do it remotely and in a short time. Fintech is financial technology through innovation in the development of applications, products or business models in the financial services industry (Lee and Low, 2018). One of the new fintech breakthroughs in the banking world today is blockchain technology. Blockchain technology discovered by Nakamoto (2009) has provided many benefits such as data security, transaction transparency, and a decentralized system. OJK Institute (2022) states that blockchain technology is similar to a digital ledger book that is easy to access anywhere and at any time without any third-party interference. Blockchain makes transactions more transparent and safer from data fraud, corruption and money laundering activities.

Blockchain transactions occur transparently and everyone can know and verify them to provide accountability and transparency. Blockchain users get security and privacy with private keys that guarantee their owners to remain anonymous. In addition, transactions recorded on the blockchain cannot be deleted or replaced. When a transaction occurs in the blockchain system, the transaction will be recorded in a block. This block must be validated first before it can be included in the chain. In this validation process, all parties who are members of the system can do it. The

authenticity of a block must be verified first through a consensus algorithm (consensus algorithm/proof of stack) where the majority of nodes or nodes with the highest stack in the distributed network chain must validate the block before the block is inserted into the chain. After the block is validated, a unique identifier code called a hash will be generated (Hasan, 2020).

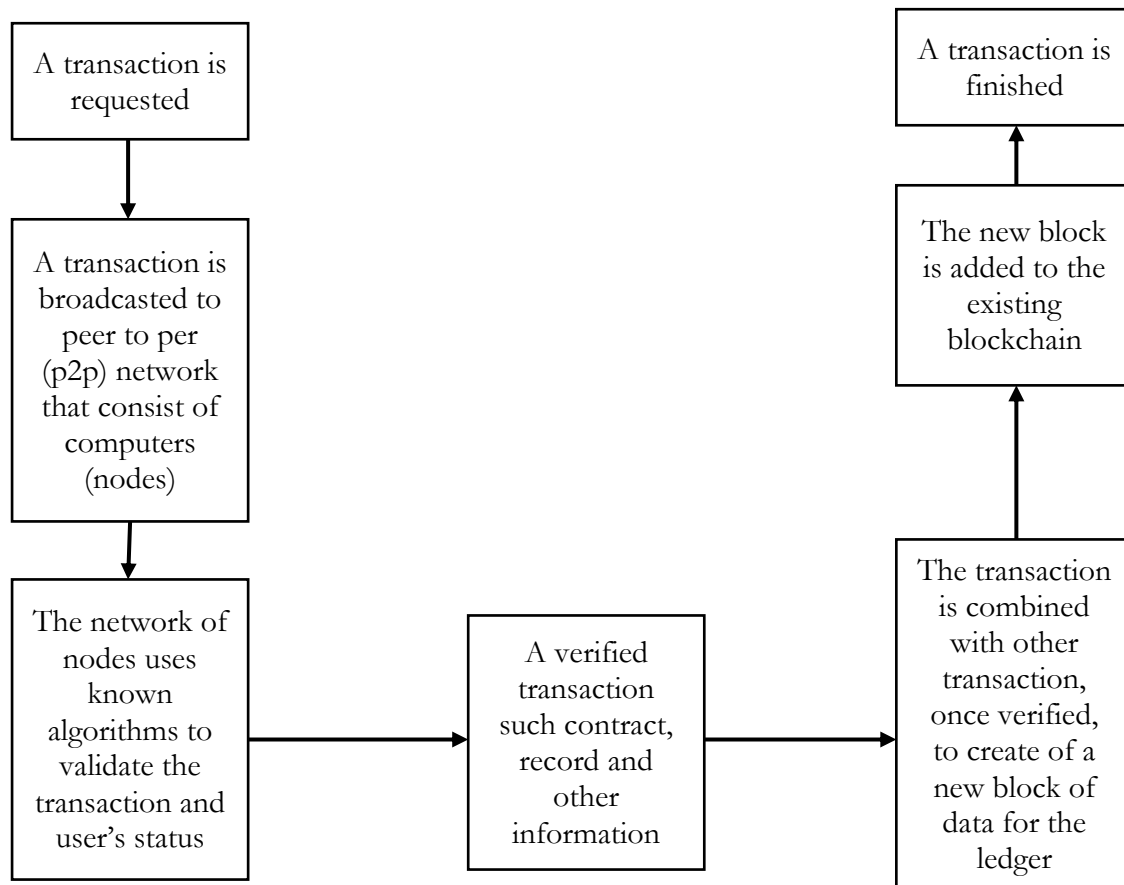


Figure 1. Blockchain technology mechanism in banking industries

In the banking industry, blockchain technology can be used to streamline and automate a number of processes, such as payment settlement, cross-border payments, and trade finance. In addition, blockchain technology can speed up the process of approving transactions, disbursing financing and complex transactions. As a decentralized and distributed ledger, blockchain records transactions across multiple computers, making it nearly impossible to change or tamper with the recorded data. Its decentralized nature means it is not controlled by a single entity, making it more transparent and secure to record and verify transactions. The working system of blockchain technology in the banking industry is shown in Figure 1.

The adoption of blockchain technology in the banking was reported by Chang, et.al. (2020) and Maiti, et.al (2021). They reported that HSBC Bank and a bank from Spain had started using blockchain technology to serve letter of credit (LC) transactions in 2018. Letter of credit (LC) is a trade finance product provided by banks to serve export-import transactions. The importer initiates an LC transaction by having his bank issue the instrument to the exporter. LC guarantees that the issuing bank will pay the agreed contract amount when the exporter proves that he delivered the goods, for example by providing documents confirming the arrival of the goods in the destination country. The collaborative model for issuing and receiving LC is quite complicated and takes a lot of time. Blockchain technology is used to streamline the trade financing process, especially in issuing and receiving LC.

Blockchain technology in LC settlement could increase process efficiency through document digitization, document checking automation, and payment automation via smart contracts (Bhat & Nor, 2021; Fridgen et al., 2021; Kapnissis et al., 2022; Kshetri, 2018; Larson, 2018; Takahashi, 2018). Features in blockchain also increase security and visibility or transparency of transactions for the parties involved (Al-Amaren et al., 2020; Chang et al., 2019). This shows that the use of blockchain technology has the potential to increase the level of efficiency and security of banks which will ultimately have an impact on increasing bank performance. Blockchain opens up opportunities for banks to reduce the need for third-party validators, modernize banking infrastructure, and secure transactions. Blockchain can make it easier for banks to analyze the background of customers applying for credit and reduce financial transaction administration costs. One of the unique characteristics of blockchain is the analytical capabilities behind it. The more organizations or companies that participate, including competitors, the greater the value blockchain offers. Blockchain technology can carry out data encryption, which can help control one's own big data and establish ownership. This can guarantee that the information is genuine and reliable, while reducing the costs of data collection by credit agencies.

In the mid-2021, Bank Permata succeeded in carrying out import transactions using Blockchain. Bank Permata is one of the commercial banks in Indonesia which have conventional services as well as Syariah services unit. Bank Permata claims to be the first bank in Indonesia capable of serving trade finance transactions by utilizing blockchain technology in issuing Letters of Credit (LC). Bank Permata partners with Bangkok Bank PLC supported Letters of Credit issuance of PT Chandra Asri Petrochemical Tbk in Indonesia to their supplier. This transaction was completed on the contour network within several hours compared to the traditional paper-based method. By adopting the blockchain technology, Bank Permata want to improve efficiency, security and increase bank profitability. Based on financial performance data for 2019-2021, Bank

Permata's operating income growth was 12.5% with operating expenses growing at 19.2% per year. After the implementation of blockchain technology, Bank Permata's operating income was 10.5 trillion rupiah or up 7.2% from 2021 to 2022. Meanwhile, operating expenses was 7.9 trillion rupiah or down 4% from 2021 to 2022.

Decreasing of operating expenses followed by increasing operating income in 2022, indicates an increase in operational expense efficiency and an increase in Bank Permata's profitability. The phenomenon of increasing efficiency and profitability of Bank Permata after the implementation of blockchain technology raises the question of whether blockchain technology really has a significant impact on the efficiency and profitability of Bank Permata. According Ruslan (2022), the adoption of blockchain technology will make the overall business process more efficient and ultimately increase profits. However, empirical research on the impact of blockchain implementation on bank efficiency and profitability in Indonesia has never been conducted. Previous research such as Daffa (2022), Ihsan (2022), Ruslan (2022) only conducted a literature review and concluded that there was the possibility and potential of adopting blockchain technology in banking. This research aims to empirically examine the impact of using blockchain technology on bank profitability and efficiency in Indonesia. There is Bank Permata as the only bank in Indonesia that has adopted blockchain technology.

METHODS

Research data retrieved from quarterly financial reports of Bank Permata as long as 2019-2023. Data is identified and processed to get efficiency ratios and profitability ratios. Financial ratio is divided into 2 groups, before blockchain adoption and after blockchain adoption. The observation period before and after blockchain adoption is 8 quarters each one. The cut off period for observation before adoption is 1st quarter of 2019 till 2nd quarter of 2021. Meanwhile, the cut off period for observation after blockchain adoption is 3rd quarter of 2021 till 2nd quarter of 2023. All groups of data are tested for normality using the Kolmogorov Smirnov test and Shapiro wilks. Difference test between before blockchain adoption and after blockchain adoption using a paired sample t-test.

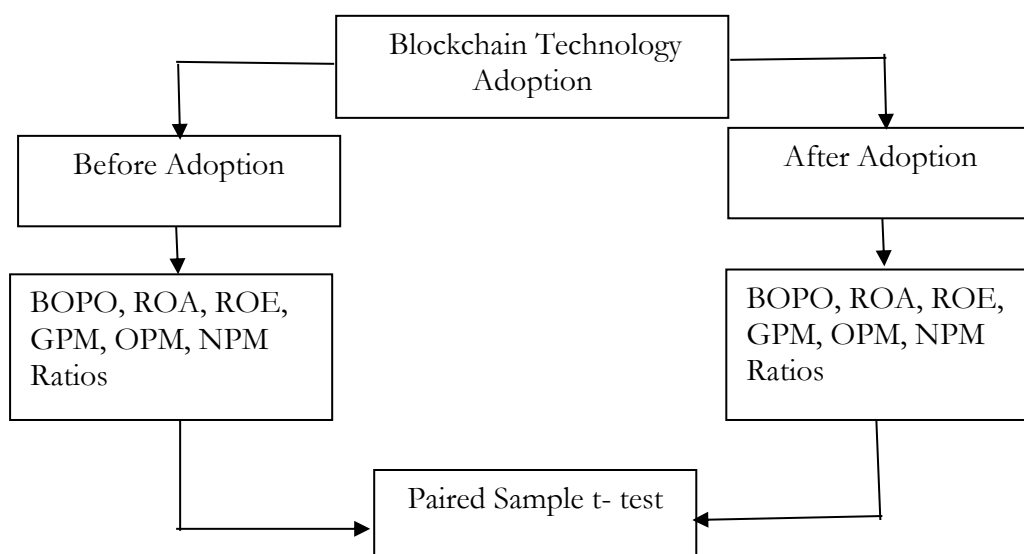


Figure 2. Research Framework

Operationalization of Variables

Bank efficiency is proxied by BOPO ratio (Operating Expenses and Operating Income) while bank profitability is proxied by ROA ratio (Return on Assets), ROE ratio (Return on Equity), NPM (Net Profit Margin), GPM (Gross Profit Margin) and OPM (Operating Profit Margin). The formula used to calculate these financial ratios is as follows:

$$\text{BOPO} = \frac{\text{Operating Expense}}{\text{Operating Income}} \times 100\% \quad (1)$$

$$\text{ROA} = \frac{\text{Net Income} + \text{Interest}}{\text{Total Aset}} \times 100\% \quad (2)$$

$$\text{ROE} = \frac{\text{Net Income} - \text{Preferen Dividen}}{\text{Equity}} \times 100\% \quad (3)$$

$$\text{GPM} = \frac{\text{Gross Income}}{\text{Total Sales}} \times 100\% \quad (4)$$

$$\text{OPM} = \frac{\text{Operating Income}}{\text{Total Sales}} \times 100\% \quad (5)$$

$$\text{NPM} = \frac{\text{Net Income}}{\text{Total Sales}} \times 100\% \quad (6)$$

Descriptive Statistics

Descriptive statistics describe the mean, minimum value, maximum value and standard deviation of each group of data. Normality test is needed to find out whether the research data is normally distributed or not distributed. Normality data testing is necessary because the data

analysis uses a parametric paired sample t-test. Normality test in this study using Kolmogorov Smirnov (KS) and Shapiro Wilks (SW).

Paired Sample T-Test

Paired sample t-test is a test of two data from the same subject on a certain influence or treatment to compare two means (average values) of two paired samples with the assumption that the data is normally distributed. The results of the paired sample t-test are determined by the significance value. A significance value (2-tailed) < 0.05 indicates that there is a significant difference, whereas a significance value (2-tailed) > 0.05 indicates that there is no significant difference at the 5% confidence level.

RESULT AND DISCUSSIONS

Descriptive statistics

Table 1 shows the results of descriptive statistics.

Tabel 1. Statistic Descriptive

| Variabel | Min | Max | Mean | Std. Deviation | KS | SW |
|-------------|--------|-------|-------|----------------|--------|--------|
| BOPO Before | 0,713 | 0,865 | 0,797 | 0,0581 | 0,122 | 0,190 |
| BOPO After | 0,601 | 0,843 | 0,705 | 0,096 | 0,200 | 0,153 |
| ROA Before | 0,000 | 0,062 | 0,004 | 0,005 | 0,025* | 0,010* |
| ROA After | 0,003 | 0,010 | 0,005 | 0,002 | 0,200 | 0,531 |
| ROE Before | 0,000 | 0,051 | 0,023 | 0,017 | 0,160 | 0,197 |
| ROE After | 0,019 | 0,060 | 0,036 | 0,015 | 0,200 | 0,313 |
| GPM Before | 0,474 | 0,641 | 0,555 | 0,064 | 0,200 | 0,416 |
| GPM After | 0,606 | 0,689 | 0,652 | 0,029 | 0,200 | 0,811 |
| OPM Before | 0,095 | 0,217 | 0,146 | 0,038 | 0,200 | 0,827 |
| OPM After | 0,125 | 0,321 | 0,235 | 0,077 | 0,200 | 0,277 |
| NPM Before | 0,0006 | 0,164 | 0,088 | 0,052 | 0,200 | 0,774 |
| NPM After | 0,093 | 0,249 | 0,181 | 0,060 | 0,200 | 0,328 |

Source: Output Eviews 12 (2024)

Table 1 shows the standard deviation of all data groups is smaller than the mean except ROA before blockchain adoption. It means that the majority of data does not have too much variation and close to the mean. The results of the normality test using Shapiro Wilks (SW) and Kolmogorov-Smirnov (KS) show all significance values are more than 0.05 except ROA before blockchain adoption. These results show that almost all research data is normally distributed.

Paired Sample T-Test

The paired sample t-test was employed to determine the differences before and after

blockchain adoption in regard to the bank's efficiency and profitability. This test compares the efficiency and profitability ratios of Bank that have been calculated previously. Table 2 shows the results of the paired sample t-test:

Tabel 2. Paired Sample t-Test

| Paired | t | p-value |
|--|--------|---------|
| BOPO Before vs BOPO After | 1,843 | 0,108 |
| ROA (<i>Return on Asset</i>) Before vs ROA After | -0,489 | 0,640 |
| ROE (<i>Return on Equity</i>) Before vs ROE After | -1,556 | 0,164 |
| GPM (<i>Gross Profit Margin</i>) Before vs GPM After | -3,524 | 0,010 |
| OPM (<i>Operating Profit Margin</i>) Before vs OPM After | -2,418 | 0,046 |
| NPM (<i>Net Profit Margin</i>) Before vs NPM After | -2,603 | 0,035 |

Source: Output Eviews 12 (2024)

The difference test on the BOPO, ROA and ROE ratios shows that there is no significantly difference after blockchain adoption. However, in the GPM, OPM and NPM ratios, the p-value is smaller than 0.05, which means there is a significant difference before blockchain adoption and after blockchain adoption.

Descriptive statistics shows that the mean of BOPO ratio after blockchain adoption is lower than before blockchain adoption. This means that there is an increase in bank operational efficiency after blockchain adoption. Unfortunately, the results on paired sample t-test showed that there is no significant difference. These results indicate that the adoption of blockchain technology at Bank Permata has been able to increase the bank's efficiency but does not make a significant difference to its efficiency performance. These findings differ from Guo and Liang (2016) which states that blockchain technology will be able to streamline bank operational costs so that it will increase the efficiency of the banking industry. The use of blockchain technology at Bank Permata just started in the 3rd quarter 2019 even it was limited to the trade finance payment activities such LC. Surely, the quantity and frequency of blockchain application will affect the size of operational costs. Perhaps it may explain why the application of blockchain technology at Bank Permata has not been able to reduce operational costs significantly.

ROA ratio after blockchain adoption is higher than before implementing it but the paired sample t-test shows that there is no significant different. ROA measures a company's ability to generate profits using their assets. ROA ratio is influenced by the use of fixed charges (operating leverage) and the company's life cycle (Hanafi, 2016). Therefore, even though Bank net profit is significantly high, if its fixed expenses increase, ROA will not increase significantly. In the early

stages of using blockchain, Bank will certainly invest more in this technology. This is what might cause ROA after blockchain adoption to be not significantly higher than before blockchain adoption. ROE ratio after blockchain adoption is also higher than before implementing blockchain. However, it is not appeared to be significantly different. ROE measures a company's ability to generate profits based on the common stocks invested. ROE ratio is influenced by the value or number of shares. Therefore, even though the net profit is significantly high, if there is an increase in the number of common stocks, ROE will not increase significantly. Financial report of Bank Permata on 3rd quarter of 2021 shows that there were 8.1 million additional common stocks. This might cause ROE after blockchain adoption not increase much even though Bank Permata's profits increase.

In contrast to the ROA and ROE ratios, profit margin ratio is significantly impacted by blockchain adoption. Descriptive statistics confirm the differences in gross profit margin (GPM), operating profit margin (OPM) and net profit margin (NPM). The mean of GPM, OPM and NPM ratios increased significantly after implementing blockchain technology. Profit margin can also be interpreted as the bank's ability to reduce costs (a measure of efficiency) in a certain period (Subramanyam and Wild, 2009). GPM ratio describes Bank ability to generate profits from spread income (conventional bank activities) or profit sharing (Syariah bank activities). OPM ratio is related to the bank's ability to earn profits of its operational activities, while the NPM ratio describes net profit of the bank (after deducting tax and funding expenses). Blockchain technology perhaps able to reduce operational costs and increase fee and commission income, thereby increasing Bank Permata's profitability.

CONCLUSION

Blockchain adoption at Bank Permata does not have a significant impact on the level of efficiency but it has some effect to the profitability. Bank efficiency after implementing blockchain technology was not significantly affected even though the average of BOPO ratio was decreasing. Bank Permata's profitability is partly affected by the adoption of blockchain technology. The GPM, OPM and NPM ratios after implementing blockchain technology are higher than before it and significantly different. However, the ROA and ROE ratios after implementing blockchain technology are not significantly different. The short adoption period, initial investments costs and the rights issue policy during observation period are the main issues in this study and challenges to the next studies. This research is limited by a short research period so that future research can use a longer research period. The data still uses gross operational costs and gross operational income, not using costs and income that are directly related to the use of

blockchain technology. The issue of transaction security in the application of blockchain technology can also be added for further research.

REFERENCES

- Al-Amaren, E. M., Md. Ismail, C. T., & Nor, M. Z. (2020). The Blockchain Revolution A Game-Changing in Letter of Credit (LC). *International Journal of Advanced Science and Technology*, 29(3), 6052–6058.
- Bhat, A., & Nor, R. M. (2021). Blockchain Letter of Credit: A Transaction-Level Analysis. *Journal of Engineering Science and Technology*, October, 120–136.
- Chang, S.E.; Chen, Y.C.; Lu, M.F. (2019). Supply chain re-engineering using blockchain technology: A case of smart contract based tracking process. *Technological Forecasting and Social Change*, 144, 1–11
- Chang, S.E.; Luo, H.L.; Chen, Y. (2020). Blockchain-Enabled Trade Finance Innovation: A Potential Paradigm Shift on Using Letter of Credit. *Sustainability*, 12, 188.
- Daffa, E.S. (2022). Blockchain Dalam Ekonomi Islam. *Jurnal ilmiah bidang sosial, ekonomi, budaya, teknologi, dan pendidikan*, Volume 1 No.11.
- Fridgen, G., Radszuwill, S., Schweizer, A., & Urbach, N. (2021). Blockchain Won't Kill the Banks: Why Disintermediation Doesn't Work in International Trade Finance. *Communications of the Association for Information Systems*, 49, pp-pp.603-623
- Hasan, N. (2020). Blockchain Technology and its Application in Libraries. *Library Herald*, 58, 118-125.
- Kapnissis, G., Vaggelas, G. K., Leligou, H. C., Panos, A., & Doumi, M. (2022). Blockchain adoption from the Shipping industry: An empirical study. *Maritime Transport Research*, 3, 100058.
- Kshetri, N. (2018). 1 Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management*, 39, 80–89
- Larson, D. A. (2018). Mitigating Risky Business: Modernizing Letters of Credit with Blockchain, Smart Contracts, and the Internet of Things. 57
- Lee, D.K.C. and Low, L. (2018), *Inclusive FinTech: Blockchain, Cryptocurrency and ICO*, World Scientific Publishing Co. Pte. Ltd.
- Hanafi, M.M. (2016). *Analisa Laporan Keuangan*. Edisi 5. UPP YKPN Yogyakarta
- Maiti, M., Kotliarov, I., & Lipatnikov, V. (2021). A future triple entry accounting framework using blockchain technology. *Blockchain Research and Applications*, 2, 100037.

- Wulandari, S., Irfan, A., Zakaria, N. B., & Mujahidin. (2024). Survey Study on Fraud Prevention Disclosure Measurement at State Islamic Universities in Indonesia. *IQTISHODUNA: Jurnal Ekonomi Islam*, 13(1), 327–348. <https://doi.org/10.54471/iqtishoduna.v13i1.2305>
- Mujahidin, M., Randi, R., Muin, R., & Sapira, S. (2023). Convergence of Qard and Ijarah Agreements Evidence of Gold Pawn Products from Bank Syariah Indonesia. *Al-'Adl*, 16(2), 110-122.
- Mujahidin, Hamzah, M. N., K, A., & Shuhufi, M. (2023). Increasing Islamic Philanthropic Funds is an Approach Model With a Trust Variable as an Intermediary. *International Journal of Professional Business Review*, 8(5), e01909. <https://doi.org/10.26668/businessreview/2023.v8i5.1909>
- Mujahidin, M. (2022). SOCIO-ECONOMIC JUSTICE IN THE QURAN'S PERSPECTIVE. *International Journal of Economics, Business and Accounting Research (IJEBAR)*, 6(4).
- MujahidinM. (2022). Analysis of the Application of the Maslahah Concept in DSN MUI Fatwa in the Sector of Sharia Economics and Finance. *Al-Kharaj : Jurnal Ekonomi, Keuangan & Bisnis Syariah*, 4(6), 1958-1970. <https://doi.org/10.47467/alkharaj.v4i6.1969>
- Mujahidin, M., Fasiha, F., Abdullah, M. R., & Praseta, M. (2022). Income of Micro, Small, And Medium Enterprises With The Presence of A Mini Market In Palopo City, Indonesia. *IQTISHODUNA: Jurnal Ekonomi Islam*, 11(2), 257–266. <https://doi.org/10.54471/iqtishoduna.v11i2.1940>
- Mujahidin, M. (2022). FINANCING IN THE PERSPECTIVE OF SHARIAH BANKING. *JURNAL ILMIAH EDUNOMIKA*, 6(2).
- OJK Institute. (2022). Peluang dan Tantangan Implementasi Blockchain di Industri Jasa Keuangan. Retrieved April 29, 2023, from OJK Intitute website. <https://www.ojk.go.id/ojk-institute>
- Ihsan, R. (2022). Opportunities and Challenges of Using Blockchain Technology in Islamic banking in Indonesia. *Eqien - Jurnal Ekonomi Dan Bisnis*, 11(03), 1037 - 1049.
- Nakamoto, S. (2009). Bitcoin: A peer-to-peer electronic cash system. *Decentralized Business Review*, 21260
- Subramanyam and Wild.(2009). *Financial Statement Analysis* .10th, Mc Graw Hill.
- Takahashi, K. (2018). Blockchain technology for letters of credit and escrow arrangements. *Banking Law Journal*, 135(2), 89–103.
- Guo, Y., Liang, C. (2016).Blockchain application and outlook in the banking industry. *Financial Innovation*. 2, 24.

Ruslan. Z, (2022). Blockchain Letter of Credit: Apakah Sekarang Saatnya?. Fair Value : Jurnal Ilmiah Akuntansi dan Keuangan. Vol. 5, No.1