Corporate bankruptcy: Evidence from the plastics and packaging industry in Indonesia

(ID) *Adita Nafisa* (a) (ID) *Helmi Muhammad* (b)* (ID) *Niki Puspita Sari* (c)

(a)*Head of Department of Management, Faculty of Economics and Business, Universitas Islam Raden Rahmat, Malang, 65163, Indonesia*
(b)*Senior Lecturer, Department of Sharia Economics, Faculty of Economics and Business, Universitas Islam Raden Rahmat, Malang, 65163, Indonesia*
(c)*Lecturer, Department of Management, Faculty of Economics and Business, Universitas Islam Raden Rahmat, Malang, 65163, Indonesia*

ARTICLE INFO

ABSTRACT

This study aims to analyze the bankruptcies of companies in the plastic and packaging industry listed on the Indonesian stock exchange. This analysis is essential to know the condition of the company's performance and in what position. The hope is to assist stakeholders in making the best decisions for sustainability. The positive contribution of the plastics and packaging industry in supporting economic growth in Indonesia, as well as the challenges of global issues regarding the negative impact of use, requires companies to avoid financial distress or bankruptcy. However, recent research argues that very few company management try hard to avoid the risk of bankruptcy. This type of quantitative descriptive research takes a sample of 10 companies selected purposively with predetermined criteria. Following the arguments of Altman (1983), the research analysis uses the Altman Z-Score for a sample of firms in one homogeneous industry. The results showed that, in general, the plastic and packaging industry was potentially vulnerable and had financial distress or went bankrupt, and there was only one healthy company. The results of this study also have an essential contribution for stakeholders to detect early on the company's financial condition and help make sound managerial decisions.

Introduction

Plastic has become a significant commodity on a global scale to fulfill aspects of human life (Brooks et al., 2018). Due to its significant diversity and advantages (companies can market effectively, design attractive packaging, distribute efficiently and economically around the world), the use of plastics in packaging has increased twenty-fold since the 1900s (Thompson et al., 2009). In addition, variations in chemical, mechanical properties and their application in everyday life, plastics are produced and used in large quantities worldwide and have become an important topic (Simon, 2019). Even its development efforts such as sustainable packaging design (Gustavo et al., 2018), development of new expertise in systems transformation, design and engineering (De los Rios & Charnley, 2017), procurement and life cycle assessment (Rezaei et al., 2019). All show that a world without plastic is inconceivable today, considering its significant functions and benefits for human life.

The use of plastic for packaging has increased significantly as a result of changes in people's lifestyles (Chaerul et al., 2014), encouraging the economic growth of a country. In Indonesia, based on data from the Ministry of Industry in 2017, at least 925 plastic companies were employing 37,327 people. Total production is 4.68 million tons per year, and demand has increased 5% in the last five years (Ministry of Industry of Republic of Indonesia, 2017). The packaging industry in Indonesia also grew by around 6% in 2020 from a value of Rp. 98.8 trillion (Indonesian Packaging Federation, 2020). However, the challenges for companies in this industry are enormous. The number of plastic and packaging companies listed on the Indonesian stock exchange in 2020 in 14 companies (17.5% of the industry), and the proportion of market capitalization is around 2.34% of the industry (Indonesia Stock Exchange, 2020). In addition, global issues related to the negative impact of using plastic also threaten the company's sustainability.

Brook et al. (2018) explained that 61% of waste in the global oceans comes from plastic packaging. Another study claims about 4.8-12.7 million tonnes of plastic accumulate in organisms that threaten marine ecosystems (Jambeck et al., 2015). Not to mention the demands of a circular economy that requires companies to elaborate on issues ranging from the quality of recycled materials to their acceptance of their use in new products (Simon, 2019).

Several global challenges and issues are sure to affect the company's performance. First, companies must maintain long-term financial performance to avoid financial distress or bankruptcy. Financial distress or company bankruptcy will hurt stakeholders such as banks, shareholders, investors, suppliers, and the community. Therefore, stakeholders are looking for optimal solutions to predict financial performance and rationalize the decision-making process through financial ratios. Furthermore, they are worried about the consequences of financial distress for the company. This interest creates inquiry and how to predict financial distress. Therefore, bankruptcy risk analysis becomes an exciting issue for stakeholders. Several research results form the basis of this issue that they are interested in predicting when the company will fail and how managerial decisions from the possibility of bankruptcy (Almamy et al., 2016; Buzgurescu & Elena, 2020; Ko et al., 2017; Sandin & Porporato, 2008). Technical accuracy of company predictions is carried out by assessing past situations, connecting with the future, and measuring company performance (Awwad & Razia, 2021). Buzgurescu & Elena (2020) explained that the analysis of bankruptcy through identifying several variables of economic and financial performance to make decisions in managerial risk situations.

Bankruptcy prediction has been a field of interest to researchers worldwide for the last 50 years. They have dedicated exploration of the company's failure prediction model with better accuracy since its introduction by Altman in 1968 (Kristóf & Virág, 2020; Shi & Li, 2019). The contribution of the researchers' exploration of the company's failure prediction model is of great benefit for world companies to take early action to prevent bankruptcy. However, in Indonesia, few companies are aware of the importance of predicting financial distress or bankruptcy analysis. Recent research argues that most companies restructure both internally and externally after bankruptcy. As a result, very few company management try hard to avoid the risk of bankruptcy (Tihar et al., 2021). However, this argument needs an in-depth study to prove it. This study analyzes the potential for bankruptcy of companies in the plastics and packaging industry to fill the existing gaps. The positive contribution of the plastics and packaging industry in supporting economic growth in Indonesia and the global challenges faced are the triggers for this research. The focus of the study is the analysis of the bankruptcy of plastic and packaging industrial companies listed on the Indonesian stock exchange. This analysis is essential to know the condition of the company's performance and in what position. The hope is that it can help stakeholders analyze and make the best decisions. In addition, management will receive an early warning about the company's condition so that it can adjust its strategy and operations. The Altman Z-Score model was used in this study because it proved to be a strong predictor for analyzing corporate bankruptcy and has been accepted worldwide for more than half a century (Ko et al., 2017; Niresh & Pratheepan, 2015).

Literature Review

Financial distress is ambiguous as there is no general agreement on its definition. Some studies define it as a bankruptcy case, such as the Altman study in 1968, while others see it as a failure or inability to pay obligations as they fall due (Arkan, 2015). Financial distress is also associated with bankruptcy, namely the company's inability to meet the debt, and there is no way to repay it. The company's assets are not sufficient to cover liabilities (Ross, 2008). Traditionally, financial distress uses financial ratios to warn that the company will face financial difficulties. Also, detect bankrupt status before filing for bankruptcy, violating creditor agreements, or undergoing a takeover by the government. In its development, predictions with statistical analysis have the same goal: observing trends and behavior of bankrupt companies' financial ratios, comparing them with healthy companies, and predicting their bankruptcy. Both are for early detection so that management can avoid company failure (Bernstein, 1993).

Altman in 1968 used multiple discriminant analysis, a model to predict financial distress in the manufacturing industry, namely the Altman Z-score. Altman Z-score examines several financial ratios simultaneously to predict the possibility of bankruptcy or financial distress. Altman examines several critical financial ratios such as liquidity, profitability, efficiency, and productivity based on the literature and its relationship with empirical research (Hotchkiss & Altman, 2013). Altman Z-score is the output of different financial ratios or variables in determining the possibility of financial distress or company bankruptcy (Altman et al., 2017). The coefficient estimation in the Altman Z-score formula uses a sample of companies in distress and good health according to the industry sector and market capitalization. The financial ratios in the Altman Z-score formula may vary according to the industry sector. The Altman Z-score summarizes valuable information from a company's balance sheet to assess a company's financial health and predict its probability of bankruptcy (Elliott et al., 2014).

In its development, the Altman Z-score model uses the manufacturing, non-manufacturing, and service sectors of the private sector (Elliott et al., 2014). Altman (1983) recommends a complete re-estimation of the model by revising the market value variable and replacing it with the book value of equity variable in X4. Using the same data, Altman extracted the Z-Score model (Altman et al., 2017). Altman (1983) stated that bankruptcy prediction would be ideal with a sample of firms in the same industry group. However, it is still possible to use a sample of companies from various industries. The results of previous studies strengthen this argument that the type of industry has a significant effect in analyzing financial distress (Smith & Liou, 2007). Altman Z-score has credible applications in various domains such as merger and investment activities, asset pricing and market efficiency, capital structure determination, credit risk pricing, etc (Agarwal & Taffler, 2007). Although in some fields, it requires detailed explanations such as

answers to questions about discrimination, underpinning theory (Taffler, 1982), generalizations (Grice & Ingram, 2001), and various gaps that require responses (Ko et al., 2017).

Development of Altman Z-Score dynamically such as linear discriminant and F-value analysis to reveal group statistical properties (Altman, 1973), principal component analysis to synthesize variables (Altman et al., 1974), logarithm analysis to reduce the possibility of outliers, stepwise analysis to rank the importance of variables, linear and quadratic analysis to validate classification (Altman et al., 1977), neural networks analysis for classification (Altman et al., 1994), aggregated and weighted rates analysis for pricing (Altman et al., 2005). Therefore, various industries around the world apply the Altman Z-score model to predict company bankruptcy. In fact, this model has played a major role because its reliability reaches 75-90% (Ko et al., 2017). Its role domains include merger and divestment activities, asset pricing and market efficiency, capital structure determination, credit risk pricing, bond and portfolio ratings (Agarwal & Taffler, 2007).

Research and Methodology

This research is a descriptive quantitative (Dulock, 1993). We employed the purposive method (Robinson, 2014) to select a sample of 10 plastic and packaging industrial companies listed on the Indonesia Stock Exchange. This study uses data from audited company financial statements (financial position and income statements) published for four years, 2017-2020. Data analysis used the revised Altman Z-Score model. Following Altman's (1983) argument, this model is appropriate for a sample of private firms in a homogeneous industry. This model is a reliable tool for assessing performance and predicting potential difficulties through several financial ratios, significantly predicting company solvency, company bankruptcy, and financial distress (Ko et al., 2017). The revised formula for the Altman Z-Score model is:

$$Z = 0.717 (X1) + 0.847 (X2) + 3.107 (X3) + 0.420 (X4) + 0.998 (X5)$$

where, $X1$ = *Working Capital/Total Assets*; $X2$ = *Retained Earnings/Total Assets*; $X3$ = *Earnings before Interest and Taxes/Total Assets;* $X4$ = *Market Value of Equity/Book Value of Total Liabilities;* $X5$ = *Sales/Total Assets*; Z = *Overall Index.*

The formula is to determine the discrimination zone with the provisions; if the index is less than 1.23, it indicates a financial distress condition, an index between 1.23 to 2.9 indicates a vulnerable condition (a grey area), and an index greater than 2.9 indicates a safe performance (Altman, 1983).

Findings and Discussions

This study uses the Altman Z-score model to predict financial distress or corporate bankruptcy. It uses the financial ratios in the Altman Z-score formula to determine the company's performance, and the Z-score index is the multiplied value of financial ratios with specific coefficients. Furthermore, this study will describe the company's performance from financial ratios and Z-score value and determine its position according to its determination.

Company Performance from Financial Ratios

The following is a presentation of the company's financial performance during the research period by calculating the components in financial ratios. The company's performance indicates the initial condition through these financial ratios, whether it is in good, moderate, or worrying condition. Altman (1968) explains that financial ratios have the potential as predictors of corporate bankruptcy. In general, financial ratios that measure profitability, liquidity, and solvency are significant indicators.

Working capital to total assets

Working capital to total assets (WCTA) measures liquid assets related to the firm size. Working capital simply means the difference between current assets and current liabilities, positive or negative. Good conditions if the company has positive working capital, which indicates its ability to pay off its short-term debt. WCTA is a measure of short-term financial health and efficiency. This ratio measures net liquid assets to overall capitalization. Companies with low working capital ratios are likely to experience operating losses that reduce working capital, which in relative terms, total assets will decrease. Compared to the current and quick ratios, this ratio is the most valuable in predicting bankruptcy and is significant both univariately and multivariable (Altman, 1968). The results of the calculation of the working capital to total assets ratio are:

Table 1: Working Capital to Total Assets of Sample Companies

No	Company Name	2017	2018	2019	2020
1	Argha Karya Prima Industry Tbk.	0.01521	0.00598	0.07479	- 0.03521
2	Asiaplast Industries Tbk.	0.13235	0.00119	0.08518	0.12432
3	Berlina Tbk.	0.03294	-0.00540	-0.07733	- 0.12616
4	Lotte Chemical Titan Tbk.	0.04856	0.06679	0.10409	0.17673
5	Champion Pacific Indonesia Tbk.	0.65360	0.60324	0.62941	0.69248
6	Impack Pratama Industri Tbk.	0.37812	0.37035	0.27812	0.24233
7	Indopoly Swakarsa Industry Tbk.	-0.00908	0.00855	0.04436	0.09380
8	Tunas Alfin Tbk.	0.24270	0.25863	0.22218	0.15385
9	Trias Sentosa Tbk.	0.06640	0.04203	0.02164	0.04108
10	Yanaprima Hastapersada Tbk.	-0.05770	0.01663	0.18856	0.24851

Source: Research result

Table 1 shows that, in general, the companies in the plastics and packaging industry are in good condition with a positive WCTA ratio indicator, except for only a few companies. In 2017 two companies had a negative WCTA ratio, namely PT. Indopoly Swakarsa Industry Tbk and PT. Yanaprima Hastapersada Tbk, in 2018 and 2019, there was one company, namely PT. Berlina Tbk, and in 2020 there will be two companies, namely PT. Argha Karya Prima Industry Tbk and PT. Berlina Tbk. A negative WCTA indicates the company's inability to pay off its short-term debt. It means that the company's operating costs are not efficient, thereby reducing working capital and total assets. WCTA is a vital liquidity ratio for an organization because it relates to cash and other current assets (Zeller et al., 1997). In this context, liquidity shows how long the company can fund all operations from its cash and current assets. The financial liquidity of companies in the plastics and packaging industry is an essential indicator Therefore, the assessing the success and failure of an organization.

Retained Earnings to Total Assets (X2)

Retained earnings are the total amount of profit reserved for business reinvestment or for specific purposes such as paying off debt or purchasing assets. The ratio of retained earnings to total assets (RETA) is related to the company's age. The assumption is that young companies, in general, have not been able to collect large amounts of retained earnings, so they tend to have a low RETA ratio. It means that companies with a younger age have a higher risk of bankruptcy than companies with older. A high RETA ratio implies that retained earnings finance total assets rather than using debt. The calculation of the ratio of retained earnings to total assets are as in table 2:

Table 2: Retained Earnings to Total Assets of Sample Companies

No	Company Name	2017	2018	2019	2020
1	Argha Karya Prima Industry Tbk.	0.11609	0.12391	0.15304	0.18473
2	Asiaplast Industries Tbk.	0.21028	0.11922	0.16602	0.15589
3	Berlina Tbk.	0.04410	0.03989	-0.00654	-0.07393
4	Lotte Chemical Titan Tbk.	-0.59396	-0.54805	-0.66773	-0.76873
5	Champion Pacific Indonesia Tbk.	0.45609	0.46191	0.48865	0.50975
6	Impack Pratama Industri Tbk.	0.32896	0.34469	0.34583	0.34466
7	Indopoly Swakarsa Industry Tbk.	0.20838	0.22166	0.24187	0.26579
8	Tunas Alfin Tbk.	0.27336	0.29854	0.23072	0.21548
9	Trias Sentosa Tbk.	0.29987	0.24805	0.25150	0.27191
10	Yanaprima Hastapersada Tbk.	0.06009	0.02809	0.04491	0.08138

Source: Research result

Table 2 indicates that, in general, the companies in the plastics and packaging industry are also in good condition. As with the condition of the WCTA ratio in table 4.1, the RETA ratio is generally favorable. It means that the company can generate retained earnings to finance its assets and demonstrate exemplary management efficiency. There are two companies with negative RETA ratios. Successively, in the last two periods, PT. Lotte Chemical Titan Tbk and PT. Berlina Tbk experienced a negative RETA ratio. This condition reflects that the two companies cannot generate retained earnings properly. As a manufacturing company, profit orientation from retained earnings is a priority. The goal is that the company's operations are well guaranteed (Gapenski & Reiter, 2016). The value of the RETA ratio is an indicator of the company's profitability in collecting income from its assets so that the company's operational continuity is maintained.

Earnings Before Interest and Taxes to Total Assets (X3)

Earnings before interest and taxes to total assets (EBITTA) is the ratio of the company's activities or operations. This ratio shows an indicator of the organization's effectiveness in using assets to generate income before liabilities such as interest and taxes (Murphy,

2021). As an activity ratio, EBITTA is also an indicator of the company's productivity in using its existing assets because the return on assets does not depend on the effect of taxes. Altman (1968) explains that the EBITTA ratio is relevant to assessing corporate bankruptcy. The basis used is the ability to generate profits by maximizing the benefits of the assets owned, which will determine the company's continuity. Data of the earnings before interest and taxes to total assets is in table 3.

Table 3: Earnings Before Interest and Taxes to Total Assets of Sample Companies

No	Company Name	2017	2018	2019	2020
1	Argha Karya Prima Industry Tbk.	0.03176	0.05162	0.05352	0.03782
2	Asiaplast Industries Tbk.	0.01294	-0.02678	0.06955	0.02092
3	Berlina Tbk.	-0.11410	-0.00862	-0.07047	-0.10567
4	Lotte Chemical Titan Tbk.	-0.01150	0.04372	-0.02615	-0.05238
5	Champion Pacific Indonesia Tbk.	0.18667	0.10829	0.13526	0.12490
6	Impack Pratama Industri Tbk.	0.04856	0.04956	0.05356	0.06506
7	Indopoly Swakarsa Industry Tbk.	0.01217	0.02615	0.02378	0.04438
8	Tunas Alfin Tbk.	0.03469	0.06182	0.02974	0.01941
9	Trias Sentosa Tbk.	0.01199	0.01829	0.00403	0.01097
10	Yanaprima Hastapersada Tbk.	-0.04908	-0.02811	0.01042	0.03663

Source: Research result

Table 3 above shows that companies with negative earnings before interest and taxes to total assets ratios every year in the study period. This condition reflects that the company cannot generate positive profits in utilizing its assets. It means that apart from the company being ineffective, it is also unproductive. In 2017, three companies had negative EBITTA ratios, namely PT. Berlina Tbk, PT. Lotte Chemical Titan Tbk and PT. Yanaprima Hastapersada Tbk. In 2018 there were also three companies with negative EBITTA, namely PT. Asiaplast Industries Tbk, PT. Berlina Tbk and PT. Yanaprima Hastapersada Tbk. In 2019 and 2020, there are two companies with negative EBITTA ratios, namely PT. Berlina Tbk and PT. Lotte Chemical Titan Tbk. The ratio means the company's worrying condition is PT Berlina Tbk, which always had a negative EBITTA ratio during the research period, was followed by PT Lotte Chemical Titan Tbk, which for the last two years is also harmful. Unlike the companies mentioned above, the other companies are in good condition. The indicator is a positive EBITTA ratio performance which means the company is in a productive condition, management performance is at a compelling point, able to cover operating expenses well and generate profits through its assets. This condition is relevant to the argument of Altman (1968), which explains that the performance of a positive EBITTA ratio is an indicator of a company's sustainability.

Market Value of Equity to Book Value of Total Liabilities

This ratio measures equity, which measures the company's net worth against its debt accumulation (Hotchkiss & Altman, 2013). This leverage ratio shows how much the company's assets can decrease concerning total liabilities before the company goes bankrupt. The book value of equity or net worth is obtained by looking at the difference between total assets and liabilities. Book value reflects the historical cost of a company's assets which is traditionally more predictable and less volatile in the long term than market value. A company's book value provides an overview of its financial health through its net assets with total liabilities. Companies with a higher percentage of net assets than total liabilities can cope with financial difficulties better than companies with net assets that are lower than their total liabilities. In this context, company equity is measured by the combined market value of all preferred and common stock shares, while accumulated debt includes both short-term and long-term debt. Altman (1968) explains that this ratio adds a market value dimension that most studies of corporate failure do not consider, making it a good indicator for assessing financial health. The calculation of the ratio of the market value of equity to book value of total liabilities are as in table 4 below:

Table 4: Market Value of Equity to Book Value of Total Liabilities

No	Company Name	2017	2018	2019	2020
1	Argha Karya Prima Industry Tbk.	0.69599	0.67181	0.81273	0.98760
2	Asiaplast Industries Tbk.	1.32457	0.68291	1.03011	1.02764
3	Berlina Tbk.	0.76722	0.83948	0.72845	0.63947
4	Lotte Chemical Titan Tbk.	0.99945	1.09909	1.49095	1.75527
5	Champion Pacific Indonesia Tbk.	7.25201	6.68634	6.65587	8.21214
6	Impack Pratama Industri Tbk.	1.28177	1.37501	1.28864	1.19064
7	Indopoly Swakarsa Industry Tbk.	1.24227	1.23948	1.43167	1.68120
8	Tunas Alfin Tbk.	4.94057	4.58736	3.14313	2.24568
9	Trias Sentosa Tbk.	1.45548	1.09273	0.99995	1.15861
10	Yanaprima Hastapersada Tbk.	0.72028	0.55521	0.77348	0.90872

Source: Research result

Table 4 above shows that all sample companies during the study period are in good health. The book value of the equity of all companies is positive, meaning that the percentage of the company's net assets is greater than the liabilities. In this case, the company can quickly pay its debt obligations, both short-term and long-term. Although it fluctuates, on average, the company with the highest market value of equity to book value of total liabilities ratio is PT. Champion Pacific Indonesia Tbk, followed by PT. Tunas Alfin Tbk, PT, PT. Indopoly Swakarsa Industry Tbk and PT. Impack Pratama Industri Tbk. However, other companies are also in a positive trend for Data Market Value of Equity to Book Value of Total Liabilities.

Sales to Total Assets

Sales to total assets are called the asset turnover ratio, a financial standard that describes the company's ability to utilize its assets to generate sales. The high value of sales to total assets indicates good management ability in facing business competition and effective use of productive capacity. Conversely, if it is low, it indicates that the company is not using its assets efficiently, so that there is the potential for financial difficulties to occur. This ratio is essential in assessing the company's financial condition. Altman (1968) suggested that this ratio has a strong relationship with other variables, so he included it in the model. The results of the calculation of the ratio of sales to total assets are as in table 5 below:

Table 5: Sales to Total Assets

No	Company Name	2017	2018	2019	2020
1	Argha Karya Prima Industry Tbk.	0.81233	0.73317	0.85978	0.78088
2	Asiaplast Industries Tbk.	0.81650	0.87045	1.04481	0.94045
3	Berlina Tbk.	0.66693	0.53603	0.53976	0.57158
4	Lotte Chemical Titan Tbk.	2.25869	2.21558	2.00295	2.07105
5	Champion Pacific Indonesia Tbk.	1.48517	1.36324	1.25736	1.11044
6	Impack Pratama Industri Tbk.	0.51992	0.58868	0.59803	0.66646
7	Indopoly Swakarsa Industry Tbk.	0.69124	0.72425	0.73235	0.70544
8	Tunas Alfin Tbk.	0.70132	0.75265	0.69571	0.69320
9	Trias Sentosa Tbk.	0.70657	0.61400	0.59004	0.70843
10	Yanaprima Hastapersada Tbk.	0.99686	1.24740	1.39492	1.09943

Source: Research result

Table 5 above shows that all companies have positive sales. This is because the company can utilize its productive assets to generate good sales. In this condition, the company's management effectively runs well to get a surplus income. For four years, PT. Lotte Chemical Titan Tbk has the highest sales to total assets ratio, followed by PT. Champion Pacific Indonesia Tbk and PT. Yanaprima Hastapersada Tbk. The success of plastic and packaging industry companies in maintaining positive sales affects other financial ratios. On average, the data on the ratio of sales to total assets shows a value above 0.5. It means that utilizing the company's productive assets in sales is at least one to two of the total assets. In other words, the company's sales achievement is at least twice the assets owned.

Analysis of Altman Z-Score Model

Altman Z-Score model serves to analyze financial distress or company bankruptcy. Early detection through this model to anticipate the company's financial distress. The management will efficiently conduct a comprehensive evaluation quickly on the company's condition for future improvements. The Altman Z-Score model uses several financial ratios to analyze the possibility of financial difficulties in a single formula that produces a Z-score index. The analysis of calculations using the Altman Z-score model for plastic and packaging industry companies during the 2017-2020 period are:

Table 6: Analysis of Altman Z-Score Model 2017-2020

No	Company Name	Z-Score			
		2017	2018	2019	2020
1	Argha Karya Prima Industry Tbk.	1.311	1.283	1.549	1.443
2	Asiaplast Industries Tbk.	1.684	1.174	1.893	1.656
3	Berlina Tbk.	0.694	0.891	0.565	0.358
4	Lotte Chemical Titan Tbk.	2.170	2.392	2.053	2.117
5	Champion Pacific Indonesia Tbk.	5.963	5.329	5.336	5.874
6	Impack Pratama Industri Tbk.	1.758	1.876	1.643	1.833
7	Indopoly Swakarsa Industry Tbk.	1.419	1.518	2.462	1.840
8	Tunas Alfin Tbk.	3.288	3.308	2.462	1.988
9	Trias Sentosa Tbk.	1.655	1.369	1.250	1.487
10	Yanaprima Hastapersada Tbk.	1.154	1.426	1.923	1.840

Source: Research result

Table 6 above is the result of the Z-Score calculation as recommended by Altman (1983). In 2017 two companies had very healthy finances, namely PT. Champion Pacific Indonesia Tbk and PT. Tunas Alfin Tbk, with a Z-Score above 2.9. Both showed excellent performance in terms of liquidity, profit, overcoming debt burden, and mobilizing productive assets. Meanwhile, six companies are in a worrying condition, with a Z-Score index between 1.23 to 2.9, and the other two companies are in a state of financial distress. The two companies are PT. Berlina Tbk and PT. Yanaprima Hastapersada Tbk. Both have been detected from their financial ratios, working capital to total assets and earnings before interest and taxes to total assets (see table 1), in terms of working capital, PT. Berlina Tbk experienced a minimal difference in current assets and current liabilities. Meanwhile, the ratio of earnings before interest and taxes to total assets is negative. It means that the company is very unproductive and unable to generate profits by maximizing the benefits of its assets. PT Yanaprima Hastapersada Tbk, even worse, experiences the condition, the ratio of working capital to total assets and the ratio of earnings before interest and taxes to total assets are all negative.

In 2018, two companies were in a healthy condition, namely PT. Champion Pacific Indonesia Tbk and PT. Tunas Alfin Tbk. As of 2017, the two companies have sufficient liquidity, effective management performance, and have good asset turnover with a Z-Score above 2.9. Six companies have a worrying financial condition—their Z-Score scores are between 1.23 to 2.9. Meanwhile, two other companies are in financial distress, namely PT. Berlina Tbk and PT. Asiaplast Industries Tbk. PT. Berlina Tbk in 2018 experienced a low level of liquidity with negative working capital to total assets ratio indicator. The negative value of the earnings before interest and taxes to total assets ratio exacerbates this condition—meanwhile, PT. Asiaplast Industries Tbk in 2017 was in a worrying condition, and in 2018 it experienced financial distress. In addition to tiny liquidity, it cannot generate positive profits.

Conditions in 2019 were very different from previous years. There is only one company in excellent condition, namely PT. Champion Pacific Indonesia Tbk. Meanwhile, eight companies are in a vulnerable condition. Although companies categorized as vulnerable have changed from previous years, this condition indicates that more and more companies have the potential to go bankrupt. What is interesting is the experience of PT. Tunas Alfin Tbk, which in 2017-2018 was in good health, 2019 began to experience financial distress. It is indicated by all financial ratios, which are decreasing. Apart from that, as in previous years, PT. Berlina Tbk is increasingly showing its bankruptcy. The Z-Score value is getting smaller. The first three financial ratios, liquidity, profitability, and activity, are harmful, and the leverage ratio and asset turnover are also tiny.

Conditions in 2020 are almost the same as in 2019. Only PT. Champion Pacific Indonesia Tbk has maintained financial health for the last four years. Companies engaged in manufacturing plastic products such as plastic bottles, disposable syringes, and cosmetics for the pharmaceutical, food, and cosmetic industries can maintain liquidity, earn profits, and be highly productive. Eight other companies are still in a worrying condition, including PT. Tunas Alfin Tbk is getting worse and closer to bankruptcy. Meanwhile, PT. Berlina Tbk really could not get up from financial distress and went bankrupt. An obvious indicator from all financial ratios and the Z-Score index during the 2017-2020 period is getting smaller in value.

The recapitulation of the Z-Score index of plastic and packaging industry companies during the 2017-2020 period is in table 7.

Table 7: Company Conditions During 2017-2020

No	Company Name	Zones of Discrimination (Z-Score)			
		2017	2018	2019	2020
1	Argha Karya Prima Industry Tbk.	Grey	Grey	Grey	Grey
2	Asiaplast Industries Tbk.	Grey	Distress	Grey	Grey
3	Berlina Tbk.	Distress	Distress	Distress	Distress
4	Lotte Chemical Titan Tbk.	Grey	Grey	Grey	Grey
5	Champion Pacific Indonesia Tbk.	Safe	Safe	Safe	Safe
6	Impack Pratama Industri Tbk.	Grey	Grey	Grey	Grey
7	Indopoly Swakarsa Industry Tbk.	Grey	Grey	Grey	Grey
8	Tunas Alfin Tbk.	Safe	Safe	Grey	Grey
9	Trias Sentosa Tbk.	Grey	Grey	Grey	Grey
10	Yanaprima Hastapersada Tbk.	Distress	Grey	Grey	Grey

Source: Research result

Table 7 provides an overview of the company's condition during the 2017-2020 period. Using the Z-Score, the actual condition is known, the conclusion through the company's existing financial ratios, liquidity, profitability, activity, leverage, and asset turnover. This condition illustrates the categorization of companies in the healthy (safe), worrying (grey), or bankrupt (distress) groups. This technique is in line with the argument of Awwad & Razia (2021) which states that the existing financial condition of the company is a basis for assessing future financial performance situations. The discrimination zone from the Z-Score calculation is of substantial value for stakeholders in rationalizing their managerial decision-making. In addition, This Z-Score method empirically works very well for assessing a company's financial performance and prediction of bankruptcy. This fact strengthens the results of research by Agarwal & Taffler (2007), Niresh & Pratheepan (2015), and Ko et al. (2017), which conclude about the reliability of Z-Score in

predicting financial distress or corporate bankruptcy. However, the empirical facts of this study contradict the arguments of other studies, which stated that the Altman Z-Score could not be used to predict corporate bankruptcy (Heaton, 2020).

The visualization of the discrimination zones for plastic and packaging industry companies during 2017-2020 also appears in the following graph:
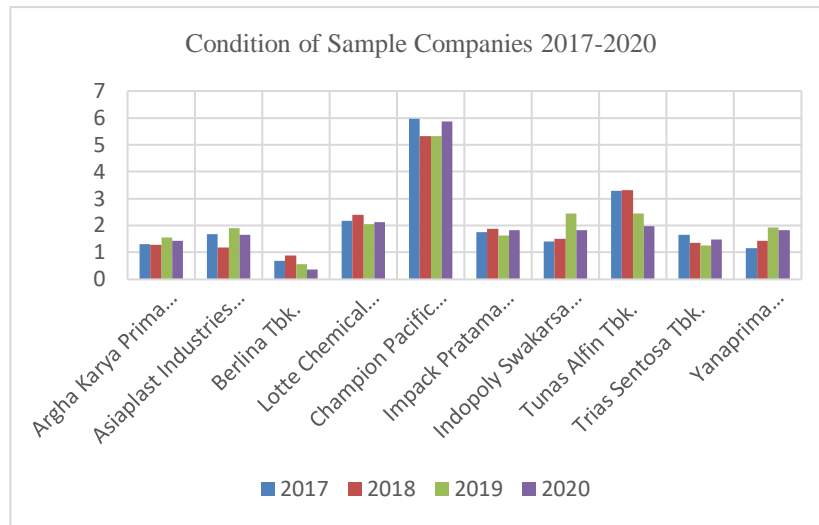

Figure 1: Discrimination Zone Graph

In general, the company's financial condition is very worrying and can go bankrupt. This phenomenon proves that the company's management does not pay attention to and ignores bankruptcy risk mitigation. Management also does not consider it important how to find out early financial distress that impacts bankruptcy. So, the results of this study strengthen the argument of Tihar et al., (2021), which states that many companies ignore the importance of predicting financial distress and do not mitigate the risk of bankruptcy.

Conclusions

The plastic and packaging industry has a significant contribution to the Indonesian economy. However, the challenges faced are enormous, including global issues related to the negative impact of using plastic that threatens the company's existence. Therefore, the study of the analysis of the potential for bankruptcy of the company is very relevant. Using the Altman Z-Score (1983), this study analyzes the bankruptcy of companies in the plastics and packaging industry listed on the Indonesian stock exchange for the period 2017-2020. The results showed that in 2017 there were two very healthy companies, namely PT. Champion Pacific Indonesia Tbk and PT. Tunas Alfin Tbk, six companies, are worrying, and two companies are in financial distress. In 2018, there were also two very healthy companies, namely PT. Champion Pacific Indonesia Tbk and PT. Tunas Alfin Tbk, six companies are vulnerable, and two companies are in financial distress (bankrupt). In 2019 there was one healthy company, namely PT Champion Pacific Indonesia Tbk; eight companies are in a worrying condition, including PT Tunas Alfin Tbk, which was in good health two years earlier. One company was in financial distress. In 2020 there will be one healthy company, namely PT. Champion Pacific Indonesia Tbk, eight companies are vulnerable, and one company is in financial distress. PT. Berlina Tbk is a company that has experienced financial distress (bankrupt) for four consecutive years. The implications of this research are essential for stakeholders (e.g., management, investors, banks, and the wider community) to detect early on the company's financial condition. In addition, it helps analyze and make the best managerial decisions to adjust its strategy and operations. Further research on bankruptcy prediction analysis using alternative models such as Springate is precious to complete the treasures of the findings of this study; what are the similarities and differences in the findings. In addition, the development of the Altman Z-Score model through the addition of financial ratios such as cash flow can be considered.

References

Agarwal, V., & Taffler, R. J. (2007). Twenty-five years of the Taffler z-score model: Does it really have predictive ability? *Accounting and Business Research*, *37*(4), 285–300. https://doi.org/10.1080/00014788.2007.9663313

Almamy, J., Aston, J., & Ngwa, L. N. (2016). An evaluation of Altman's Z-score using cash flow ratio to predict corporate failure amid the recent financial crisis: Evidence from the UK. *Journal of Corporate Finance*, *36*, 278–285. https://doi.org/10.1016/j.jcorpfin.2015.12.009

Altman, E. I. (1968). Financial Ratios, Discriminant Analysis And The Prediction Of Corporate Bankruptcy. *The Journal of Finance*, *23*(4), 589–609. https://doi.org/10.1111/j.1540-6261.1968.tb00843.x

Altman, E. I. (1973). Predicting Railroad Bankruptcies in America. *The Bell Journal of Economics and Management Science*, *4*(1), 184. https://doi.org/10.2307/3003144

Altman, E. I. (1983). *Corporate financial distress: A complete guide to predicting, avoiding, and dealing with bankruptcy*. Wiley.

Altman, E. I., Brady, B., Resti, A., & Sironi, A. (2005). The Link between Default and Recovery Rates: Theory, Empirical Evidence, and Implications*. *The Journal of Business*, *78*(6), 2203–2228. https://doi.org/10.1086/497044

Altman, E. I., Haldeman, R. G., & Narayanan, P. (1977). ZETATM analysis A new model to identify bankruptcy risk of corporations. *Journal of Banking & Finance*, *1*(1), 29–54. https://doi.org/10.1016/0378-4266(77)90017-6

Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial Distress Prediction in an International Context: A Review and Empirical Analysis of Altman's Z- Score Model. *Journal of International Financial Management & Accounting*, *28*(2), 131–171. https://doi.org/10.1111/jifm.12053

Altman, E. I., Marco, G., & Varetto, F. (1994). Corporate distress diagnosis: Comparisons using linear discriminant analysis and neural networks (the Italian experience). *Journal of Banking & Finance*, *18*(3), 505–529. https://doi.org/10.1016/0378-4266(94)90007-8

Altman, E. I., Margaine, M., Schlosser, M., & Vernimmen, P. (1974). Financial and Statistical Analysis for Commercial Loan Evaluation: A French Experience. *The Journal of Financial and Quantitative Analysis*, *9*(2), 195. https://doi.org/10.2307/2330096

Arkan, T. (2015). Detecting Financial Distress with the b-Sherrod Model: A Case Study. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki Finansowe, Ubezpieczenia*, *nr 74 T.2 Mierzenie i ocena wyników przedsiębiorstw*, 233–244. https://doi.org/10.18276/frfu.2015.74/2-21

Awwad, B., & Razia, B. (2021). Adapting Altman's model to predict the performance of the Palestinian industrial sector. *Journal of Business and Socio-Economic Development*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/JBSED-05-2021-0063

Bernstein, L. A. (1993). *Financial statement analysis: Theory, application, and interpretation* (5th ed). Irwin.

Brooks, A. L., Wang, S., & Jambeck, J. R. (2018). The Chinese import ban and its impact on global plastic waste trade. *Science Advances*, *4*(6), eaat0131. https://doi.org/10.1126/sciadv.aat0131

Buzgurescu, O. L. P., & Elena, N. (2020). Bankruptcy Risk Prediction in Assuring the Financial Performance of Romanian Industrial Companies. In S. Grima, E. Özen, & H. Boz (Eds.), *Contemporary Studies in Economic and Financial Analysis* (pp. 19–28). Emerald Publishing Limited. https://doi.org/10.1108/S1569-375920200000104003

Chaerul, M., Fahruroji, A. R., & Fujiwara, T. (2014). Recycling of plastic packaging waste in Bandung City, Indonesia. *Journal of Material Cycles and Waste Management*, *16*(3), 509–518. https://doi.org/10.1007/s10163-013-0201-2

De los Rios, I. C., & Charnley, F. J. S. (2017). Skills and capabilities for a sustainable and circular economy: The changing role of design. *Journal of Cleaner Production*, *160*, 109–122. https://doi.org/10.1016/j.jclepro.2016.10.130

Dulock, H. L. (1993). Research Design: Descriptive Research. *Journal of Pediatric Oncology Nursing*, *10*(4), 154–157. https://doi.org/10.1177/104345429301000406

Elliott, R. J., Siu, T. K., & Fung, E. S. (2014). A Double HMM approach to Altman Z-scores and credit ratings. *Expert Systems with Applications*, *41*(4), 1553–1560. https://doi.org/10.1016/j.eswa.2013.08.052

Gapenski, L. C., & Reiter, K. L. (2016). *Healthcare finance: An introduction to accounting & financial management* (Sixth edition). Health Administration Press ; Association of University Programs in Health Administration.

Grice, J. S., & Ingram, R. W. (2001). Tests of the generalizability of Altman's bankruptcy prediction model. *Journal of Business Research*, *54*(1), 53–61. https://doi.org/10.1016/S0148-2963(00)00126-0

Gustavo, J. U., Pereira, G. M., Bond, A. J., Viegas, C. V., & Borchardt, M. (2018). Drivers, opportunities and barriers for a retailer in the pursuit of more sustainable packaging redesign. *Journal of Cleaner Production*, *187*, 18–28. https://doi.org/10.1016/j.jclepro.2018.03.197

Hotchkiss, E., & Altman, E. I. (2013). *Corporate financial distress and bankruptcy: Predict and avoid bankruptcy, analyze and invest in distressed debt*. Wiley. http://rbdigital.oneclickdigital.com

Indonesia Stock Exchange. (2020). *IDX Statistics 2020*. https://www.idx.co.id/media/9628/idx_annually-statistic_2020.pdf

Indonesian Packaging Federation. (2020). *Packaging Industries in Indonesia*. https://packindo.org/2019/04/08/packaging-in-indonesia/

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., Narayan, R., & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, *347*(6223), 768–771. https://doi.org/10.1126/science.1260352

Ko, Y.-C., Fujita, H., & Li, T. (2017). An evidential analysis of Altman Z -score for financial predictions: Case study on solar energy companies. *Applied Soft Computing*, *52*, 748–759. https://doi.org/10.1016/j.asoc.2016.09.050

Kristóf, T., & Virág, M. (2020). A Comprehensive Review of Corporate Bankruptcy Prediction in Hungary. *Journal of Risk and Financial Management*, *13*(2), 35. https://doi.org/10.3390/jrfm13020035

Ministry of Industry of Republic of Indonesia. (2017). *Kemenperin: Pengembangan Industri Plastik dan Karet Hilir Prospektif*. https://kemenperin.go.id/artikel/18225/Pengembangan-Industri-Plastik-dan-Karet-Hilir-Prospektif

Niresh, J., & Pratheepan, T. (2015). *The Application of Altman's Z-Score Model in Predicting Bankruptcy: Evidence from the Trading Sector in Sri Lanka* (SSRN Scholarly Paper ID 2698532). Social Science Research Network. https://papers.ssrn.com/abstract=2698532

Rezaei, J., Papakonstantinou, A., Tavasszy, L., Pesch, U., & Kana, A. (2019). Sustainable product-package design in a food supply chain: A multi-criteria life cycle approach. *Packaging Technology and Science*, *32*(2), 85–101. https://doi.org/10.1002/pts.2418

Robinson, R. S. (2014). Purposive Sampling. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 5243–5245). Springer Netherlands. https://doi.org/10.1007/978-94-007-0753-5_2337

Ross, S. A. (Ed.). (2008). *Modern financial management* (8. ed., [internat. student ed.]). McGraw-Hill Irwin.

Sandin, A. R., & Porporato, M. (2008). Corporate bankruptcy prediction models applied to emerging economies: Evidence from Argentina in the years 1991-1998. *International Journal of Commerce and Management*, *17*(4), 295–311. https://doi.org/10.1108/10569210710844372

Shi, Y., & Li, X. (2019). A bibliometric study on intelligent techniques of bankruptcy prediction for corporate firms. *Heliyon*, *5*(12), e02997. https://doi.org/10.1016/j.heliyon.2019.e02997

Simon, B. (2019). What are the most significant aspects of supporting the circular economy in the plastic industry? *Resources, Conservation and Recycling*, *141*, 299–300. https://doi.org/10.1016/j.resconrec.2018.10.044

Smith, M., & Liou, D. (2007). Industrial sector and financial distress. *Managerial Auditing Journal*, *22*(4), 376–391. https://doi.org/10.1108/02686900710741937

Taffler, R. J. (1982). Forecasting Company Failure in the UK Using Discriminant Analysis and Financial Ratio Data. *Journal of the Royal Statistical Society. Series A (General)*, *145*(3), 342. https://doi.org/10.2307/2981867

Thompson, R. C., Swan, S. H., Moore, C. J., & vom Saal, F. S. (2009). Our plastic age. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1526), 1973–1976. https://doi.org/10.1098/rstb.2009.0054

Tihar, A., Sari, I. P., & Handoko, B. L. (2021). Effect of Debt Default, Disclosure, and Financial Distress on the Receiving of Going Concern Audit Opinions. *The Winners*, *22*(2). https://doi.org/10.21512/tw.v22i2.7072

Zeller, T. L., Stanko, B. B., & Cleverley, W. O. (1997). A new perspective on hospital financial ratio analysis. *Healthcare Financial Management: Journal of the Healthcare Financial Management Association*, *51*(11), 62–66.