Effect of IT Investment Announcement on Company Value: Evidence from Indonesia Stock Exchange

(Kesan Pengumuman Pelaburan IT terhadap Nilai Syarikat: Bukti dari Bursa Saham Indonesia)

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ABSTRACT

This study examines the effect of IT investment on company value in the Indonesian Stock Exchange. The method used is the event study analysis. The beta used to calculate abnormal returns are the traditional beta and the corrected beta of Dimson and Scholes-Williams given that the Indonesian market is a thin trading market. The results of this study indicate that there is an effect of IT investment announcements on firm value on the post-event window. The results also show that investors tend to react positively to IT investment announcements made by companies in 2020 thus suggesting that the occurrence of the COVID-19 pandemic has effectively affected investors in processing new information regarding technology investments made by companies. The study is expected to provide benefits to assist policy making on Indonesia Stock Exchange and Capital Market and Financial Institutions Supervisory Agency (Bapepam-LK) regarding the disclosure of company information on the implementation of IT investments.

Keywords: IT Announcement; company value; market reaction; corrected beta; Indonesia stock exchange; event study analysis

ABSTRAK

Kajian ini mengkaji pengaruh pelaburan teknologi maklumat terhadap nilai syarikat di Bursa Saham Indonesia. Kaedah yang digunakan dalam penyelidikan ini adalah analisis kajian peristiwa. Beta yang digunakan untuk mengira pulangan yang tidak normal adalah beta tradisional dan beta yang diperbaiki dari Dimson dan Scholes-Williams kerana pasaran Indonesia adalah pasaran perdagangan yang tipis. Hasil kajian ini menunjukkan bahawa terdapat pengaruh pengumuman pelaburan teknologi maklumat terhadap nilai firma pada tetingkap pasca acara. Hasil juga menunjukkan bahawa pelabur cenderung untuk bereaksi positif terhadap pengumuman pelaburan teknologi maklumat yang dibuat oleh syarikat pada tahun 2020 yang bermakna kejadian pandemik COVID-19 telah cukup menjejaskan pelabur dalam memproses maklumat baharu berkenaan pelaburan teknologi yang dibuat oleh syarikat. Kajian ini diharapkan dapat memberi manfaat untuk membantu pembuat dasar di Bursa Saham Indonesia dan Bapepam-LK berhubung pendedahan maklumat syarikat mengenai pelaksanaan pelaburan IT.

Kata Kunci: Pengumuman IT; nilai syarikat; reaksi pasaran; beta yang dibetulkan; bursa saham Indonesia; analisis kajian peristiwa

INTRODUCTION

The Industrial Revolution was an era that cannot be avoided and that also heralded the age of technological developments. The start of the First Industrial Revolution began with the advent of the steam engine in the 18th century that revolutionised the production system from a human-based to machine-based processing. The subsequent emergence of the electric power industry in the 19th century marked the beginning of the Second Industrial Revolution. The 20th century ushered in the Third Industrial Revolution when computers became central to every human activity including the conduct of business. The era was consolidated further with the introduction of the internet that also importantly supported business systems and procedures (Malihah &

Setiyorini 2019). The Industrial Revolution and parallel technological developments did not stop there, but continued until the present when the world in general and Indonesia in particular, began to enter the era of the Fourth Industrial Revolution, commonly known as the Industrial Revolution 4.0. This latent technological advancement is characterised by the combination of the internet-of-things, big data, artificial intelligence, and fast data networks that collectively spurred the development of smart businesses and factories.

The President of the Republic of Indonesia, Joko Widodo, stated that Indonesia was ready and committed to implementing Industrial Revolution 4.0 with the launch of „Making Indonesia 4.0" in 2018 (Kompas 2018). The year was taken as the starting time for the entry of the Industrial Revolution in developing countries in general and Indonesia in particular. However, the global pandemic of COVID-19 in 2020 slowed down and restricted human mobility and activities and effectively incapacitated the global economy. However, the paralysis was partially overcome with the internet and the accelerated development of the digitalized economy. The existence of the internet with various information platforms also encouraged companies to invest heavily in information technology (IT) with the aim of improving product quality, service quality, internal processes, and company performance (Achjari & Wahyuningtyas 2014).

The development and management of websites, social media, and mobile phone applications in the form of corporate information and technology investment effectively served as a means for consumers, internal company parties, and investors to source information and to assist in decision making. Amri (in Kontan 2013), related the main director of Bank Mandiri, Budi G. Sadikin, who mentioned that social media is a strategic way to market bank products and communicate with its customers. Sadikin further tweeted that „Bank Mandiri wants to use social media for service, customer care, product development, human resources, and marketing". The investment in technology and information is believed to improve company performance and serves as a measurement of improvement through increased productivity, profits, and consumer value. Ndoroakung, a digital creator at Bank Mandiri, conveyed that social media is the main source of information that can be used to market products, increase brand awareness and sales, or to identify market leads (Kontan 2020). Wani Sabu, a Vice President of the Center of Digital BCA, explained that as a component of social media, services increased by 200% in 2019 (Kontan 2019). The enhanced connectivity provided through investment in technology and information greatly facilitated companies to effectively network with their consumers and intensify added value for the company. According to Walfajri (Kontan 2021) digitization will greatly increase efficiency in business companies in general and financial companies in particular.

Past studies however recorded inconsistent responses in market reactions to IT investment made by listed companies. Early studies such as Sanchez et al. (2016), Nwankpa (2016), Janke et al. (2015) and Tang et al. (2018) showed that investors responded to announcements on IT investment. A more recent study by Achjari & Wahyuningtyas (2014) however explained that the Indonesian market did not show any reaction to such announcements.

Past research recorded inconsistent results in market reactions to IT investment announcements in Indonesia. There is also the absence of more in-depth research on this phenomenon at the beginning of the Industrial Revolution 4.0 in 2018 and during the global pandemic in 2020 when the market became more internet dependent. These are the reasons that induced market reaction to IT investment announcements made by Indonesian companies. This response should be re-examined to elucidate the difference between the financial and non-financial sectors, considering that current technological development is shifting from manufacturing to services (Wolf & Terrell 2016). The service companies in Indonesia are dominated by the financial sector companies and as such researchers use factors from both sectors to further explain the effect of IT announcements on company values. The theories underlying research on such market reactions include the Effective Market Hypothesis (EMH), Signaling Theory, and Single Person Decision Theory.

In this study three factors were used to explain market reaction to IT announcements, as adopted by Wijayana & Achjari (2020), namely the type of industry (financial and non-financial industries), company size (above or below the average number of company assets) and competitive position of the company (above or below the average number of company income). The time factor in company technology adoption (used in Wijayanan & Achjari 2020) was not utilized since the companies were not included as early adopters at the beginning of the Industrial Revolution 4.0. These were basically early majority adopters, meaning that the companies embraced the technology after they were widely accepted as being able to survive and adapt to the current market conditions. As such, investors will tend to favour these companies since they can operate their technology better and more efficiently in maximizing profits, and not determined by the lead time in technology adoption (Parente 1994). Thus, instead of using the time factor, this study chose to do a data split test to examine market reaction to the announcement of IT investment following the Industrial Revolution 4.0 before the pandemic, and against market reaction following the Industrial Revolution 4.0 but after the pandemic. The study also sought to identify shortcomings in Achjari & Wahyuningtyas (2014) who earlier analyzed market reaction to IT announcements before and after the occurrence of a crisis. In addition, the factor related to the type of company technology

adoption was not used since this was obviated by current technological advances that integrate traditional ERP (Enterprise Resource Planning) transaction data and streaming multi-platform big data into a single analytical system (Shi & Wang 2018). As stated in Hutauruk (2019), banking companies, such as BNI, OCBC NISP, and Mandiri, were developing a cash management business that was growing well and contributing good fee-based income and this development was favourably received by investors. Further, the service did not only focus on fund transfer transactions, but also included improvement in the ERP integration scheme.

LITERATURE REVIEW

EFFICIENT MARKET HYPOTHESIS

The Efficient Market Hypothesis theory stated that accounting competes with other sources of information such as the media, financial analysts, and even with the stock price itself. In general however, stock prices should reflect the information available at the time of the announcement (Zhang et al. 2016). Under ideal conditions, investors will take advantage if information can be obtained for free. Unfortunately, under normal non-ideal conditions costs are invariably incurred in obtaining information (Scott 2015). As such, investors need to decide on how much accounting information is required for analysis to estimate the value of a company. But such estimate can easily change as new information becomes available. To exacerbate this disadvantage, other sources of information that compete with accounting can be easily accessed by investors at no cost (Fama et al. 1969).

The form of efficient market according to Fama et al. (1969) may be categorized into three groups of Efficient Market Hypotheses; namely, the weak form, the semi-strong form, and the strong form. The particular group of market forms is based on the level of absorption of information available in the market. The weak-form Efficient Market Hypothesis assumes that stock prices reflect information contained in past history on the prices of these securities. The semi-strong form of Efficient Market Hypothesis is a market whose share price not only reflects historical stock prices but also information on the market. The type of information available can be in the form of financial statements or additional information. The strong form Efficient Market Hypothesis is a market that has a stock price that reflects all information, both public and private.

In efficient market testing, irregularities (anomalies) are often found, especially those related to the semi-strong form of Efficient Market Hypothesis, where investors assumed that they can make a profit through the occurrence of a phenomenon (event). (Foster et al. 1984). One form of such anomaly is the announcement drift or delayed market reaction (Bernard & Thomas 1989)

which occurs among investors who are late in processing information on an available event. This however does not invalidate the Efficient Market Hypothesis, but serves to indicate that new market information that becomes public can affect the price of securities.

It is assumed in the Efficient Market Hypothesis that stock prices in the capital market describe all the information necessary for the investors including IT investment announcements. This response to information in stock prices is usually called market reaction, meaning that investors will respond to the information they received. This reaction can generally be seen in abnormal response, especially in stock returns that are not in accordance with expectation following information published by the company. In this study the information is in the form of IT investment announcements.

SINGLE-PERSON DECISION THEORY

In general, changes in the market value of the company are influenced by investors' decisions to invest and these are determined by the ownership of such information. The importance of holding information on a company prior to investment is because investors generally have to make decisions under uncertain conditions (Scott 2015). Basically if there is no uncertainty, information will no longer be needed. But with market uncertainty as the norm, investors are always faced with two possible risks as consequences of their actions or decisions. The role of using information is therefore very important under such circumstances.

Scott (2015) stated that in individual decision theory, probabilities are no longer objective under ideal conditions, thus giving rise to formal procedures that allow individuals to make the best decisions from a set of alternative courses of action. In this theory, individuals (investors) involved in decision making are considered to already have information on the company, but since the circumstances are no longer objective under ideal conditions, investors can use other information to make decisions. Such information is not always in the form of accounting from financial statements, but also include information on conditions of the company's environment, such as political conditions, natural disasters, and others. The theory also defines information as evidence that has the potential to influence individual decision. It can thus be concluded that information has ex-ante definition, in that at least some evidence must be included in the information for it to be sufficiently influential in decision making. Sources for obtaining information in today's era are quite numerous, varied, and easily accessible. Indeed, it can even be said that nowadays information is no longer sought, but is readily available. One type of information that can be used by individuals, or this case investors, is related to investments made by companies in the form of IT. Such information is generally known to increase company productivity and consumer value, so that announcements on a company's investment in IT can be

additional information for an investor to make decisions on. This study uses the basis of individual decision theory (single-person decision theory) to analyze the effect of other information, namely the announcement of the company's IT investment, on investor decision making, which can be illustrated by the stock market reaction.

SIGNALLING THEORY

Investors will continue to need available information and the types accessible will greatly affect the decision-making process (Morris 1987). This can be explained by the signal theory, which states that companies tend to announce information that indicates the company is in good condition, such as an increase in sales. Such information is normally included in financial statements which predictably gives a good signal for investors to decide on investment. Conversely, the company will withhold information that tends to send a bad signal to investors. This control on information allows every company with the opportunity to signal or otherwise the quality of its company to outsiders.

Several explanations of the signal theory model state that quality is one of the distinguishing characteristics in the formation of the company's signal to investors and in this case quality is defined as a variety of relevant ways. One indication of a good signal is when the company can increase productivity and add value for consumers through investing in technology and information. This suggests that announcements regarding IT investments are perceived as signals for investors, despite the fact that the company's practices in the form of good corporate governance should also be categorized as a good signal for investors. However, the intensity of the announcements made by the company also may influence investors in making decisions. Achjari & Wahyuningtyas (2014) stated that small companies that in general rarely announce their investment in IT will make a breakthrough if they do otherwise. These will usually receive a positive response from investors who favourably interpret such announcements as a good signal. There are times however when companies make too many announcements on IT investments, that investors tend to read as a bad signal. The frequency of announcement carries cost implication thus leading investors to assume that the more often the company invests, the higher the costs incurred. Upon receiving a signal from the information obtained or published by the company, the investor will make a decision to make or cancel an investment in the company and this will affect the value of the company. The information obtained by investors through the announcement of the company's IT investment thus becomes information signals that have important benefits for the value of the firm (Connelly et al. 2011).

HYPOTHESIS DEVELOPMENT

Past research has shown that the market will definitely respond to the spread of information even though the response reaction may be delayed (Hirshleifer 2015). This is one of the anomalies that often occur in the semi strong form of market (Bernard & Thomas 1989). Since investors do not process the information released in a timely manner, the stock price thus does not immediately reflect the value of reported earnings at that point of time (Ball & Brown 1968; Ball & Brown 2019). Winarno et al. (2021) stated that it takes a 1-year time lag on IT investment before its impact is registered on the firm's financial performance. Various lag times were reported in the literature from a few days after the announcement (Ali et al. 2021), to several weeks (Kovacs 2016), or up to 13 weeks (Engelberg et al. 2018) or even two months (Foster 1984) following the announcement. Given the above context, the first hypothesis is posited as follows:

H_1 There is a market reaction to the announcement of the company's IT investment.

Wolf & Terrell (2016) stated that technology adoption is increasingly shifting from manufacturing companies to service companies which also comprise the financial sector. The market reaction to IT investment announcements in the financial and non-financial sectors is basically explained by innovative and non-innovative factors, strategic roles, and contextual factors such as size, leverage, and timeframe, as well as efficiency.

Companies in the financial and non-financial sectors basically have different business characteristics and this has prompted research to determine whether IT investment announcements made by companies in both sectors are judged differently by investors. Takeda et al. (2021) found that there was no significant response on the financial company's IT investment announcement, whereas Wijayana & Achjari (2020) showed that investors tend to response positively to the announcement. Hence, this study will elucidate whether there are differences in the level of market reaction to IT investment announcements in financial and non-financial sector companies. In accordance with the past records, the second hypothesis is posited as follows:

H_2 There are differences in the level of market reaction to IT investment announcements in the financial sector and the non-financial sector.

Past studies have shown that the market generally responds more to information provided by smaller companies compared to large ones since information from the former has greater value (Shi et al. 2018). Large

companies usually make announcements more often than small companies, thus indicating that company size generally exerts a negative effect when associated with market reactions (Zhang et al. 2016). To examine the impact of firm size, in this study the sample will be divided into two firm categories, above and below the average size, calculated based on the total assets of the firm. So, the subsequent hypothesis that can be derived from the above explanation is as follows:

H$_3$ There is a difference in the level of market reaction to IT investment announcements at above and below average company sizes.

The investment in IT in today's global market competition also aims at gaining a competitive position for the company, so that most that aspire to attain such position will tend to invest more aggressively. In this study, the company's competitive position is indicated by its sales revenue relative to those of its competitors, since the main purpose of investment and adoption of IT, more than anything else, is to increase sales (Arora & Rahman 2017). Therefore, to test the significance level of market reaction to the announcement on IT investment in the company's competitive position, the companies were grouped into two categories, namely those above and below the average sales revenue. From the explanation above, the following hypothesis is thus formulated:

H$_4$ There is a difference in the level of market reaction to the announcement of IT investment in the company's competitive position above and below the average sales revenue.

METHODOLOGY

This research is an event study analysis carried out to elucidate whether an event contains information that induces investors to react to the information. According to Wu and Ow (2021) there are two basic kinds of information that may cause price fluctuation in the stock market, indicating a reaction from investors. The information may come from a dividend announcement or personnel change announcement that may exert an impact on stock market prices.

Secondary data were used in this study, namely stock prices obtained from the Indonesia Stock Exchange, and IT announcements obtained from business publications and web-based news media, namely Google search, Yahoo! Finance, Indonesian Business News, Bisnis Indonesia Kontan, Infovesta, and company websites (Achjari & Wahyuningtyas 2014).

In this study, data collection utilized search engines and use of keywords such as „ICT implementation news and public companies", „ERP implementation news and

public companies", and „SCM implementation news and public companies" (Achjari & Wahyuningtyas 2014). Company websites were visited and scanned for news on technology and information. Similarly, Indonesian business news sites were visited for news on IT. The list of companies sourced for this information were then categorized into financial and non-financial sector companies. Data on the company's daily stock prices were obtained through the site, www.idx.co.id.

Firm value described by market reaction in this study was proxied by Abnormal Return which is the difference between the expected return and the actual return of a company on day t in each day of the event period. The calculation of Abnormal Return is as follows:

$$AR = R\_(j,t) - (\alpha\_j + \beta\_j . R\_mt)$$

Where R$\_$(j,t) is the return of company j, on day t, α_j is the regression coefficient that represents the intercept term of stock j, β_j is the coefficient that represents the slope of the regression, the expected change in the return of stock j for every 1% change in the return market R$\_$mt is the Return on the market portfolio on day t.

Company size is a scale to describe the classification of the size of a company. In general, the size of the company can be proxied through the total assets owned by the company, where the greater the total assets owned by the company, the larger the size of the company. To determine whether the company size is large or small, the average value of the total assets of the companies that were sampled was calculated, then the total sample divided into two categories; namely large companies with total assets above average and small companies with total assets below average (Dang et al. 2018).

Competitive position is a result of quantitative and qualitative evaluation of comparisons between a company and other companies (Piatkowski 2012). A company is said to have a superior competitive position when it obtains greater returns than current or potential competitors in its industry, indicating that superior company performance serves as a key indicator of competitive advantage (Danko et al. 2017). To determine the boundary between companies with high and low competitive positions, the average of the total sales of the sample companies was calculated. The sampled companies were then divided into two groups, where the group with high competitive positions are those with a total sales/revenues above the average value. Conversely, the group with low competitive positions is below the average.

The step-by-step analysis method was used to test each hypothesis (Achjari & Wahyuningtyas 2014). The steps used in the analysis are as follows:

1.   Identify IT investment announcements, with each examined to ensure that there are no other company activities that may affect its value. An event is included in the sample if it is isolated from other company activities.

2. The estimation period is then conducted. It comprises an estimate of 100 days starting from two days before the announcement date (t-2) to 101 days before the same date (t-101).
3. The event window is then determined; namely one day before the announcement date (t-1), the day of the announcement (t0), and one day after that date (t+1). The event window will indicate whether the market elicits an immediate reaction to the event being tested. According to McWilliams & Siegel (1997), the shorter the event window the better it is because it is expected to capture a strong impact on testing. If the event window is too long it will overlap with other events affecting the capital market.
4. The post event window is then determined; namely the 60th day (t+59) after the event window period (t+1). This period was chosen on the assumption that there is an anomaly present especially in the semi-strong form of the market (Bernard & Thomas 1989) The step anticipates a late market response to new information since investors may fail to absorb this information (Foster et al. 1984).
5. The next step is to collect the daily closing stock prices of the sample companies during the estimation period and the event window period.
6. The closing stock price index is recorded daily during the estimation period, event window period, and post-event window period.
7. The rate of return is then calculated. It is the actual return of a company on day t for the estimation period and the event window period.
8. The market return in the estimation period and the event window period is calculated.
9. Next is the calculation of the value A and B using market modeling techniques.
10. Next is to calculate the estimated stock return value for each company during the event window period using market techniques.
11. The next step is to test the abnormal return in the event period with the estimated average return subtracted from the actual average return. If the difference is not equal to zero, an abnormal return is indicated. The significance of the difference in the average abnormal return in the two corporate sectors, namely the financial and non-financial sectors, is determined using the Z test (n> 30).
12. To test for differences in the level of significance of market reactions to IT investment announcements in the financial and non-financial sectors. Company sizes, higher or lower than the average, and similarly competitive ratings based on company sales above

and below average, are determined by using methodology in the first to the 10th steps. This is conducted following calculation on the abnormal return of the company on day t for every day of the event period.
13. Next, to calculate the abnormal return for company j on a certain day, namely t-1, t0, and t+1, where t-1 is the day before the announcement in the daily period.
14. To calculate the three-day average abnormal return for company j and company sample N (Dos Santo 1993).
15. To determine whether the Cumulative Abnormal Return (CAR) of each category is greater than that of the other categories, by calculating the difference between the two.
16. The final step is to test the significance of the difference in CAR using the Z test.

RESULTS

There were 30 IT investment announcements made by companies listed on the Indonesia Stock Exchange, during 2018-2020. Companies from the financial industry sector dominated the frequency of announcements, namely 14 of 30. The implementation these announcements was mostly carried out by companies in 2020, namely 15 of the total 30.

To test the hypotheses in this study, the CAR calculation was used via three methods, based on the market model that employed the traditional beta estimation method (CARMm), the Dimson method (CARDim), and the Scholes-Williams method (CARSch). As mentioned earlier, there were a total of 30 observations made consisting of 14 announcements by companies in the financial industry sector and 16 from the non-financial industry sector.

The statistical descriptions in Table 1 shows that the CAR value is generally negative thus indicating that on average, the market reacts negatively to IT investment announcements made by the companies. Negative market reactions occur both around the time of announcement (on the event window) or after this (post event window). Table 1 also shows that negative market reactions are seen to be greater after the announcement. In contrast, the median value shows differences in market reactions, both negative and positive, after the announcement. The results establish that the company's announcement on IT is more receptive to investors thus indicating positive reaction to appear in the post event window period rather than in the event window period.

TABLE 1. Statistical description

Statistcs	CAR3Mm	CAR3Dim	CAR3Sch	CAR59Mm	CAR59Dim	CAR59Sch
N	30	30	30	30	30	30
Mean	-0.0079	-0.0056	-0.0107	-0.0247	-0.0096	-0.0146
Std. Dev.	0.0238	0.0308	0.0296	0.2039	0.2102	0.2141
Median	-0.0069	-0.004	-0.0105	0.0359	0.0576	0.0147
Minimum	-0.0445	-0.0588	-0.0795	-0.5266	-0.5452	-0.5337
Maximum	0.0565	0.0807	0.0565	0.2736	0.3261	0.4762

Source: Data processed

The mean value of CAR59Mm and median value of CAR3Mm derived through traditional methods, differ from results based on the Dimson and Scholes-Williams method. Generally, CAR values using the traditional beta of the market model differs from those derived using the Dimson and Scholes-Williams beta. The results on CAR values using corrected betas can better capture market reactions and are consistent with findings of Wijayana & Achjari (2020) who stated that the use of Dimson and Scholes-Williams corrected betas is suitable for thin trading markets such as in Indonesia.

REPORTING RESEARCH RESULTS

Results of the z-test indicate that there is a significant market reaction to CARMm3 (z-value = -1.825; p-value = 0.039) thus suggesting the occurrence of market reaction around the event window. Tests on CAR3Sch (z-value = -1.990; p-value = 0.028) showed similar results, namely that there was an indication of market reaction which was significantly smaller than zero around the time of the IT investment announcements. However, CAR3Dim (z-value = -1.001; p-value = 0.162) showed contrasting results to those of the two earlier methods. No significant market reaction, greater or less than zero, was recorded around the time of the announcement.

Table 2 also shows that the Z-test results on CAR59Mm, CAR59Dim, and CAR59Sch do not indicate a market reaction that is significantly greater or smaller than zero, with the respective z-values of -0.664; -0.249; and -0.373 (p-value = 0.256; 0.402; 0.356). The results indicate that investors generally react immediately to IT investment announcements around the time of the event.

TABLE 2. The Results of Z-test (one-tailed)

	CAR3Mm	CAR3Dim	CAR3Sch	CAR59Mm	CAR59Dim	CAR59Sch
N	30	30	30	30	30	30
z-value	-1.825	-1.001	-1.990	-0.664	-0.249	-0.373
p-value	0.039	0.162	0.028	0.256	0.402	0.356

Source: Data processed

Past studies related to market reactions stated that there was a possibility that positive market reactions can be eliminated as a result of negative market reactions (Dobija et al. 2012). Thus, as consistent with Wijayana & Achjari (2020), this study also aimed on testing market reactions through separating positive and negative reactions to abnormal returns for both CAR3 and CAR59.

The results are presented in Table 3 which is divided into columns, A for positive results on market reactions and column B for negative results. The results suggest that market reactions can be found at the time of announcement or after, when a separation is made between positive and negative reactions.

TABLE 3. Results of T-test separating positive and negative CAR

	CAR3Mm	CAR3Dim	CAR3Sch	CAR59Mm	CAR59Dim	CAR59Sch
A (Positive market reaction)						
N	12	14	12	17	17	18
t-value	3.566	3.145	4.033	7.07	6.425	4.447
p-value	0.002	0.004	0.001	0.000	0.000	0.000
B (Negative market reaction)						
N	18	16	18	13	13	12
t-value	-7.046	-6.110	-5.661	-6.109	-4.050	-4.211
p-value	0.000	0.000	0.000	0.000	0.001	0.000

Source: Data processed

A T-test was conducted to determine the difference in market reactions to IT investment announcements made based on the industrial sector. This study involved 14 companies in the financial sector and 16 companies in the non-financial sector. The results is shown in Table 4 in accordance to sector and also test time either around the announcement (CAR3) or after (CAR59).

TABLE 4. Resultf of T-test comparing market reaction of financial and non-financial sector companies

	Financial	Non-Financial	Financial	Non-Financial	Financial	Non-Financial
A	CAR3Mm		CAR3Dim		CAR3Sch	
Mean	-0.0030	-0.0095	-0.0001	-0.007	-0.0015	-0.0168
Variance	0.0190	0.0277	0.0224	0.0376	0.0262	0.0319
N	14	14	14	14	14	14
t Stat	0.6540		0.4850		1.2620	
p-value	0.5250		0.6360		0.2290	
B	CAAR3Mm		CAAR3Dim		CAAR3Sch	
Mean	0.0303	0.0373	0.0359	0.0441	0.0372	0.0434
Variance	0.0201	0.0189	0.0218	0.0316	0.0225	0.0316
N	14	14	14	14	14	14
t Stat	-0.7950		-0.7150		-0.5480	
p-value	0.2205		0.2435		0.2965	
	Financial	Non-Financial	Financial	Non-Financial	Financial	Non-Financial
A	CAR59Mm		CAR59Dim		CAR59Sch	
Mean	-0.0004	-0.0494	0.0201	-0.0357	0.0199	-0.0466
Variance	0.1993	0.2234	0.2093	0.2270	0.2278	0.2154
N	14	14	14	14	14	14
t Stat	0.5680		0.6470		0.7540	
p-value	0.5800		0.5290		0.4640	
B	CAAR59Mm		CAAR59Dim		CAAR59Sch	
Mean	0.7862	1.0829	0.8769	1.2020	0.8855	1.1450
Variance	0.2668	0.4712	0.2923	0.6235	0.2942	0.4629
N	14	14	14	14	14	14
t Stat	-1.9220		-1.7310		-1.7120	
p-value	0.0385		0.0535		0.0555	

Source: Data processed

The average cumulative abnormal returns were calculated using the traditional CAR3Mm market model, the Dimson CAR3Dim, and the Scholes-Williams CAR3Sch method for smaller financial companies (respectively; -0.0030; -0.0001; -0.0015) compared to non-financial firms (respectively; -0.0095; -0.0070; -0.0168). The market reaction to IT investment announcements was more negative for non-financial sector companies than for financial sector ones. However, the p-value shows non-significant difference.

A further test using CAAR (Table 4) showed that the average market reaction in financial sector companies was smaller than that in the non-financial sector. In general, the T-test results revealed that there was a market reaction to announcements made by companies, both financial and non-financial, at the time following the announcement. The findings thus indicate that the proposal in Hypothesis 2 is accepted.

Table 5 shows the results of the T-test comparing market reactions between large and small companies. Market reaction following the announcement results was smaller for companies with above average size (CAAR59Mm = 0.6268; CAAR59Dim = 0.7227; CAAR59Sch = 0.7205) relative to those below average size (CAAR59Mm = 1.0433; CAAR59Dim = 1.1439; CAAR59Sch = 1.1141). The result was significant at 1% (1-tailed) level. These results support Hypothesis 3 that there is a difference in the level of market reaction in company sizes above and below the average value.

TABLE 5. Results of T-test independent sample comparation of market reaction based on the company size

	Large	Small	Large	Small	Large	Small
A	CAR3Mm		CAR3Dim		CAR3Sch	
Mean	-0.0063	-0.0085	0.0018	-0.0083	0.0003	-0.0148
Variance	0.0208	0.0252	0.0190	0.0341	0.0164	0.0325
N	8	22	8	22	8	22
t Stat	0.2160		0.7940		1.2480	
p-value	0.8300		0.3140		0.2220	
B	CAAR3Mm		CAAR3Dim		CAAR3Sch	
Mean	0.0295	0.0363	0.0385	0.0449	0.0317	0.0440
Variance	0.0111	0.0210	0.1214	0.0285	0.0115	0.0294
N	8	22	8	22	8	22
t Stat	-0.8610		-1.5680		-1.1430	
p-value	0.1980		0.0640		0.1315	
	Large	Small	Large	Small	Large	Small
A	CAR59Mm		CAR59Dim		CAR59Sch	
Mean	0.0395	-0.048	0.0444	-0.0292	0.0271	-0.0297
Variance	0.1275	0.2233	0.1030	0.2365	0.1086	0.2418
N	8	22	8	22	8	22
t Stat	1.3350		1.1840		0.6260	
p-value	0.1950		0.2470		0.5300	
B	CAAR59Mm		CAAR59Dim		CAAR59Sch	
Mean	0.6268	1.0433	0.7227	1.1440	0.7205	1.1141
Variance	0.1124	0.3985	0.1427	0.5235	0.1538	0.3986
N	8	22	8	22	8	22
t Stat	-4.4410		-2.223		-2.6950	
p-value	0.0000		0.0170		0.0060	

Source: Data processed

Results of the independent sample T-test comparison of market reactions between competitive positions of companies are presented in Table 6. The market reactions for companies above and below the average value at around the time of announcement, under the traditional market model, was negative (CAR3Mm = -0.0029; -0.0107 respectively). Different results were however obtained when the Dimson and Scholes-Williams method was used where the reaction was positive for companies with an above-average competitive position, but negative for below-average companies (CAR3Dim = 0.0009; -0.0094 respectively; CAR3Sch = 0.0014; -0.0178 respectively). The overall results of the T-test conducted on the day-59 after the announcement, support Hypothesis 4; i.e., there are differences in the level of market reaction in the company's competitive position above and below the average value.

TABLE 6. Results of T-test independent sample comparing the market reaction based on the company compatitive position

	Higher	Lower	Higher	Lower	Higher	Lower
A	CAR3Mm		CAR3Dim		CAR3Sch	
Mean	-0.0029	-0.0108	0.0009	-0.0094	0.0014	-0.0178
Variance	0.0203	0.0256	0.0185	0.0361	0.0185	0.0328
N	11	19	11	19	11	19
t Stat	0.8660		0.8750		1.7680	
p-value	0.3940		0.3890		0.0880	
B	CAAR3Mm		CAAR3Dim		CAAR3Sch	
Mean	0.0297	0.0372	0.0312	0.0460	0.0328	0.0453
Variance	0.0093	0.2256	0.0123	0.0304	0.0122	0.0311
N	11	19	11	19	11	19
t Stat	-1.2660		-1.5330		-1.2670	
p-value	0.1080		0.0680		0.1070	
	Higher	Lower	Higher	Lower	Higher	Lower
A	CAR59Mm		CAR59Dim		CAR59Sch	
Mean	0.0220	-0.0517	0.0415	-0.0391	0.0243	-0.0371
Variance	0.1415	0.2318	0.1076	0.2494	0.1078	0.2568
N	11	19	11	19	11	19
t Stat	1.0810		1.2270		0.9130	
p-value	0.2890		0.2310		0.3690	
B	CAAR59Mm		CAAR59Dim		CAAR59Sch	
Mean	0.6872	1.0741	0.7769	1.1790	0.7806	1.1414
Variance	0.1520	0.4195	0.1523	0.5567	0.1648	0.4238
N	11	19	11	19	11	19
t Stat	-3.6290		-2.9630		-2.6920	
p-value	0.0000		0.0030		0.0060	

Source: Data processed

DISCUSSION

The advent of the Industrial Revolution 4.0 in Indonesia represented the beginning of a shift in business activities that are becoming more dependent on technology. Business companies are required to adapt to a changing environment, one of which is the intensive use of technology which powered a tectonic shift in business activities towards a digital economy. The momentum of change was unfortunately slowed with the emergence of the COVID-19 pandemic that paralyzed the world economy. The acceleration of digitalization and the growing demands to harness this technology has encouraged companies to invest in IT, in the hope of improving their performance and to survive today's increasing global competition. The company's decision to invest in IT is favourably supported by company stakeholders and companies are compelled to make the necessary announcements on the associated investments as a form of good corporate governance.

Announcements on IT investments made by a company can be considered as news or signals for investors, which will influence them in making decisions. Such decisions will exert an impact on the company's stock price as market reaction to the announcements. Such reaction is reflected by the existence of an abnormal return calculated from the difference between the expected return and the actual return.

The results of this study indicate that the four hypotheses formulated are accepted as elaborated below.

1. Hypothesis 1

The Z-test revealed the market reaction to the IT investment made around the time of the announcement (t-1, t0, t+1). Market reaction was also registered following the announcement (t+59) when positive and negative market reactions were separated in the analysis as per previous studies (Achjari 2020). The results were significant (1% level) and consistent with Achjari (2020). Investors in the Indonesian Stock Exchange tend to react late to announcements made by the companies.

2. Hypothesis 2

The results of the paired T-test show that there are differences in the level of market reaction to IT investment announcements between financial and non-financial

sector companies. The latter companies registered greater market reaction and this is inconsistent with Achjari's findings (2020) which revealed that financial sector companies display a greater market reaction since they often make significant investments to maintain competitive position.

The contradictory results may be due to the negative reaction displayed by investors in the Indonesian Stock Exchange who tend to be more concerned for non-financial sector companies rather than the risk of IT investments which can adversely affect company performance. This view is consistent with Bharadwaj et al. (2009) who observed that the market generally reacts slightly more negatively to technology investment failures in manufacturing industry companies relative to service companies.

3.   Hypothesis 3

The T-test results show that there are differences in market reactions to IT investment announcements that are related to company size. Companies sampled for the study are public companies listed on the Indonesian Stock Exchange with net worth or total net assets of at least IDR 5 billion. They are at least medium-sized companies.

The study revealed that companies with below average size showed greater market reaction compared to those with above average size. These results are consistent with Achjari (2020) who observed that small companies that rarely make announcements on IT investments generally tend to attract the attention of potential investors. In contrast, large companies which regularly make announcements and issue details on their IT investments become quite familiar to investors, thus drawing less reaction from them.

4.   Hypothesis 4

In an increasingly fierce global economic rivalry, competitive position is important to a company for survival and acquiring the competitive edge. This importantly motivates companies to broadly strategize to maintain their competitive edge. One important strategy is through investing in IT. Achjari (2020) suggested that companies with high competitive position will generally tend to invest frequently in IT and regularly issue public announcements. The competitive position so gained is measured by the amount of company revenue/sales. In this study such position was derived from the average value of income/sales of the sample company. Companies with income/sales that are above the average are regarded as having high competitive position. Conversely, companies below this average are regarded to occupy a low competitive position.

Results of the T-test indicate that there are different levels of market reaction to announcements of technology investments in the company's competitive position, above or below the average. The results obtained in this study are consistent with Achjari's (2020) findings, namely that there is a market reaction to announcements of greater IT investments in companies with a lower competitive position than with the reverse position. This is the reverse of the initial assumptions of researchers.

Similar to how the market reacts to small-sized companies, market reactions in companies with lower competitive positions can be caused by external factors as per the COVID-19 pandemic. This motivated investors to put more negative sentiments on companies with higher revenue/sales values that are below the average when it comes to investing in IT which generally will require a lot of funds. Investors see this as an expense that can affect company performance, hence placing companies with lower competitiveness in an unfavorable light thus causing a large negative market reaction.

These results support the signalling theory which indicates that the announcement of IT investment by the company is a signal for investors in making decisions. The results also support the Efficient Market Hypothesis (Fama et al. 1969) on the semi-strong market with anomalies as per the condition of the Indonesian market (Bernard & Thomas 1989; Foster et al. 1984), since it indicates that abnormal returns was appearing on the post-event window period.

An additional test of conducting a split-sample comparison between 2018-2019 and 2020 was conducted to examine whether the COVID-19 pandemic affected market reaction to IT investments made by the company. The results showed that the tests conducted after the announcement day (t+59) revealed a larger positive market reaction in 2020 during the COVID-19 pandemic. This shows that the occurrence of the COVID-19 pandemic has affected investors in processing new information regarding technology investments by companies. The result also revealed that there is a difference between market reaction before and after the pandemic crisis. This directly answers queries on market reaction by earlier workers including Achjari & Wahyuningtyas (2014).

CONCLUSION

This research constitutes a study conducted to observe market reactions to IT investment announcements made by companies listed on the Indonesia Stock Exchange, in the period 2018-2020. The study refers Wijayana & Achjari (2020), who studied market reactions at the time of the above announcements. In addition, given that the type of Indonesian capital market is in the form of a thin trading market, and apart from adopting the traditional market model calculation method as used in Achjari & Wahyuningtyas (2014), this study also adopts the calculation by Dimson and Scholes-Williams corrected beta method as used in Wijayana & Achjari (2020). The ensuing results supported the four hypotheses as posited earlier.

Some of the managerial implications from this study are as follows: Providing input to users of financial and non-financial information of a company, in understanding the mechanism of using information in decision making; emphasizing the importance of investment and investment announcements on the ownership, participation and management of IT such as websites, social media accounts and applications, as forms of good corporate governance; providing an overview of how investment in IT can be a means for companies to create added value by maintaining relationships with consumers, since the quality of the investment made for the management of company IT is very important considering that the digital economy will continue to grow and will not cease in the near future. As such, companies in Indonesia need to take advantage of this opportunity; providing benefits to assist policy making regarding the disclosure of company information on the implementation of investments, especially in the field of IT; providing benefits as additional information that digital change and transformation will continue to occur and accelerate, so that people can be prepared to adapt, accept, and support the course of digital transformation which is expected to facilitate the public in making transactions.

The theoretical implication of the study is the contribution made to the literature in the field of financial management, management information systems, and strategic management, namely corporate IT investment and its relation to the application of the Effective Market Hypothesis (EMH) in the capital market of Indonesia. This research is also expected to provide an adequate understanding on the application of signaling theory and single person decision theory.

LIMITATION

Considering that the research was carried out on data samples taken over a short period of time under the conditions of the global COVID-19 pandemic, the results were relatively influenced by external factors thus constituting one of the limitations in this study. Since this research is an event study that observes market reaction to the announcement of IT investment in Indonesia, another limitation should include limited sources of information regarding IT investment announcements for public companies in Indonesia. In determining the lag and lead periods used to calculate the corrected beta using only 2 lags and 2 leads, there is a limitation of information disclosed in announcements related to IT investments made by the company, hence it is not possible to measure the level of IT investment risk.

The limitations in this study are expected to present an opportunity for later researchers to make improvements and continue the enquiry. Future researchers should consider conducting studies over longer time periods given that 2019 and 2020 were the beginning of the global COVID-19 pandemic. It would also be more interesting if further research is in the form of observing market reactions to technology investment announcements on the post-pandemic period which has greatly affected the norms of human life which is induced to become more dependent on technology. Companies and policy makers should consider making announcements of IT investment mandatory, bearing in mind that technological developments will not stop and will continue to grow. Announcements on technology investments should be regarded as a form of corporate accountability to stakeholders, in the form of disclosing the company's efforts to continue to improve its performance which can provide benefits for its stakeholders. In addition, this may also make it easier for researchers to obtain company e-strategy data for research work.

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