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WHAT HAS BEEN HAPPENING TO INDONESIA'S MANUFACTURING INDUSTRY?

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Abstract
This paper is the second part of the first paper published by the LPEM UI on January 18th 2021 (Verico, 2021a). This first part discussed Indonesia's output gap, the global pandemic's impact, and the scenario to avoid the middle-income trap by 2040. In this second part, the paper figures out the manufacturing sector performance from 1968 until 2019, before the global pandemic hit Indonesia's economy. Indonesia's economy needs an adjustment that depends on the pandemic containment to achieve even higher economic growth to compensate for economic contraction during the pandemic. This paper finds that Indonesia's manufacture can boost economic growth, decrease open unemployment and improve productivity. This paper argues that Indonesia can achieve the second wave of the Chenery-Syrquin phenomenon of economic transformation from service to manufacturing through two scenarios: one, medium to long-run over the enhancement of the backward linkage of global value chains (GVCs), and two, natural short-run with the role of information and communication technology (ICT).

JEL Classification: D83; F43; L60; N10; O14

Keywords
economic growth — manufacturing — industrial structure — economic transformation — Information Communication Technology

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1. Introduction

1.1 Background

Indonesia's manufacture recorded higher economic growth than total economic growth from 1968 to 1995 with several years showed the opposite such as 1971–1972 and 1981–1982. Since 1984, Indonesia's manufacturing sector has significantly grown above both the agriculture and service sector. However, as manufacturing share to total Indonesia's economy in 1983 was the lowest at 13.43 percent compared to the service sector at 39.27 percent and agriculture sector at 24.1 percent, it took time for the manufacturing sector to surpass the share of other sectors and become the backbone of Indonesia's economic growth. The manufacturing sector achieved a higher share over the agriculture sector in 1991 at 20.96 percent and 19.66 percent. This fact was the first Chenery and Syrquin's phenomenon for Indonesia.

Meanwhile, the manufacturing sector share is still below that of the service sector until today. In terms of growth, the manufacturing sector was always above the service sector from 1983 to 1996 until Asian Financial Crises (AFC) came and turned the position upside down. In 1997, manufacturing sector growth was below that of the service sector at 5.25 percent and 5.58 percent.

In the period of crises, the economic growth of manufacturing back to the previous condition was higher than that of the service sector but only until the year of 2000. Since 2001, Indonesia's manufacturing sector growth was below that of the service sector but remained higher than total economic growth until 2004. From 2005 until now, Indonesia's manufacturing growth has been lowered than total economic growth and service sector growth.

In 2005, the manufacturing, total economy, and service sectors grew at 4.6 percent, 5.7 percent, and 7.9 percent, respectively. Indonesia did not experience the second phenomenon of Chenery and Syrquin since it has not surpassed the service sector's economic share until now. Furthermore, Indonesia's manufacturing sector growth is always lower than total economic growth, which confirmed that the manufacturing sector is no longer Indonesia's economic growth backbone. In the last 15 years, Indonesia depends on the service sector with less labor absorptive and skilled labor orientation than the manufacturing sector.

The previous first paper showed that Indonesia needs to accelerate its economic growth to avoid the middle-income trap by 2040 (Verico, 2021a). This second paper found that Indonesia needs to have at least 1.5 times average manufacturing growth above its economic growth until 2040. Reflecting Indonesia's experience, the data showed that Indonesia's manufacturing sector had an average growth of 11 percent in 1968–1991 with average economic growth of 7 percent. This number means that the elasticity of manufacturing to total economic growth was 0.58. This paper found that nowadays, it increased to 0.74, which means more elastic than during the New Order (*Orde Baru*). In the end, Indonesia needs to articulate the idea into what manufacturing can support this objective.

Long experience since Industrial Revolution 1.0 in the late 19th century until now with Industrial Revolution 4.0. No country can develop its manufacturing, even the original idea, design, research, and prototype development owned by its own. Every country has to establish a network at all

levels, from production to after-sales service, and these need a combination of trade and investment networks. The so-called Global Value Chains network needs all levels, global and regional. Indonesia needs to understand its economic potential and comparative advantage and apply structural reform and harmonization to the worldwide trade and investment rules and inquiries. Indonesia needs an economic transformation and becoming the compact part of both the global production and service center network.

1.2 Objective

Given the background, this paper has several related objectives:

1. Understanding Indonesia's manufacturing sector in value-added growth and labor absorption
2. Knowing the impact of the global pandemic on Indonesia's economy
3. Analysing Indonesia's manufacturing figures
4. Assessing the comparative and competitive advantage of Indonesia's manufacturing
5. Understanding Indonesia's manufacturing strategies of both the long-run and short-run

1.3 Research Question

Given the objectives above, this paper proposes several research questions:

1. How much does the manufacturing sector contribute to Indonesia's value-added and job creation?
2. How much the impact of the global pandemic on Indonesia's economy?
3. How do Indonesia's manufacturing figures look alike?
4. How does Indonesia's manufacturing comparative and competitive advantage look alike?
5. How does Indonesia adjust its manufacturing strategies both the short and medium to long-run?

1.4 Specific Coverage

This paper focuses on Indonesia's manufacturing sector role to support economic growth given the pandemic impact on the economic contraction and scenario to boost manufacturing growth to avoid the middle-income trap by 2040.

This paper applies descriptive analysis with secondary data analysis using the World Development Indicators of the World Bank, the primary data analysis on a survey of Indonesia's upper-middle manufacturing, labor-intensive analysis, comparative and competitive trade indexes with the trade map dataset, analysis of backward and forward linkage with trade-in value-added data of the OECD and primary data of the role of the ICT in Indonesia's manufacturing sector.

This paper also applies a statistic inference analysis with a simple regression of economic growth as a dependent variable and manufacturing sector growth and time-dummy as independent variables.

2. Reference and Theoretical Overview

The study of Todaro & Smith (2012) confirmed Lewis's two-sector model that describes labor surplus in developing countries as a development advantage. The Lewis model showed that a developing country has two sectors. One is the traditional and overpopulated rural sector with zero or negative marginal productivity, and two are modern and skilled worker labor.

The study of Naudé & Szirmai (2012) proved that developing countries' economic transformation needs manufacturing sector transformation. This effort needs improvement in labor productivity and employment. This result consistent with the division of labor and benefits of openness and trade. Moreover, this study also found that the manufacturing sector became the engine of economic growth with structural reform and catching-up technology.

A study by Romer in 1994 proved its endogenous growth theory that economic growth is the result of endogenous forces that needs investment in human resources, innovation, and knowledge. These are the most vital factors to economic growth. This study also shows the positive spillover effect of technology and expertise on economic transformation and development.

Mankiw in 2010 showed that the endogenous growth models in line with the technological change, which resulted from total investment in the manufacturing vital factors of both human capital and its knowledge and know-how improvement. His study confirmed that the endogenous growth model needs human capital investment and foreign private investment in labor productivity.

Zhong & Ge in 2018 argued that the Internet of Things (IoT) for manufacturing is essential to support the manufacturing transformation. The IoT is critical to transforming the quality of work and product of the manufacturing sector. The IoT helps manufacture track and control their production, selling service, and after-sales services network. Moreover, their study found that the manufacturing sector needs a support system based on the IoT, such as smart factories, robotic automation, agile, and quick decision-making. Firms can use the IoT to improve both productivity and product quality.

Zhong et al. in 2016 found that manufacturing firms usually utilize a lot of wireless tools and applications that create high benefits, mainly to accelerate the product's delivery and services as well as to increase manufacturing productivity. This system is useful for both the improvement of product quality and reliability.

The input tariff reduction increased productivity level at least double compared to the output tariff reduction (Amiti & Konings, 2007). Their study uses Indonesia's annual medium-large manufacturing survey and applied tariff rate from the period of 1991 to 2001. They found that having a lower intermediate input tariff rate than that of final good increased firm's productivity twice higher than having the opposite. Their study supported the implementation of the discriminative tariff barrier policy of Indonesia of which the tariff rate of imported final product was always higher than that of the imported intermediate input. This tariff different policy has been the base for the measurement of the Effective Rate Protection (ERP) in Indonesia.

A study by Lin in 2017 describes five technological options for manufacturing acceleration of economic growth. They are the catching-up whereas technological transfer from developed to developing is important, the leading- and cutting-edge industrialization with the vital role of R&D, design, and innovation. The other factors include the com-

parative advantage losing industries that decision was taken based on the comparative advantage analysis, implementing the short-innovation cycle to catching-up with the advanced countries. Finally, the option that Indonesia has adopted for years is the strategic industry. The latter is government-led industrialization. Indonesia must combine and harmonize several manufacturing strategies based on the complete set of information on manufacturing development benefits and cost. These strategies must be applied from short, medium, to the long-run framework.

2.1 The Economic Growth and Elasticity

A previous paper (Verico, 2021b) showed the Saving-Investment Gap Model, Harrod-Domar Model, Cobb-Douglas, and Solow Growth Model, which proved the significant factors that affect economic growth. They are:

$$\frac{\partial y_{nt}}{y_{nt}} = \frac{\{[I_{nt} + (X_{nt} - M_{nt})] - [\partial_{nt} + \rho_{nt} + \frac{\partial E}{E_{nt}}]\}.\sqrt{\frac{(K,k)_{nt}}{(L,l)_{nt}}}}{c_{nt}} \quad (1)$$

Where:
$\frac{\partial y_{nt}}{y_{nt}}$: Real Economic Growth country n time t;
I_{nt} : Manufacturing Strategies based Investment;
$X_{nt} - M_{nt}$: Current Account;
∂_{nt} : depreciation;
ρ_{nt} : Population;
$\frac{\partial E}{E_{nt}}$: Marginal Productivity of Labour;
$\frac{K_{nt}}{L_{nt}}$: Infrastructure Availability;
$\frac{k_{nt}}{l_{nt}}$: Level of Technology (Manufacture Strategy);
c_{nt} : ICOR.

These combination models indicated that economic growth had been affected by investment. This fact is closely related to the manufacturing sector and how the Foreign Direct Investment connects with the trade, particularly net export indicators, the country's competitiveness, and trade-investment options (Verico, 2017).

The other essential factors are sustainable development with the proxies of the depletion, degradation, and depreciation of environment, number of populations, marginal productivity, the availability of adequate infrastructure, technological level and transfer from the parent's companies and the excellent institution economy with good governance, clean government, good regulatory framework, and Information and Information Communication Technology system. Therefore, in the context of investment relations between home and host country, technology transfer from home to host country is necessary and supports the long-run vision to enhance the manufacturing sector's role.

This combined model is necessary to find the medium to long-run solutions for accelerating sustainable economic growth. The previous first paper has explained sources of economic growth from an expenditure and productivity perspective.

This second paper will show economic growth from the elasticity relation between the manufacturing sector and total economic growth. Elasticity economic growth calculation applies bivariate log-log regression, which describes as follows:

$$\log \frac{\Delta y_{nt}}{y_{nt}} = \alpha_{nt} + \log \frac{\Delta y_{nit}}{y_{nit}} + d_{nit} + \in_{nit} \quad (2)$$

$\log \frac{\Delta y_{nt}}{y_{nt}}$: economic growth of country n, time t;
$\log \frac{\Delta y_{nit}}{y_{nit}}$:economic sector growth of country n, time t, sector i;
d_{nit} : time dummy of break point of country n, time t, sector i.

2.2 Trade Analysis

The paper applies the combination of Terms of Trade (ToT), Net Export (NX), Revealed Comparative Advantage (RCA) and Constant Market Share Analysis (CMSA). These analyses utilize the Harmonized System digit four (HS4) from the Trade Map. The formulations are described below:

$$RCA_{ijt} = \frac{X_{int}/\sum_{i=1}^{i=n} X_{nt}}{X_{iwt}/\sum_{i=1}^{i=n} X_{nt}} \quad (3)$$

Where:
i : value of export (X) commodity i from country n in time t;
w : world data;
n : country data.

$$\begin{aligned} X_{ijt1} - X_{ijt0} &= \sum(X_{iw\Delta t}).X_{ijt0} - X_{ijt0} \\ &+ (X_{iw\Delta t} - \sum X_{iw\Delta t}).X_{ijt0} \\ &+ (X_{ijt1} - X_{iw\Delta t}.X_{ijt0}) \end{aligned}$$

Where:
$\sum(X_{iw\Delta t}).X_{ijt0} - X_{ijt0}$: General Factor (CMSA1);
$(m_{iw\Delta t} - \sum m_{iw\Delta t}).X_{ijt0}$: Composition Factor (CMSA2);
$(X_{ijt1} - m_{iwj\Delta t}.X_{ijt0})$: Comparative Factor (CMSA3).

This paper combines the RCA and comparative factor (CMSA3) to estimate four types of manufacturing: Great if RCA>1 and CMSA3>0, Sunrise if RCA<1 and CMSA3>0, Sunset if RCA>1 and CMSA3<0, and Suffer if RCA<1 and CMSA3<0. The other combination is Terms of Trade and Net Export as formulated below.

$$ToT_{it} = \frac{PX_{it}}{PM_{it}} \quad (4)$$

$$NX_{it} = X_{it} - M_{it} \quad (5)$$

This combination reflects the product quality that can be classified in four different categories as Elegance if ToT>1 and NX>0, Increase if ToT<1 and NX>0, Decrease if ToT>1 and NX<0, and Poor if ToT<1 and NX<0.

The period of analysis is 2015 and 2019 which fulfill last five-year analysis and before the global pandemic. The latter is to avoid outlier condition.

2.3 Labor Intensive Index

This paper calculates the labor-intensive manufacturing product by comparing the percentage of labor of each product at the firm level to total labor with the share of value-added of that product at the firm level to total value-added.

$$L_{int} = \frac{l_{int}}{\sum l_{int}} \Big/ \frac{VA_{int}}{\sum VA_{int}} \quad (6)$$

L : labor intensive;
i : commodity;
n : country;
t : time;
VA : value-added.

If Lint of a product is above one, then the product is labor-intensive, and the higher the index, the more labor-intensive the product.

2.4 The Effective Rate of Protection (ERP)

As for the tariff reduction comparing output and input, the study of Hayakawa et al. (2017) found that output tariff reduction created a lower impact than that of input tariff. They confirmed that the application of tariff discrimination between final product and intermediate input is useful for Indonesia's trade liberalization. This trade liberalization policy reduces import tariff for intermediate input while keeping that of final product import. This policy gives incentive for firms to produce a product as input tariff rate decrease while imported output tariff rate remains. The Effective Rate of Protection formulation is explained as follows:

$$ERP_{i,t} = \frac{\left((fp.(1+tf_{i,t}) - \left(\frac{in_{i,t}}{on_{it}}\right).in_{i,t}.(1+tin_{i,t})\right)}{\left(1-\frac{in_{i,t}}{on_{it}}\right)} \quad (7)$$

fp : value added final product;
$tf_{i,t}$: tariff of final product;
$in_{i,t}$: volume of input;
on_{it} : volume of output;
$tin_{i,t}$: tariff of input.

3. Descriptive Analysis

3.1 Relative Economic Growth: Total Economy vs Manufacture Sector

Indonesia's manufacturing sector has successfully passed agriculture sector growth in 1992 but experienced slower growth due to the Asian Financial Crises (AFC) 1998 and struggled to go back to the track. This fact shows that Indonesia had experienced the first Chenery-Syrquin phenomenon that manufacturing contribution to the GDP is more than agriculture sector contribution to the GDP.

Indonesia performed good economic policy in finding the equilibrium and connectivity between trade balance and openness degree in 1987–1991, which successfully helped Indonesia experience the first Chenery-Syrquin phenomenon However, from 1993 to 1996, Indonesia experienced reversing policies that affect both international trade and manufacturing firms' competition, for instance, the national car project of 1996 which was incompatible with the World Trade Organization (WTO) rules in 1998. This project was not challenged by foreign countries but also by the local joint ventures.

During the AFC, Indonesia applies a series of structural reforms and changes the government era from New Order (*Orde Baru*) to Reform Era (*Era Reformasi*). Indonesia's manufacturing made some adjustments, including the strategic industries such as the national aircraft industry of IPTN (*Industri Pesawat Terbang Nusantara*)[1], which has to implement internal restructuring considering the economic reform recipes.

From 1998 to 2004, Indonesia was struggling to adjust its manufacturing competitiveness from policy-driven to market mechanism-driven during the reform era. Nevertheless, since 2005, this sector has shown a lower economic growth rate than total economic growth which made its contribution to the GDP, continue to decrease. This fact showed that Indonesia's economy has depended on the service sector for the last 16 years. Therefore, Indonesia's manufacturing had no longer the engine of growth, like from 1968 to 1991. Indonesia manufacturing sector needs the interventions which must meet the market mechanism equilibrium (Cournot-Nash Equilibrium).

This figure (See **Figure 1**) confirms that the manufacturing sector is no longer Indonesia's growth engine since the Asian Financial Crises 1998. In almost 20 years, Indonesia depends on the service sector, which has been suffering from a deficit trade balance. This condition confirmed that Indonesia's service sector is not globally competitive and, hypothetically, mostly small to medium-sized in the informal sector. How are Indonesia's current manufacturing figures and competitiveness look alike?

3.2 Manufacture Role in Indonesia's Labor Absorption

Even though manufacturing's economic growth is lower than average total economic growth, the manufacturing sector remains the dominant employment creation sector. This fact proves that the manufacturing sector's contribution to labor absorption is more than the average total industry of six percent and annual growth more than the entire annual growth of 0.11 percent. This figure also proves that the manufacturing sector remains very important for developing countries like Indonesia to create jobs.

The manufacturing sector remains the essential sector in absorbing employment, reducing unemployment, and supporting the output gap's quality, as mentioned in the first paper (Verico, 2021b). This finding shows that Indonesia must improve its manufacturing productivity by combining market mechanisms and policy intervention. The latter must harmonize with the market mechanism and adopts market-friendly approaches. Any policies must not create discrimination among firms. However, given the backward policies in mid of the 1990s before the AFC came, manufacturing sector competitiveness improvement must be started from the supply-side (production side).

From the labor absorption side (see **Table 1**), the manufacturing sector remains dominant in Indonesia. The manufacturing sector absorbs around 14 percent of the labor force of which more than the national average absorption at six percent. In terms of labor absorption, the manufacturing sector grows at 1.4 percent annually in the last ten years. This growth rate has been above the average growth rate of total absorption at 0.11 percent over the previous ten years.

Given these two facts, the value-added growth and labor absorption, Indonesia's manufacturing sector has not

[1] Dirgantara Indonesia - Wikipedia; https://id.wikipedia.org/wiki/Dirgantara_Indonesia

experienced deindustrialization per se. It experiences decreasing productivity as its value-added growth has been declining while its labor absorption has been increasing. To increase its economic growth, Indonesia needs to increase its manufacturing sector productivity.

3.3 Indonesia's Economic Potential

In the first paper (Verico, 2021b), Indonesia has immense potential to grow even more. Indonesia's output gap has been consistently improved since 2007 as its open unemployment kept decrease. This fact indicates economic growth has been above minimum economic growth to absorb employment. This condition affects the increasing nominal inflation rate above its expected rate and increasing real economic growth above its potential one. In the last ten years, Indonesia has been significantly focusing on developing massive infrastructure. Before the Asian Financial Crises (AFC), construction contributed around 7 percent per GDP, while after the AFC, it was dropped less to 5 percent and increase in the last ten years before the pandemic 2020 at 6 percent. As to follow up, Indonesia would focus on human capital issues, yet unfortunately, the global pandemic hit human capital quality. Indonesia needs to work simultaneously on human capital development and manufacturing sector development acceleration.

Indonesia needs to accelerate its economic growth to decrease economic growth during pandemic times. The economic growth of 2020 decline to -2 percent; therefore, Indonesia needs to have at least 7 percent economic growth in a particular year to return Indonesia to the previous normal track before the pandemic. But if Indonesia needs to avoid the Middle-Income Trap, the first paper shows that Indonesia has to have minimum 6 percent economic growth. This means Indonesia has to have a minimum of 8 percent economic growth in a particular year or 7 percent economic growth in two years. The more economic contraction a country has, the more compensation of economic growth must achieve. The thing is the minimum average economic growth from 2021 to 2040 at the minimum is 6 percent.

3.4 Global Pandemic Impact on Indonesia's Middle-Income Trap Scenario

Before the global pandemic that negatively affects Indonesia's economy in 2020, Indonesia, as explained above, recorded classy economic growth, which decreased the open unemployment rate (Okun's Law) and increased nominal inflation above its expected nominal inflation rate (Phillips Curve). Indonesia's economy was moving on the right track and accumulating potential growth over the years with massive infrastructure development and human capital orientation. However, the global pandemic has changed this figure upside down in the year 2020 (see **Figure 2**).

Official data from Central Agency on Statistics on February 5th, 2021 showed that in 2020, Indonesia's economy experienced a contraction of around -2 percent, with the lowest point in the second quarter at -5.32 percent. The Government of Indonesia successfully holds the economic growth to increase in the third and fourth quarter. Even though the overall economic growth remained contraction in the below-zero growth zone, it showed recovery trends. Indonesia must preserve this economic optimism to 2021, moving to a positive economic growth zone (Verico, February 10th, 2021a).

As economic growth experienced a contraction, the number of open unemployment increases from 7.1 million to 9.77 million or about 2.67 million people. It was around 2 percent of the total unemployment number. Indonesia's open unemployment rate has increased from 5 percent to 7 percent, as described in **Figure 3**.

The increasing number of open unemployment has also increased the number of people living below the poverty line from 9.2 percent in September 2019 to 10.2 percent in September 2020 (see **Figure 4**). The poverty rate has risen by around 1 percent or 2.7 million people. In terms of the number of people, open unemployment and poverty rate showed a similar number.

However, this indicator does not reflect an 'apple to apple' comparison since the Poverty Severity Index has also increased. The latter indicates that the average expenditure of people living below the poverty line has been decreasing. It shows that there was a natural decrease of people from near-poor to become poor people.

Given these facts, Indonesia must protect the poor in very-short time and those who lost formal jobs and fixed income. This fact indicates that a high alert on the non-formal service sector, which is dominantly run by the MSMEs (Micro Small-Medium Enterprises), is necessary. Pandemic containment is an essential condition for demand-driven recovery and increasing consumption, notably durable goods. Another essential thing is expanding the market over the export tunnel to the non-traditional market of neighboring countries such as Timor-Leste, Papua New Guinea, the Philippines, and Malaysia.

Indonesia's income gap (Gini Ratio) has slightly increased from 0.38 in September 2019 to 0.385 in September 2020, as described in **Figure 5**. It indicates, even in a small percentage, the pandemic increased the income gap. This fact proved that the impact of the global pandemic on income distribution is asymmetric. The richer are getting richer while the poorer are getting poorer. Therefore, in 2020 and 2021, Indonesia remains focused on the social safety net to hold the decreasing expenditure of the lowest cohort of people (bottom 40 percent of national income).

Many field surveys found that Indonesia's counter-cyclical effectively supports economic growth, reflecting its ability to reduce the contraction in labor absorption, the increase in the poverty rate, and the income gap. As Indonesia's economy experienced a contraction, it needs to accelerate the economic growth. One of the most practical ways is to improve the manufacturing sector's performance and accelerate its economic growth by empowering the manufacturing sector's role as its multiplier impact on the economy is higher than other sectors. This orientation will help Indonesia to graduate from the middle-income trap and enter the high-income level.

The simple regression of elasticity between manufacturing growth and economic growth with log-log model shows that elasticity growth of manufacturing sector and time-dummy to the entire real economy is 0.74 (see **Table 2**). This finding indicates that the manufacturing sector in Indonesia has to grow 8 percent. This target is not unfamiliar for Indonesia as it can achieve on average 11 percent of

manufacturing economic growth from 1968–1990.

As previously explained, Indonesia's manufacturing sector has been experiencing productivity declining with low intermediate goods production rate. Indonesia needs to formulate the manufacturing sector strategies by starting to understand Indonesia's manufacturing sector's current situation. Ideally, strategies are not about aiming the product (picking the winner) but more on the supportive and friendly ecosystem to generate manufacturing competitiveness.

The priority products have to emerge on their own. Product competitiveness must exist because of its natural competitiveness process instead of by design. Sustainable product competitiveness increases because of market mechanisms, not because of government intervention per se. The combined force of market and policy are required for a demand-driven recovery scenario. How do the current manufacturing figures look alike?

3.5 Indonesia's Current Manufacturing Figures

The Government of Indonesia needs to formulate the manufacturing sector strategies by starting to understand Indonesia's manufacturing sector's current situation. This paper adopts the Indonesian upper-middle manufacturing survey data of 2015.

The data shows that in terms of the number of firms, most of Indonesia's firms are in Food Industry then followed by the textile and clothing (see **Figure 6**). These figures show that the majority of Indonesia's manufacturing sector adopts the light technology level.

The data shows that most of Indonesia's manufacturing is in food-related products. The number of foreign firms that invest direct investment (Foreign Direct Investment/FDI) in Indonesia follows suit (see **Figure 7**). The highest number of foreign firms invest in food-related products, as for the next highest number followed by rubber, clothing, and chemical as shown below.

These last two figures confirmed that most Indonesian manufacturing firms work in the level of light technology, including those from abroad. The latter can be seen from the comparative value of investment between FDI and DDI (Domestic Direct Investment) below, which shows that the largest FDI is in computer and electronics, motor vehicle, other transportation, footwear, and clothing in terms of value.

The last three figures (see **Figure 8**) confirm that the dominant Indonesian manufacturing sector that attracts domestic investors and foreign investors in terms of number or value are food-related products, textile, clothing, footwear, rubber, chemical products, computer, and electronics. Indonesia has potential in motor vehicles and machinery, two kinds of heavy industrial products that Indonesia can aim for its economic transformation.

This paper needs to complete the last three figures describing Indonesia's current manufacturing level of technology and its potential level with Indonesia's achievement in the Industrial Revolution classification. The subsequent analysis will combine a survey of the upper-middle manufacturing and trade (HS-4) dataset.

3.6 Indonesia's Industrial Revolution Level

This paper generates an index as a proxy to measure the level of labor-intensive. The calculation method of the index can be found in the previous chapter. Based on this calculation, this paper confirmed that labor-intensive manufacturing in Indonesia includes clothing, textile, footwear, pharmacy, and rubber manufacturing.

Labor intensive index is useful to assess the previous signals which shows Indonesia manufacturing sector experience decreasing of productivity as one of the hypotheses were the increasing of job creation is faster than that of value-added.

Labor-intensive index was explained above and the complete calculation results of labor-intensive index by product of firm's level are described in **Figure 9**.

This figure shows that most labor-intensive in Indonesia, the above one indexes, are clothing, furniture, textile, wood, footwear, metal non-machinery, printing product, pharmacy, rubber, and plastic. This figure confirmed previous findings that Indonesia's manufacturing remains dependent on labor-intensive products of clothing, textile, footwear, and natural resource products of wood, furniture, printing products, rubber, plastic, and mining. This figure indicates that Indonesia remains in Industrial Revolution 2.0[2], with clothing and footwear as its dominant labor-intensive industry.

In terms of value-added, Indonesia produces motor vehicles, basic metal, chemical, machinery, non-metal products, and electricity tools. The lower rate of labor-intensive indexes proves that these products need more skilled labor. The increase in labor productivity and quality is the key to meet these product needs.

These figures also show that beverages and food were not labor-intensive. These facts indicate that relatively skilled workers operated both dominant manufacturing firms. Product of computer and electronics are more labor-intensive than food and beverages. This finding shows that computers and electronics in Indonesia were dominantly assembling production lines. Indonesia needs to improve its competitiveness in computer and electronic products like what it started in vehicles.

Indonesia also needs to increase quality and productivity in furniture, textile, and mining of metal non-machinery. Indonesia has potential in pharmacy-related products, and given the global pandemic, improvement in this product is very timely and essential.

The combination calculations of RCA – CMSA3 and ToT-NX with HS-4 of 2015 and 2019 confirms previous estimates using upper-middle manufacturing survey that Indonesia has both the comparative and competitive advantage (Great and Elegance) in food-related products and labor-intensive products of clothing, footwear, and mining (see **Table 3**). In addition to mining-related products, this calculation shows that Indonesia is competitive in motorcycles, bicycles, and spare parts. These findings indicate that in addition to motor vehicles and machinery, Indonesia can produce spare parts of motor vehicles.

[2] ASEAN The Next Horizon Implications for New Zealand - ppt download (slideplayer.com); https://slideplayer.com/slide/6235465/.

3.7 Indonesia's Trade Structure

These two figures (see **Figure 10 and 11**) show that Indonesia import depends on intermediate goods while Indonesia's export relies on consumer goods (final products) and very weak on machinery products.

These two figures confirm that Indonesia either competitive in natural resource-related products or final products but less competitive in intermediate goods and machinery. This fact indicates that Indonesia needs to transform its manufacturing competitiveness.

3.8 Effective and Non-Effective Rate of Protection

Instead of implementing the Local Content Requirement (LCR), the government needs to improve domestic local content's quality standard. Indonesia needs to stimulate local intermediate input production by opening up the long-run investment (FDI) inflows in intermediate input. If the domestic producer can produce high-quality intermediate input producer will buy local intermediate inputs.

Table 4 shows that after very long years of implementing the discriminative tariff rate policy between the final product and intermediate information since 2009, Indonesia attempted to no longer protect the final product.

The annual tariff rate data of final and intermediate goods can be seen below. This annual data confirmed that Indonesia had tried to protect intermediate goods from 2009 to 2015 by applying the higher tariff rate towards the final products. This policy aims to support the mainstreaming industry purposes but ineffective as it depends a lot on global commodity price.

The issue was not on the aggregate demand side but the aggregate supply one. Anytime the global price of commodity increases, raw materials are uneasy to keep domestically as the pressure to export them increased. This pressure has nothing to do with the tariff rate of intermediate inputs.

The other reason was the investment in intermediate inputs was not only affected by the tariff protection of intermediate input but also by other factors such as investment climate and ease of doing business.

Therefore, Indonesia started to build massive infrastructure in 2015 and structural reform in 2020 to attract investment inflows including in intermediate products. Simultaneously, Indonesia increases its commitment to environment-friendly targets to support its manufacturing export in a greener global economy nowadays.

In addition to the average form of tariff, this paper also presents the ERP and Non-ERP (the adverse condition of ERP) in an annual data set below (see **Figure 12**).

This adverse of effective rate of protection policy aims to increase the intermediate product supply from the domestic market, and surely it needs the supply-side supporting policy. Therefore, the ERP in Indonesia has been decreasing (Marks, 2017). In Indonesia, the average nominal tariffs during the period 1995 and 2008 have decreased while the average effective rate of protection rate was increased and decreased (Marks & Rahardja, 2012). They also argued the non-tariff barriers are now more favorable for protection policy including in intermediate products import.

A study by Verico & Pangestu in 2020 shown that Indonesia is better to focus on the supply side on how to improve its manufacturing sector competitiveness rather than applying the adverse model of effective rate of protection.

This paper proposes two ideas to enhance manufacturing in Indonesia. One is for the medium to a long run of transforming the economy from exporting raw materials to exporting intermediate goods. Two is for the short-run to enhance the ICT role in the manufacturing production process.

3.9 Medium to Long-Run and A Need for Intervention: Forward and Backward Linkage in the GPNs

This paper adopts and utilizes the Trade in Value-Added (TiVA) methods of the OECD to confirm previous findings above on Indonesia's manufacturing competitiveness. These findings (see **Figure 13 and 14**) are useful for formulating a medium to long-run strategy for Indonesia to boost manufacturing-led export and economic growth in Indonesia.

This paper shows that Indonesia, compared to neighboring countries of some ASEAN member states, was very competitive in forward linkage and weak in backward linkage. These TiVA figures have confirmed that Indonesia needs to improve its productivity for transforming its economy from assembling dominant and natural resources major to be one of the global production base countries. Indonesia's export is fragile due to the fluctuated international commodity price. A series of structural reforms (implementation of the Omnibus Law) is what Indonesia must-do to attract foreign direct investment that aims for production efficiency and networks. This strategy completes both the massive infrastructure development in the last seven years and human capital focus towards the year 2024.

Learning from the advanced countries' experiences, accelerating manufacturing sector development, and turning it into the engine of economic growth needs two conditions. First is the necessary condition covering good institutions and regulatory frameworks to avoid moral hazard and adverse selection at any attempts to pick the winner. This condition is related to structural reforms. Second is sufficient condition related to effective monetary policies and sound fiscal policies that sidestepped the crowding out of both trade and investment. These public policies have to enhance endogenous factors of human capital development related to education, health, and environmental justice, as well as the exogenous ones of infrastructure and technological progress.

3.10 Short-Run and Natural: Manufacturing and the ICT Role

As for the short-run strategy, this paper refers to the quick progress in developing the ICT-based economy. In particular, during the global pandemic impacts on people movement and both work and school from home, the ICT's role becomes critical (see **Table 5**).

This table confirms that Indonesia shows progress in utilizing the ICT platform, particularly in pharmacy, metal not machinery, and printing products. Indonesia must increase the ICT role to other products, in particular the labor-intensive ones such as clothing, textile, footwear and food, and beverages related products.

The ICT role must also be dominant in the production process. This strategy will increase Indonesia's firm productivity and decrease its dependency on unskilled labor, which indirectly reduces minimum wage pressure. This strategy fits the short-innovation cycle (Lin, 2017), and Indonesia has potential in this strategy.

4. Conclusion

This paper found that:

1. From 1968 to 1991, Indonesia's manufacturing sector grows above total economic growth at 11 percent and 7 percent, respectively. Indonesia experienced the first stage of the Chenery-Syrquin phenomenon in 1992 since the proportion of manufacturing to GDP is higher than that of the agriculture sector.
2. After the Asian Financial Crises (1997–1998), the condition above changed to the opposite that manufacture grows below the economic growth (2005–2019) at 4 percent and 5 percent respectively. This fact explains why manufacture sector proportion to GDP has been decreasing in the last 16 years.
3. Nevertheless, the manufacturing sector remains dominant in labor absorption. It absorbs 14 percent of labor which is more than average labor absorption at 6 percent. Labor absorption grows in the last ten years at 1.4 percent, which has been above 0.11 percent of the total average labor absorption growth. As value-added contribution has been dropped while labor absorption increased, Indonesia's manufacturing sector is experiencing decreasing productivity, which means not only deindustrialization per se.
4. Given the global pandemic impact on the economic contraction, Indonesia needs to accelerate its economic and manufacturing sector to grow even more to avoid the middle-income trap by 2040 (the end of the demographic bonus. Therefore, Indonesia needs above 6 percent of average economic growth. Based on the simple elasticity regression in this paper, Indonesia needs the manufacturing sector to grow average at 9 percent. This growth is achievable based on its historical data because Indonesia experienced 11 percent of manufacturing growth from 1968 to 1991.
5. Analysis using the Upper-Middle Manufacturing Firm-Level Survey (UMMFLS) proves that Indonesia's manufacturing dominantly in light manufacturing such as food and beverage and labour-intensive manufacturing like clothing, footwear, textile, and natural resource-related products both unrenewable such as oil, gas and mining and renewables such as wood product, furniture, and printing products. The UMMFLS analysis also shows that Indonesia has potential manufacturing in computer and electronics, pharmacy, motor vehicles, and machinery.
6. Trade analysis using the indexes combination of RCA, CMSA3, ToT and NX consistently prove similar results to UMMFLS analysis that Indonesia has competitiveness in food-related products, labour-intensive, natural resources the unrenewable and renewable products. From the industrial revolution level perspective, Indonesia's competitiveness both from industrial and trade analysis, Indonesia is dominantly at light technological-labor intensive manufacturing of IR 2.0.
7. As from product classification, this paper finds that Indonesia's manufacturing is competitive at consumer products and raw materials while less competitive in intermediate products and capital. The analysis using the Trade in Value-Added (TiVA) OECD also confirms similar results that Indonesia competitive in Forward Linkage (consumer/final product and raw materials) and less competitive in Backward Linkage (intermediate inputs and machinery).
8. As for the medium to long-run purpose, Indonesia needs to experience economic transformation from Forward Linkage to Backward Linkage through supply-side improvements such as the enhancement of the R&D role, human capital productivity improvement, appropriate and massive infrastructure development, and structural reforms of the accurate and effective the Omnibus Law implementation.
9. In the short-run, Indonesia can adopt a short-innovation cycle strategy by enhancing and advancing the role of Information and Communication Technology (ICT) in both the production and non-production side of the manufacturing sector.
10. There are two conditions to accelerate and turn the manufacturing sector into the engine of economic growth. One is the necessary condition of structural reforms to have good institutions and regulatory frameworks. These factors are essential to evade moral hazard and adverse selection in any attempt to pick the winner. Two are sufficient conditions related to effective monetary policies and sound fiscal policies that sidestepped the crowding out of both trade and investment. All public policies must enhance both the endogenous factors of human capital development of education, health, environmental justice and the exogenous ones of infrastructure and technology transfer options.

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Figures

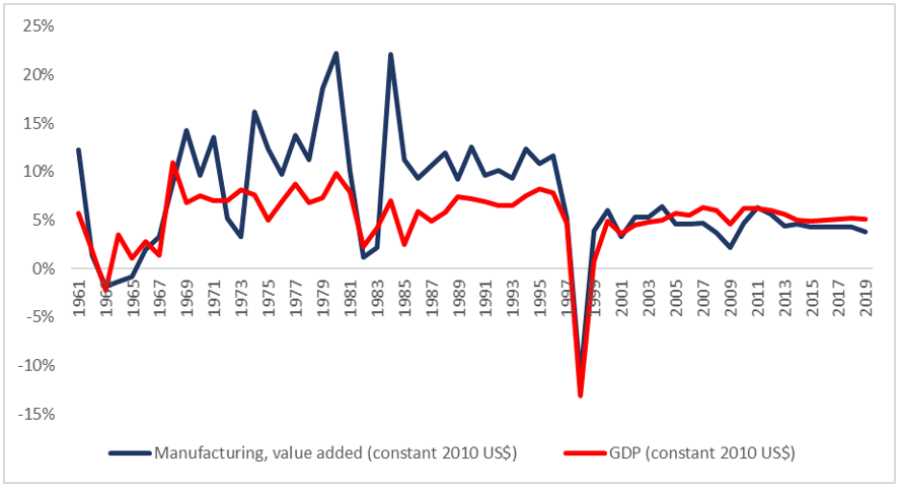

Figure 1. Indonesia's Economic Growth vs Manufacture Growth 1961–2019

Source: Own calculation based on WDI Dataset, 2021

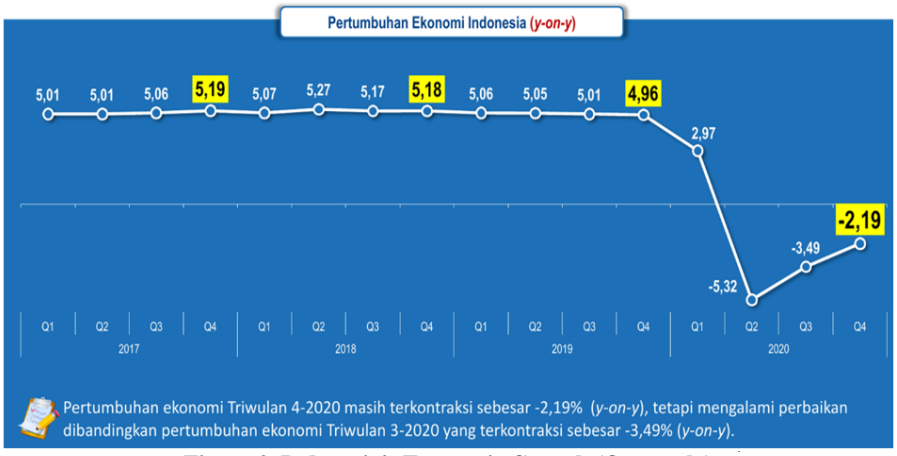

Figure 2. Indonesia's Economic Growth (Quarterly) 2017–2020

Source: Adopted from Berita Resmi Statistik, BPS – Indonesia, February 5th 2021

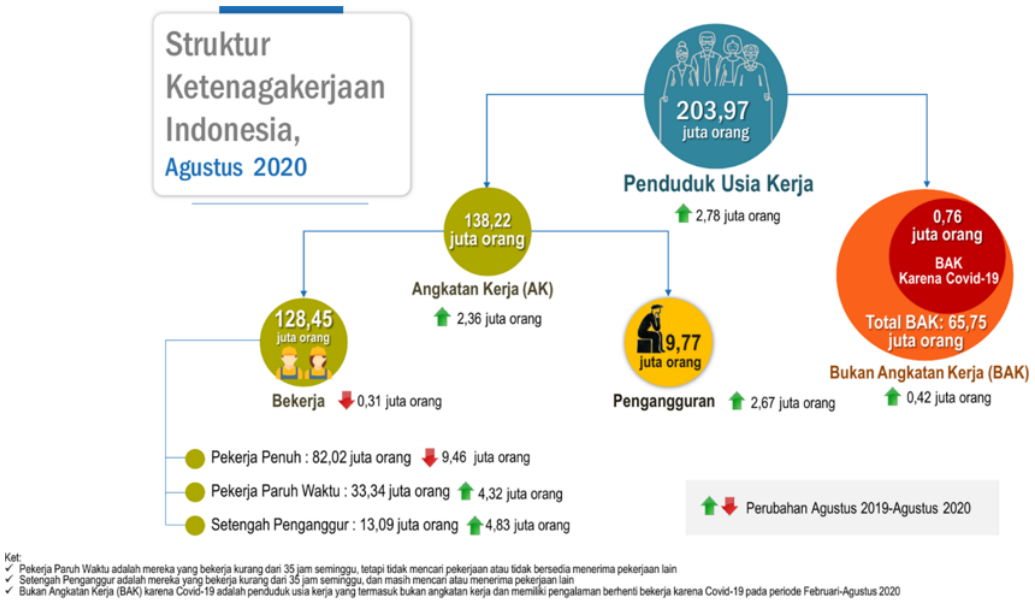

Figure 3. Indonesia's Open Unemployment
2020 (August)
Source: Adopted from Berita Resmi Statistik, BPS – Indonesia, November 5th 2021

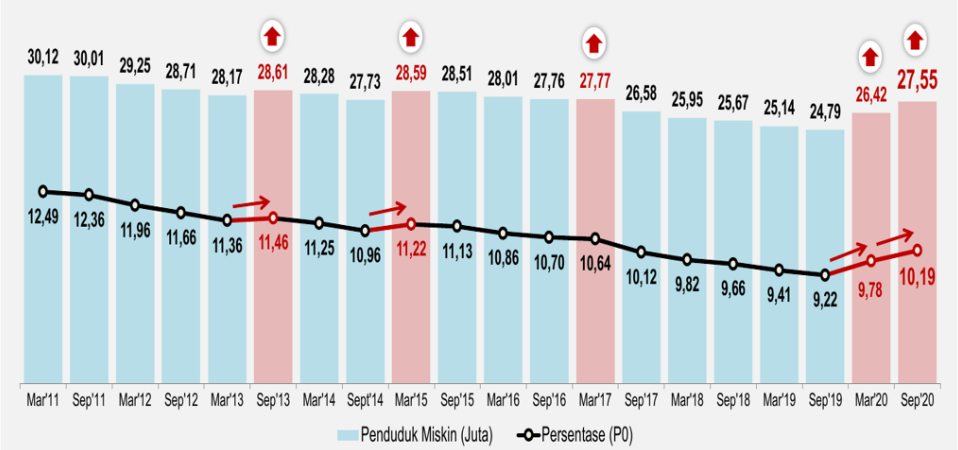

Figure 4. Indonesia's Poverty Line and Number of People
March of 2011 to September 2020
Source: Adopted from Berita Resmi Statistik, BPS – Indonesia, February 15th 2021

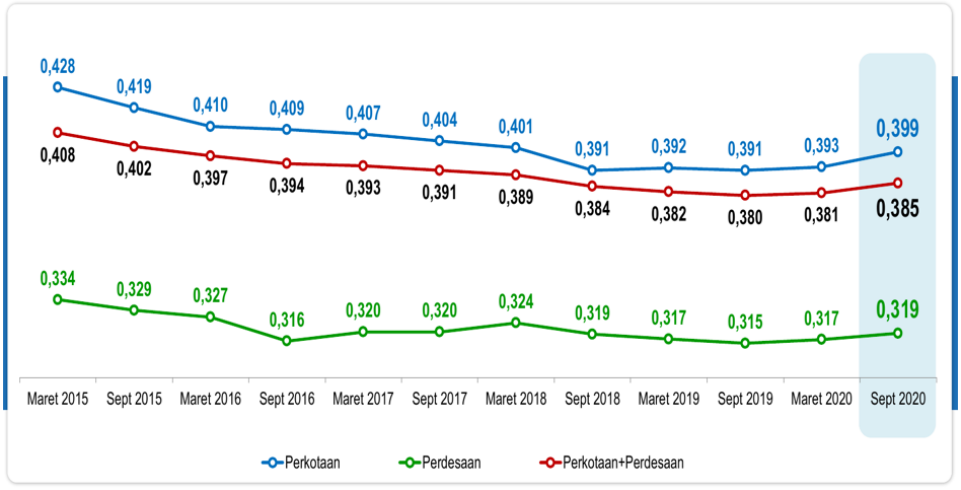

Figure 5. Indonesia's Gini Ratio
March of 2015 to September 2020
Source: Adopted from Berita Resmi Statistik, BPS – Indonesia, February 15th 2021

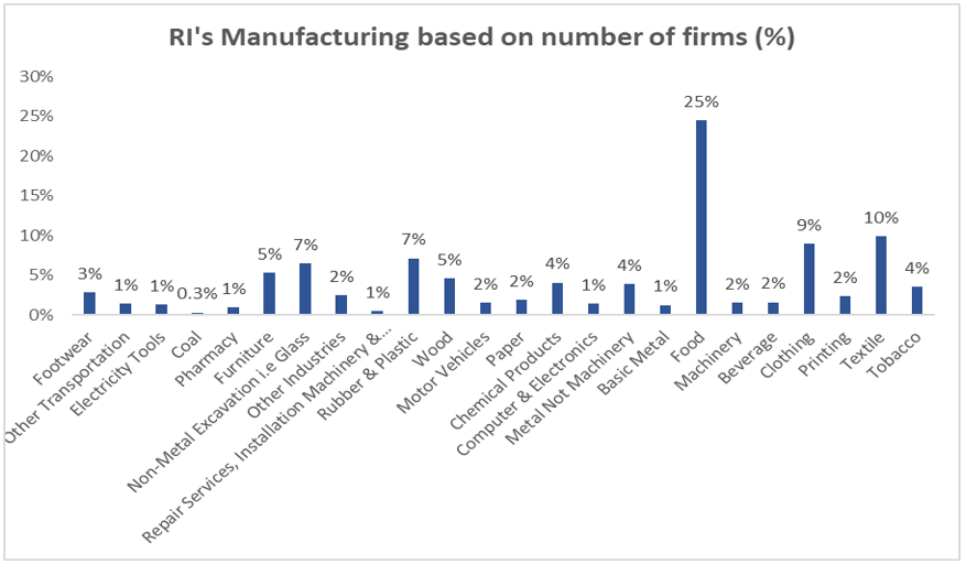

Figure 6. Indonesia's Manufacturing Firms
Source: Own calculation based on 2015 the Upper-Middle Manufacturing Firm-Level Survey, 2020

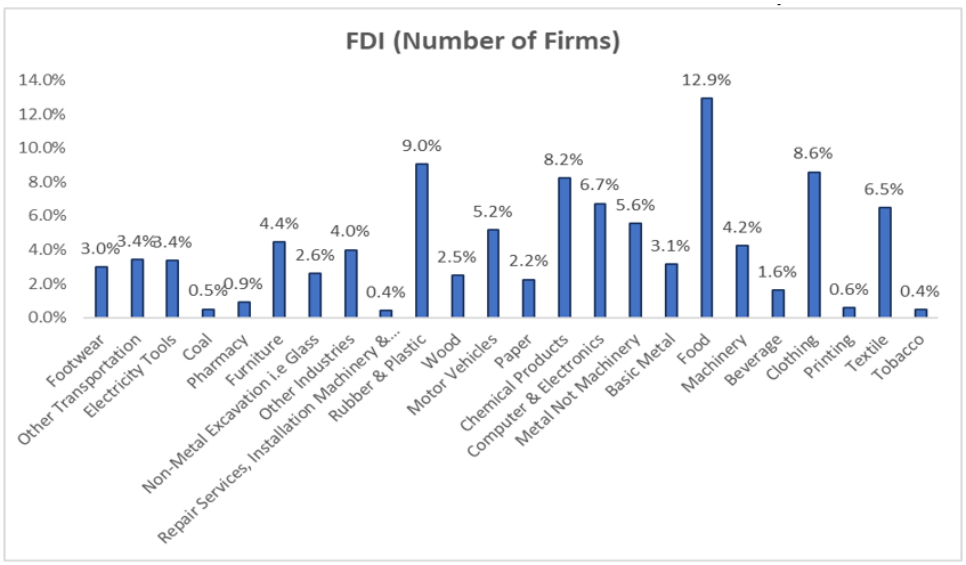

Figure 7. Indonesia's FDI in Manufacturing (Number of Firms)
Source: Own calculation based on 2015 the Upper-Middle Manufacturing Firm-Level Survey, 2020

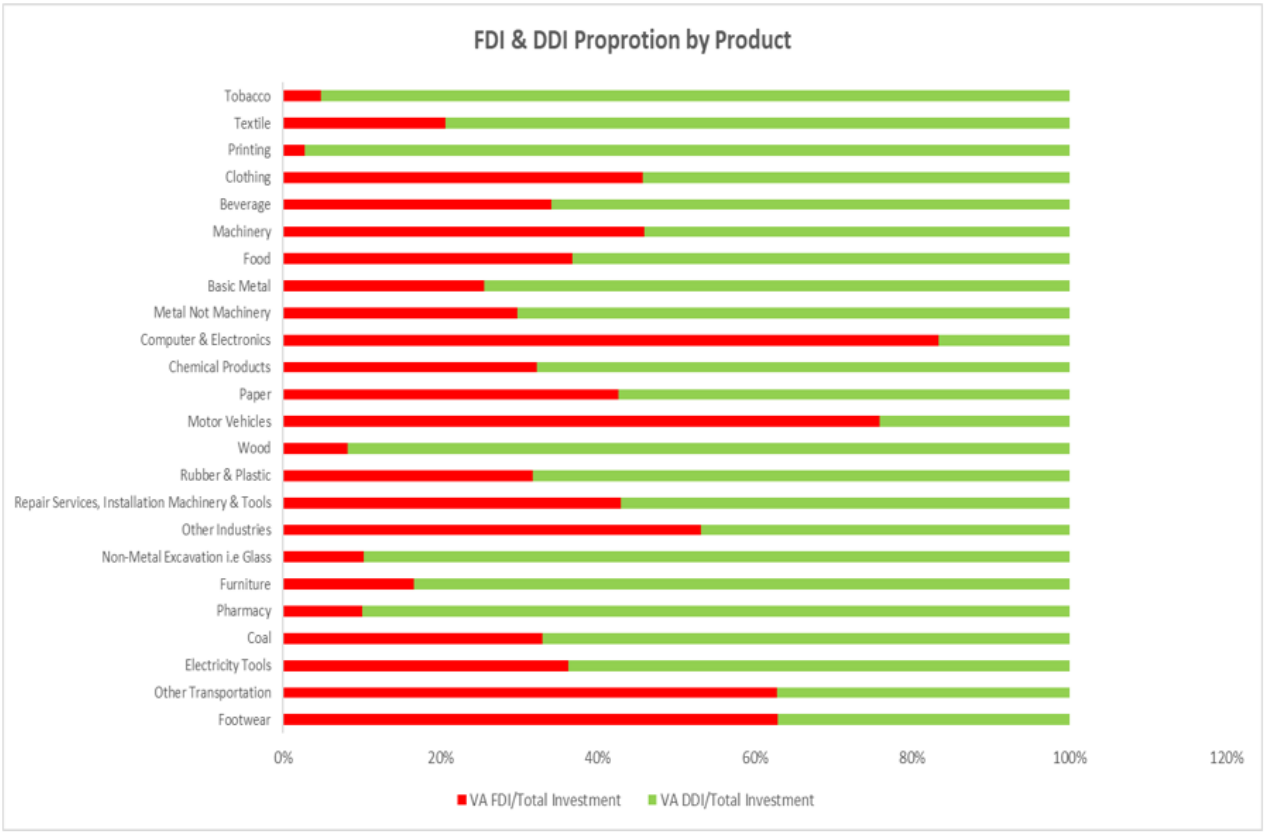

Figure 8. Indonesia's FDI in Manufacturing (Number of Firms)
Source: Own calculation based on 2015 the Upper-Middle Manufacturing Firm-Level Survey, 2020

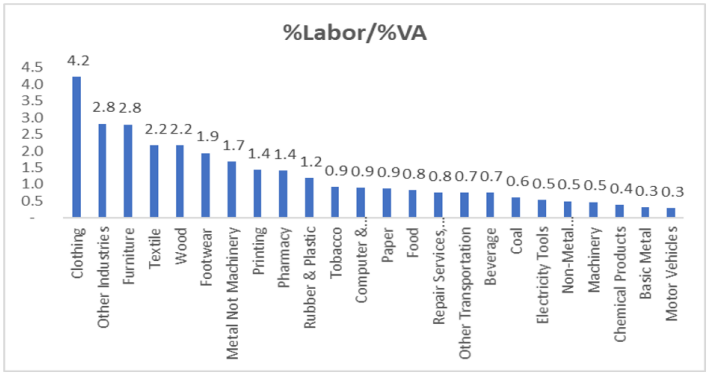

Figure 9. Indonesia's Labor Intensive (% of labor absorption divided by % of value-added share)
Source: Own calculation based on 2015 the Upper-Middle Manufacturing Firm-Level Survey, 2020

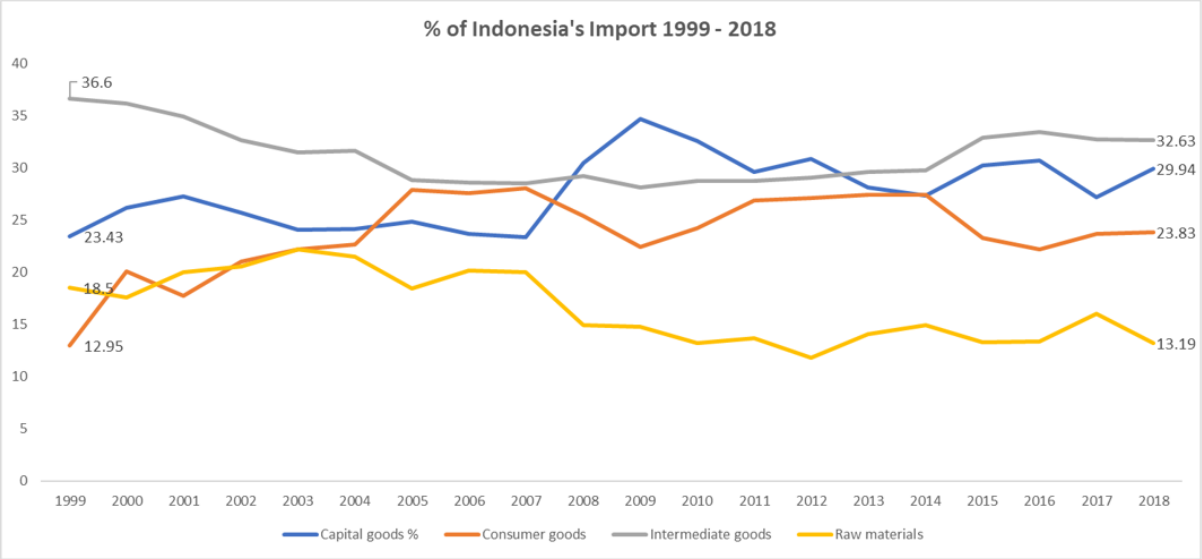

Figure 10. Indonesia's Import Share by Type of Goods 1999–2018

Source: Own illustration based on WDI dataset, 2020

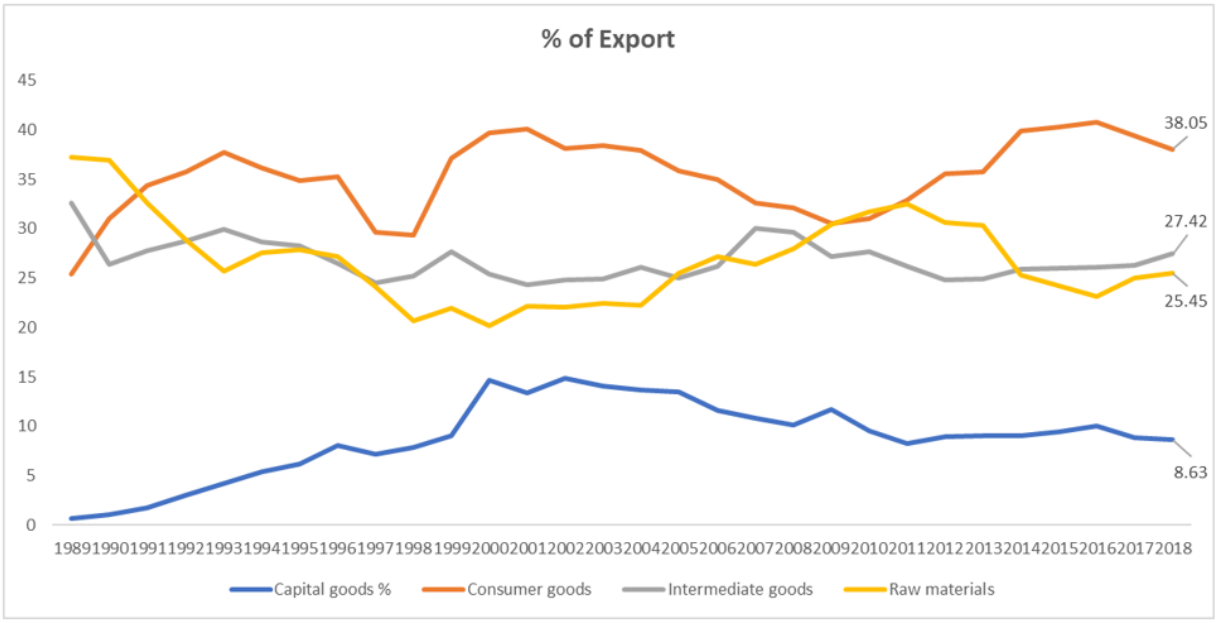

Figure 11. Indonesia's Export Share by Type of Goods 1999–2018

Source: Own illustration based on WDI dataset, 2020

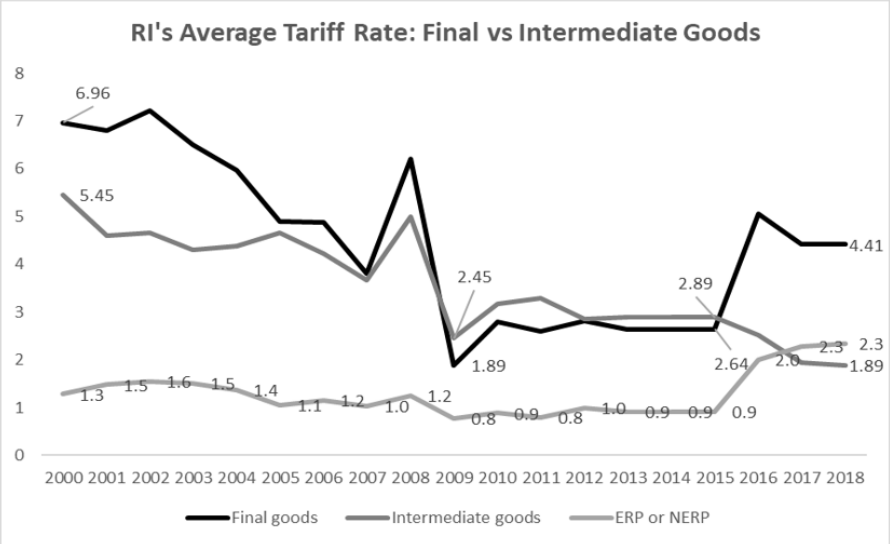

Figure 12. Indonesia's Effective Rate of Protection 2000–2018

Source: Own illustration based on WITS, 2021

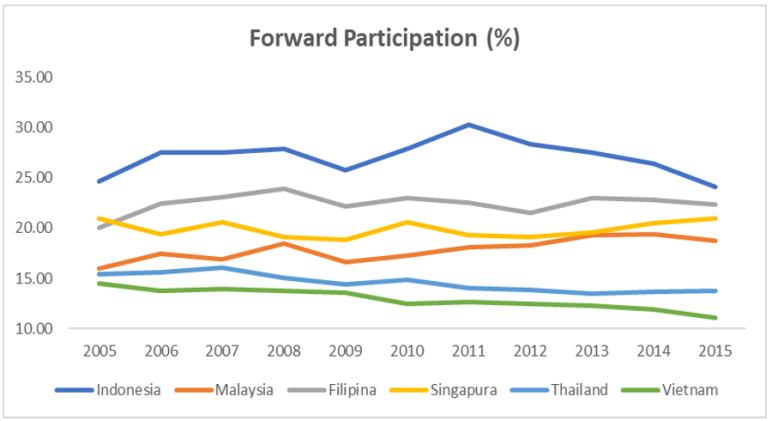

Figure 13. Indonesia's Forward Linkage based on the TiVA OECD 2005–2015

Source: Based on TiVA (Ingot, S.R., Graduate Thesis), 2021

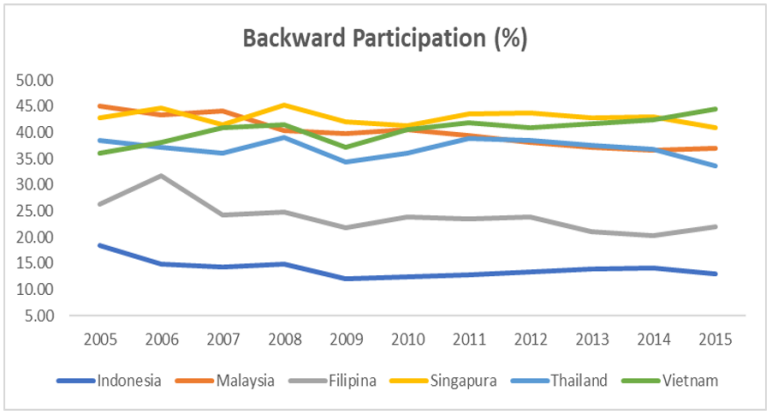

Figure 14. Indonesia's Forward Linkage based on the TiVA OECD 2005–2015

Source: Based on TiVA (Ingot, S.R., Graduate Thesis), 2021

Tables

Table 1. Indonesia's Labour Absorption by Sector 2011–2019

Share in 2011	Labor Absorption by Sector	Share in 2019	CAGR 2011-2019	Status
37.9%	Agriculture, Forestry and Fisheries	29.5%	-0.6%	Not Dominant
1.2%	Mining and Quarrying	1.1%	0.1%	Not Dominant
12.7%	**Manufacturing**	**14.1%**	**1.4%**	**Dominant**
0.2%	Procurement of Electricity, Gas, Steam / Hot Water and Cold Air	0.2%	2.6%	Not Dominant
0.2%	Water Management, Waste Management and Recycling, Waste and Waste Disposal and Cleaning	0.3%	4.7%	Not Dominant
5.0%	**Construction**	**6%**	**1.6%**	**Dominant**
17.6%	**Large And Retail Trade; Repair and Maintenance of Cars and Motorcycles**	**18.9%**	**1.2%**	**Dominant**
4.2%	Transportation and Warehousing	4.0%	0.5%	Not Dominant
3.9%	**Provision of Accommodation and Provision of Drinking Food**	**6.8%**	**3.7%**	**Dominant**
0.8%	Information and Communication	0.7%	0.2%	Not Dominant
1.0%	Financial Services and Insurance	1.4%	2.8%	Not Dominant
0.1%	Real Estate	0.3%	3.9%	Not Dominant
0.9%	Corporate Services	1.3%	2.9%	Not Dominant
3.6%	Government Administration, Defense and Compulsory Social Security	4.0%	1.4%	Not Dominant
4.8%	Education Services	5.1%	1.1%	Not Dominant
1.1%	Health Services and Social Activities	1.5%	2.4%	Not Dominant
4.8%	Other Services	4.9%	0.9%	Not Dominant
100%	**TOTAL**	**100%**		

Source: Own calculation based on WDI Dataset, 2021

Dominant: The proportion of workers to total workers is more than the entire sector average (6%) and Growth in worker absorption is more than the normal weighted average of all sectors (0.11%), Not Dominant when fulfilling only one of these two conditions

Table 2. Indonesia's Elasticity of Manufacturing Sector Growth to National Economic Growth 1960–2019

Dependent Variable: LOG(GDPC)
Method: Least Squares
Date: 02/08/21 Time: 14:13
Sample: 1960 2019
Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(MANUF)	0.638465	0.014545	43.89475	0.0000
DUMMY	0.113744	0.041370	2.749408	0.0080
C	10.70552	0.344399	31.08465	0.0000

R-squared	0.988683	Mean dependent var	26.32826
Adjusted R-squared	0.988286	S.D. dependent var	0.920859
S.E. of regression	0.099666	Akaike info criterion	-1.725278
Sum squared resid	0.566198	Schwarz criterion	-1.620561
Log likelihood	54.75835	Hannan-Quinn criter.	-1.684318
F-statistic	2489.839	Durbin-Watson stat	0.096275
Prob(F-statistic)	0.000000		

Source: Own calculation based on WDI Dataset, 2021

Table 3. Indonesia's Trade Analysis
2015–2019

HS4	Product	RCA-CMS	ToT N
'0301	Live fish	Great	Elegance
'0304	Fish fillets and other fish meat, whether or not minced, fresh, chilled or frozen	Great	Elegance
'0305	Fish, fit for human consumption, dried, salted or in brine; smoked fish, fit for human consumption, ...	Great	Elegance
'0410	Turtles' eggs, birds' nests and other edible products of animal origin, n.e.s.	Great	Elegance
'0905	Vanilla	Great	Elegance
'0907	Cloves, whole fruit, cloves and stems	Great	Elegance
'1302	Vegetable saps and extracts; pectic substances, pectinates and pectates; agar-agar and other ...	Great	Elegance
'1604	Prepared or preserved fish; caviar and caviar substitutes prepared from fish eggs	Great	Elegance
'1605	Crustaceans, molluscs and other aquatic invertebrates, prepared or preserved (excluding smoked)	Great	Elegance
'1804	Cocoa butter, fat and oil	Great	Elegance
'2403	Manufactured tobacco and manufactured tobacco substitutes and "homogenised" or "reconstituted" ...	Great	Elegance
'4106	Tanned or crust hides and skins of goats or kids, pigs, reptiles and other animals, without ...	Great	Elegance
'4203	Articles of apparel and clothing accessories, of leather or composition leather (excluding ...	Great	Elegance
'6102	Women's or girls' overcoats, car coats, capes, cloaks, anoraks, incl. ski jackets, windcheaters, ...	Great	Elegance
'6103	Men's or boys' suits, ensembles, jackets, blazers, trousers, bib and brace overalls, breeches ...	Great	Elegance
'6104	Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, ...	Great	Elegance
'6108	Women's or girls' slips, petticoats, briefs, panties, nightdresses, pyjamas, négligés, bathrobes, ...	Great	Elegance
'6110	Jerseys, pullovers, cardigans, waistcoats and similar articles, knitted or crocheted (excluding ...	Great	Elegance
'6116	Gloves, mittens and mitts, knitted or crocheted (excluding for babies)	Great	Elegance
'6201	Men's or boys' overcoats, car coats, capes, cloaks, anoraks, incl. ski jackets, windcheaters, ...	Great	Elegance
'6203	Men's or boys' suits, ensembles, jackets, blazers, trousers, bib and brace overalls, breeches ...	Great	Elegance
'6205	Men's or boys' shirts (excluding knitted or crocheted, nightshirts, singlets and other vests)	Great	Elegance
'6206	Women's or girls' blouses, shirts and shirt-blouses (excluding knitted or crocheted and vests)	Great	Elegance
'6208	Women's or girls' singlets and other vests, slips, petticoats, briefs, panties, nightdresses, ...	Great	Elegance
'6210	Garments made up of felt or nonwovens, whether or not impregnated, coated, covered or laminated; ...	Great	Elegance
'6212	Brassieres, girdles, corsets, braces, suspenders, garters and similar articles and parts thereof, ...	Great	Elegance
'6216	Gloves, mittens and mitts, of all types of textile materials (excluding knitted or crocheted ...	Great	Elegance
'6704	Wigs, false beards, eyebrows and eyelashes, switches and the like, of human or animal hair ...	Great	Elegance
'7101	Pearls, natural or cultured, whether or not worked or graded, but not strung, mounted or set, ...	Great	Elegance
'7108	Gold, incl. gold plated with platinum, unwrought or not further worked than semi-manufactured ...	Great	Elegance
'7202	Ferro-alloys	Great	Elegance
'7403	Copper, refined, and copper alloys, unwrought (excluding copper alloys of heading 7405)	Great	Elegance
'7404	Waste and scrap, of copper (excluding ingots or other similar unwrought shapes, of remelted ...	Great	Elegance
'7406	Powders and flakes, of copper (excluding grains of copper and spangles of heading 8308)	Great	Elegance
'7507	Tubes, pipes and tube or pipe fittings "e.g., couplings, elbows, sleeves", of nickel	Great	Elegance
'8001	Unwrought tin	Great	Elegance
'8003	Tin bars, rods, profiles and wire, n.e.s.	Great	Elegance
'8418	Refrigerators, freezers and other refrigerating or freezing equipment, electric or other; heat ...	Great	Elegance
'8522	Parts and accessories suitable for use solely or principally with sound reproducing and recording ...	Great	Elegance
'8527	Reception apparatus for radio-broadcasting, whether or not combined, in the same housing, with ...	Great	Elegance
'8531	Electric sound or visual signalling apparatus, e.g. bells, sirens, indicator panels, burglar ...	Great	Elegance
'8544	Insulated "incl. enamelled or anodised" wire, cable "incl. coaxial cable" and other insulated ...	Great	Elegance
'8711	Motorcycles, incl. mopeds, and cycles fitted with an auxiliary motor, with or without side-cars; ...	Great	Elegance
'8712	Bicycles and other cycles, incl. delivery tricycles, not motorised	Great	Elegance
'8714	Parts and accessories for motorcycles and bicycles and for carriages for disabled persons, ...	Great	Elegance
'9106	Time of day recording apparatus and apparatus for measuring, recording or otherwise indicating ...	Great	Elegance
'9205	Wind musical instruments "e.g. clarinets, trumpets, bagpipes, keyboard pipe organs, harmoniums ...	Great	Elegance
'9207	Musical instruments, the sound of which is produced, or must be amplified, electrically, e.g. ...	Great	Elegance
'9404	Mattress supports (excluding spring interiors for seats); articles of bedding and similar furnishing, ...	Great	Elegance
'9602	Worked vegetable or mineral carving material and articles of these materials n.e.s; moulded ...	Great	Elegance

Source: Own calculation based on HS-4 Trademap dataset, 2020

Table 4. Classification of Protection
1995–2015

Period	Consumer Goods (Final Products)	Intermediate Inputs	Classification
1995–2000	11%	8%	ERP
2000–2005	6%	5%	ERP
2005–2010	4.1%	3.9%	ERP
2010–2015	2.6%	3.0%	NERP

Source: Own calculation based on WITS dataset, ERP is Effective Rate of Protection and NERP is the Non-ERP (Non-Effective Rate of Protection of which tariff rate of intermediate input is equal or higher than that of final product), 2020

Table 5. Indonesia's Labor-Intensive Index and the ICT Index

ISIC	Labor Intensive	ICT Index	Character
Footwear	1.94	11.86	Stay
Other Transportation	0.75	12.70	Stay
Electricity Tools	0.53	16.31	Stay
Coal	0.60	19.19	Stay
Pharmacy	1.41	23.08	Agile
Furniture	2.79	8.79	Stay
Non-Metal Excavation i.e Glass	0.50	11.90	Stay
Other Industries	2.82	11.02	Stay
ir Services, Installation Machinery & Tools	0.76	11.22	Stay
Rubber & Plastic	1.19	10.83	Stay
Wood	2.16	13.12	Stay
Motor Vehicles	0.28	3.80	Stay
Paper	0.88	10.24	Stay
Chemical Products	0.38	16.27	Stay
Computer & Electronics	0.89	6.83	Stay
Metal Not Machinery	1.68	25.07	Agile
Basic Metal	0.32	13.78	Stay
Food	0.82	9.19	Stay
Machinery	0.47	16.30	Stay
Beverage	0.75	15.28	Stay
Clothing	4.22	11.86	Stay
Printing	1.44	24.76	Agile
Textile	2.17	7.48	Stay
Tobacco	0.93	9.60	Stay
Average	**1.28**	**13.35**	

Source: Own calculation for Labor-Intensive Index; the ICT index from Rizky, T.M., Graduate Thesis, 2020

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