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The Performance of Indonesian Businesses during Covid-19 Pandemic: Do Technological Dependence and Tax Incentives Matter?

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Abstract

No previous study in emerging economies has investigated the impact of technological dependence on business performance during the Covid-19 pandemic. Moreover, no detailed analysis has been conducted to study the link between the utilisation of tax incentives and business performance during these unprecedented times. Based on nationwide survey data comprising 12,361 Indonesian businesses, this study examines the association between technological dependence, tax incentives, and business performance. This paper reveals strong empirical evidence indicating information technology and tax incentives have facilitated Indonesian businesses to be more resilient during the pandemic. While demonstrating the role of tax incentives in supporting business resiliency, the finding implies that the Indonesian government needs to accelerate the expansion of digital infrastructure across the nation and encourage nontechnology-based businesses to reap the benefit of adopting information technology. These results can be used to compare with those from other emerging economies or developed countries.

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1. INTRODUCTION

The role of information technology (IT) as a company's key success factor has become a topic of debate among researchers (Breznik, 2012). This is indicated by the existence of some research results that support IT is a source of competitive advantage for a company. Other studies have shown that IT is not a source of competitive advantage. This is because the adoption of IT is not necessarily under the concept of competitive advantage, namely the existence of uniqueness. On the other hand, some studies conclude that information technology investment harms company performance (Breznik, 2012).

A study conducted in South Africa found that disruptive technology has an impact on the success of micro-small-medium-enterprises (MSMEs) (Chishakwe & Smith, 2012). The reason is technology has changed the way a business operates. The results of this study are in line with prior research results which show the presence of IT in creating a competitive advantage both in terms of cost and differentiation (Porter & Millar, 1985). Several studies have highlighted the benefit of the adoption of information technology for the performance of large businesses (Kneller & Timmis, 2016; Bertschek & Niebel, 2016; Fernandes et al., 2019). In particular, the use of information technology has been linked to increased labour productivity and company growth (Clarke et al., 2015).

The adoption of information technology has the potential to maintain business performance. Tzokas et al (2015) concluded that the company's ability to recognize new information, then assimilate that information, and apply it to increase commercial goals—commonly referred to as absorption capacity—leads to better performance in terms of new product development, performance market, and profitability. Unfortunately, little evidence is available concerning the role of information technology in a sustainable competitive advantage in emerging economies.

Competitive advantage is not only necessary in business-as-usual conditions. In the time of the pandemic, a sustainable competitive advantage can be a determining factor for businesses in dealing with the declines caused by the pandemic. However, there are no studies that show whether this sustainability will continue during times of crisis such as the Covid-19 pandemic where shocks hit the global economy. Therefore, the goal of this study is to provide some empirical evidence on the fundamental question as to the impact of technological dependence in supporting businesses' resiliency during the pandemic.

By using the level of use of information technology as an indicator of a company's competitive advantage, this study attempts to shed some light on whether the use of information technology plays a vital role in businesses performance in Indonesia. In this sense, an official report by Statistics Indonesia (2020) stated that accommodation and food and service activities is the most affected sector by Covid-19 in 2020. This report also suggested that, regionally, businesses in Bali were suffered the most during the pandemic. Another official report by the Indonesian Central Bank also confirmed that the province with the lowest decline in economic growth in 2020 was Bali with -12.32% (Bank Indonesia, 2021).

For those reasons, this paper particularly seeks to investigate the role of technological dependency and the performance of Indonesian businesses particularly during the Covid-19 pandemic. In addition, to mitigate the economic impact of the Covid-19 pandemic, the Indonesian government launched the National Economy Recovery Program (PEN). This is a government response to the severe economic impact of social activity restrictions, as part of nonpharmacological interventions during the pandemic. Among this program was the provision of tax incentives for businesses. These include Government-borne Income Tax Article 21 (DTP), Article 22 Import Income Tax Exemption, 50% reduction in instalments of Income Tax Article 25, and

Acceleration of VAT refunds. To the best of the authors' knowledge, no prior research has examined whether and to what extent technological dependence and the utilisation of tax incentives facilitate business resiliency during the pandemic. Thus, this motivates us to place technological dependence and tax incentives participation as two central variables under investigation.

The overarching aims of this paper can be reflected in three broad research questions. First, what are the relationships between technological dependency, business performance, and types of major business hindrances faced by businesses during the pandemic? Second, is there a main effect for technological dependency? That is, do firms in various categories of technological dependency differ significantly in terms of sales and profit, and which group is better than the other during the pandemic? Third, is there a main effect for utilising tax incentives? That is, do firms utilising and not utilising tax incentives differ significantly in terms of sales and profit, and which group is better than the other during the pandemic?

Our empirical findings suggest that there are significant differences in businesses' performance based on their levels of technological dependence and their status of tax incentives utilisation. We found that business performance is better for highly technology-based entities and those that used tax incentives. Our results indicate that business performance is positively correlated with businesses' reliance on information technology and the utilisation of tax incentives, implying that the government needs to accelerate the expansion of digital infrastructure across the nation and encourage nontechnology-based businesses to reap the benefit of adopting information technology. Thus, this study contributes to adding the extant literature on the role of information technology in providing competitive advantages for businesses during unprecedented times of pandemic.

This paper is organised as follows. We begin the present paper with a brief introduction and background from our study. The next second section explains the research methodology including data collection and analysis method. The third section provides discussion and results from the analysis. And the final section is the conclusion from our study.

2. METHODOLOGY

2.1 Data

The study relies on primary data collected through a national survey administered using a questionnaire from 21 July to 7 August 2020. The survey targeted to sample Indonesian businesses representing all regions across Indonesia, various business scales, and all business sectors. The survey yielded 12.361 responses. Referring to several variables in the work of Chetty et al. (2020), Fairlie (2020), and Shen et al. (2020), this study specifically examines ten variables of interest: i) the number of workers; (ii) primary market share; (iii) main source of supply; (iv) annual sales turnover; (v) impact on sales; (vi) impact on profit, (vii) major business hindrance; (viii) tax incentives participation; (ix) technological dependence; and (x) the main characteristics of the company. Details on the questions and answer options used in the survey can be seen in Table 1.

We use the responses relating to survey questions 5, 6, 8, and 9 described in Table 1 as our main variables of interest under study. In this sense, one of the main concerns in utilising survey data is ensuring a valid interpretation of respondents' responses (Vaus, 2014). It is possible that in some cases the same response may represent or indicate different meaning, vice versa.[3]

[3] For instance, when answering the question: "*Based on the extent to which information technology is used in your business operations, what is the type of your businesses?*', it is possible that respondents may have different meanings despite the fact of answering the same responses. That is respondents might variously interpret the options '*nontechnology-based*, *technology-based*, and *highly technology-based*', resulting in a potentially different meanings and responses.

Table 1: Survey questions and available responses

No	Survey question	Available responses	Scale
1	How many permanent workers are in your business (choose 1 if you are self-employed without hiring other people)?	(i) 1 person; (ii) 2 - 10 employees; (iii) 11 - 50 employees; (iv) 51 - 100 employees; (v) 101 - 250 employees; (vi) 251 - 500 employees; and (vii) > 500 employees	Ordinal
2	What is your primary market share?	(i) domestic; (ii) overseas; (iii) mixed (domestic and export)	Nominal
3	What is the primary source of your supply?	(i) domestic; (ii) overseas; (iii) mixed; and (iv) no or little raw materials	Nominal
4	Annual sales turnover (IDR)?	(i) < 5 billion; (ii) 5 billion – 10 billion; (iii) 10 billion – 25 billion; (iv) 25 billion – 50 billion; (v) 50 billion – 100 billion; (vi) > 100 billion[4]	Ordinal
5	Compared to the second quarter (April-June) of 2019, how were your sales in the second quarter of 2020?	(i) decreasing >50%; (ii) decreasing 25% – 50%; (iii) decreasing < 25%; (iv) not change; (v) increasing >25%; (vi) increasing 25% – 50%; (vii) increasing >50%	Ordinal
6	Compared to the second quarter (April-June) of 2019, how was your profit in the second quarter of 2020?	(i) decreasing >50%; (ii) decreasing 25% – 50%; (iii) decreasing < 25%; (iv) not change; (v) increasing >25%; (vi) increasing 25% – 50%; (vii) increasing >50%	Ordinal
7	When you filled out this survey, what was the biggest hindrance to your business operations?	(i) obtaining raw materials; (ii) paying operational cost; (iii) paying labour cost; (iv) product distribution; (v) decrease in demand; (vi) increase of operational cost; (vii) debt payment; (viii) no extraordinary hindrance	Nominal
8	Based on the extent to which information technology is used in your business operations, what is the type of your business?	(i) nontechnology-based; (ii) technology-based; (iii) highly technology-based	Nominal / ordinal
9	Have your businesses utilised tax incentives?[5]	(i) yes and (ii) no	Nominal
10	What is the primary characteristic of your businesses?	(i) nonmanufacturer (ii) manufacturer	Nominal

Source: Authors

4 As of December 2021, IDR 5 billion is currently around USD 349 thousand; IDR 10 billion is currently around USD 699 thousand; IDR 25 billion is currently around USD 1,7 million; IDR 50 million is currently around USD 3,5 million; and IDR 100 billion is currently around USD 7 million.

[5] Note that in this study, the term tax incentives specifically refer to certain tax incentives provided by the government in response to the Covid-19 pandemic. These include Government-borne Income Tax Article 21 (DTP), Article 22 Import Income Tax Exemption, 50% reduction in instalments of Income Tax Article 25, and Acceleration of VAT refunds. Thus, a business is considered utilising tax incentives regardless of the number of tax incentives being used.

For instance, when answering the survey question in Table 1 point 8: "*Based on the extent to which information technology is used in your business operations, what is the type of your businesses?",* it is possible that respondents may have different meanings despite the fact of answering the same responses, vice versa. That is, respondents might interpret the options '*nontechnology-based*, *technology-based*, and *highly technology-based*' differently, resulting in various meanings.

While it seems no scientific approach can be adopted to fully eliminate this issue (Vaus, 2014), some approaches can be utilised to address the problem of meaning in survey responses. One way is by examining the pattern of people's responses under study (Vaus, 2014). Following this, we qualitatively examine the pattern of responses on the levels of technological dependence based on the occupation of the respondents.[6] In general, we found a relatively homogenous pattern among the various type of respondents' occupations. Our descriptive analysis shows comparable proportions of responses among the respondents, indicating the respondents have a relatively similar meaning in responding to the question. See Appendix 1 for the details.

2.2 Empirical strategy

Research endeavour in social sciences generally has two primary goals—to provide either a description or explanation (Babbie, 2010). The focus of this paper is the former—to provide a description. Although for some researchers the most interesting thing in social science is perhaps causal relationships, descriptive research has an important role in policymaking (Angrist & Pischke, 2009). To achieve this goal, this study adopts an applied research approach. Applied research is designed to answer specific problems or offer solutions to practical problems (Neuman, 2011).

[6] In our survey, we asked the respondents to self-identify themselves if they are: i) staff; ii) business owner; (iii) manager; (iv) director; and (v) commissioner.

Considering the exploratory and descriptive natures of this study, we employ several statistical methods. Initially, we conduct correspondence analysis. There are two justifications for this. First, correspondence analysis can be used to simplify complex data by displaying associations between categorical variables while retaining all the valuable information in the data set (Sourial et al., 2009; Doey & Kurta, 2011). Second, correspondence analysis is a method to visually depict tabular data and easily accommodate large data sets (Beh & Lombardo, 2014; Greenacre, 2017)—despite the fact the mathematical procedures involved in correspondence analysis are quite complex (Bendixen, 2003).

In the spirit of applying appropriate statistical methods to answer the research questions as suggested by Velleman & Wilkinson (1993), we then utilise an analysis of variance (ANOVA) to gain an understanding of whether technological dependence and tax incentives influence the impact of sales and profit during the pandemic, by comparing its samples means. By doing so, we expect to see whether there is sufficient evidence to conclude that the means of the corresponding categories also differ. In the final analysis, to validate our second analysis, we employ multiple regression analysis to examine whether the technological dependence and the utilisation of tax incentives improve business performance, indicated by the impact of both sales and profit of the surveyed businesses.

We use two proxies to gauge respondents' business performance: by using the extent to which sales and profit have decreased (or increased) during the pandemic.[7] Technological dependence scale comprised three items indicating the level to which businesses relied on information technology for business operations (i.e.,

[7] As described earlier in Table 1, we used ordinal scale to measure the change on both sales and profit: i) decreasing >50%; (ii) decreasing 25% – 50%; (iii) decreasing < 25%; (iv) not change; (v) increasing >25%; (vi) increasing 25% – 50%; (vii) increasing >50%.

nontechnology-based, technology-based, and highly technology-based. Using the overall sample, we propose the following multivariate Ordinary Least Squares (OLS) regression models:

Model 1:

Impact on sales = a + $b1$(technological effects) + $b2$(tax incentives effects) + $b3$(market effects) + $b4$(supplier effects) + $b5$(business type effect) + $b6$(annual sales turnover) + $b7$(number of employees) +$b8$(regional effects) + $b9$(sector effects) + $b10$(year effects) + $b11$(business hindrance effects)

Model 2:

Impact on profit = a + $b1$(technological effects) + $b2$(tax incentives effects) + $b3$(market effects) + $b4$(supplier effects) + $b5$(business type effect) + $b6$(annual sales turnover) + $b7$(number of employees) +$b8$(regional effects) + $b9$(sector effects) + $b10$(year effects) + $b11$(business hindrance effects)

where, technological effects: technological dependence dummy (i.e., nontechnology-based, technology-based, and highly technology-based, with nontechnology-based being the omitted category); tax incentives effect: tax utilisation dummy, with nonutilising tax incentives being the omitted category); market effects: primary market share dummy (i.e., domestic, overseas, and mixed (domestic and export), with domestic market being the excluded category).

Supplier effects are the dummy variables denoting different primary sources of supply. The supplier dummies are no or little raw materials, domestic, overseas, mixed (domestic and overseas), with no or little raw materials being the omitted category. Next, business type effect is dummy variables for nonmanufacturing and

manufacturing businesses, with nonmanufacturing being the omitted type; size effects are two ordinal variables indicating the annual sales turnover and number of employees; regional effects: main islands dummy (Java, Sumatra, Kalimantan, Sulawesi, Bali-Nusa Tenggara, and Papua Maluku, with Java being the omitted category); sector effects: sector dummy (wholesale and retail trade, constructions, manufacturing, other services activities, financial and insurance activities, transportation and storage, business activities, information and communication, agriculture, forestry and fishing, human health and social work activities, mining and quarrying, real estate activities, accommodation and food service activities, electricity and gas, education, water supply, sewerage, waste management and remediation activities, with constructions being the omitted sector; year effects: year dummy (before 1980, 1980–1990, 1990–1995, 1996–2000, 2001–2005, 2006–2010, 2011–2015, 2016–2020, with 2016–2020 being the omitted period). The last is business hindrance effects. It is dummy variables for the biggest hindrance for business operations: no extraordinary hindrance, obtaining raw material, paying the operational cost, paying labour cost, product distribution, decrease in demand, increase of operational cost, and debt payment, with no extraordinary hindrance being the omitted category.

3. RESULTS AND DISCUSSIONS

3.1 Results

3.1.1 Descriptive statistics

As indicated earlier, this study examined a national data set collected from 12,361 businesses, covering all 34 provinces in Indonesia. Table 2 provides the descriptive statistics of minimum, maximum, means, median, standard deviation, and variance of variables under study, by three levels of technological dependency. The proportion businesses based on the level of their dependence on information technology is as

follows: nontechnology-based (22%, n = 2,732), technology-based (57%, n = 7,046), and highly technology-based (21 %, n = 2,583).

Table 2: Descriptive statistics (n = 12,361)

Descriptive Statistics							
Level of technological dependency		N	Min.	Max.	Mean	SD	Variance
Nontechnology-based	Number of employees	2,732	1	7	3.01	1.431	2.047
	Primary characteristic	2,732	1	2	1.29	0.453	0.205
	Primary source of supply	2,732	1	4	1.81	1.148	1.317
	Primary market share	2,732	1	3	1.18	0.537	0.288
	Annual sales turnover	2,732	1	6	2.50	1.681	2.826
	Impact on sales	2,732	1	7	2.06	1.249	1.559
	Impact on profit	2,732	1	7	2.06	1.225	1.501
	The biggest hindrance	2,732	1	8	4.58	1.750	3.061
	Tax incentives status	2,732	0	1	0.49	0.500	0.250
Technology-based	Number of employees	7,046	1	7	3.13	1.490	2.220
	Primary characteristic	7,046	1	2	1.27	0.446	0.199
	Primary source of supply	7,046	1	4	2.02	1.191	1.419
	Primary market share	7,046	1	3	1.26	0.633	0.401
	Annual sales turnover	7,046	1	6	2.64	1.773	3.142
	Impact on sales	7,046	1	7	2.21	1.309	1.714
	Impact on profit	7,046	1	7	2.13	1.252	1.568
	The biggest hindrance	7,046	1	8	4.54	1.768	3.126
	Tax incentives status	7,046	0	1	0.50	0.500	0.250
Highly technology-based	Number of employees	2,583	1	7	3.14	1.478	2.184
	Primary characteristic	2,583	1	2	1.20	0.396	0.157
	Primary source of supply	2,583	1	4	2.32	1.277	1.630
	Primary market share	2,583	1	3	1.33	0.716	0.513
	Annual sales turnover	2,583	1	6	2.54	1.727	2.984
	Impact on sales	2,583	1	7	2.26	1.313	1.723
	Impact on profit	2,583	1	7	2.19	1.280	1.637
	The biggest hindrance	2,583	1	8	4.53	1.771	3.135
	Tax incentives status	2,583	0	1	0.48	0.500	0.250
	Total observations	12,361					

Note: Recall Table 1 for the description of responses for each variable.

Source: Authors' calculation based on survey data

The composition of the surveyed business based on their location is as follows: Java (70%, n = 8,681), Sumatra (13%; n = 1,633), Kalimantan (6%; n = 706), Sulawesi (5%; n = 612), Bali and Nusa Tenggara (5%; n = 573), Papua and Maluku (1%; n =

156) (see Appendix 2 for the details). Our additional descriptive analysis shows that around 30% of the surveyed businesses in this study have more than 50 employees. More specifically, businesses with 51-100 employees are 11%, those with 101-250 employees are 8.6%, those with 251-500 employees are 4.1%, and businesses with employees more than 500 are 4.6%. The majority of businesses are nonmanufacturers (73.9%), with the main source of supply is from domestic (53.4%) and the main market share is domestic (85.1%).

In terms of sales, 59% of the surveyed businesses reported an annual turnover above IDR 5 billion. Nearly 41% of businesses reported a decline in sales of more than 50% at the time of the survey conduct. Around 42.7% of businesses also reported a decline in profits of more than 50% during the pandemic. Approximately 62% of businesses also reported a reduction in business operating activities with 53.5% of the businesses reporting the use of business activities between 25%-75%. Nearly half (49.6%) of surveyed businesses reported a shock in demand for goods and/or services as the main hindrance of their businesses. In addition, almost half of the surveyed businesses (49,4%) stated that they used the tax incentives provided by the government.

3.1.2 Correspondence analysis (CA)

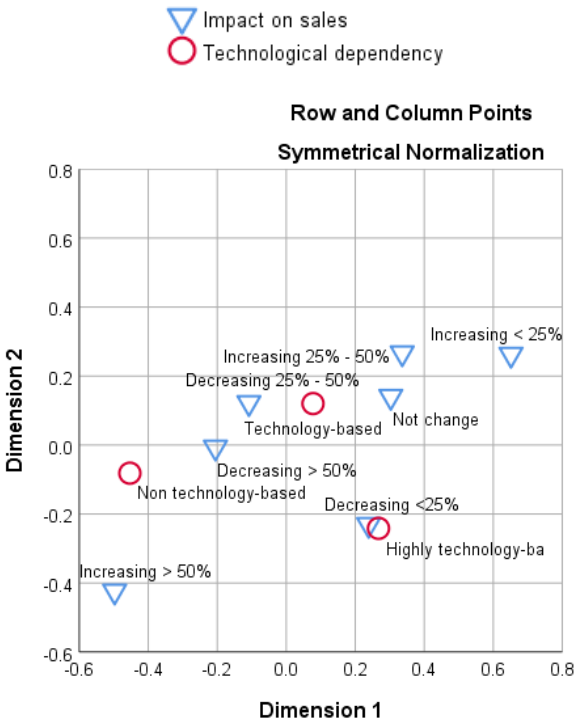
Initially, we conduct CA to better understand the relationships between technological dependency, impact on sales,[8] and business hindrance. Graph 1 shows a visualization of the correlational relationship between technology dependence and the level of impact on sales during the pandemic. Panel A of Graph 1 shows several empirical findings related to the relationship between business operational difficulties and turnover of the surveyed businesses based on correspondence analysis (Chi-

[8] Due to space consideration and for the sake of simplicity, we excluded the variable 'impact on profit' from correspondence analysis. In addition, we found a somewhat high correlation (r = .789) between 'impact on sales' and 'impact on profit'. Thus, it is safe to expect the similarity of the results. See Appendix 3 for details.

Square=56.200; ρ = 0.000; df=12). First, there is a tendency that a deeper decline in demand (>50%) is likely to be experienced by businesses that are not dependent on technology. Second, businesses that are dependent on technology tend to experience a lower decline in sales than those of the nontechnology-based group.

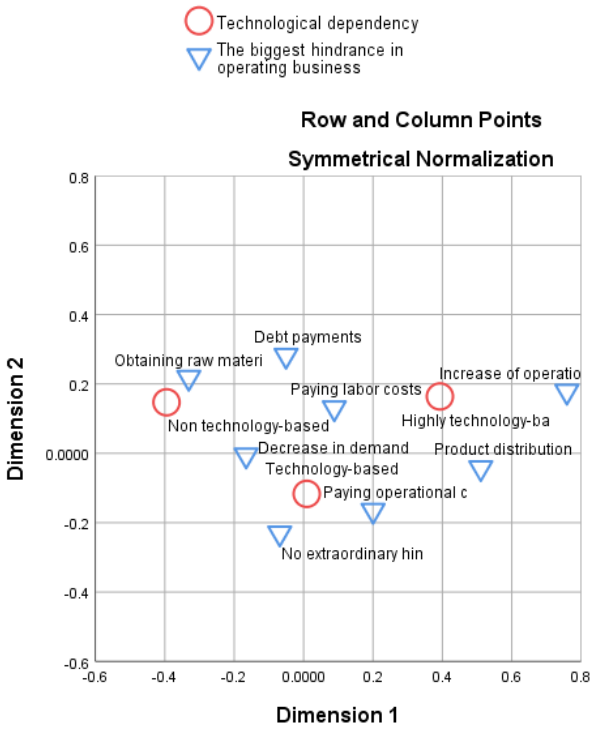
Graph 1: Technological dependency, impact on sales, and primary business hindrance

Panel A (n = 12,361)



Chi-Square = 56.200; ρ = 0.000; df = 12

Panel B (n = 12,361)



Chi-Square = 45.658; ρ = 0.000; df = 6

Note: Panel A shows the variation in the association between technological dependency and impact on sales. The distance between the two types of legend indicates a strong similarity or trend. In panel A, for example, nontechnological-based businesses tend to experience a decline of more than 50% which is higher than technological-based businesses. Meanwhile, highly technological-based businesses tend to experience lower sales declines of less than 25%. Panel B shows the variation in the association between the level of dependence on technology and the biggest hindrance reported by surveyed businesses during the pandemic. Companies with a high degree of dependence on technology have a strong tendency to report product distribution as their primary hindrance, while companies that are not highly dependent on technology tend to experience supply shortages and a decrease in demand.

Source: Authors' calculation based on survey data

Third, there is a strong trend that highly technology-based businesses experience a decline of less than 25%. Cross tabulation between technological dependency and impact on sales can be seen in Appendix 4.A.

Panel B of Graph 1 shows some of the biggest differences in the difficulty levels faced by the three groups of companies (Chi-Square = 59.243; ρ = 0.000; df = 14). First, nontechnology-based businesses have a strong tendency to report raw material supply and declining demand as major difficulties. Declining demand is also the main difficulty reported by technology-based businesses, in addition to difficulty paying operational costs. Second, high technology-based businesses tend to experience product distribution as a major difficulty. The cross tabulation between the level of technology dependence of surveyed businesses and the status of their primary business hindrance is provided in Appendix 4.B.

3.1.3 Analysis of variance (ANOVA)

Impact on sales

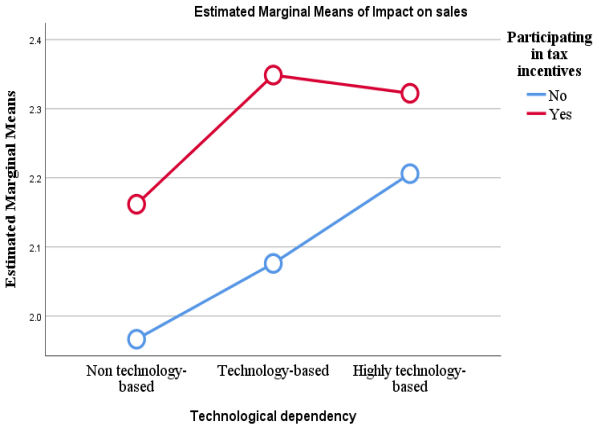
Following the CA results, we conduct a one-way between-subjects analysis of variance (ANOVA) to determine whether the impact on sales was related to the level of technological dependency. The differences among the three groups were evident when considered jointly on the dependent variables of impact on sales (see Appendix 5.A for details). The lowest mean scores (M = 2.06) indicates that nontechnology-based businesses experiencing the largest sales contractions compared to technological-based businesses and highly technological-based businesses.

With ANOVA evaluated at an α level of 0.05, this study found a significant main effect for technological dependency: the sales of nontechnology-based businesses (M = 2.06) impacted significantly larger than those of technology-based businesses (M = 2.21) or highly technology-based businesses (M = 2.26), F (2, 12,355) = 18.29, ρ = 0.000, $\eta 2$ = 0.003. This study also found a significant main effect for tax incentives status: the sales of businesses not utilising tax incentives (M = 2.08) impacted significantly larger than those of businesses utilising tax incentives (M = 2.30), F (1, 12,355) = 57.04, ρ = 0.000, $\eta 2$ = 0.005.

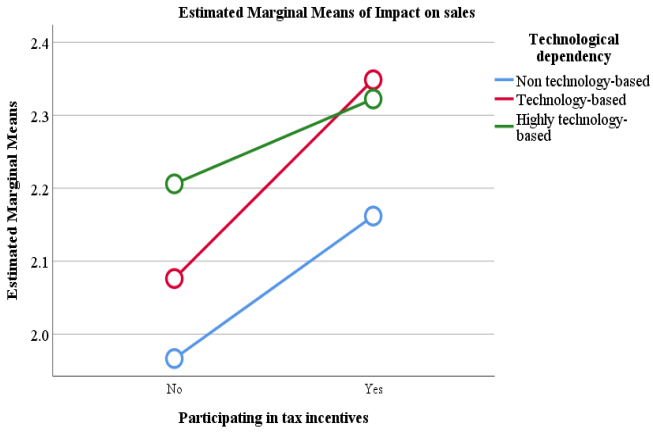
In addition, this study found that there is a significant interaction effect for technological dependency and participating in tax incentives, F (2, 12,355) = 3.64, ρ = 0.026, $\eta 2$ = 0.005. Thus, the sales contractions for businesses that have a technological dependency and utilising tax incentives differed significantly from those of nontechnology-based businesses and not utilising tax incentives. Graph 2 provides a visualised comparison of estimated marginal means of sales contractions. Panel A shows that technological-based and highly technological-based businesses scored higher than nontechnology-based businesses, meaning that the impact of sales on the former group was less severe than the latter. Panel B depicts all groups that utilised incentives had a lower impact than groups that did not utilised tax incentives.

Graph 2: Technological dependence and impact on sales

Panel A (n = 12,361)



Panel B (n = 12,361)



Note: This graph compares the means of six groups based on their technological dependence categories and their tax incentives utilisation status. Both Panels A and B show that in general technology-based businesses experience a lower impact on sales (indicated by the higher means score compared to the other groups), with those utilising tax incentives having a lower impact than those not utilising tax incentives.

Source: Authors' calculation based on survey data

Considering that the three groups have different numbers of observations, a post-hoc analysis was conducted to test the robustness of the findings (see Appendix 5.B for details). The test results show that there are statistically significant differences among the sales contractions experienced by nontechnology-based businesses and the

technology-based group (mean difference = -0.152; ρ = 0.000) and the highly technology-based businesses group (mean difference = -0.200; ρ = 0.000).

Table 3 shows the differences in the mean value of the sales contractions of the three groups. The first row shows the difference in the mean values of nontechnology-based businesses with technology-based and highly technology-based groups. A negative value indicates that the mean value of the nontechnology-based group is smaller than that of the two technology-based groups. The highest difference occurs between the mean value of nontechnology-based companies and highly technology-based companies (-0.200).

Table 3: *Post-hoc analysis of the impact on sales*

Games-Howell					
(I) Technological dependency	(J) Technological dependency	Mean Difference (I-J)	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Nontechnology-based	Technology-based	-0.152* (0.019)	0.000	-0.22	-0.08
	Highly technology-based	-0.200* (0.035)	0.000	-0.28	-0.12
Technology-based	Nontechnology-based	0.152* (0.029)	0.000	0.08	0.22
	Highly technology-based	-0.049 (0.030)	0.240	-0.12	0.02
Highly technology-based	Nontechnology-based	0.200* (0.035)	0.000	0.12	0.28
	Technology-based	0.049 (0.030)	0.240	-0.02	0.12

*. The mean difference is significant at the 0.05 level. Standard errors are in parentheses

Source: Authors' calculation based on survey data

The second row shows the difference in the mean value of the sales impact of technology-based companies with nontechnology-based and highly technology-based companies. The difference in the mean value of the sales impact of technology-based and highly technology-based companies is negative (-0.049).

This shows that the sales impact of highly technology-based companies is lighter than the sales impact of technology-based companies. However, this difference was not statistically significant (ρ = 0.240). In the last row, the mean difference column all shows positive values. This indicates that the mean value of the highly technology-based company is greater than the other two groups, although the difference with the mean value of the technology-based group is not statistically significant.

Impact on profit

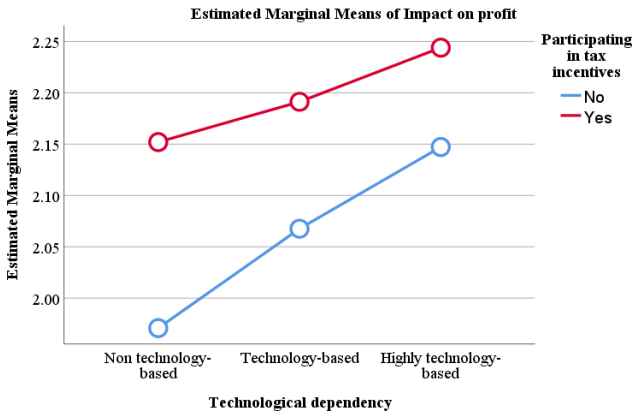
Next, we employed a one-way between-subjects analysis of variance (ANOVA) to examine whether impact on profit was related to the level of technological dependency. Based on the analysis of the observations, differences among the three groups were evident when considered jointly on the dependent variables of the impact on profit (see Appendix 6.A for details). Nontechnology-based businesses experienced the largest impact on profit than technological-based businesses and highly technological-based businesses.

With ANOVA evaluated at an α level of 0.05, this study found a significant main effect for technological dependency: the profit of nontechnology-based businesses (M = 2.06) impacted significantly larger than those of technology-based businesses (M = 2.13) or highly technology-based businesses (M = 2.19), F (2, 12,355) = 7.64, ρ = 0.000, η2 = 0.001. This study also found a significant main effect for tax incentives status: the profit of businesses not utilising tax incentives (M = 2.06) impacted significantly larger than those of businesses utilising tax incentives (M = 2.19), F (1, 12,355) = 28.77, ρ = 0.000, η2 = 0.002. However, this study found no significant technological dependency by the status of tax incentives interaction, F (2, 12,355) = 0.82, ρ = 0.439, η2 = 0.000.

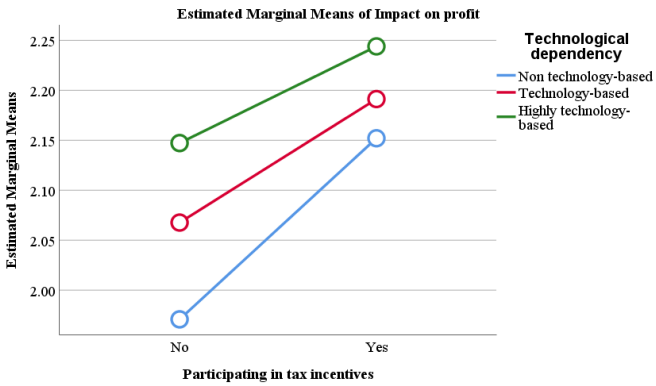
The impact on profit for businesses that have a technological dependency and utilising tax incentives differed significantly from those of nontechnology-based businesses and not utilising tax incentives. Graph 3 provides a visualised comparison of estimated marginal means of profit contractions. Panel A shows that technological-based and highly technological-based businesses scored higher than nontechnological-based businesses, meaning that the impact of profit on the former group was less severe than the latter. Panel B depicts all groups that utilised incentives had a lower impact than groups that did not utilised tax incentives.

Graph 3: Technological dependence and impact on profit

Panel A (n = 12,361)



Panel B (n = 12,361)



Note: This graph compares the means of six groups based on their technological dependence categories and their tax incentives utilisation status. Both Panels A and B consistently show that highly technology-based businesses experienced the lowest impact on profit (indicated by the higher means score compared to the other groups), with those utilising tax incentives having the lower impact than those not utilising tax incentives.

Source: Authors' calculation based on survey data

As mentioned earlier, considering that the three groups have different numbers of observations, a post-hoc analysis was conducted to test the robustness of the findings (see Appendix 6.B for details). The test results show that there are statistically significant differences among the impact on profit experienced by nontechnology-based businesses and the technology-based group (mean difference = -0.071; $\rho = 0.029$)

and the highly technology-based businesses group (mean difference = -0.135; ρ = 0.000).

Table 4 shows the differences in the mean value of the impact on profit of the three groups. The first row shows the difference in the mean values of nontechnology-based businesses with technology-based and highly technology-based groups.

Table 4: Post-hoc analysis of the impact on profit

Games-Howell					
(I) Technological dependency	(J) Technological dependency	Mean Difference (I-J)	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Nontechnology-based	Technology-based	-0.071** (0.028)	0.029	-0.14	-0.01
	Highly technology-based	-0.135** (0.034)	0.000	-0.22	-0.05
Technology-based	Nontechnology-based	0.071** (0.028)	0.029	0.01	0.14
	Highly technology-based	-0.064* (0.029)	0.074	-0.13	0.00
Highly technology-based	Nontechnology-based	0.135** (0.034)	0.000	0.05	0.22
	Technology-based	0.064* (0.029)	0.074	0.00	0.13

**. The mean difference is significant at the 0.05 level; *. The mean difference is significant at the 0.1 level. Standard errors are in parentheses

Source: Authors' calculation based on survey data

A negative value indicates that the mean value of the nontechnology-based group is smaller than that of the two technology-based groups. The highest difference occurs between the mean value of nontechnology-based companies and highly technology-based companies (-0.135).

The second row shows the difference in the mean value of the sales impact of technology-based companies with nontechnology-based and highly technology-based companies. The difference in the mean value of the sales impact of technology-based and highly technology-based companies is negative (-0.064). This shows that the impact on the profit of highly technology-based companies is lighter than the impact

on profit of technology-based companies. However, this difference was not statistically significant (ρ = 0.074). In the last row, the mean difference column all shows positive values. This indicates that the mean value of the highly technology-based company is greater than the other two groups, although the difference with the mean value of the technology-based group is not statistically significant.

3.1.4 Multiple regression analysis

The results of regression analysis are shown in Table 5 with Durbin–Watson Test shows no significant problems of autocorrelation. As indicated earlier, our primary variables of interest are technological dependence and tax incentives effects.

Table 5: Regression results of the impact on sales and profit

Independent variable	Impact on sales		Impact on profit	
(Constant)	3.020***	(0.066)	2.818 ***	(0.066)
Technological effects				
Technology-based	0.116***	(0.026)	0.053 **	(0.027)
Highly technology-based	0.129***	(0.033)	0.078 **	(0.033)
Tax incentives effect				
Receiving incentives	0.066***	(0.023)	0.059 **	(0.023)
Market effects				
Mixed (domestic & export)	-0.126***	(0.037)	-0.058	(0.037)
Overseas	-0.047	(0.056)	-0.382 ***	(0.057)
Supplier effects				
Domestic	-0.011	(0.033)	0.041	(0.033)
Overseas	-0.082	(0.050)	-0.001	(0.050)
Mixed	-0.009	(0.039)	-0.046	(0.039)
Business type effect				
Manufacturer	0.082**	(0.032)	0.073 **	(0.033)
Size effects				
Annual sales turnover	0.049***	(0.008)	0.033 ***	(0.008)
Number of employees	0.077***	(0.011)	0.038 ***	(0.011)
Regional effects				
Sumatra	0.134***	(0.032)	0.130 ***	(0.032)
Kalimantan	0.182***	(0.046)	0.190 ***	(0.046)
Sulawesi	0.057	(0.049)	0.066	(0.050)
Bali - Nusa Tenggara	-0.143***	(0.051)	-0.107 **	(0.051)
Papua Maluku	0.148	(0.094)	0.124	(0.094)
Sector effects				
Wholesale and retail trade	0.171***	(0.036)	0.166 ***	(0.036)
Manufacturing	0.096**	(0.048)	0.095 **	(0.048)
Other services activities	0.144***	(0.036)	0.186 ***	(0.037)

Financial and insurance activities	0.435***	(0.063)	0.511 ***	(0.063)
Transportation and storage	0.064	(0.068)	0.075	(0.068
Business activities	0.168**	(0.073)	0.234 ***	(0.074)
Information and communication	0.405***	(0.073)	0.331 ***	(0.073)
Agriculture, forestry, and fishing	0.185***	(0.069)	0.216 ***	(0.070)
Human health and social work activities	0.274***	(0.073)	0.152 **	(0.073)
Mining and quarrying	-0.027	(0.104)	-0.100	(0.104)
Real estate activities	-0.087	(0.089)	-0.082	(0.090)
Accommodation and food service activities	-0.291***	(0.081)	-0.295 ***	(0.081)
Electricity and gas	0.420***	(0.099)	0.505 ***	(0.099)
Education	0.054	(0.138)	0.025	(0.138)
Water supply, sewerage, waste management, and remediation activities	0.629***	(0.159)	0.495 ***	(0.159)
Year effects				
< 1980	-0.197***	(0.057)	-0.085	(0.057)
1980 - 1990	-0.054	(0.048)	-0.003	(0.048)
1990 - 1995	0.008	(0.044)	-0.138 ***	(0.045)
1996 - 2000	-0.102**	(0.044)	-0.023	(0.044)
2001 - 2005	-0.094**	(0.039)	-0.068 *	(0.039)
2006 - 2010	-0.065*	(0.034)	-0.060 *	(0.034)
2011 - 2015	-0.020	(0.031)	-0.003	(0.031)
Business hindrance effects				
Obtaining raw material	-0.705***	(0.070)	-0.377 ***	(0.070)
Paying operational cost	-1.716***	(0.049)	-1.355 ***	(0.050)
Paying labour cost	-1.804***	(0.057)	-1.500 ***	(0.057)
Product distribution	-0.825***	(0.069)	-0.480 ***	(0.069)
Decrease in demand	-1.605***	(0.045)	-1.237 ***	(0.045)
Increase of operational cost	-0.548***	(0.061)	-0.448 ***	(0.061)
Debt payment	-1.695***	(0.058)	-1.412 ***	(0.059)
Observations	12,361		12,361	
Adjusted R-square	0.209		0.144	
F-value	73.713		47.308	
Durbin-Watson	1.949		1.905	

Notes: Standard errors are in parentheses and displayed next to the coefficient to save space.
∗ Significance at 90% confidence level.
∗∗ Significance at 95% confidence level.
∗∗∗ Significance at 99% confidence level

Source: Authors' calculation based on survey data

Validating our previous ANOVA analysis, results from the coefficients of technological dependence dummies indicate that both technological-based and highly technological-based possess a positive and significant influence on the impact on sales

and impact on profit. This means that during the pandemic technology-based and highly technology-based businesses experienced better business performance in terms of changes in sales and profit, compared to those of nontechnology-based businesses. In addition, from Table 5, holding all other regressor variables constant, the regression coefficient of highly technology-based businesses is larger than that of technology-based businesses, meaning that the business performance of the highly technology-based is better than those of technology-based entities.

This result is the same for the tax incentives effect. That is, the coefficients for businesses utilising tax incentives are positive and statistically significant, meaning that the businesses utilising tax incentives experienced better business performance—i.e., in terms of sales and profit—during the pandemic. Thus, both technology-based and highly technology-based businesses and businesses that utilising tax incentives consistently and significantly report lower sales contraction and lower declined profit compared to nontechnology-based businesses and without tax incentives, as indicated earlier in ANOVA analysis (recall the visual representations depicted in Graphs 2 and 3 for easier comparisons).

In terms of market effects, we found that the coefficients for businesses with its primary market shares were overseas and mixed (i.e., domestic and export) are all negative—although with different statistical significance, meaning that in general businesses with the dominant domestic market experiencing better business performance. Another characteristic is that the coefficients for supplier effects are all negative but all not statistically significant, implying that the origin of inputs does not relate with business performance during the pandemic.

Further, the coefficients of annual sales turnover and the number of employees are all negative and statistically significant both for Model 1 and Model 2. This implies that

the higher the size of businesses, the higher the resilience of the businesses during the pandemic. In terms of regional effects, the findings confirm official reports that Bali suffered the most during the pandemic.[9] In terms of sector, our study found that businesses in the accommodation and food service activities sector appeared to be hit the most during the pandemic, indicated by the only sector with negative and statistically significant coefficient. This also confirms official reports that explicitly stated this sector experienced the largest decline in business operation due to the pandemic.[10]

Finally, the coefficient for business hindrance effects is all negative and statistically significant meaning that businesses that experienced financial and non-financial hardships reported a decline both in sales and profit. Thus, evidence is robust that business hindrance caused by the pandemic has created sales and profit contractions.

3.2 Discussions

We empirically examine the role of technological dependency and the performance of Indonesian businesses in the time of Covid-19. In general, our results appear to be as expected. Our findings generally support the notion that information technology has facilitated businesses to be more resilient (see, for example, Porter and Millar, 1985; Chishakwe & Smith, 2012; Harel, 2021). According to World Bank (2016), by lowering information costs, information technology has the potential to significantly reduce the cost of economic and social transactions for enterprises, individuals, and the public sector. Several mechanisms explain how digital technology fosters progress.

First, by facilitating automation and better coordination, the internet can increase efficiency. Second, by offering potentially frictionless communication and

[9] See, Bank Indonesia (2021).

[10] See, Statistics Indonesia (2020).

collaboration, the internet supports new delivery models for goods and services, collaborative action, and innovation. Third, by expanding commerce, providing jobs, and improving access to previously inaccessible public services—such as tax incentives, the internet promotes market effects thereby facilitating inclusion.

In the context of the pandemic, as the empirical findings of this study have shown, it seems the second and the third mechanism to be more relevant. Highly technology-based businesses have ample opportunities to participate in the digital economy by, for example, creating new marketing channels, selling products or services on the existing prominent marketplaces or platforms, and sourcing their input material online. In short, technology-based businesses have more opportunities not only to increase their production but also to expand their market shares. This justifies the findings that show both technology-based and highly technology-based businesses have a lower impact on sales and profit during the pandemic and supports several studies (Clarke, Qiang, and Xu 2015; Kneller and Timmis 2016; Bertschek and Niebel 2016; Fernandes et al. 2019).

For this reason, we argue government and related stakeholders need to prioritise infrastructure investment in information technology to attain sustainable development and support businesses and communities. Data for 2020 shows that Indonesia is still experiencing an internet access gap (ITU, 2021). Only about 54% of the population uses the internet, this is much lower than its two neighbouring countries, namely Singapore (95%) and Malaysia (90%). The reason is that in the absence of fundamental technological services, it is impossible to create programs that direct companies to go digital and have adequate technological capabilities. This solution should include the availability of infrastructure that supports the use of information technology, such as increasing internet access speed and bandwidth, network availability especially in the area where the internet penetration rate is low.

Further, during the Covid-19 pandemic, the main area of tax policy measures has been on giving liquidity assistance to businesses to help them stay afloat, as well as income assistance to vulnerable breadwinners (OECD, 2020). In this sense, many governments have taken significant efforts to mitigate the economic impact caused by the direct consequences of social limitation measures. About this, we found that there is a strong relationship between tax incentives and the ability of businesses in preserving their economic capacity. Our results suggest that there is a significant interaction effect between technological dependency and participating in tax incentives. That is the economic contractions for businesses that have a technological dependency and utilising tax incentives differed significantly from those of nontechnology-based businesses and not utilising tax incentives.

Thus, concerning the implementation of tax policy measures, government bodies need to develop effective communication and public relation strategies regarding the benefits of tax incentives. By doing so, policymakers can keep pace with more targeted and stronger measures to address evolving impact and risks faced by businesses, meaning that it is necessary to segment specific groups of businesses to increase their level of participation. Government authorities or related parties can also further use behavioural approaches to exercise policy interventions. However, further analysis needs to be undertaken to gain a better understanding of these findings. For instance, the status of tax incentive participation in this study is inherently general; that is, it does not differ specifically what types of tax incentives are being utilised nor what is the total amount of tax incentives used.

4. CONCLUSION

This study seeks primarily to investigate the relationship between technological dependency and the performance of Indonesian businesses, particularly during the

Covid-19 pandemic. In doing so, this study places technological dependence as the central variable under investigation. Our findings can be summarised as follows.

First, employing correspondence analysis, we found that the dependency on information technology has a strong association with business resiliency, particularly during the pandemic. That is, technology-based and highly technology-based businesses experienced a lower decline in sales than those of nontechnology-based businesses. Our analysis also found that businesses experienced different hindrances during the pandemic. For instance, high technology-based businesses tend to experience product distribution as a major difficulty while nontechnology-based businesses have a strong tendency to report obtaining raw material and declining demand as major difficulties.

Second, confirming the correspondence analysis results, our analysis using ANOVA and multiple regression found that both impacts on sales and profit were related to the level of technological dependency. During the pandemic, nontechnology-based businesses experienced the largest impact on sales and profit compared to technological-based businesses and highly technological-based businesses, meaning that the later categories appeared to demonstrate better business performance than the former. We also found a significant main effect for tax incentives status: the sales and profit of businesses not utilising tax incentives impacted significantly larger than those of businesses utilising tax incentives.

While our study has successfully confirmed findings from official reports (e.g., Bank Indonesia, 2021; Statistics Indonesia, 2020), it is worth noting however that these results provide evidence on the correlation between technological dependency and business performance, but do not offer a causal explanation between the two. The same caveat also applies to the correlation between the utilisation of tax incentives and

business performance. This is because the causal nature of the relationship between these variables requires different empirical data and strategies. It is beyond the scope of this study to provide these causal relationships. Also, this study heavily relied on survey data, specifically within the Indonesian context. Consequently, the relevance of the findings to other contexts is therefore unknown. This is because businesses in other regions might have different challenges and operating contexts. For these reasons, we also acknowledge that we might not be able to extrapolate the findings in this paper in other developing countries.

Finally, we believe a better understanding of the relationship between technological dependence—including tax incentives—and business performance found in our work offer relevant and useful insights for both policymakers and businesses. Relating to this, in addition to the use of administrative data, future research could scrutinize several further questions. How, and in what ways, do the technological dependencies influence business performance? Do market characteristics shape how businesses react to the adoption of information technology? How do businesses respond in the provision of various tax incentives? Answering these follow-up questions is likely to generate useful insights relevant to policy design and formulation.

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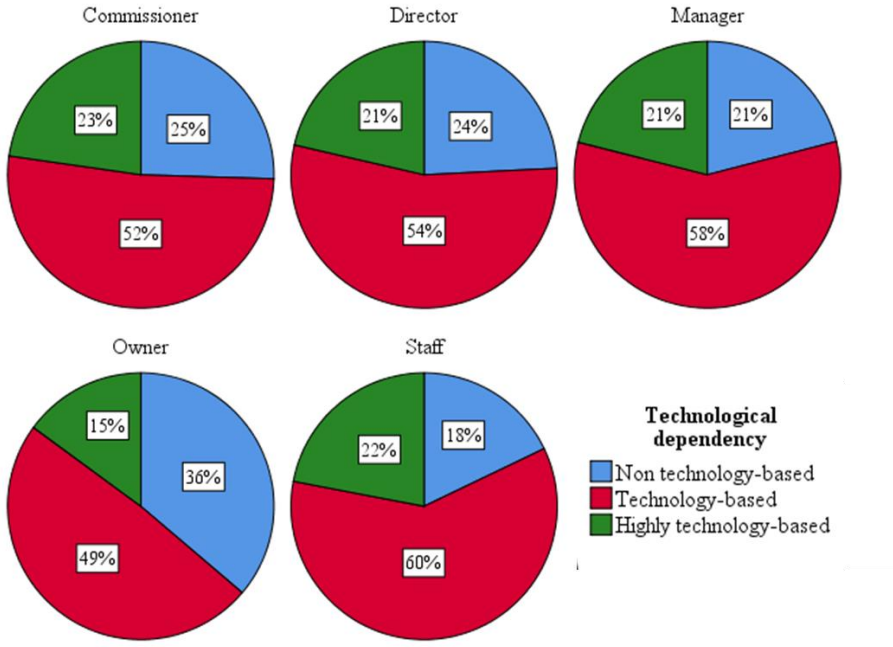
6. APPENDICES

Appendix 1: Technological dependency responses by types of respondents

Survey respondent	Technological dependency			Total
	Nontechnology-based	Technology-based	Highly technology-based	
Staff	853 (6.9%)	2,866 (23.2%)	1,056 (8.5%)	4,775 (38.6%)
Owner	406 (3.03%)	556 (4.5%)	168 (1.4%)	1,130 (9.1%)
Manager	590 (4.8%)	1,645 (13.3%)	586 (4.7%)	2,821 (22.8%)
Director	822 (6.6%)	1,848 (15.0%)	715 (5.8%)	3,385 (27.4%)
Commissioner	61 (0.5%)	131 (1.1%)	58 (0.5%)	250 (2.0%)
	2,732 (22.1%)	7,046 (57.0%)	2,583 (20.9%)	12,361 (100%)

Note: This table is a cross tabulation of respondents' occupation (row) with the technological dependency variables (column). The percentage relative to the total observations is in parentheses. The table shows that a large part of respondents (61,4%) are those at either managerial or high levels (i.e., owner, manager, director, commissioner).



Note: This graph shows the proportion of responses based on the levels of respondents' technological dependence. It suggests that in general there are relatively comparable proportions among the different types of respondents, with 'owner' is somewhat an exception. For instance, the proportion for 'highly technology-based' responses range relatively stable from 21% to 23%, while the proportion for 'technology-based' and 'nontechnology-based' range from 52% to 60% and 18% to 25% respectively. Thus, it seems safe to suggest that the survey respondents have relatively similar meaning in responding the question regardless of their occupations—note that respondents with 'owner' status contribute only 9% of the total respondents (see the table above).

Appendix 2: Variables under study by level of technological dependency (n = 12,361)

		Technological dependency			Total	%
		Nontech no-logy-based	Technology-based	Highly technology-based		
Number of employees	1 / owner	227	509	198	934	7.6%
	2 - 10 employees	977	2,333	782	4,092	33.1%
	11 - 50 employees	795	2178	871	3,844	31.1%
	51 - 100 employees	295	786	273	1,354	11.0%
	101 - 250 employees	221	616	227	1,064	8.6%
	251 - 500 employees	135	264	111	510	4.1%
	> 500 employees	82	360	121	563	4.6%
Total		2,732	7,046	2,583	12,361	100%
Business location	Jawa	1,912	4,977	1,792	8,681	70.2%
	Sumatra	402	925	306	1,633	13.2%
	Kalimantan	154	390	162	706	5.7%
	Sulawesi	130	354	128	612	5.7%
	Bali – Nusa T.	102	315	156	573	4.6%
	Papua Maluku	32	85	39	156	1.3%
Total		2,732	7,046	2,583	12,361	100%
Year of establishment	1980 - 1990	139	283	117	539	4.4%
	1990 - 1995	182	471	147	800	6.5%
	1996 - 2000	198	653	207	1,058	8.6%
	2001 - 2005	212	530	212	954	7.7%
	2006 - 2010	320	762	279	1,361	11.0%
	2011 - 2015	454	1,104	437	1,995	16.1%
	2016 - 2020	584	1,681	602	2,867	23.2%
Total		2,732	7,046	2,583	12,361	100%
Primary characteristic	Nonmanufacturer	1,947	5,109	2,079	9,135	73.9%
	Manufacturer	785	1,937	504	3,226	26.1%
Total		2,732	7,046	2,583	12,361	100%
Primary source of supply	Domestic	1,723	3,750	1,122	6,595	53.4%
	Overseas	174	588	219	981	7.9%
	Mixed	457	1,528	540	2,525	20.4%
	No or little materials	378	1,180	702	2,260	18.3%
Total		2,732	7,046	2,583	12,361	100%
Primary market share	Domestic	2,434	5,969	2,115	10,518	85.1%
	Overseas	106	338	90	534	4.3%
	Mixed	192	739	378	1309	10.6%
Total		2,732	7,046	2,583	12,361	100%
Annual sales turnover (IDR)	< 5 billion	1,156	2,873	1,080	5,109	41.3%
	5 billion – 10 billion	471	1,156	457	2,084	16.9%

	10 billion – 25 billion	377	901	344	1,622	13.1%
	25 billion – 50 billion	276	725	241	1,242	10.0%
	50 billion – 100 billion	209	564	185	958	7.8%
	> 100 billion	243	827	276	1,346	10.9%
Total		2,732	7,046	2,583	12,361	100%
Impact on sales	Decreasing > 50%	1,223	2,836	1,001	5,060	40.9%
	Decreasing 25% - 50%	649	1,621	556	2,826	22.9%
	Decreasing <25%	536	1,504	623	2,663	21.5%
	Not change	184	580	214	978	7.9%
	Increasing < 25%	95	388	146	629	5.1%
	Increasing 25% - 50%	23	76	27	126	1.0%
	Increasing > 50%	22	41	16	79	0.6%
Total		2,732	7,046	2,583	12,361	100%
Impact on profit	Decreasing > 50%	1,221	3,006	1,048	5,275	42.7%
	Decreasing 25% - 50%	621	1,527	540	2,688	21.7%
	Decreasing <25%	585	1,635	666	2,886	23.3%
	Not change	175	490	170	835	6.8%
	Increasing < 25%	90	291	116	497	4.0%
	Increasing 25% - 50%	23	53	21	97	0.8%
	Increasing > 50%	17	44	22	83	0.7%
Total		2,732	7,046	2,583	12,361	100%
The biggest hindrance	Obtaining raw material	110	237	81	428	3.5%
	Paying operational cost	413	1213	458	2,084	16.9%
	Paying labour cost	206	532	209	947	7.7%
	Product distribution	80	263	114	457	3.7%
	Decrease in demand	1,442	3,490	1,196	6,128	49.6%
	Increase of oper. cost	110	385	190	685	5.5%
	Debt payment	198	465	181	844	6.8%
	No extraord. hindrance	173	461	154	788	6.4%
Total		2,732	7,046	2,583	12,361	100%
Participating in tax incentives	No	1,403	3,506	1,345	6,254	50.6%
	Yes	1,329	3,540	1,238	6,107	49.4%
Total		2,732	7,046	2,583	12,361	100%

Source: Authors' calculation based on survey data

Appendix 3: Pearson correlations of variables under study

	Pearson Correlations (N = 12,361)								
	Participating in tax incentives	*Number of employees*	*Primary characteristic*	*Primary source of supply*	*Primary market share*	*Annual sales turnover*	*Impact on sales*	*Impact on profit*	*The biggest hindrance*
Participating in tax incentives	1	.356**	.240**	.019*	.179**	.345**	.086**	.052**	.008
Number of employees	.356**	1	.382**	.072**	.288**	.644**	.173**	.092**	.009
Primary characteristic	.240**	.382**	1	-.088**	.233**	.266**	.083**	.045**	-.021*
Primary source of supply	.019*	.072**	-.088**	1	.143**	.024**	.038**	.008	.060**
Primary market share	.179**	.288**	.233**	.143**	1	.219**	0.015	-.009	-.027**
Annual sales turnover	.345**	.644**	.266**	.024**	.219**	1	.170**	.103**	.063**
Impact on sales	.086**	.173**	.083**	.038**	.015	.170**	1	.789**	.174**
Impact on profit	.052**	.092**	.045**	.008	-.009	.103**	.789**	1	.129**
The biggest hindrance	.008	.009	-.021*	.060**	-.027**	.063**	.174**	.129**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 4: Crosstabulation of correspondence analysis data

Appendix 4.A: Cross tabulation of technological dependency and impact on sales

Impact on sales	Technological dependency of the businesses			Total
	Nontechnology-based	Technology-based	Highly technology-based	
Decreasing > 50%	1,223 (9.9%)	2,836 (22.9%)	1,001 (8.1%)	5,060 (40.9%)
Decreasing 25% - 50%	649 (5.3%)	1,621 (13.1%)	556 (4.5%)	2,826 (22.9%)
Decreasing <25%	536 (4.3%)	1,504 (12.2%)	623 (5.0%)	2,663 (21.5%)
Not change	184 (1.5%)	580 (4.7%)	214 (1.7%)	978 (7.9%)
Increasing < 25%	95 (0.8%)	388 (3.1%)	146 (1.2%)	629 (5.1%)
Increasing 25% - 50%	23 (0.2%)	76 (0.6%)	27 (0.2%)	126 (1.0%)
Increasing > 50%	22 (0.2%)	41 (0.3%)	16 (0.1%)	79 (0.6%)
Total observations	2,732 (22.1%)	7,046 (57.0%)	2,583 (20.9%)	12,361 (100.0%)

Note: This table is a cross tabulation of the impact on sales (row) with the technological dependency variables (column). The percentage relative to the total observations is in parentheses.

Appendix 4.B: Cross tabulation of technological dependency and business hindrance

The biggest hindrance in operating business	Technological dependency			Total
	Nontechnology-based	Technology-based	Highly technology-based	
Obtaining raw materials	110 (0.9%)	237 (1.9%)	81 (0.7%)	428 (3.5%)
Paying operational costs	413 (3.3%)	1,213 (9.8%)	458 (3.7%)	2,084 (16.9%)
Paying labour costs	206 (1.7%)	532 (4.3%)	209 (1.7%)	947 (7.7%)
Product distributions	80 (0.6%)	263 (2.1%)	114 (0.9%)	457 (3.7%)
Decrease in demand	1,442 (11.7%)	3,490 (28.2%)	1.196 (9.7%)	6,128 (49.6%)
Increase of operational costs	110 (0.9%)	385 (3.1%)	190 (1.5%)	685 (5.5%)
Debt payments	198 (1.6%)	465 (3.8%)	181 (1.5%)	844 (6.8%)
No extraordinary hindrance	173 (1.4%)	461 (3.7%)	154 (1.2%)	788 (6.4%)
Total observations	2,732 (22.1%)	7,046 (57.0%)	2,583 (20.9%)	12,361 (100.0%)

Note: This table is a cross tabulation of the biggest hindrance in operating business (row) with the technological dependency variables (column). The percentage relative to the total observations is in parentheses.

Appendix 5: ANOVA for impact on sales

Appendix 5.A: Descriptive statistics

Dependent Variable: Impact on Sales				
Technological dependency	Utilising tax incentive?	Mean	Standard Deviation	N
Nontechnology-based	No	1.97	1.245	1,403
	Yes	2.16	1.246	1,329
	Total	2.06	1.249	2,732
Technology-based	No	2.08	1.254	3,506
	Yes	2.35	1.348	3,540
	Total	2.21	1.309	7,046
Highly technology-based	No	2.21	1.290	1,345
	Yes	2.32	1.334	1,238
	Total	2.26	1.313	2,583
Total	No	2.08	1.262	6,254
	Yes	2.30	1.326	6,107
	Total	2.19	1.299	12,361

Appendix 5.B: Robustness tests for impact on sales

Levene's Test of Equality of Error Variances[a,b]					
		Levene Statistic	df1	df2	Sig.
Impact on sales	Based on Mean	14.345	5	12,355	0.000
	Based on Median	5.555	5	12,355	0.000
	Based on Median and with adjusted df	5.555	5	11,070.599	0.000
	Based on trimmed mean	13.646	5	12,355	0.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Dependent variable: Impact on sales

b. Design: Intercept + Technological dependency + Tax incentives status + Technological dependency * Tax incentives status

Tests of Between-Subjects Effects								
Dependent Variable: Impact on Sales								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	227,621[a]	5	45.524	27.284	0.000	0.011	136.421	1.000
Intercept	47,743.181	1	47,743.181	28,614.165	0.000	0.698	28,614.165	1.000
Tech. dependency	60.937	2	30.469	18.261	0.000	0.003	36.522	1.000
Tax incentives status	95.174	1	95.174	57.041	0.000	0.005	57.041	1.000
Technological dependency * Tax incentives status	12.162	2	6.081	3.644	0.026	0.001	7.289	0.674
Error	20,614.510	12,355	1,669					
Total	80,111.000	12,361						
Corrected Total	20,842.131	12,360						

a. R Squared = .011 (Adjusted R Squared = .011)

b. Computed using alpha = .05

Robust Tests of Equality of Means: Impact on Sales				
	Statistic[a]	df1	df2	Sig.
Welch	19.376	2	5,487.645	0.000
Brown-Forsythe	18.747	2	8,218.130	0.000
a. Asymptotically F distributed.				

Appendix 6: ANOVA for impact on profit

Appendix 6.A: Descriptive statistics

Dependent Variable: Impact on profit				
Technology dependency	Utilising tax incentive?	Mean	Standard Deviation	N
Nontechnology-based	No	1.97	1.194	1,403
	Yes	2.15	1.251	1,329
	Total	2.06	1.225	2,732
Technology-based	No	2.07	1.229	3,506
	Yes	2.19	1.272	3,540
	Total	2.13	1.252	7,046
Highly technology-based	No	2.15	1.248	1,345
	Yes	2.24	1.311	1,238
	Total	2.19	1.280	2,583
Total	No	2.06	1.227	6,254
	Yes	2.19	1.276	6,107
	Total	2.13	1.253	12,361

Appendix 6.B: Robustness tests for impact on profit

Levene's Test of Equality of Error Variances[a,b]					
		Levene Statistic	df1	df2	Sig.
Impact on profit	Based on Mean	4.464	5	12,355	0.000
	Based on Median	1.510	5	12,355	0.183
	Based on Median and with adjusted df	1.510	5	12,193.616	0.183
	Based on trimmed mean	2.834	5	12,355	0.015

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Dependent variable: Impact on profit

b. Design: Intercept + Technological dependency + Tax incentives status + Technological dependency * Tax incentives status

Tests of Between-Subjects Effects								
Dependent Variable: Impact on profit								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	79,530[a]	5	15.906	10.171	0.000	0.004	50.857	1.000
Intercept	45,517.882	1	45,517.882	29,107.168	0.000	0.702	29,107.168	1.000
Tech. dependency	23.903	2	11.952	7.643	0.000	0.001	15.285	0.948
Tax incentives status	44.997	1	44.997	28.774	0.000	0.002	28.774	1.000
Technological dependency * Tax incentives status	2.573	2	1.287	0.823	0.439	0.000	1.646	0.192
Error	19,320.788	12,355	1.564					
Total	75,345.000	12,361						
Corrected Total	19,400.318	12,360						

a. R Squared = .004 (Adjusted R Squared = .004)

b. Computed using alpha = .05

Robust Tests of Equality of Means				
Impact on profit				
	Statistic[a]	df1	df2	Sig.
Welch	7.725	2	5,431.740	0.000
Brown-Forsythe	7.696	2	8,109.931	0.000

a. Asymptotically F distributed.