

Dynamics of Indonesian Machinery Industry

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Abstract

The industrial revolution changed the processes and ways of producing an item and reflects the rapid progress in technology. Previously, the production process needed human labor, but then underwent changes, human labor no longer become a priority in production activities because it was replaced by machines and sophisticated equipment that can increase productivity and efficiency in production. Through industrialization, economic activities are increasingly open and free, this is certainly a threat to the state if the products produced cannot compete in the market. In this study, we will discuss the growth of the machinery industry in Indonesia, analyze whether the machinery industry in Indonesia can compete competitively in the world market, how government policies support the industry, and slightly discuss how the industry relates to the concept of green economics. The method used in this study uses descriptive qualitative methods from various reference sources, and quantitative methods using secondary data in analyzing the comparative Indonesian machinery commodities. This study finds that: (1) The growth of the machinery and equipment industry has fluctuated over the past 6 years; (2) Indonesian machine commodities have a comparative disadvantage and have low competitiveness in the global market; (3) Government policies are needed to support the industrial sector; (4) Through the process of industrial development, it is necessary to realize the bill for the implementation of an industry that is advanced, competitive, independent and green.

Keywords: Machinery Industry, Comparative Advantage, RSCA, TBI, Government Policy.

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INTRODUCTION

The industrial revolution 4.0 is often known as the cyber physical system. The concept is centered on the collaboration of cyber technology with automation technology. In the process, human involvement is decreasing but the effectiveness and efficiency in the work environment is increasing. In the industrial world, the industrial revolution 4.0 causes a shift in production patterns, has a significant impact on the quality of work and production costs, changes the processes and ways of working humans in producing goods. In the traditional supply chain process, human labor is one of the important inputs in the production process, which relies on the speed of the human hand and foot, it experiences a shifting pattern, human labor is no longer a priority needed in the production process, because it is replaced by various sophisticated machines which helps the production process to be more productive and efficient.

There are at least nine main pillars behind the industrial revolution such as the internet of things (IoT), big data, augmented reality (AR), cyber security, artificial intelligence (AI), cloud computing, additive manufacturing, simulation, and system integration. The emergence of various artificial intelligences makes everything more effective and minimizes waste, it is closely related to the production activities of a company. Technological improvements can increase productivity and reduce production cost. Using advanced technology, companies can produce more output with the same quality, through which companies can compete competitively. On the other hand, technological advances can be a threat in influencing future supply chain developments. The skills of the workforce needed are in controlling the machine. The development of machines with increasingly sophisticated technology affects the use of supply chains in decision making and automation.

Table 1: Export & Import Value of Indonesian Machinery commodity (HS 84) in global market

Year	Export Value (US\$)	Import Value (US\$)
2004	3.853.031.799	6.310.998.247
2005	4.560.041.892	8.076.193.592
2006	4.362.346.892	7.403.596.176
2007	4.670.247.618	9.518.651.612
2008	5.211.566.602	18.304.995.589
2009	4.709.268.785	14.723.974.309
2010	4.986.727.072	20.019.020.782
2011	5.749.543.819	24.728.825.265
2012	6.103.085.752	28.429.600.602
2013	5.968.489.537	27.290.504.908
2014	5.969.079.734	25.834.884.215
2015	5.215.107.363	22.376.703.319
2016	5.450.846.308	21.070.907.169
2017	5.869.420.596	21.768.129.656
2018	5.865.947.956	27.197.372.573
2019	5.542.611.670	26.817.436.952

(Source: UNCOMTADE, the data has processed by researcher)

The development of the machinery and equipment industry sector in Indonesia in recent years has fluctuated and reflects a fairly slow growth, this is because Indonesia is still dependent on imported raw materials, due to limited domestic raw materials. So that Indonesia is unable to compete with imported products whose prices are much cheaper. Thus technological progress affects trade and the economy of a country, becomes a challenge and a threat to the economy and trade of a country, therefore the role of the government in making policies is needed to minimize the impact that occurs from these technological advances. One of them, so that domestic products can compete in trade is through a policy of maximizing the export of products that have a comparative advantage.

EXPERIMENTAL SECTION

Concept and overview

Advances in Technology and Machinery Industry

Industrialization is closely related to technological progress, in the era of industrialization various economic activities changed from traditional to modern. The changes can be seen from advances in machine technology. The use of machines can make it easier for humans to do work more efficiently, and reduce various levels of the risk of work accidents. Therefore, many companies create various engine technologies, with various specifications based on needs. Technological developments have also changed production patterns, from traditional patterns that rely on human labor to all machines, therefore along with technological advances, the demand for the machine

industry is increasing. Machinery industry as a supporting industry that becomes a priority in providing capital goods and developing other industries that are more effective and efficient. Through the development and improvement of machine technology will encourage various industries to produce quality products. The use of machines in production can be a factor that supports smooth production and is expected to operate optimally. The goal is to achieve the target in time, quality, quantity and efficient cost by utilizing these production factors.

Growth of Machinery and Equipment Industry in Indonesia

The machinery industry in Indonesia is still dependent on imported raw materials and technology, as a result, domestic products are unable to compete, this can be seen in terms of the price of imported machinery products which tend to be cheaper. The composition of imports in this industry is quite large, especially in non-critical equipment products in several sectors such as electricity and energy, imported components are capital goods that have high capacity and power such as generator components, and others. The ability of the domestic machinery industry has not been able to fulfill it, causing dependence on imported raw materials. The domestic machinery industry must do a lot of technological innovation and not depend on imported technology. One of the reasons behind the dependence on imported raw materials is the weak national trade structure, high imports of capital goods and raw materials are one of the causes of the trade balance deficit.

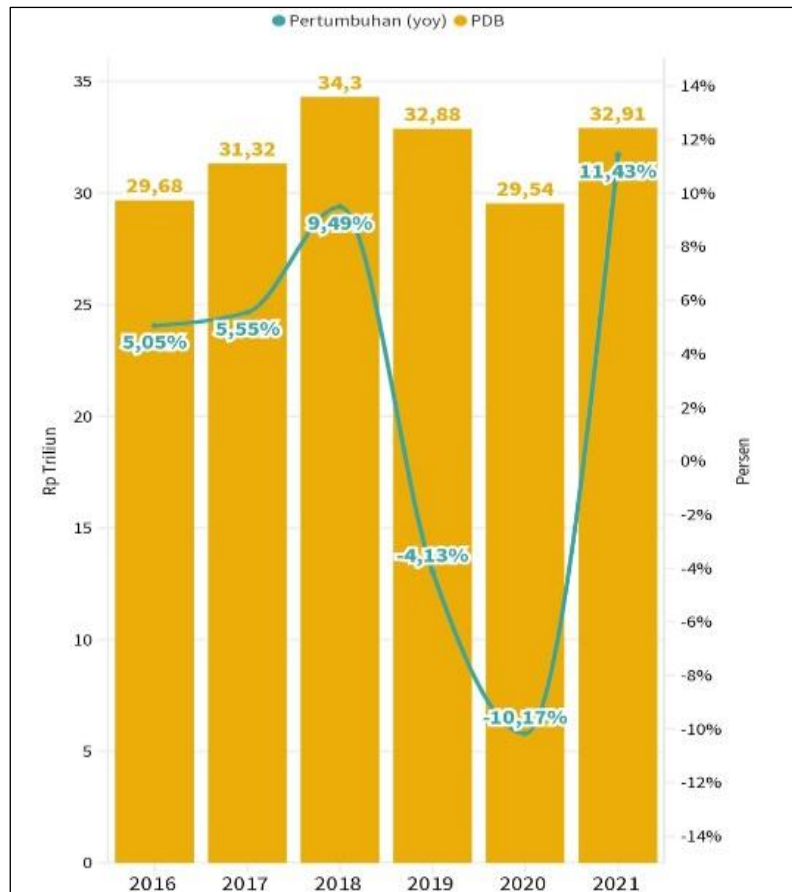


Figure 1: Growth of Machinery and Equipment Industry in Indonesia Period 2016-2021
(Source: BPS - Statistics Indonesia)

Based on the Central Statistics Agency (BPS) it was recorded that gross domestic product (GDP) at constant prices (ADHK) was recorded that in 2019-2020 the machinery industry experienced a deep contraction, and for the last 6 years the performance of the machinery and equipment industry has fluctuated. In 2016, the machinery and equipment industry grew by 5.05% (year on year) with a GDP value of 29.68 trillion rupiah. Furthermore, in 2017 it grew 5.55% (year on year) with a GDP value of 31.32 trillion rupiah. In 2018 the GDP of the machinery and equipment industry experienced a rapid growth of 9.49% (year on year) with a GDP value of 34.3 trillion rupiah. However, in 2019-2020 GDP growth experienced a fairly deep contraction, in 2019 GDP by -4.13% (year on year) and in 2020 by -10.17% (year on year), this was exacerbated by the pandemic. Covid-19. In 2021 the GDP growth of the machinery and equipment industry rose and grew rapidly with a growth value of 11.43% (year on year) with a GDP value of 32.91 trillion rupiah. The government must strengthen the development of the industry, in order to compete competitively. Especially for the machinery and equipment industry, which plays an important role in the company's production process activities in producing quality products, therefore the machinery and equipment industry is required to innovate and develop quickly. The more sophisticated the machine technology, the more

productive and efficient in producing products and the machinery industry will develop.

Constraints Faced by the Machinery Industry in Indonesia

Based on previous research (Hafid, dkk. 2015) with the title article is Analysis Of The Growth Obstacles In The National Machinery Industries and Factory Equipment. There are some several obstacles that impade the growth of the machinery and factory equipment industry.

1. Raw Material

Obtaining local raw materials poses a challenge in the domestic market industry. The availability of local raw materials for factory machinery and equipment is limited. This has led to a significant reliance on imports. The scarcity of these materials in the domestic market, coupled with their high cost, makes it difficult for products from this industry to compete in the global market.

2. Technology

The competitiveness of machinery industry technology struggles to meet the dynamic market demands. Machinery and equipment that are generally over 10 years old face tough competition from newer,

more productive, and efficient machines and technologies.

3. Product Development

The ability to process design, front-end engineering design, manufacturing processes, and meet SNI quality standards, as well as international standards.

4. Machines and Equipment

The machinery and equipment industry plays a crucial role in supporting the production of other industries. The development of this industry necessitates the restructuring and modernization of production machinery and equipment.

5. Product Marketing

While there are still opportunities for expanding the marketing of machinery industry products from Indonesia in the ASEAN or global markets, marketing remains challenging due to well-established competitors from advanced economies.

6. Capital

The machinery industry in Indonesia faces significant challenges related to capital availability and accessibility. Limited access to funding options and financial resources hinders the expansion and modernization of machinery production facilities. This restricts the industry's capacity to invest in cutting-edge technologies and develop competitive products.

7. Human Resources

Improving the capabilities of human resources in the machinery and equipment industry is key to enhancing competitiveness in both domestic and global markets.

8. Infrastructure

Insufficient and outdated infrastructure further compounds the challenges faced by the machinery industry in Indonesia. Inadequate transportation networks, including roads, ports, and logistics systems, hamper the efficient movement of raw materials and finished products. Additionally, inadequate energy supply and outdated facilities constrain the industry's capacity for large-scale production and innovation.

9. Policy and Incentives

Government support, including subsidies, protection, and market safeguards, is essential for the development of the machinery industry.

Government's Role in Industry

In developing machinery and equipment technology as a production support industry, the government must continue to strive to develop the potential of domestic manufacturing tools and machines through superior programs that increase added value. In addition, the demand for tools and machinery through the

government's business capital expenditure and State-Owned Enterprises (BUMN) needs to be increased in optimizing the development of the capital goods industry. The government's role in developing the machinery and equipment industry sector can be seen from the 35,000 megawatt power plant development program in 2015, this program is one of the programs in mobilizing strategic sectors, especially energy sovereignty. Another government role in developing the industrial sector as a whole is to facilitate the development of industrial estates in the country, the development of priority industrial areas in the 2020-2024 RPJMN, there are as many as 27 industrial areas outside Java. The government is committed to continuing to maintain and develop the industrial sector through three principles, firstly an independent and sovereign industry, an advanced and competitive industry, and an industry that is fair and inclusive. The principle of an independent and sovereign industry means that it must not depend on foreign resources, in encouraging this principle the government will carry out 35% import substitution programs by 2022, which are carried out simultaneously with increasing production utilization, encouraging deepening of the industrial structure, and increasing investment. The instruments used are through the implementation of tariff measures, trade remedies, non-tariff measures, and import trading systems. On the principle of an advanced and competitive industry, the government implements the Making Indonesia 4.0 program in 7 industrial sectors, including the food and beverage industry, chemical industry, textile and clothing industry, automotive industry, electronics industry, pharmaceutical industry, and medical device industry. Furthermore, the principles of fairness and inclusion are realized by the government through the Development of Small and Medium Industries (IKM) in helping the resilience of domestic industries.

Discourse on Green Economics and Industry

Green economy is defined as an economic system that aims to improve human well-being without compromising the right of future generations to enjoy natural resources. The concept of a green economy does not allow unlimited economic development, but to keep the country's economy stable. From an environmental management point of view, the ten principles of a green economy are outlined, namely: (1) prioritizing use value, intrinsic value and quality, (2) following the flow of nature; (3) understand the (economic) value of waste; (4) work neatly and various functions; (5) consider the appropriate scale; (6) fostering diversity; (7) improve self and organizational abilities; (8) promote participation and democracy; (9) emphasizes creativity and community development; and (10) paying attention to the strategic role of the environment. The Green Economy has the principle of recognizing the value and investment of natural resources, reducing poverty and increasing employment opportunities and social equality. Based on the industrial bill as a substitute for Law No. 5/1984 on industry, industry is organized with

the objectives of: (1) opening up business and employment opportunities; (2) realizing business certainty, fair competition and preventing the centralization or control of industry by one group or individual that is detrimental to the community; (3) realizing an advanced, competitive, and independent industry as well as a green industry; (4) Strengthening and strengthening national resilience, as well as realizing equitable distribution of industrial development throughout the territory of Indonesia and (5) Increasing the prosperity and welfare of the community in a just manner. As an embodiment of the goal of industrial administration, namely to create advanced, competitive, independent and green industries, this study will discuss government policies to realize the bill.

The concept of green economics is still being debated, but several international institutions have begun to define this concept. Among these institutions is UNICEF, which defines green economy as “greening the economy refers to the process of reconfiguring businesses and infrastructure to deliver better returns on natural, human and economic capital investments, while at the extracting and using less natural resources, creating less water and reducing social disparities”. Green economics is a model of economic development approach that no longer relies on economic development based on excessive exploitation of natural resources and the environment. Green economics is based on knowledge of ecological economics which discusses the economic dependence of humans on natural ecosystems and the consequences of the effects of human economic activities on climate change and global warming. Indonesian government realizes the importance of implementing green economics in a directed and comprehensive manner. To ensure the success of its implementation, as has been determined by the United Indonesia Cabinet II in the National Medium-Term Development Plan (RPJMN) for the 2010-2014 period as the basis for developing the Indonesian economy. The implementation and application of green economics in Indonesia must be accompanied by government policies to ensure the success of its implementation. United Indonesia Cabinet II in its national mid-term development plan (RPJMNN) for the 2010-2014 period has set as the basis for the sustainable development of the Indonesian economy through the application of green budgeting, the aim of which is to manage government budget finances. The role of the ministry of finance focuses on fiscal policy, climate finance, investment and market-based approaches. The implementation of the green economic concept in fiscal and economic policies to implement a climate change risk reduction that focuses on land use and the industrial sector. In addition, it is also required to develop a fiscal policy that is oriented towards green budgeting. The following principles were developed in the broad application of the green concept: (1) economic efficiency and renewable energy; (2) efficiency of resource utilization; (3) relationship

between natural and human systems (4) Green Industrial Park.

The Indonesian Ministry of Industry drafted the concept in Permenpernd No. 05/M-IND/PER/1/2011 stated that the green industry is an environmentally sound industry that harmonizes growth with environmental sustainability, prioritizes the efficiency and effectiveness of the use of natural resources and benefits the community. The industrial sector that applies the green industry concept is one that pays attention to the pattern of using raw materials, auxiliary materials, environmentally friendly alternative energy and more efficient production processes, producing environmentally friendly products, handling post-production or distribution processes that apply the 4R pattern, to business management. sustainable and more responsible (according to the concept of people-planet profit). In the green industry concept, there are general standards such as environmental management (ISO 14000), social responsibility (ISO 26000), green label, threshold value for the environment, proper, and so on. Until now, there has been no suggestion for green industry infrastructure, such as regulations or legal aspects that support the application of the concept. The implementation and application of the green industry in Indonesia must be accompanied by government policies to ensure the success of its implementation.

METHOD

The study involved mainly literature studies on the machinery industry and policies in Indonesia. Secondary data used in this study was obtained from UN COMTRADE for the period 2017-2021, namely data on the export value of machine commodities (code H84) and the value of world exports. This study will use an indicator of comparative advantage, namely the Revealed Symmetric Comparative Advantage (RSCA) proposed (Laursen, 2015) and using the Trade Balance Index (TBI) proposed by (Lafay, 1992). Revealed Symmetric Comparative Advantage (RSCA) proposed (Laursen, 2015) is a simple modification of the previously used index, Revealed Comparative Advantage (RCA) or the Balassa index (Balassa, 1965). The RCA and RSCA indices are expressed by:

$$RCA_{ij} = \frac{(x_{ij}/x_{in})}{(x_{rj}/x_{rn})} \quad (1)$$

$$RSCA_{ij} = \frac{(RCA_{ij} - 1)}{(RCA_{ij} + 1)} \quad (2)$$

RCA_{ij} : index of revealed comparative advantage of country i product group j

$RSCA_{ij}$: index of revealed symmetric comparative advantage of country i product group j

x_{ij} : total exports of country i product group j

x_{in} : total exports of country i product group n (except product j)

x_{rj} : total exports of countries other than i product group j

x_{rn} : total exports of countries other than i product group n (except product j)

The RSCA index ranges from -1 to +1. RSCA index greater than 0 means country i has a comparative advantage in item j . RSCA less than 0 means country i has a comparative disadvantage in product j .

Trade Balance Index (TBI) proposed by (lafay, 1992) is formulated as follows:

$$TBI_{ij} = (X_{ij} - M_{ij}) / (X_{ij} + M_{ij}) \quad (3)$$

X_{ij} = Export commodity i for country j

M_{ij} = Import commodity i for country j

The value of Trade Balance Index is range from -1to +1. If the TBI is equals +1 or show positive value means the country only export or the country is net-exporter. TBI -1 mean that a country only import, when the TBI shows negative value a country is referred as net-importer of commodity.

RESULT AND DISCUSSION

Technological developments can increase productivity and reduce production costs. Using advanced machine technology, companies can produce more output and lower production costs but with the same quality, and allow companies to compete competitively. The era of globalization has changed various sectors in people's lives, especially in the economic field, every country is competing in producing products that can compete in trade. Through this competition determines the success of a country in international trade. Reflecting on the success of Japan through the concept of development which is often called flying gees, there are two important indicators in this concept, namely regarding comparative advantage and export-import. Indonesian export value for 2004-2019 of machinery commodities did not show rapid growth but the import values of Indonesian machinery commodities continues to increase. In 2019 the import value of Indonesian machinery commodity was 26, 81 Billion US\$. The value was much greater than the export value of machinery commodity achieved in that year with a value of 5, 54 Billion US\$.



Figure 2: The Growth of Export and Import Value of Indonesia Machinery Commodity (Code HS 84) Period 2005-2019

Source: UN COMTRADE the data has processed by researcher

Table 2: The result of Revealed Symmetric Comparative Advantage & Trade Balance Index of Indonesian Machinery Commodity (HS 84) period 2004-20019

Year	Value Of RSCA Index	Value Of TBI
2004	-0.477	-0.242
2005	-0.469	-0.278
2006	-0.540	-0.258
2007	-0.555	-0.342
2008	-0.555	-0.557
2009	-0.535	-0.515
2010	-0.610	-0.601
2011	-0.630	-0.623
2012	-0.585	-0.647

Year	Value Of RSCA Index	Value Of TBI
2013	-0.572	-0.641
2014	-0.570	-0.625
2015	-0.572	-0.622
2016	-0.544	-0.589
2017	-0.573	-0.575
2018	-0.597	-0.645
2019	-0.593	-0.657
Average	-0,561	-0.526

(Source: UNCOMTRADE. The result of RSCA & TBI, the data has processed by researcher)

Figure 2 shows export and import growth of Indonesian machinery commodity. In 2008 import growth of Indonesian machinery commodities reached its peak with 92% growth, then in 2009 decreased by 20%. The export growth of Indonesian machinery commodities during the period 2004-2019 tends to fluctuate. Overall, import growths were greater than export growth of machinery commodities. The RSCA ratio for trade in Indonesian machinery commodities exports from 2004-2019 has a value of -0.561, reflect the average negative RSCA value. Indonesia machinery

commodities have low competitiveness in the global market. Based on the result, Trade Balance Index (TBI) of Indonesian machinery commodity periode 2004 until 2019, shows the average value -0.526, which means Indonesia has a tendency become a net-importer of machinery commodity (HS 84). Indonesia machinery industry is not superior in the global market, so government intervention is needed in supervising and encouraging the machinery industry, with the help of related institutions.



Figure 3: Import Value of Capital Goods in Indonesia Manufacturing Industry in May 2020
(Source: Indonesian Ministry of Industry)

Based on figure 3 in May 2020, imports of capital goods were dominated by the machinery industry sector with a value reaching US\$ 0.6 billion. The ability of the domestic industry to create and fulfill capital goods for machine production is still very minimal. Machinery commodities as a supporting industry in providing capital goods must certainly develop and not depend on imported raw materials. This condition occurs because most of the raw materials must be imported, and

no less important, another reason is that in the machinery industry, technology transfer from several developed countries to Indonesia is not going well. Until now, the demand for machinery in the industry is getting higher, but the Indonesian machinery industry has not been able to fulfill it. So the government must continue to import from various countries. The Indonesian government implements a 35% import substitution policy in 2022, with the aim of improving the international trade

balance, the policy is expected to trigger an increase in the consumption of local raw materials and auxiliary materials. There are several approaches taken in carrying out the 35% import substitution policy, including: (1) industrial expansion to increase the production of raw and auxiliary materials as derivative industries, with the aim of expanding production volume and domestic supply capability; (2) New investment for industries in capturing opportunities for the large import of raw materials and auxiliary materials through domestic production of raw materials and auxiliary materials; (3) Increasing the utilization of industry, as an outcome in increasing the utilization of the domestic industry, is expected to reduce dependence on imports of raw materials and auxiliary materials.

The analysis of Revealed Symmetric Comparative Advantage (RSCA) and Trade Balance Index calculation for Indonesia's machinery commodity (HS code 84) export shows that in period 2014-2019 has a value RSCA and TBI reflect a negative average value. So these commodities have low competitiveness in the global market and Indonesia is referred as net-importer of machinery commodity (HS 84). Indonesia's machine industry is not superior in the global market, so government intervention is needed in supervising and encouraging the machinery industry. Here, the role of policy makers is needed so that the Indonesian machinery industry can continue to be developed. However, the ability to supply raw materials for the domestic machinery industry has not been able to be fulfilled, causing dependence on imported raw materials. And causing the Indonesian machinery industry to be unable to compete with other imported products because the prices of imported products are relatively cheap, the domestic machinery industry must do a lot of technological innovation and not depend on imported technology. The machinery and equipment industry is required to be more innovative and fast growing, because it is an industry that provides capital goods. The more sophisticated the machine technology, the more productive and efficient in producing products and the machinery industry will develop. In the application of the green economic concept as the embodiment of the bill in the implementation of an advanced, competitive, and green industry. Until now, there is no infrastructure advice and legal aspects that support the implementation of the concept. The implementation and application of the green industry in Indonesia must be accompanied by government policies to ensure the success of its implementation.

CONCLUSION

Indonesia's machine industry is not superior in the global market, so government intervention is needed in supervising and encouraging the machinery industry. Here, the role of policy makers is needed so that the Indonesian machinery industry can continue to be developed.

- A. Government's role is needed to increase the productivity of machinery industry
- B. Provision of raw materials
- C. Provision of production facilities
- D. Human resource development
- E. Increase competitiveness through export maximization
- F. Strengthening the government's partnership pattern so that the industry grows

In the realization of the bill through the implementation of an industry that is advanced, competitive, independent and green. Until now, there is no infrastructure advice and legal aspects that support the implementation of the concept. The government needs to control through policies to create a conducive climate.

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