The Effect of Technology and Company Characteristics on Firm's Survival: Case Study of Indonesian Manufacturing Industry

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A B S T R A C T

Facing globalization and industrial revolution 4.0 requires companies to continue innovation to maintain their existences. Innovation can be carried out well if the company can absorb and apply the latest technology to increase the efficiency of its business. Firms that are unable to adapt to technology will not be able to compete with their counterparts. Therefore, this research was conducted to see the effect of technology, the firm's characteristics (size and location), and productivity (productivity and company profit) on the firm's survival. Using logistic regression, this study shows that technology, the firm's size, and productivity have a significant positive effect on the firm's survival. The location has a significant negative impact on the firm's survival, and profit does not significantly affect the firm's survival. The Hosmer and Lemeshow Test show that the model used in this study is fit for estimating all variables.

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INTRODUCTION

Economic globalization and liberalization have brought rapid changes and have had a broad impact on the economy, both at the national and international levels. The impact of globalization has been very strong since the organization of agreements between countries, both bilateral and multilateral, in the form of free trade agreements (free trade areas), free entry visas, and other agreements. Globalization can facilitate the exchange of information technology, mobility of human resources, distribution of goods and services, and etc. It impacts increasingly tighter competition in various economic activities, especially in the manufacturing industry sector (Sutopo, 2011).

Globalization and liberalization occurring in the industrial sector require producers to maintain their existence through ever-evolving technology. It is undeniable that in this era of industrial revolution 4.0, technology has become the main motor in driving the company's existence (Doms et al., 1995; Agarwal and Audretsch, 2001; Silalahi, 2014). Audretsch (1991) asserts that the resilience of new companies is influenced by innovation due to accelerated technology used in the production process. Apart from technology, several other factors such as company size (Dunne and Hughes, 1994; Geroski, 1995; Disney et al., 2003; Pérez, 2004; and Febriani, 2016), location (Stearns et al., 1995), productivity (Wulandari, 2012)) and company behavior also affects the existence of a company. Changes in the behavior and orientation of stakeholders referred to above are that companies can better adapt to the industrialization process, which continues to develop the optimal profit.

Compared to small firms, large firms have better access to the capital or labor market, which in turn increases their chances of survival (Pérez, 2004). It means that the firm's size positively affects its survival—the bigger firm, the greater opportunity for the company to survive. In line with this, the firm's location also affects the firm's survival. It is related to the existence of supporting facilities to support the production process. Firms located inside industrial estates are thought to be more survive than the firms located outside industrial estates because the facilities offered by industrial estates are completed and integrated.

The company's productivity is in line with the level of efficiency. Companies that can carry out their activities more efficiently will be more resilient than other companies. An efficient production process can minimize existing resources to produce certain outputs to increase competitiveness with other companies. Meanwhile, the relationship between the profit and the firm's survival can be explained as the same as the productivity variable. Companies with high productivity will also have high competitiveness so that the resulting profit is also greater-the bigger the profit, the more resilient the company itself.

The manufacturing industry has a significant role in the Indonesian economy. In 2019, the added value of the manufacturing industry was recorded at 3,119.6 trillion rupiahs or contributed to the economy by 20 percent, followed by the trade sector (13 percent) and agriculture (12 percent). In terms of employment, the manufacturing industry can absorb a workforce of 14 percent. It means that of the entire population working in Indonesia, 14 percent or as many as 17 million workers are absorbed in the manufacturing industry. So it is not surprising that the position of the manufacturing industry is considered strategic enough to improve the country's economy and expand employment.

Over the last few years, the performance of the manufacturing industry has been quite encouraging. Nominally, there is an increase in the added value produced. However, there was a decrease in the number of large and medium scale
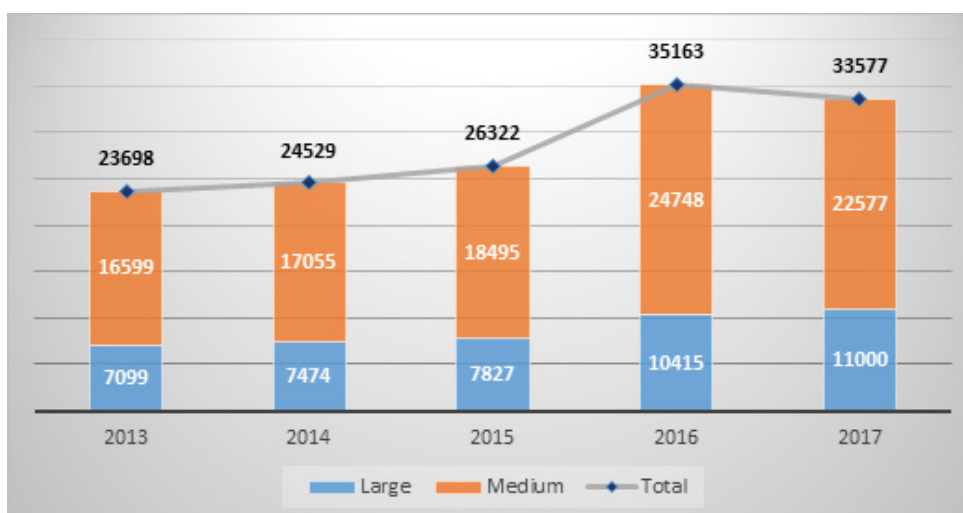
Figure 1.
Number of Large and Medium Scale Companies in the Manufacturing Industry,
2013-2017

manufacturing industrial companies in 2017 (Figure 1). If examined more deeply, there was an increase in the number of large-scale companies in 2017 by 5.65 percent compared to 2016. Meanwhile, the number of medium-scale companies decreased by 8.77 percent. Logically, several reasons that can explain the decline in the number of medium-scale companies are first, the possibility of several companies changing to a large scale or downgrading to a small scale. The second reason is that the company has changed its business field outside the manufacturing industry. The third reason could be that the company is no longer carrying out the production process for various reasons.

Based on the introduction above, it is important to discuss the factors that affect the manufacturing firm's survival in Indonesia, emphasizing technological factors because technology is the main motor driving industrial manufacturing activities. Apart from technology, several factors considered to play an important role in manufacturing firm's survival in Indonesia include firm's size, location, productivity, and profits. A simple binary logistic regression method is used to analyze the firm's survival and the factors that influence it.

METHODOLOGY

This study uses qualitative analysis techniques using secondary data based on individual companies sourced from the Large and Medium Industries Survey by the Badan Pusat Statistik (BPS). The number of companies became the research sample was 23,345 of large and medium scale companies engaged in the manufacturing industry sector. The scope of the company is all large-medium scale manufacturing companies in Indonesia. The research period is 2010-2015, where 2010 is considered the initial year of research and 2015 as the final year of the research.

The analytical method used in this research is binary logistic regression analysis. Binary logistic regression analysis is used to explain the relationship between response variables in the form of dichotomic or binary data and independent variables in nominal scale data (Harlan, 2018). The value of the dependent variable (Y) can be differentiated into categories with Y = 1 (success) and Y = 0 (failure) and will follow the Bernoulli distribution for each observation. This model can be used to analyze firm's survival as in the research of Audretsch (1991) and Wulandari (2012).

The dependent variable used in the

study is the dummy variable of the firm's survival (Y). The firm's survival variable is defined as a company/industry that still exists (in the sense that it is still carrying out the production process) until the end of the observation period, namely 2015. Companies that still exist in 2015 are assessed with the dummy variable 1, while companies that no longer exist in 2015 set with a dummy variable 0.

Meanwhile, the independent variables used in the firm's survival analysis are **(1) Technology**, in this study, technology is described by the electric power used by the company in its production process. The technology variable is a dummy variable with a value of 0 if the electricity used (Kwh) is less or same as the average value of electricity usage for all samples and a value of 1 if the electricity used (Kwh) is more than the average value of electricity usage for all samples. **(2) Firm's size**, in this study, the firm's size is represented by the number of workers. The firm's size is described by a dummy variable where the value is 0 for the medium-scale industry with the number of workers is less than 20 people, and others are 1 for the large-scale industry with the number of workers is more than 20 people. **(3) Productivity**, productivity describes the efficiency of the company in carrying out the production process. In this study, the productivity is calculated from the output divided by the number of workers. Furthermore, the productivity variable is made into a dummy variable with a value of 0 if the output per worker is less than the average of all firms. On the contrary, 1 for the output per worker is more than the average. **(4) Firm's location** is a dummy variable with value of 1 if companies located inside the industrial estate, and value of 0 if others. **(5) Profit** is defined as the gain or the difference between the output value and the input value. In other words, profit is the company's value-added. In this study, profit is calculated using the formula for the output value mi-

nus the input value. Furthermore, profit is made into a dummy variable with a value of 0 if the company's profit is less than the same as the average profit of the whole company and 1 if the profit is more than the average.

The binary logistic regression model used in this study is as follows:

$$Logit(Y) = \beta_0 + \beta_1 Tech + \beta_2 Size + \beta_3 Loc + \beta_4 Prod + \beta_5 Profit$$

Where Y is the dummy firm's survival. Meanwhile, Tech is the use of technology, Size is the firm's size, Loc is the firm's location, Prod is the firm's productivity, and Profit is the profit of the company.

The Hosmer and Lemeshow Test is a Goodness of fit test (GoF), which is a test to determine whether the model formed is correct or not. It is said right if there is no significant difference between the model and its observation value. Thus the arrangement of the null hypothesis and the alternative hypothesis is as follows:

H_0 : The firm's survival model is fit
H_1 : The firm's survival model is not fit

The H_0 decision is not rejected if the statistical value of the Hosmer and Lemeshow test is greater than the value of the Chi-square table with the degree of freedom is equal to a number of independent variables. The decision to reject or not reject H_0 can also be seen by comparing the p-value with the alpha error rate. Reject H_0 if p-value < alpha.

The next step after the GoF test is the Wald partial test, namely testing for the parameter coefficient β. Wald test is used to see the significance of the effect of independent variables on the dependent variable. Thus the arrangement of the null hypothesis and the alternative hypothesis is as follows:

$H_0 : \beta_j = 0$
$H_1 : \beta_j \neq 0$

The decision H_0 is rejected if the p-value of the Wald test statistical value is smaller than the alpha error rate. If H_0 is rejected, the independent variable has a significant

effect on the dependent variable.

RESULT AND DISCUSSION

Table 1 shows that the percentage of companies that still exist in 2015 was 16.8 percent and companies that no longer existed in 2015 were 83.2 percent. The number of companies that no longer exist in 2015 requires further analysis. Companies that no longer exist are likely to be caused by at least three things, namely (1) the company decided to shut down its production activities, (2) the company switched its main business field, and (3) the company expanded its business so that the company's identity was different compared to that at the beginning of the observation, namely the year 2010.

For the technology variable, as many as 93.5 percent of the medium-scale manufacturing industries have used sufficient technology to support their production process. Only 6.5 percent still use low-average technology. As many as 81.9 percent of medium-scale companies have a worker of less than 20 people, while the remaining 18.1 percent are large-scale companies with a worker of 20 people or more. In terms of productivity, most companies also have low-average productivity. It means that most of the manufacturing companies in Indonesia in 2010 had a level of efficiency that had not yet reached optimal levels. It is probably because several companies in Indonesia are still implementing labor-intensive systems.

As much as 65.3 percent of manufacturing industries in Indonesia are located outside industrial estates, and the remaining 34.7 percent are located inside industrial estates. The profit variable shows an unexpected result that almost all manufacturing industrial companies in Indonesia generate profits below the average. It indicates that there is an imbalance between large and medium-scale manufacturing industries in Indonesia. There are only a few companies that dominate the economy. It can be seen that from the variable indicators of company size, productivity and profit, there are only a few companies that have achieved above-average achievement.

Table 1.
Percentage of Dependent and Independent Variables

Variables	Percentage
Firm's Survival Status	
Survive	16,8
Other	83,2
Use of Technology	
Equal or less than average	6,5
More than average	93,5
Firm's Scale	
Medium (Worker < 20)	81,9
Large (Worker ≥ 20	18,1
Firm's Location	
Outside industrial estate	65,3
Inside industrial estate	34,7
Productivity	
Equal or less than average	87,1
More than average	12,9
Profit	
Equal or less than average	99,9
More than average	0,1

Note: The results of data processing using SPSS.

The results of the Hosmer and Lemeshow Test show that the Hosmer and Lemeshow value is 2.302 less than the Chi-Square table 7,814 or a significance value of 0.512 (more than 0.05) so that the decision accepts H0, which indicates that the firm's survival model is fit or acceptable and testing hypothesis can be made because there is no significant difference between the model and its observation value.

To see the ability of the independent variable in explaining the dependent variable, the values of Cox & Snell R Square and Nagelkerke R Square are used as in table 3 below. These values are also called the Pseudo R-Square or if the linear regression (OLS) is better known as the R-Square. The Nagelkerke R Square value is 0.042, and Cox & Snell R Square is 0.025, which indicates that the ability of the independent variable to explain the dependent variable is 0.042 or 4.2%, and there are 100% - 4.2% = 95.8% other factors outside the model explaining the dependent variable. However, the overall percentage value is 83.2 percent, which means that the accuracy of this research model is quite good.

Logistic regression equation, the results of data processing using SPSS 20 are as follows:

$$Ln\left(\frac{P}{1-P}\right) = -2,201 + 1,130\ Size + 0,618\ Productivity -$$
$$0,909\ Profit + 0,164\ Technology - 0,075\ Location$$

$$\left(\frac{P}{1-P}\right) = 0,111 + 03,097\ Size + 1,855\ Productivity +$$
$$0,403\ Profit + 1,178\ Technology + 0,928\ Location$$

Partial parameter testing follows the following hypothesis:

H_0 = The constant variables, technology, firm's size, location, productivity, and profit have no effect on the firm survival.

H_1 = Constant variables, technology, firm's size, location, productivity, and profit affect the firm survival.

Based on table 4 below, it can be seen that the significance value for each of the independent variables is less than alpha (0.05) except for the profit variable with a significance value of 0.260, which is greater than alpha (0.05). Thus the decision is to reject H_0 for the constant variables, technology, size, location, and productivity. Conversely, the decision accepts H_0 for the profit variable. This means that

Tabel 2.
Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	2.302	3	.512

Note: The results of data processing using SPSS.

Tabel 3.
Output SPSS Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	20546.038[a]	.025	.042

Note: a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Tabel 4.
Parameter Estimation Results in Binary Logistic Regression

Variabel	B	S.E.	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Constant	-2,201	0,807	1	0,006	0,111		
Tech	0,164	0,068	1	0,016	1,178	1,031	1,347
Size	1,130	0,067	1	0,000	3,097	2,716	3,531
Loc	-0,075	0,038	1	0,046	0,928	0,862	0,999
Prod	0,618	0,068	1	0,000	1,855	1,623	2,120
Profit	-0,909	0,806	1	0,260	0,403	0,083	1,956

Note: B = parameter coefficient, S.E. = standard error, df = degree of freedom, Sig. = level of significance, Exp (B) = coefficient of odds ratio.

the variables constant, technology, firm's size, location, and productivity have a significant effect on the firm survival. In contrast, the profit variable does not have a significant impact on the firm's survival.

The interpretation of the parameter coefficient can be seen from the Odd Ratio or Exp (B) value in table 4 above. Large companies are 3.097 times more likely to be survive than medium-sized companies. The productivity variable has an odds ratio of 1.855, which means that companies with high-average productivity will have a chance of being 1.855 more survive than companies with low-average productivity levels. The technology variable's odds ratio value is 1.178, which means that companies with above-average technology (high technology) have the opportunity to be 1.178 percent more survive than companies with low levels. Finally, the firm's location variable with an odds ratio value of 0.928 means that companies located in industrial estates are 0.928 more survive than companies located outside industrial estates. It is implied that companies located outside industrial estates are more resilient than companies located inside industrial estates. In this case, the function of industrial estates is not sufficient to support a more efficient production process since the legal rules regarding Industrial Estates has only been realized since 2015, namely Government Regulation No. 42 About Industrial Estates.

CONCLUSIONS

This study used binary logistic regression analysis to analyze the firm's survival in the Indonesian manufacturing industry during 2010-2015. The results of processing on a sample of 23,345 companies show that the variables of a firm's size, productivity, and technology have a significant positive effect on the firm's survival. Meanwhile, the firm's location has a significant adverse effect on the firm's survival.

However, this study has limitations. The limitation of this study is methodological. The companies as the research object are still active in the early 2010 period and the end of 2015 period, so it does not take into account the companies that may appear in the 2010 to 2015 period. Those which unable to survive the observation period cannot be explored any deeper. It could be that the company in 2015 was not found compared to 2010 because the company changed its business scale, changed its business field, etc., so that the company identity number was different, not because the company was closed or temporarily not operating. For further research, it is expected to accommodate the limitations of this study.

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