Website:
ejournal.umm.ac.id/index.php/jrak

*Correspondence:
febriyantimody@student.ub.ac.id

DOI: [10.22219/jrak.v14i3.36339](https://doi.org/10.22219/jrak.v14i3.36339)

Citation:
Kusumatuti, F, M., Ghofar, A., Prihatiningtias, Y, W. (2024). Social Media Usage And Stock Return: The Mediating Role Of Profitability. Jurnal Reviu Akuntansi Dan Keuangan, 14(3), 834-851.

Article Process
Submitted:
July 13, 2024

Reviewed:
July 17, 2024

Revised:
October 9, 2024

Accepted:
October 16, 2024

Published:
October 16, 2024

Office:
Department of Accounting
University of Muhammadiyah Malang
GKB 2 Floor 3.
Jalan Raya Tlogomas 246,
Malang, East Java,
Indonesia

P-ISSN: 2615-2223
E-ISSN: 2088-0685

Article Type: Research Paper

SOCIAL MEDIA USAGE AND STOCK RETURN: THE MEDIATING ROLE OF PROFITABILITY

Febriyanti Mody Kusumatuti[1*], Abdul Ghofar[2], Yeney Widya Prihatiningtias[3]

Affiliation:

[1,2,3] Departement of Accounting, Faculty of Economics and Business, Universitas Brawijaya, Malang, Indonesia

ABSTRACT

Purpose: *This study aims to determine the effect of social media usage on stock return and the role of profitability as a mediating variable.*

Methodology/approach: *This study uses a quantitative approach. The population in this study were consumer non-cyclical sector companies listed on the Indonesia Stock Exchange in 2020-2023. The sampling technique used was purposive sampling and 31 companies were obtained with an observation period of 4 years, resulting in 124 sample units in this study.*

Findings: *The results showed that the social media usage had a positive effect on stock return, but profitability was unable to mediate the positive effect of social media usage on stock return.*

Practical implications: *The results of this study can provide strategic insights to consumer non-cyclical companies regarding the maximization of social media usage by companies. This aims to see the dynamics of social media which will ultimately affect the company's stock return.*

Originality/value: *Research related to impression management on social media and stock return has not been widely conducted. Research with similar themes was conducted in the previous decade so it can be indicated that it is less relevant to current conditions. The research is a development of previous research that separately tested the use of social media on profitability and profitability on stock return. Therefore, this study uses a mediating variable of profitability with a proxy for return on assets. This study also adds one category of impression management, namely financial achievement*

Keywords: *Profitability; Social Media; Stock Return*

ABSTRAK

Tujuan penelitian: Penelitian ini bertujuan untuk mengetahui pengaruh penggunaan media sosial terhadap *return* saham dan peran profitabilitas sebagai variabel mediasi. Populasi dalam penelitian ini adalah perusahaan sektor *consumer non-cyclical* yang terdaftar di Bursa Efek Indonesia tahun 2020-2023.

Metode/pendekatan: Penelitian ini menggunakan pendekatan kuantitatif. Populasi dalam penelitian ini adalah perusahaan sektor *consumer non-cyclical* yang terdaftar di Bursa Efek Indonesia tahun 2020-2023. Teknik pengambilan sampel yang digunakan yaitu *purposive sampling* dan diperoleh 31 perusahaan dengan periode pengamatan selama 4 tahun sehingga diperoleh 124 unit sampel dalam penelitian ini.

Hasil: Hasil penelitian menunjukkan bahwa penggunaan media sosial berpengaruh positif terhadap *return* saham, namun profitabilitas tidak mampu memediasi pengaruh positif penggunaan media sosial terhadap *return* saham.

Implikasi praktik: Hasil penelitian ini dapat memberikan pandangan strategis kepada perusahaan *consumer non-cyclical* terkait maksimalisasi penggunaan media sosial oleh perusahaan. Hal ini bertujuan untuk melihat dinamika pada media sosial yang pada akhirnya akan berpengaruh pada *return* saham perusahaan.

Orisinalitas/kebaharuan: Penelitian terkait manajemen kesan di media sosial dan *return* saham masih belum banyak dilakukan. Penelitian dengan tema sejenis dilakukan dalam satu dekade sebelumnya sehingga dapat diindikasikan kurang relevan dengan kondisi saat ini. Penelitian merupakan pengembangan dari penelitian terdahulu yang menguji secara terpisah penggunaan media sosial terhadap profitabilitas dan profitabilitas terhadap *return* saham. Oleh karena itu, penelitian ini menggunakan variabel mediasi profitabilitas dengan proksi *return on asset.* Penelitian ini juga menambahkan satu kategori manajemen kesan yaitu *financial achievement.*

Kata kunci: Media Sosial, Profitabilitas , *Return* Saham

INTRODUCTION

Companies in carrying out their operational activities aim to gain profit, maximize share value and improve investor welfare (Sofyan *et al.*, 2020). To achieve these goals, companies must meet the need for capital by offering shares on the capital market. In this case, investors as capital owners have the main goal of investing in the capital market, namely getting return. Return can be in the form of capital gains or dividends (Hartono, 2017).

In 2020, there was a decline in the Bakrie Group's stock price after news of the arrest of Nia Ramadhani and Ardi Bakrie in connection with a drug case posted through various social media accounts (Fernando, 2021). In addition, issues such as labor disputes at PT Alpen Food Indonesia, the alleged involvement of the Sari Roti company in the 212 demonstration and discussions around gender issues at Unilever, have sparked discussions in cyberspace and have had an impact on the company's stock price (CNN Indonesia, 2020; Firmansyah, 2016; Indozone, 2020).

In addition to cases directly related to the company, other actions involving the company can also threaten the company's reputation. For example, when a brand ambassador from PT Sido Muncul was involved in a religious controversy, the hashtag #BoycottTolakAngin emerged and calls not to buy Tolak Angin products (Muhyiddin, 2017). Therefore, companies need to pay attention to these real-world events because they are likely to become a topic of conversation on social media and can harm the company's reputation.

Reputation is something that needs to be considered by companies, especially consumer non-cyclical companies because it is a sector that plays an important role in meeting the needs of society (Utama *et al.*, 2023). When interest in consumer needs is high, competition in the business world is getting bigger (Rohman & Naufaldi, 2022; Siregar & Nasution, 2020). In addition, consumer non-cyclical companies are also a sector that is closely related to environmental issues so it is necessary to maintain their reputation (Rahardja & Aritonang, 2022). Environmental issues that are widely discussed on social media are related to the packaging of Unilever, Indofood and Mayora products which have been proven to pollute 11 coastal areas in Indonesia (Greenpeace, 2022).

In dealing with the potential for good and bad impacts on social media, companies must ensure that their strategies in building and maintaining reputation are balanced. One method that can be used by companies is through impression management (Prasetyanto, 2020; Schniederjans et al., 2013). Impression management with efforts to form a positive perception of the company is becoming an increasingly relevant strategy in a competitive business environment. The application of impression management on social media allows companies to measure responses and impressions of their products or services, and creates opportunities as investor preferences in buying shares (Tajvidi & Karami, 2017; Zu et al., 2019). Therefore, companies must utilize the dimensions of impression management when communicating through social media.

In the context of information disclosure, signaling theory provides an overview of every action taken by company management will contain information (Scott, 2014). This information will present an overview of the company, one of which is reflected in the annual report. Profit reflected in the financial statements is one of the metrics for evaluating management performance, so one of the steps that management can take to improve its performance is to build the company's reputation (Ahmad et al., 2018).

Research that uses an impression management perspective to explain social media variables, namely by Schniederjans et al (2013) explains that impression management on social media has a partially positive effect on financial performance, where the exemplification indicator is considered to have no effect on the company's financial performance. Several studies also explain that social media is considered to be able to save administration and communication costs and has an effect on innovation performance and brand awareness (Dewi & Supriyanto, 2017; Kusumawardhany, 2018; Tritama & Tarigan, 2017). In addition, previous studies also explain that social media engagement is considered to have a positive effect on revenue growth and company stock value (Apenteng et al., 2020; Chamberlain et al., 2019; Kim et al., 2018; Yoon et al., 2018). This is because word of mouth on social media is considered capable of providing predictions regarding stock returns, stock trading volume, and quarterly earnings (Bartov et al., 2017; Liu et al., 2018; Xun & Guo, 2016).

This study examines the influence of social media usage on stock returns because researchers want to see whether the use of social media by companies reviewed from an impression management perspective will influence investors in making investment decisions (Mcgurk et al., 2019; Syafitri & Suryani, 2022). This is different from the study conducted by Schniederjans et al (2013) which looked at the influence of social media usage by companies reviewed from an impression management perspective on consumer decisions to use a product/service as reflected in the company's financial performance. In addition, this study adds the category of financial achievement impression management to see the influence of information on the company's financial achievements published on social media on stock returns.

Based on the research problems and literature review, it is known that there has been no research publication that specifically discusses the impression management of consumer non-cyclical sector companies on social media, especially in relation to stock returns. Therefore, this study aims to empirically test the influence of the use of impression management on social media on stock returns in consumer non-cyclical companies. The use of profitability as a mediating variable can explain how the use of social media can increase the effectiveness of companies in using their assets to generate profits which will then have an impact on increasing stock prices.

Impression management theory explains how individuals or groups consciously or unconsciously regulate their actions to control other people's perceptions of them (Goffman, 1959; Leary & Kowalski, 1990). Management as the company manager provides information through social media, one of which is to provide investors with an overview of the company's condition (Hidayat et al., 2023). The way to provide information is through a communication strategy that conveys the trust, competence, and experience of an organization called organizational promotion (Bolino et al., 2008; Gardner, 1992; Schniederjans et al., 2013). Another dimension of impression management is the ingratiation category which aims to position the company as an attractive and interesting institution (Bolino et al., 2008; Jones & Pittman, 1982; Turnley & Bolino, 2001). Management tries to convince investors by implementing a corporate communication strategy that links the organization with morality, ethics and commitment called exemplification (Bolino et al., 2008; Dunne et al., 2020).

The company will also provide financial information to investors, one of which is through a communication strategy via social media that shows achievements in the financial sector called financial achievement. Corporate disclosure via social media is viewed by investors as additional information provided by the company voluntarily. Compared to traditional disclosure media, social media is a stronger and more effective communication strategy (Yang & Liu, 2017). Based on this description, the following hypothesis can be formulated:

H1: Social Media Usage Has a Positive Influence on Stock Returns

Signaling theory states that information released by a company can be a signal for investors in making investment decisions (Spence, 1973). If the announcement of information has a positive impact in the form of an increase in stock prices, then the announcement is a positive signal. However, if the announcement has a negative impact in the form of a decrease in stock prices, then the announcement is a negative signal for investors (Scott, 2014). The information provided by the company to investors is a sign of how the company's operations are run by management.

Previous studies have explained that disclosure of information on social media has a positive effect on company profitability (Fernando & Wilujeng, 2023; Jia et al., 2020; Tajvidi & Karami, 2017; Yang & Liu, 2017; Zu et al., 2019). Separately, research conducted by Zakaria (2016) explains that company profitability has a positive effect on stock returns. Kurniawan & Mawardi (2017) in their research explain that an increase in ROA will increase stock returns, because it is an indicator of the company's welfare level. Research by Budiarjo (2016) also stated that a high ROA ratio indicates the company's ability to generate profits for investors is also high or the profit will be reinvested in the company, thus affecting the increase in stock returns. Based on several previous research results, there is a potential that the relationship between social media and stock returns does not only occur directly, but also indirectly. Therefore, the following hypothesis can be formulated:

H2: Profitability mediates the positive effect of social media usage on stock returns.

Based on the hypothesis above, the conceptual framework of this study is formulated as follows:

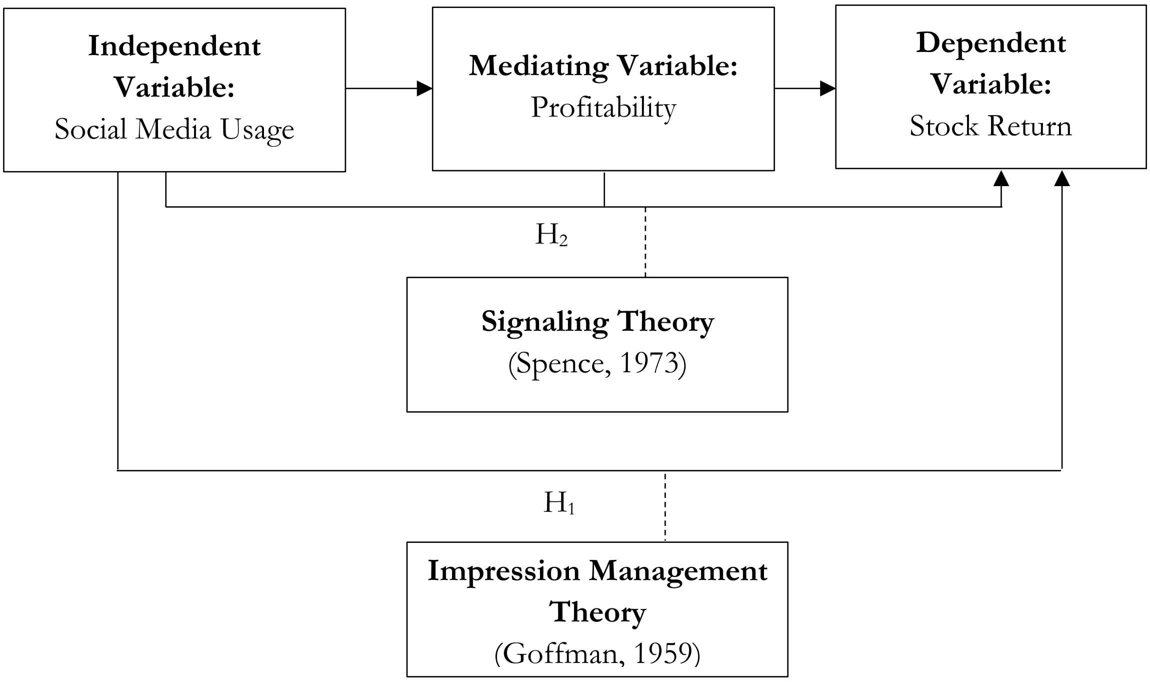

Figure 1. Conceptual Framework

METHOD

This study uses a quantitative content analysis approach to see the effect of impression management in Instagram on stock returns (Riffe *et al.*, 2019). Content analysis is used to see patterns or categories of textual data for use in quantitative analysis (Neuendorf, 2002; Riffe *et al.*, 2019). In addition, the research model also allows for reliability procedures to ensure the reliability of the impression management data coding procedure (Neuendorf, 2002; Weber, 1990). This study uses secondary data, namely data obtained indirectly related to the topic being studied. In this study, data was collected using documentation techniques by collecting data related to the variables being studied. The data in this study came from the company's Instagram account and the company's annual report for 2020-2023.

The population in this study were 88 consumer non-cyclical sector companies listed on the Indonesia Stock Exchange for the 2020-2023 period. The 2020-2023 research period was chosen because in 2020 the Covid-19 Pandemic occurred which had encouraged many people to work from home and had an impact on the increasing use of social media such as Instagram (Burhan, 2020). In 2020, Instagram ranked highest among institutions/corporations as the most widely used social media during the pandemic to stay connected with audiences (Razak, 2020).

Instagram users at Indonesia in 2020 also increased significantly, which was around 21 million users compared to the previous year (Rizaty, 2020). On the other hand, there are environmental issues that are widely discussed on social media, namely regarding the packaging of Unilever, Indofood and Mayora products which have been proven to pollute 11 coastal areas in Indonesia (Greenpeace, 2022). Purposive sampling techniques in this study was intended to obtain research samples that met the predetermined criteria. The research criteria are presented below:

Table 1. Sample Selection Criteria

No.	Description	Total
1.	Consumer non-cyclical sector companies listed on the Indonesia Stock Exchange in 2020-2023	88
2.	Consumer non-cyclical sector companies that do not use Instagram.	(34)
3.	Consumer non-cyclical sector companies with Instagram accounts that are currently suspended, have never posted, are not directly connected to the company website and the last post update was before the research period.	(12)
4.	Consumer non-cyclical sector companies that newly joined Instagram after the research period.	(11)
	Total of Company Sample	31
	Total of Observations (31 x 4)	**124**

This study uses dependent, independent and mediating variables. The dependent variable is stock returns. This study uses actual returns, namely returns that occur calculated using historical data (Bartov *et al.*, 2017). Actual returns are used because they present changes in stock prices from the previous period to the next period. This is useful for comparing increases or decreases in stock prices between periods. Stock returns are calculated by subtracting the current year's stock price from the previous year's stock price and then dividing it by the previous year's stock price (Bartov *et al.*, 2017; Mcgurk *et al.*, 2019). The independent variable is social media usage. The use of social media on the company's Instagram account is measured using the impression management category developed by Bolino and Turnley (1999) and Jones and Pittman (1982). Each social media data that uses impression management will be given the same weight, which is 1, while for social media data that does not use the impression management category will be given a value of 0. Then each upload that includes impression management will be accumulated and divided by 4 indicators of impression management (organizational promotion, ingratiation, exemplification and financial achievement) that use in this study (Fernando & Wilujeng, 2023). The mediating variable in this study is profitability which is proxied by return on assets. The proxy is measured by dividing net profit after tax by the company's total assets (Hasanah & Enggariyanto, 2018; Zu et al., 2019).

Linear regression analysis is used to analyze the relationship between the dependent variable and the independent variable (Hair *et al.*, 2019). Linear regression analysis is used in this study to determine the relationship between stock returns that act as dependent variables and their independent variables, namely social media usage. Path Analysis is used to test the influence of mediating variables. Testing of mediating variables is carried out using a procedure developed by Sobel (1982) and is known as the Sobel Test (Ghozali, 2021). Sobel test is used to determine whether the relationship through a mediating variable is significantly capable of being a mediator in the relationship. The Sobel test is carried out by testing the strength of the indirect influence of the independent variable on the dependent variable. The regression model can be formulated as follows:

$Y = \alpha_0 + \beta X + e$....................................(1)

$Y = \alpha_0 + \beta X + \beta Z + e$.........................(2)

RESULT AND DISCUSSION

Coding of social media usage variables with impression management indicators between researchers and independent coders was carried out for reliability testing which can be seen in Table 2.

Table 2. Reliability Test Result

		Value	Asymp. Std. **Error**^{a}	Approx. **T**^{b}	Approx. Sig.
Measure of Aggreement	Kappa	0,803	0,036	70,416	0,000
N of Valid Cases		124			

Source: Data Processed (2024)

Instagram caption data obtained by utilizing the menu provided by the apify.com site was analyzed using content analysis by looking at the impression management theme used. Data coding was carried out by researchers and independent coders to ensure coding consistency. Independent coders conducted coding with the codebook guide that had been created. Independent coders aimed to ensure coding consistency, provide validation of the coding procedure and ensure that the coding provided accurate results. In Table 2, the reliability test between researchers and independent coders produced an intercoder reliability level measured by a kappa value of 0.803. This value is considered good because it has produced a kappa value above 0.75 (Banerjee *et al.*, 1999).

Descriptive Statistics

Based on Table 3, the stock return variable has a minimum value of -0.44 at PT Midi Utama Indonesia Tbk in 2023 and PT Sekar Laut Tbk in 2023. In 2023, PT Midi Utama Indonesia Tbk and PT Sekar Laut Tbk held a corporate action, namely a stock split or splitting the nominal value of shares according to a certain rasio (Binekasri, 2023; Putra, 2023). The stock split has an impact on the price per share becoming lower and the number of shares outstanding increasing. Based on the maximum stock return value of 0.95 at PT Mustika Ratu Tbk in 2022. In 2022, PT Mustika Ratu Tbk experienced a 36% increase in stock price. This increase in stock price reflects the positive response of investors to PT Mustika Ratu Tbk's business strategy. In 2022, PT Mustika Ratu Tbk focused on innovation and development of personal care products (Elvira, 2022).

The variable of social media usage showed the lowest value of 2.93 at PT Hero Supermarket Tbk in 2020. Based on the search for the Instagram account of PT Hero Supermarket Tbk in 2020, the company actively uses Instagram social media. However, the use of Instagram is not accompanied by posts containing impression management. The profitability variable proxied by return on assets has the highest value of 0.24 at PT Unilever Indonesia Tbk in 2020. In 2020, PT Unilever Indonesia managed to obtain a net profit of 7.2 trillion. This was driven by the business strategy of PT Unilever Indonesia Tbk which launched various relevant innovations to answer consumer needs in the midst of the pandemic (Unilever, 2021). The lowest value of return on assets as a proxy for profitability was -0.06 at PT Hero Supermarket Tbk in 2020. In 2020, PT Hero Supermarket experienced a decline in food segment sales of 32.67%. Tight market competition and changes in consumer behavior who prefer to shop via e-commerce also affect the sales level of PT Hero Supermarket Tbk (Sidik, 2021).

Table 3. Descriptive Statistics

	N	Min	Max	Mean	Std. Deviation
Stock Return	124	-0.44	0.95	0.03	0.33
ROA	124	-0.06	0.24	0.07	0.07
Social Media Usage	124	2.93	1022.08	115.95	240.61
Valid N (listwise)	124				

Source: Data Processed (2024)

Classical Assumption Test

The classical assumption test is used as a prerequisite for conducting a regression test. This test aims to test whether the data has met the classical assumptions, so that it can be used for a regression analysis test.

The normality test in this study uses histogram graphs and P-P Plot graphs. The histogram graph forms a bell and does not lean to the right or left. The P-P Plot graph shows that the data is spread around the diagonal line and follows the direction of the diagonal line. Thus, it can be concluded that the data for Model 1 and Model 2 are normally distributed.

Multicollinearity testing in this study can be seen from the VIF (Variance Inflation Factors) and tolerance values (Hair *et al.*, 2019). Based on Table 4, it can be seen that the tolerance value of each variable of social media usage and profitability proxied by ROA is greater than 0.10 and the VIF value is less than 10. So it can be concluded that the regression model is free from multicollinearity problems.

The autocorrelation test in this study used the Durbin-Watson test (dW-Test) (Gujarati, 2004). The results of the autocorrelation test with the Durbin-Watson test can be seen in Table. From Table 5, it is known that the dW value for Model 1 is 2.171 which is between the dU value of 1.723 and the 4-dU value of 2.277 so it can be concluded that there is no autocorrelation. In Table 5.5, the dW value for Model 2 is 2.184 which is between the dU value of 1.723 and the 4-dU value of 2.277 so it can be concluded that there is no autocorrelation.

In this study, heteroscedasticity testing was carried out using a scatterplot graph (Hair *et al.*, 2019). The result of test show that the points are spread randomly and are spread both above and below the number 0 on the Y axis. It can be concluded that the data in this study do not show symptoms of heteroscedasticity.

Table 4. Multikolinearity test

Variable	Tolerance	VIF	Conclusion
Social Media Usage (X)	0.875	1.142	No multicollinearity
ROA (Z)	0.875	1.142	No multicollinearity

Source: Data Processed (2024)

Table 5. Autocorrelation test

Model	Durbin-Watson	Conclusion
1	2.171	No autocorrelation
2	2.184	No autocorrelation

Source: Data Processed (2024)

Hypothesis Test

Linear regression analysis is used in this study to determine the influence that occurs between stock returns which act as dependent variables with independent variables of social media usage (Hair *et al.*, 2019). Based on Table 6, it can be seen that the equation for Model 1 is, Y= -0,01862 + 0,00046X + e it can be concluded that the constant value is -0,01862. This means that if the independent variable or variable X is not entered, the Y value will still increase by -0,01862. X1= 0,00046 means that if social media usage is increased by 1%, stock returns will increase by 0,00046.

Based on the results of the multiple linear regression test in Table 7, the regression equation can be seen as Y = -0,0146 + 0,0005X – 0,0734Z + e, while the path equation can be seen as Y = 0,3328X – 0,0161Z + e.

Based on table 8, the regression results to test the effect of the variables of social media usage and profitability on stock returns simultaneously, where simultaneously or together the use of social media and profitability affect stock returns. This can be seen from the p-value <0,05 (Ghozali, 2021).

The t-test is used to test whether there is an influence between the independent variable of social media usage on the dependent variable of stock returns partially. The test results show that the use of social media has a positive effect on stock returns. This can be seen in table 9 which shows a significance value of 0.00021 <0.05. So it can be concluded that the use of social media has a positive and significant effect on stock returns.

In table 7 it can be seen that return on assets (ROA) has no effect on stock returns. This is indicated by a significance value of 0.861 > 0.05. The return on assets variable in this study is a mediating variable. So the analysis will be continued using path analysis it can be seen on figure 2.

Table 6. Regression Analysis Model 1

	Unstandardized Coefficients		Sig.
	B	Std. Error	
(Constant)	-0.01862	0.03169	0.55792
Social Media Usage	0.00046	0.00012	0.00021

Source: Data Processed (2024)

Table 7. Regression Analysis Model 2

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-0.0146	0.0393		-0.3709	0.7114
Social Media Usage	0.0005	0.0001	0.3328	3.6253	0.0004
ROA	-0.0734	0.4186	-0.0161	-0.1753	0.8611

Source: Data Processed (2024)

	Model	Sum of Squares	df	Mean Square	F	Sig.
2	Regression	1.479	2	0.739	7.269	0.001[b]
	Residual	12.306	121	0.102		
	Total	13.785	123			

Source: Data Processed (2024)

Table 8.
F-test

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-0.01862	0.03169		-0.58756	0.55792
Social Media Usage	0.00046	0.00012	0.32716	3.82405	0.00021

Source: Data Processed (2024)

Table 9.
t-test Model 1

Hypothesis	Coefficient	Sig.	Conclusion
Social media usage has a positive influence on stock return	0.00046	0.00021	Accepted

Source: Data Processed (2024)

Table 10.
Hypothesis Test Model 1

Based on the previous regression test, the path analysis can be described as follows:

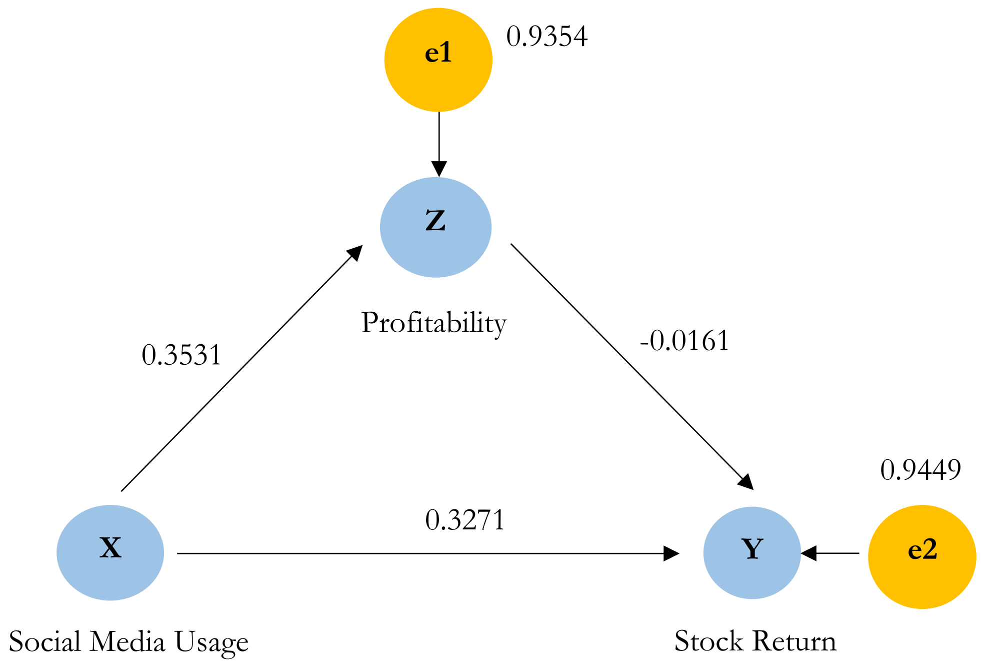

Figure 2.
Path Alaysis Result

The calculation of the Sobel test is as follows:

$$t = \frac{a\ x\ b}{\sqrt{b^2 x S a^2 + a^2 x S b^2}}$$

$$t = \frac{0.3531\ x\ -0.0161}{\sqrt{0.0002\ \ x\ 0.0000 + 0.1246\ x\ 0.1752}}$$

$t = 0.038$

Table 11. Sobel test

Path Analysis	Standardized Coefficients Beta	Standar Error	Sig.
Social media usage on stock return	0.3271	0.000	0.0002
Social media usage on profitability	0.3531	0.000	0.0001
Profitability on stock return	-0.0161	0.418	0.8611

Source: Data Processed (2024)

Table 12. Hypotesis Test Model 2

Hypothesis	t calculation from Sobel Test	t table	Result	Conclusion
Profitability mediates the effect of social media usage on stock return	0.0385	1.98	0.0385 < 1.98	Rejected

Source: Data Processed (2024)

Table 13. Coefficient Determination Result

Model	R	R Square	Adjusted R Square
1	0.327[a]	0.107	0.100
2	0.328[a]	0.107	0.093

Source: Data Processed (2024)

In table 12 it is explained that t count is smaller than t table, so it can be concluded that profitability is not able to mediate the effect of social media usage on stock returns. It can also be said that hypothesis 2 in this study is rejected.

The coefficient of determination (R^2) value of model 1 of 0.100 in table 13 shows that the variable of social media usage is able to explain 10% of the variation in stock returns. The rest (90%) is explained by other variables. On the other hand, the test of Model 2 obtained an adjusted r square value of 0.093. These results mean that the variation in changes in stock return variables can be explained by the variables of social media usage and profitability of 9.3% and the rest (90.7%) is influenced by other variables.

Discussion

The results of the test on hypothesis 1 show that the use of social media has a positive effect on stock return. This means that the higher the use of social media by a company, the higher the company's stock return. Social media is often a source of fast information about the latest developments in the company (Apenteng *et al.*, 2020). New product announcements, strategic partnerships and good financial performance are often shared on social media (Erianto, 2023; Srikant, 2019). Quick access to this information allows investors to make better and faster decisions that have an impact on stock prices.

Instagram allows companies to share the latest information about products, innovations, achievements and other information quickly and widely (Syafitri & Suryani, 2022). Companies that are active on social media can communicate directly with investors, provide updates and clarifications that can reduce uncertainty and increase investor confidence. High transparency and engagement on social media can increase positive perceptions and investor confidence in company management.

Impression management that is carried out well on Instagram can produce a positive image for the company. When a company shows success in building a good image on social media, investors see it as a positive signal (Jia *et al.*, 2020). This means to investors that management has the ability to adapt to digital trends and create value for shareholders.

The ability to manage and respond quickly to news circulating on social media can mitigate the negative impact of incidents or bad news related to the company (Rahmansyah *et al.*, 2023). A quick and effective response can help maintain customer and investor trust, as well as reduce the potential for a decline in stock prices. A positive image can improve public perception, especially investors, and increase investor confidence in the company.

Companies can use social media to monitor and analyze market sentiment towards the company. By understanding public sentiment, companies can adjust their marketing and communication strategies to maximize the positive impact on public perception (Fernando & Wilujeng, 2023). Positive information on social media, especially Instagram, can increase market sentiment and investor interest and will have a positive impact on stock prices.

This study is in line with the impression management theory which explains that management as a company manager provides information through social media, one of which is to provide investors with an overview of the company's condition (Fernando & Wilujeng, 2023; Goffman, 1959; Syafitri & Suryani, 2022) The use of social media allows companies to strengthen and position positive information. The motivation is the desire to achieve a certain public perception or to correct the gap between what the public perceives and what they want to perceive (Liu *et al.*, 2018).

When a company is active on social media and shares information openly, it can be a signal that the company is transparent and trustworthy. This transparency can increase investor confidence, which in turn can increase investment interest and impact stock prices (Sofyan *et al.*, 2020). Companies that are proactive and responsive to issues and public questions on social media show that the company is competent and cares about public perception which can increase investor confidence and will impact stock prices.

The results of this study are in line with research conducted by Mcgurk *et al* (2019), Sofyan *et al* (2020), and Syafitri and Suryani (2022) which explain that the more active a company is on social media and effective in implementing impression management, the higher the stock return. Bartov *et al* (2017) and Blankespoor *et al* (2013) also explain that information shared on social media affects investor perceptions, market reactions and investor decisions to buy shares of a company.

The results of the test on hypothesis 2 show that profitability is unable to mediate the effect of social media usage on stock return. This is reflected in the path analysis which explains that social media usage has a positive effect on profitability, but profitability does not affect stock returns. So, it can be concluded that profitability is unable to mediate the effect of social media usage on stock returns.

The results of this study are not in line with signaling theory. Profitability is unable to mediate the effect of social media usage on stock return because profitability reflects the company's long-term performance (Li *et al.*, 2022). The increase in stock returns associated with social media usage is only influenced by investor's short-term perceptions.

Companies that implement impression management on social media effectively are better able to build a positive image and increase investor confidence. Investors tend to view companies that have a good reputation on social media as more transparent entities which will ultimately make it easier for investors to estimate the potential for investment profits (Li *et al.*, 2022). Investors can make investment decisions more quickly, so that when there is an increase in profitability, investors do not respond to information about the increase in profitability.

Social media often disseminates non-financial information that can influence investors. Such information includes management reputation, product innovation, or responses to social issues (Rahmansyah *et al.*, 2023). This information may not be directly reflected in profitability but can affect investor expectations regarding the company's future growth and potential.

The results of this study are not in line with studies conducted by Budiarjo (2016), Jia *et al* (2020), Kurniawan and Mawardi (2017), and Putri and Widyaningdyah (2023) which explain that increasing profitability will increase stock return. This study show that profitability does not affect stock return. However, this study is in line with studies conducted by Chahine and Malhotra (2018), Hsu and Lawrence (2020), Li *et al* (2022), Luo *et al* (2021), and Nur (2021) which explain that social media usage has a direct effect on stock return without going through profitability.

Changes in stock prices often do not depend on the company's profitability, but rather on how the information affects market expectations (Luo *et al.*, 2021). This is due to factors such as market sentiment, investor expectations, and rapid response to new information spread through social media. Perceptions formed on social media can trigger rapid emotional reactions from the market which can ultimately affect stock prices.

Market sentiment can influence investment decisions and stock price changes (Nur, 2021). When positive information about a company is widely spread on social media, it can create optimism among investors, which ultimately drives up stock prices, even if the company's financial performance has not changed significantly. Conversely, negative information or rumors circulating on social media can also quickly damage a company's reputation, causing a decline in stock prices even though the company's fundamentals remain strong.

Social media allows for the rapid spread of information, which means that market responses to certain news or events can be very fast. Investors can respond to small changes in public perception or unverified rumors with quick investment decisions, leading to sharp stock price fluctuations (Hsu & Lawrence, 2020). This shows that in the digital era, market expectations can occur not because of the company's financial performance, but by the way the company projects itself and how information about the company is perceived by the public on social media.

CONCLUSION

This study aims to determine the effect of social media usage on stock returns along with the effect of social media usage on stock returns through profitability. The results of this study indicate that social media usage has a positive effect on stock returns. Based on the results of the study, it is known that posts on Instagram that form the impression of achievement, friendliness, integrity, and concern for the environment will have a positive effect on stock returns. The more companies implement impression management on posts on social media, the more investors will be attracted to invest in the company.

The results of the study also show that profitability is unable to mediate the effect of social media usage on stock return. Social media often disseminates non-financial information that can influence investors. This influence often does not depend on the profitability of the company, but rather on how the information affects market expectations. Profitability is unable to mediate the effect of social media usage on stock returns because the increase in stock return associated with social media usage is only influenced by short-term investor perceptions.

The results of this study support the theory of impression management as evidenced by the positive influence of social media usage on stock return. Management as the company manager provides information through social media, one of which is to provide investors with an overview of the company's condition. Information published by the company will be responded to by investors which is reflected in changes in stock prices. The results of this study can provide strategic insights to consumer non-cyclical companies regarding the maximization of social media usage by companies. This aims to see the dynamics of social media which will ultimately affect the company's stock returns.

This study has several limitations that can be considered for further research. First, the web scrapper apify.com applies access restrictions and rate limiting to retrieve Instagram data, so it takes more time to collect large amounts of data. Second, data collected through apify.com is often not well structured and requires further processing to be used in analysis. This adds complexity and time to the data collection process. Based on the limitations that have been explained, there are several suggestions for further research. First, to overcome the problem of access restrictions and rate limiting, further researchers can consider using paid apify.com. This aims to provide more stable and faster access to obtain Instagram data. Second, further research can be conducted on company posts in the form of visual media (photos or images) using a semiotic approach. The semiotic approach allows researchers to explore hidden or implicit meanings in images or photos. These are things like symbolic messages or values that the company wants to convey through images or photos.

REFRENCE

Ahmad, S. Z., Rahim, A., Bakar, A., & Ahmad, N. (2018). Social media adoption and its impact on firm performance : the case of the UAE. *International Journal of Enterpreneurial Behavior & Research*, *25*(1), 84–111. https://doi.org/10.1108/IJEBR-08-2017-0299

Apenteng, B. A., Ekpo, I. B., Mutiso, F. M., Emmanuel, A., & Opoku, S. T. (2020). Examining the relationship between social media engagement and hospital revenue. *Health Marketing Quarterly*, *37*(1), 10–21. https://doi.org/10.1080/07359683.2020.1713575

Banerjee, M., Capozzoli, M., Mcsweeney, L., & Sinha, D. (1999). Beyond Kappa: A Review of Interrater Agreement Measures. *The Canadian Journal of Statistics*, *27*(1), 3–23. https://doi.org/10.2307/3315487

Bartov, E., Faurel, L., & Mohanram, P. (2017). Can Twitter Help Predict Firm-Level Earnings and Stock Returns? In *The Accounting Review* (No. 2631421). https://dx.doi.org/10.2139/ssrn.2782236

Binekasri, R. (2023). Umumkan Stock Split Rasio 1:10, Saham Sekar Laut (SKLT) ARA. *CNBC Indonesia*. https://www.cnbcindonesia.com/market/20231002111916-17-477002/umumkan-stock-split-rasio-110-saham-sekar-laut--sklt--ara

Blankespoor, E., Miller, G., & White, H. D. (2013). The Role of Dissemination in Market Liquidity: Evidence From Firms' Use of Twitter. *Association, American Accounting*, *89*(1), 79–122.

Bolino, M. C., Kacmar, K. M., Turnley, W. H., & Gilstrap, J. B. (2008). A Multi-Level Review of Impression Management Motives and Behaviors. *Journal of Management*, *34*(6), 1080–1109. https://doi.org/10.1177/0149206308324325

Bolino, M. C., & Turnley, W. H. (1999). Measuring Impression Management in Organizations: A Scale Development Based on the Jones and Pittman Taxonomy. *Organizational Research Method*, *2*(2), 187–206.

Budiarjo, R. (2016). Good Corporate Governance Terhadap Return Saham dengan Profitabilitas Sebagai Variabel Intervening dan Moderating. *Jurnal Online Insan Akuntan*, *1*(1), 163–194.

Burhan, F. (2020). *Pengguna Whatsapp dan Instagram Melonjak 40% Selama Pandemi Corona*. Katadata.Co.Id. https://katadata.co.id/febrinaiskana/digital/5e9a41f84eb85/penggunaan-whatsapp-dan-instagram-melonjak-40-selama-pandemi-corona

Chahine, S., & Malhotra, N. K. (2018). Impact of social media strategies on stock price : the case of Twitter. *European Journal of Marketing*, *52*(8), 1526–1549. https://doi.org/10.1108/EJM-10-2017-0718

Chamberlain, D., Rudolph, H., & Smith, L. M. (2019). Analysis of Social Media Usage and Relationship to Firm Size and Revenue Growth among Major CPA Firms. *Services Marketing Quarterly*, *39*(4), 345–357. https://doi.org/10.1080/15332969.2018.1514798

CNN Indonesia. (2020). *Kronologi Serikat Buruh "Geruduk" Manajemen Es Krim Aice*. https://www.cnnindonesia.com/ekonomi/20200229162547-92-479349/kronologi-serikat-buruh-geruduk-manajemen-es-krim-aice

Dewi, N. P., & Supriyanto, A. (2017). Dampak Media Sosial Terhadap Kinerja Bisnis Melalui Pemasaran Berbasis Output dan Biaya. *Riset Manajemen Dan Akuntansi*, *8*(2), 1–11.

Dunne, N. J., Brennan, N. M., & Kirwan, C. E. (2020). Accounting , Organizations and Society Impression management and Big Four auditors : Scrutiny at a public inquiry. *Accounting, Organizations and Society*, *88*(1), 1–42. https://doi.org/10.1016/j.aos.2020.101170

Elvira, V. (2022). Agresif Lakukan Pengembangan Produk, Begini Strategi Mustika Ratu (MRAT) pada 2022. *Kontan.Co.Id*. https://industri.kontan.co.id/news/agresif-lakukan-pengembangan-produk-begini-strategi-mustika-ratu-mrat-pada-2022#google_vignette

Erianto, B. (2023). Instagram Endorsement and Stock Return. *Journal of Accounting and Business Education*, *8*(1), 1–14.

Fernando, A. (2021). *Diguncang Kabar Ardi Bakrie-Nia, 4 Saham Grup Bakrie Nyungsep*. CNBC Indonesia. https://www.cnbcindonesia.com/market/20210712110039-17-260032/diguncang-kabar-ardi-bakrie-nia-4-saham-grup-bakrie-nyungsep

Fernando, F., & Wilujeng, A. (2023). " Don't Be a Bragger !": Social Media Impression and Firm's Financial Performance. *Corporate Reputation Review*.

Firmansyah, T. (2016). *Klarifikasi Sari Roti Soal 212 Jadi Trending Topic*. Republika.Co.Id. https://news.republika.co.id/berita/ohrazh377/klarifikasi-sari-roti-soal-212-jadi-trending-topic

Gardner, W. L. (1992). Lessons in Organizational Dramatz: The Art of Impression Management. *Organizational Dynamics*, *21*(1), 33–46.

Ghozali, I. (2021). *Aplikasi Analisis Multivariate dengan Program SPSS* (10th ed.). Badan Penerbit Universitas Diponegoro.

Goffman, E. (1959). *The Presentation of Self in Everyday Life*. Penguins Book.

Greenpeace. (2022). *Kemasan Unilever, Indofood dan Mayora Terbukti Mencemari 11 Titik Pantai di Indonesia*. https://www.greenpeace.org/indonesia/cerita/46350/kemasan-unilever-indofood-dan-mayora-terbukti-mencemari-27-titik-pantai-di-indonesia/

Gujarati, D. N. (2004). *Basic Econometrics* (4th ed.). The McGraw-Hill Companies.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis* (8th ed.). Annabel Ainscow.

Hartono, J. (2017). *Teori Portofolio dan Analisis Investasi* (11th ed.). BPFE.
Hasanah, A., & Enggariyanto, D. (2018). Analisis Faktor-Faktor yang Mempengaruhi Return on Asset pada Perusahaan Manufaktur yang Terdaftar di Bursa Efek Indonesia. *Journal of Applied Managerial Accounting*, *2*(1), 15–25.
Hidayat, M., Saggaf, A., Siregar, M. I., & Erman, E. (2023). Pengaruh Pengungkapan Media Terhadap Nilai Perusahaan Saat Pandemi Covid-19 Pada Perusahaan Retail dan Grosir yang Terdaftar di Bursa Efek Indonesia. *Owner: Riset Dan Jurnal Akuntansi*, *7*(3), 2625–2632.
Hsu, L., & Lawrence, B. (2020). The Role of Social Media and Brand Equity During a Product Recall Crisis: A Shareholder Value Perspective. *International Journal of Research in Marketing*, *9*(3), 1–56. https://doi.org/10.1016/j.ijresmar.2015.04.004
Indozone. (2020). *Dukung LGBT, Netizen Serbu Instagram dan Ramai-ramai Boikot Produk Unilever.* https://news.indozone.id/news/911497365/dukung-lgbt-netizen-serbu-instagram-dan-ramairamai-boikot-produk-unilever
Jia, W., Redigolo, G., Shu, S., & Zhao, J. (2020). Can social media distort price discovery ? Evidence from merger rumors. *Journal of Accounting and Economics*, *70*(1), 1–27. https://doi.org/10.1016/j.jacceco.2020.101334
Jones, E. E., & Pittman, T. S. (1982). Toward a General Theory of Strategic Self-Presentation. *Psychological Perspectives on the Self*, *1*(1), 231–262.
Kim, W., Chae, B. K., & Kim, W. (2018). Understanding the relationship among resources , social media use and hotel performance The case of twitter use by hotels. *International Journal of Contemporary Hospitality Management*, *30*(9), 2888–2907. https://doi.org/10.1108/IJCHM-02-2017-0085
Kurniawan, N., & Mawardi, W. (2017). Analisis Pengaruh Profitabilitas Keputusan Investasi Keputusan Pendanaan dan Kebijakan Dividen terhadap Nilai Perusahaan. *Diponegoro Journal of Management*, *6*(2), 1–11.
Kusumawardhany, P. A. (2018). Pengaruh Kapasitas Absorptif dan Situs Jejaring Sosial terhadap Kinerja inovasi Usaha Mikro Kecil dan Menengah (UMKM) di Indonesia. *Jurnal Manajemen Teori Dan Terapan*, *11*(1), 1–18.
Leary, M. R., & Kowalski, R. M. (1990). Impression Management : A Literature Review and Two-Component Model. *Psychological Bulletin*, *107*(1), 34–47.
Li, T., Dalen, J. Van, & Rees, P. J. Van. (2022). More than just noise? Examining the information content of stock microblogs on financial markets. *Journal of Information Technology*, *8*(1), 268–282. https://doi.org/10.1057/s41265-016-0034-2
Liu, P., Xia, X., & Li, A. (2018). Tweeting the Financial Market: Media Effect in the Era of Big Data. *Pacific-Basin Finance Journal*, *51*(10), 267–290. https://doi.org/10.1016/j.pacfin.2018.07.007
Luo, X., Zhang, J., & Duan, W. (2021). Social Media and Firm Equity Value. *Information System Research*, *24*(1), 146–163.
Mcgurk, Z., Nowak, A., & Hall, J. C. (2019). Stock Returns and Investor Sentiment: Textual Analysis and Social Media. In *Economics Faculty Working Papers Series* (Vol. 37).
Muhyiddin. (2017). *Dikaitkan Dalam Kasus Ernest Prakarsa, PT Sido Muncul Klarifikasi*. Republika.Co.Id. https://news.republika.co.id/berita/omfyl9361/dikaitkan-dalam-kasus-ernest-prakasa-pt-sido-muncul-klarifikasi
Neuendorf, K. (2002). *The Content Analysis Guidebook*. SAGE Publications.
Nur, E. (2021). The Impact of Social Media on Firm Value: A Case Study of Oil and Gas Firms in Indonesia. *Journal of Asian Finance*, *8*(3), 987–996. https://doi.org/10.13106/jafeb.2021.vol8.no3.0987
Prasetyanto, W. E. (2020). Manajemen Kesan pada Media Sosial dan Pengaruhnya terhadap

Efektivitas Targeting dan Kinerja Penjualan. *Jurnal Bisnis Dan Manajemen*, *7*(2), 1–20.

Putra. (2023). Pecah Nominal & Tambah Modal, Saham MIDI Mahal Gak Masuk Akal. *CNBC Indonesia*. https://www.cnbcindonesia.com/research/20230203123350-128-410749/pecah-nominal-tambah-modal-saham-midi-mahal-gak-masuk-akal

Putri, F., & Widyaningdyah, A. (2023). Pengaruh Penggunaan Media Sosial terhadap Transparansi Pengungkapan Informasi Pelaporan Keuangan. *Jurnal Akuntansi Netral, Akuntabel, Objektif*, *5*(2).

Rahardja, L., & Aritonang, D. (2022). The Influence of Corporate Social Responsibility (CSR) on the Financial Perfomance of Non-Cyclical and Basic Material Consumer Companies. *International Journal of Digital Enterpreneurship and Business*, *3*(2), 60–73.

Rahmansyah, A., Mulyany, R., & Geumpana, T. A. (2023). Using Social Media as A Legitimation Tool in Sustainability Reporting: Evidence from SOEs Listed on the Indonesia Stock Exchange. *Jurnal Dinamika Akuntansi Dan Bisnis*, *10*(2), 265–284.

Razak, N. (2020). Kolaborasi dan Sinergi, Solusi Public Relation di Masa Pandemi. *PR Indonesia*, 10–11.

Riffe, D., Lacy, S., Watson, B. R., & Fico, F. (2019). *Analyzing Media Messages: Using Quantitative Content Analysis in Research* (3rd ed.). Routledge Communication Series. https://doi.org/https://doi.org/10.4324/9780429464287

Rizaty, M. (2020). *Bertambah Lagi, Ini Jumlah Pengguna Instagram per Kuartal I 2022*. Databoks. https://databoks.katadata.co.id/datapublish/2022/06/17/bertambah-lagi-ini-jumlah-pengguna-instagram-per-kuartal-i-2022

Rohman, I. Z., & Naufaldi, F. (2022). Pengaruh Kepuasan Konsumen, Kualitas Produk, Citra Merek dan Word of Mouth terhadap Minat Beli Ulang. *Jurnal Manajemen Dewantara*, *6*(1), 53–60.

Schniederjans, D., Cao, E. S., & Schniederjans, M. (2013). Enhancing financial performance with social media: An impression management perspective. *Decision Support Systems*, *55*(4), 911–918. https://doi.org/10.1016/j.dss.2012.12.027

Scott, W. R. (2014). *Financial Accounting Theory*. Pearson Education Inc. https://doi.org/10.4324/9780429468063

Sidik, S. (2021). Astaga! Rugi Hero Bengkak Jadi Rp. 1,2T di 2020 Efek Pandemi. *CNBC Indonesia*. https://www.cnbcindonesia.com/market/20210312095325-17-229611/astaga-rugi-hero-bengkak-jadi-rp-12-t-di-2020-efek-pandemi

Siregar, L., & Nasution, I. (2020). Perkembangan Teknologi Informasi terhadap Peningkatan Bisnis Online. *Jurnal Ilmiah Manajemen Bisnis*, *2*(1), 71–75.

Sobel, M. (1982). Asymptotic Confidence Intervals for Indirect Effects in Structural Equation Models. *American Sociological Association*, *13*(1), 290–312. https://doi.org/https://doi.org/10.2307/270723

Sofyan, R., Gusma, D., & Riyadi, P. (2020). Does the Information on the Internet Media Respond to the Stock Market? *Advances in Economics, Business and Management Research*, *152*, 510–520.

Spence, M. (1973). Job Market Signaling. *Quarterly Journal of Economics*, *87*(3), 355–374.

Srikant, C. D. (2019). Impression management strategies to gain regulatory approval. *Journal of Business Research*, *105*(12), 136–153. https://doi.org/10.1016/j.jbusres.2019.08.006

Syafitri, Z., & Suryani, A. W. (2022). Stock Information on Social Media and Stock Return. *The Indonesian Journal of Accounting Research*, *25*(3), 383–412. https://doi.org/10.33312/ijar.653

Tajvidi, R., & Karami, A. (2017). The effect of social media on firm performance. *Computers in Human Behavior*, *115*(2), 105174. https://doi.org/10.1016/j.chb.2017.09.026

Tritama, H. B., & Tarigan, R. E. (2017). Pengaruh Media Sosial terhadap Brand Awareness

Produk Perusahaan. *Jurnal Bisnis Dan Manajemen*, *2*(1), 1–15.

Turnley, W. H., & Bolino, M. C. (2001). Achieving Desired Images While Avoiding Undesired Images : Exploring the Role of Self-Monitoring in Impression Management. *Journal of Applied Psychology*, *86*(2), 351–360. https://doi.org/10.1037//0021-9010.86.2.351

Unilever. (2021). *Siasati Tantangan Pandemi Berkepanjangan, Unilever Indonesia Catat +1,5% Pertumbuhan Penjualan Domestik Retail pada Tahun Berjalan Desember 2020*. Unilever.Co.Id. https://www.unilever.co.id/news/press-releases/2021/siasati-tantangan-pandemi-berkepanjangan-unilever-indonesia-catat/

Utama, B., Sastrodiharjo, I., & Mukti, A. (2023). Pengaruh Mekanisme Tata Kelola Perusahaan terhadap Kinerja Keuangan Perusahaan: Studi Empiris pada Perusahaan Non Consumer Cyclicals yang Terdaftar di Bursa Efek Indonesia Periode 2019-2021. *Jurnal Akuntansi, Keuangan Dan Manajemen*, *4*(4), 249–261.

Weber, R. P. (1990). *Basic Content Analysis* (2nd ed.). SAGE Publications.

Xun, J., & Guo, B. (2016). Twitter as Customer eWOM: an Empirical Study on Their Impact on Firm Financial. *Emerald Publishing*, *27*(5), 1–52.

Yang, J. H., & Liu, S. (2017). Accounting Narratives and Impression Management on Social Media. *Accounting and Business Research*, *47*(6), 673–694. https://doi.org/10.1080/00014788.2017.1322936

Yoon, G., Li, C., Ji, Y. G., North, M., & Hong, C. (2018). Attracting Comments : Digital Engagement Metrics on Facebook and Financial Performance. *Journal of Advertising*, *47*(1), 24–37. https://doi.org/10.1080/00913367.2017.1405753

Zakaria, H. M. (2016). Pengaruh Pengungkapan Corporate Social Responsibility dan Penilaian Kinerja Perusahaan terhadap Return Saham. *Jurnal Kebijakan Ekonomi*, *11*(2), 111–125.

Zu, X., Diao, X., & Meng, Z. (2019). The impact of social media input intensity on firm performance : Evidence from Sina Weibo. *Physica A*, *536*(12), 1–10. https://doi.org/10.1016/j.physa.2019.122556